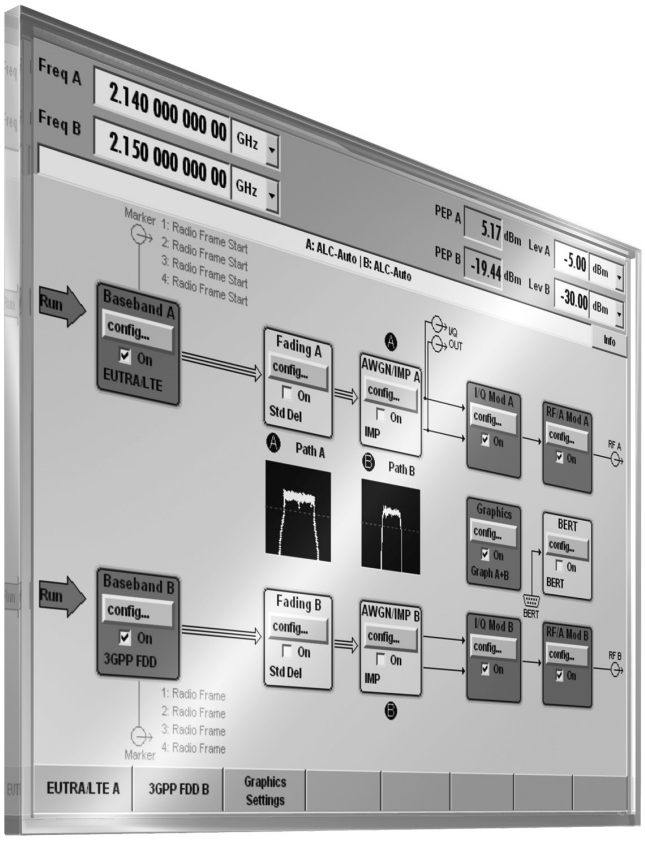
DIGITAL STANDARDS FOR SIGNAL GENERATORS

Specifications

R&S®SMW200A Vector Signal Generator
R&S®SMBV100B Vector Signal Generator
R&S®SMBV100A Vector Signal Generator



Data Sheet
Version 18.00

ROHDE&SCHWA

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CONTENTS

Introduction

This document describes the digital standard options of the R&S®SMW200A, R&S®SMBV100B and R&S®SMBV100A vector signal generators.

Notations and abbreviations

The following abbreviations are used in this document for Rohde & Schwarz products:
The R&S®SMW200A vector signal generator is referred to as SMW.
The R&S®SMBV100A vector signal generator is referred to as SMBV.

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®SMW-K42 is the 3GPP FDD option for the R&S®SMW200A, R&S®SMBV-K42 is the 3GPP FDD option for the R&S®SMBV100A, R&S®SMBVB-K42 is the 3GPP FDD option for the R&S®SMBV100B. 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®SMW-K42, R&S®SMBV-K42, R&S®SMBVB-K42), unless otherwise stated.

I/Q baseband generators and prerequisite for installation

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®SMW200A	R&S®SMW-B10	baseband generator with ARB (64 Msample) and digital modulation (realtime), 120 MHz RF bandwidth
	R&S®SMW-B10F	baseband generator for GNSS with high dynamics [1], with ARB (64 Msample) and digital modulation (realtime), 120 MHz RF bandwidth
	The following enhancement options can be added to the R&S®SMW-B10/B10F options:	
	R&S®SMW-K511	ARB memory extension to 512 Msample
	R&S®SMW-K512	ARB memory extension to 1 Gsample
	R&S®SMW-K522	bandwidth extension to 160 MHz RF bandwidth
	R&S®SMW-B9	wideband baseband generator with ARB (256 Msample), 500 MHz RF bandwidth
	The following enhancement options can be added to the R&S®SMW-B9 option:	
	R&S®SMW-K515	ARB memory extension to 2 Gsample
	R&S®SMW-K525	bandwidth extension to 1 GHz RF bandwidth
	R&S®SMW-K527	bandwidth extension to 2 GHz RF bandwidth
For the R&S®SMBV100B	standard, included in minimum configuration	baseband generator with ARB (64 Msample), 120 MHz RF bandwidth
	The following enhancement options can be added:	
	R&S®SMBVB-K511	ARB memory extension to 512 Msample
	R&S®SMBVB-K512	ARB memory extension to 1 Gsample
	R&S®SMBVB-K513	ARB memory extension to 2 Gsample
	R&S®SMBVB-K520	baseband realtime extension
	R&S®SMBVB-K523	baseband extension to 240 MHz RF bandwidth
	R&S®SMBVB-K524	baseband extension to 500 MHz RF bandwidth
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-B10F	baseband generator for GNSS with high dynamics, digital modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth
	R&S®SMBV-B51	baseband generator with ARB (32 Msample), 60 MHz RF bandwidth
	The following enhancement options can be added to the R&S®SMBV-B51 option:	
	R&S®SMBV-K521	bandwidth extension to 120 MHz RF bandwidth
	The following enhancement options can be added to the R&S®SMBV-B10/B10F/B51 options:	
	R&S®SMBV-K511	ARB memory extension to 256 Msample
	R&S®SMBV-K512	ARB memory extension to 512 Msample
	R&S®SMBV-K522	bandwidth extension to 160 MHz RF bandwidth

[1] This baseband generator enables high dynamics with GNSS standards. For details, see the GNSS simulation for Rohde & Schwarz signal generators datasheet (PD 5213.9434.22). Enhancements of the R&S®SMW-B10 option and software options that run on the R&S®SMW-B10 option work also with the R&S®SMW-B10F option.

Prerequisite for installation – R&S®SMW200A

At least one I/Q baseband generator R&S®SMW-B9 or R&S®SMW-B10/B10F must be installed. Which standard is available with which baseband generator is shown in the overview table in the next section.

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®SMW-K40). If only one R&S®SMW-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®SMBV100B

The baseband realtime extension R&S®SMBVB-K520 must be installed.

Prerequisite for installation – R&S®SMBV100A

An R&S®SMBV-B10 or R&S®SMBV-B10F baseband generator must be installed. The options cannot be used with the R&S®SMBV-B51 I/Q baseband generator.

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

Overview of digital standards on the different instruments

The following table gives an overview of the standards that are available for the different instruments, as well as of the respective option types. For better readability, option types are abbreviated as follows:

The R&S®SMW-K55 option is referred to as “SMW-K55”, and so on.

	R&S®SMW200A with wideband baseband (R&S®SMW-B9)	**R&S®SMW200A** with standard baseband (R&S®SMW-B10)	**R&S®SMBV100B**	**R&S®SMBV100A**
Cellular standards				
5G New Radio	SMW-K144	SMW-K144	SMBVB-K144	–
5G NR closed-loop BS tests	SMW-K145	SMW-K145	–	–
Verizon 5GTF signals	SMW-K118	SMW-K118	–	–
EUTRA/LTE	SMW-K55	SMW-K55	SMBVB-K55	SMBV-K55
EUTRA/LTE closed-loop BS test	–	SMW-K69	–	–
EUTRA/LTE, 5G NR log file generation	SMW-K81	SMW-K81	–	–
EUTRA/LTE release 9 and enhanced features	SMW-K84	SMW-K84	SMBVB-K84	SMBV-K84
EUTRA/LTE release 10	SMW-K85	SMW-K85	SMBVB-K85	SMBV-K85
LTE release 11 and enhanced features	SMW-K112	SMW-K112	SMBVB-K112	SMBV-K112
EUTRA/LTE release 12	SMW-K113	SMW-K113	SMBVB-K113	SMBV-K113
LTE releases 13 and 14	–	–	–	SMBV-K119
LTE releases 13, 14 and 15	SMW-K119	SMW-K119	SMBVB-K119	–
Cellular IoT	SMW-K115	SMW-K115	SMBVB-K115	SMBV-K115
Cellular IoT release 14	SMW-K143	SMW-K143	SMBVB-K143	–
Cellular IoT release 15	SMW-K146	SMW-K146	SMBVB-K146	
OneWeb user-defined signal generation	SMW-K130	SMW-K130	–	–
OneWeb reference signals	SMW-K355	SMW-K355	–	–
3GPP FDD	SMW-K42	SMW-K42	SMBVB-K42	SMBV-K42
3GPP FDD enhanced MS/BS tests, including HSDPA	SMW-K83	SMW-K83	SMBVB-K83	SMBV-K43
3GPP FDD HSUPA	SMW-K83	SMW-K83	SMBVB-K83	SMBV-K45
3GPP FDD HSPA+	SMW-K83	SMW-K83	SMBVB-K83	SMBV-K59
GSM/EDGE	SMW-K40	SMW-K40	SMBVB-K40	SMBV-K40
EDGE Evolution	SMW-K41	SMW-K41	SMBVB-K41	SMBV-K41
CDMA2000®	SMW-K46	SMW-K46	SMBVB-K46	SMBV-K46
1xEV-DO	SMW-K47	SMW-K47	SMBVB-K47	SMBV-K47
1xEV-DO Rev. B	SMW-K87	SMW-K87	SMBVB-K87	SMBV-K87
TD-SCDMA	SMW-K50	SMW-K50	SMBVB-K50	SMBV-K50
TD-SCDMA enhanced BS/MS tests, including HSDPA	SMW-K51	SMW-K51	SMBVB-K51	SMBV-K51
TETRA release 2	SMW-K68	SMW-K68	–	SMBV-K68

Wireless standards				
IEEE 802.11a/b/g/n/j/p	SMW-K54	SMW-K54	SMBVB-K54	SMBV-K54
IEEE 802.11ac	SMW-K86	SMW-K86	SMBVB-K86	SMBV-K86
IEEE 802.11ax	SMW-K142	SMW-K142	SMBVB-K142	SMBV-K142
IEEE 802.11ad	SMW-K141	–	–	–
IEEE 802.16 WiMAX™	–	SMW-K49	–	SMBV-K49
NFC A/B/F	SMW-K89	SMW-K89	SMBVB-K89	SMBV-K89
Bluetooth®	SMW-K60	SMW-K60	SMBVB-K60	SMBV-K60
Bluetooth® 5.0	SMW-K117	SMW-K117	SMBVB-K117	SMBV-K117
LoRa	SMW-K131	SMW-K131	SMBVB-K131	SMBV-K131
GNSS standards				
GPS	–	SMW-K44	–	SMBV-K44
Galileo	–	SMW-K66	–	SMBV-K66
GLONASS	–	SMW-K94	–	SMBV-K94
Modernized GPS	–	SMW-K98	–	–
Extension to 48 GNSS channels per baseband	–	SMW-K99	–	–
SBAS/QZSS	–	SMW-K106	–	SMBV-K110/-K105
BeiDou	–	SMW-K107	–	SMBV-K107
Real-world scenarios	–	SMW-K108	–	–
GNSS realtime interfaces (RT remote control)	–	SMW-K109	–	–
Advanced GNSS applications	–	SMW-K120	–	–
Audio/video standards				
DVB-H/DVB-T	SMW-K52	SMW-K52	–	SMBV-K52
DVB-S2/DVB-S2X	SMW-K116	SMW-K116	–	SMBV-K116
DAB/T-DMB	–	–	–	SMBV-K53
XM Radio	–	–	–	SMBV-K56
FM stereo	–	–	–	SMBV-K57
Sirius	–	–	–	SMBV-K58
Other standards and modulation systems				
OFDM signal generation	SMW-K114	SMW-K114	SMBVB-K114	–
Baseband power sweep	SMW-K542	SMW-K542	–	–
Multicarrier CW	SMW-K61	SMW-K61	SMBVB-K61	SMBV-K61

Related documents

This document contains the functional specifications of the digital standards that are running on the instrument (K40 to K89, K112 to K119, K130, K141 to K144, K355 and K542 options). The digital standards with R&S®WinIQSIM2™ (K240 to K294 options and K407 to K444 options) are described in the R&S®WinIQSIM2™ data sheet (PD 5213.7460.22). The GNSS options for the R&S®SMW200A are described in the “GNSS Simulator in the R&S®SMW200A Vector Signal Generator” data sheet (PD 3607.6896.22). The GNSS options for the R&S®SMBV100A are described in the “GNSS and Avionics Simulator in the R&S®SMBV100A Vector Signal Generator” data sheet (PD 5214.5284.22). The options with external R&S®Pulse Sequencer software (K300 to K350) are described in the pulse sequencer options data sheet (PD 3607.1388.22).

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

R&S®SMW200A data sheet: PD 3606.8037.22
R&S®SMBV100A data sheet: PD 5214.1114.22

Key features

Large variety of digital standards

- 5G New Radio
- Verizon 5GTF signals
- EUTRA/LTE including release 9, release 10, release 11, release 12 and releases 13/14
- Cellular IoT (eMTC and NB-IoT)
- Cellular IoT enhancements
- OneWeb reference signals and OneWeb user-defined signal generation
- 3GPP FDD with HSDPA, HSUPA and HSPA+ (HSPA Evolution)
- CDMA2000® [2] and 1xEV-DO
- TD-SCDMA
- GSM/EDGE/EDGE Evolution
- WLAN IEEE 802.11 a, b, g, n, j, p, ac, ax and ad
- WiMAX™ [3] 802.16
- DVB-H, DVB-T, DAB, T-DMB
- Bluetooth® [4]
- XM Radio, Sirius, TETRA release 2
- NFC A/B/F including EMV type A/B [5]
- OFDM signal generation
- LoRa

5G New Radio

- Downlink and uplink
- CP-OFDM in downlink and uplink and optionally DFT-S in uplink
- Carrier aggregation
- Sub-6-GHz deployments and mmWave
- Channel bandwidths up to 400 MHz
- Several SS/PBCH simultaneously at multiple frequency positions
- All numerologies up to 240 kHz subcarrier spacing
- Multi numerology (mixed numerology)
- PSS, SSS, PBCH, PDSCH, CORESET/PDCCH, PUSCH, PUCCH, PRACH channels and dummy resource elements
- DMRS, CSIRS, PTRS, SRS
- Channel coding
- DCI and UCI
- Automatic PDSCH scheduling from DCI
- Search space assistance
- MIB coding
- MIMO and multi-layer transmission
- Resource element modulations BPSK, π/2-BPSK, QPSK, 16QAM, 64QAM, 256QAM
- PRBS data or user provided data as input to the channels
- Flexible BWP configuration
- Multiple users
- Flexible channel scheduling throughout the subframes and slots
- FRCs and NR-TMs of TS 38.141 for FR1 and FR2
- Optional BWP-wise filtering
- Time domain windowing/WOLA
- Intuitive user interface with graphical display of time plan

Verizon 5GTF signals

- Supports different predefined configurations in line with V5G.211, V5G.212, and V5G.213
- Four predefined downlink configurations comprise xPDCCH, xPDSCH, xPBCH channels, including reference and synchronization signals
- Four predefined uplink configurations comprise xPUSCH and xPUCCH channels, including reference signals
- AutoDCI mode
- CSI-RS settings
- Cell-specific and UE-specific antenna ports can be configured

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

[3] 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.

[4] 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.

[5] NFC Forum and the NFC Forum logo are trademarks of the Near Field Communication Forum.

- Configuration TX modes of UEs
- Timeplan of generated signal
- Multi-antenna scenario modes such as TX diversity and spatial multiplexing
- Channels xPBCH, xPDCCH, xPDSCH can be generated including DMRS reference signals
- CSI-RS
- DCI formats A1, A2, B1, B2 can be configured in terms of CCEs/xREGs
- xPDSCHs/CSI-RS are automatically generated from xPDCCH via AutoDCI mode
- User-specific uplink settings
- LDPC channel coding for xPUSCH
- Flexible configuration of xPUSCH channel including UL PCRS
- Flexible configuration of xPUCCH channel including UL PCRS
- Up to four uplink users can be configured

OFDM signal generation

- Supported modulation types: OFDM, f-OFDM, UFMC, FBMC, GFDM
- Flexible physical parameterization of sequence length, total/occupied number of subcarriers, subcarrier spacing, cyclic prefix
- Custom parameters can be set for each individual modulation type
- Customization of predefined filters such as RC, RRC, dirichlet, rectangular, soft truncation
- Support of user-defined filters that were designed by a numeric toolbox, e.g. MATLAB™
- Different users can be configured, each allocated a different data source (e.g. PRBS sequence, data list/pattern)
- Allocation table for flexible assignment of users or individual allocations (each with a different modulation type, data source, power offset and time-frequency resources)
- Custom I/Q sources can be used as an allocation source
- Visualization of resource grid assignments in a global time plan graphic
- Multiple access scheme SCMA to multiplex different users to the same allocation
- OFDM/f-OFDM: allocations can be defined to be used as pilots
- OFDM/f-OFDM: xml configuration file for automatic R&S®FSW-K96 settings configuration is automatically exported

EUTRA/LTE release 8, release 9, release 10, release 11, release 12 and releases 13/14

- 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, EPDCCH supported
- PDCCH with full DCI configuration
- 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 1 to 3
- SRS, including aperiodic SRS
- 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, dual-layer and up to eight-layer beamforming scenarios as well as CoMP and (f)eICIC (transmission modes 7, 8 and 10) on antenna ports 5 and 7 to 14
- 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
- Support of CSI reference signals
- Automatic scheduling of downlink transmissions according to long HARQ patterns
- 256QAM modulation for PDSCH, downlink dummy resource elements and PMCH
- Downlink test models for 256QAM in line with 3GPP TS 36.141 v.12.9.0
- DCI format 1C for eIMTA-RNTI
- Uplink carrier aggregation, including mixed duplexing and mixed TDD settings
- Further DL MIMO enhancements (enhanced 4TX codebook)
- 256QAM modulation for PUSCH
- DL LAA (frame structure type 3, DRS for LAA, DCI1C for LAA)
- Support of (e)FD-MIMO CSI-RS
- PUSCH in special subframes (special subframe configuration 10)
- Enhancements for DCI formats 2C/2D
- Support of sidelink transmission for D2D and V2X

Cellular IoT releases 13, 14, 15

- Support of LTE release 13 cellular IoT variants NB-IoT (Cat-NB1) and eMTC (Cat-M1)
- Support of LTE release 14 cellular IoT variants NB-IoT (Cat-NB2) and eMTC (Cat-M2)
- NB-IoT and eMTC downlink and uplink signal generation
- NB-IoT in-band, guard-band and standalone modes
- Realtime processing of HARQ feedback commands for closed-loop base station tests

OneWeb reference signals and OneWeb user-defined signal generation

- Selected reference signals for OneWeb satellite air interface
- Fully standard-compliant OneWeb signal generation
- Highest flexibility for customized signal design
- Signal generation for forward link (SC-TDM) and reverse link (SC-FDMA)
- Define multicarrier scenarios for reverse link
- Single carrier scenarios for forward link

3GPP FDD/HSDPA/HSUPA/HSPA+

- Support 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, DC-HSDPA, 4C-HSDPA and 8C-HSDPA

WLAN 802.11n/ac

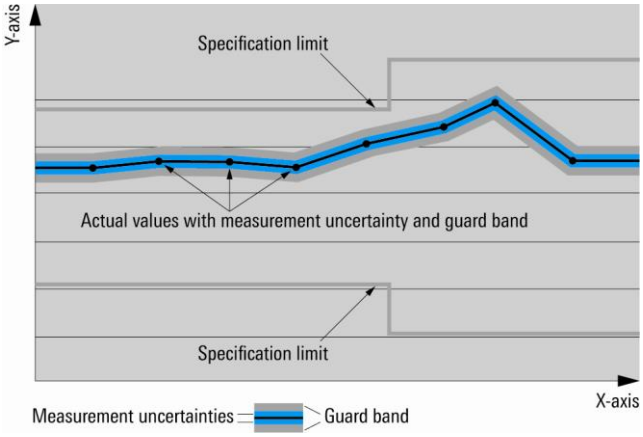
- In line with IEEE 802.11-2012 and IEEE P802.11ac/D1.2
- Support of 3 or 4 TX antennas, ready for MIMO
- Bandwidths of 20 MHz, 40 MHz , 80 MHz and 160 MHz supported
- Frame block types: data, sounding
- Transmit modes: LEGACY, MIXED MODE, GREEN FIELD
- Space-time block coding

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.

Device settings and GUI parameters are indicated as follows: “parameter: value”.

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.

Cellular standards

5G New Radio

For the R&S®SMW-K144 and R&S®SMBVB-K144 options.

3GPP 5G NR digital standard		in line with the following versions of the 3GPP release 15 specifications, or newer: • TS 38.211 15.4.0 • TS 38.212 15.4.0 • TS 38.213 15.4.0 • TS 38.214 15.4.0
Note that the given parameter ranges may be additionally restricted due to inter-parameter dependencies.		
General settings		
RF frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
RF output level		default: –30 dBm, user-selectable in entire output level range of respective Rohde & Schwarz instrument
Sequence length		can be entered in frames (10 ms each); the maximum length depends on the available ARB memory options and the configured 5G NR settings, e.g. the channel bandwidth
Filter mode		channel BW, per BWP, off
Suppress subcarrier on output carrier		off, on
Sample rate variation		off, on
Marker		• subframe • radio frame start • restart (ARB) • user period • on/off period • system frame number restart
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Link direction		downlink, uplink
Node settings		
Number of carriers		1 to 8
RF phase compensation		off, on
Cell indicator	per carrier	0 to 15
Cell ID	per carrier	0 to 1007
Deployment	per carrier	f ≤ 3 GHz, 3 GHz < f ≤ 6 GHz, f > 6 GHz
Frequency in GHz	per carrier	0 to 44 GHz
Channel bandwidth	per carrier Note that the resulting signal sample rate does not only depend on the configured channel bandwidth but also on other 5G NR settings. Note also that not all resulting signal sample rates are supported on all instruments and all system configurations. See the data sheet of the instrument and (for the system configuration) the fading options for the maximum supported sample rate on a specific output of a baseband block.	5 MHz, 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz, 200 MHz, 400 MHz
DMRS TypeA position	per carrier	2, 3
SUL	per carrier	off, on
Point A to carrier center	per carrier	frequency in the lower half of the channel bandwidth
Use 15 kHz SCS	per carrier	off, on
Use 30 kHz SCS	per carrier	off, on
Use 60 kHz SCS	per carrier	off, on
Use 120 kHz SCS	per carrier	off, on
TX BW offset/RB 15 kHz SCSs	per carrier	0 to 9

TX BW offset/RB 30 kHz SCSs	per carrier	0 to 9
TX BW offset/RB 60 kHz SCSs	per carrier	0 to 9
TX BW offset/RB 120 kHz SCSs	per carrier	0 to 9
Number of SS/PBCH patterns	per carrier	0 to 4
SS/PBCH offset relative to	per carrier	TX BW, point A
SS/PBCH subcarrier spacing	per carrier and per SS/PBCH pattern	15 kHz, 30 kHz, 120 kHz, 240 kHz
SS/PBCH RB offset and SC offset	per carrier and per SS/PBCH pattern	in the channel bandwidth
SS/PBCH case	per carrier and per SS/PBCH pattern	A, B, C, D, E
SS/PBCH L	per carrier and per SS/PBCH pattern	4, 8, 64
SS/PBCH positions	per carrier and per SS/PBCH pattern	pattern of 0 or 1
SS/PBCH burst set periodicity	per carrier and per SS/PBCH pattern	5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 160 ms
PSS power	per carrier and per SS/PBCH pattern	–80 dB to +10 dB
SSS power	per carrier and per SS/PBCH pattern	–80 dB to +10 dB
PBCH power	per carrier and per SS/PBCH pattern	–80 dB to +10 dB
PBCH dummy content for MIB	per carrier and per SS/PBCH pattern	off (MIB), on (dummy)
MIB content	per carrier and per SS/PBCH pattern	as of 3GPP TS 38.331
PBCH channel coding	per carrier and per SS/PBCH pattern	off, on
PBCH data source	per carrier and per SS/PBCH pattern	PN9, PN11, PN15, PN16, PN20, PN21, PN23, All0, All1, pattern (length: 1 bit to 64 bit), data lists
Dummy RE state	per carrier	off, on
Dummy RE power	per carrier	–80 dB to +10 dB
Dummy RE subcarrier spacing	per carrier	15 kHz, 30 kHz, 60 kHz, 120 kHz, 240 kHz
Dummy RE modulation	per carrier	BPSK, π/2-BPSK, QPSK, 16QAM, 64QAM. 256QAM
Dummy RE slot format	per carrier	0 to 1
Dummy RE DFT-S	per carrier	off, on
Dummy RE data source	per carrier	PN9, PN11, PN15, PN16, PN20, PN21, PN23, All0, All1, pattern (length: 1 bit to 64 bit), data lists
Users/BWP settings		
Number of users		1 to 10
UE ID	per user	0 to 65535
DSCH/USCH channel coding	per user	off, on
PDSCH data source	per user	PN9, PN11, PN15, PN16, PN20, PN21, PN23, All0, All1, pattern (length: 1 bit to 64 bit), data lists
Number of DL BWPs	per user and per carrier	1 to 4
Number of UL BWPs	per user and per carrier	0 to 4
BWP indicator	per user and per carrier and per BWP	0 to 3
BWP subcarrier spacing	per user and per carrier and per BWP	15 kHz, 30 kHz, 60 kHz, 120 kHz
BWP no. RBs	per user and per carrier and per BWP	in the transmission bandwidth of the respective numerology
BWP RB offset in TX BW	per user and per carrier and per BWP	in the transmission bandwidth of the respective numerology
PDSCH/PUSCH: DMRS configuration type	per user and per carrier and per BWP per DMRS set (DL and UL)	1, 2
PDSCH/PUSCH: DMRS additional position index	per user and per carrier and per BWP per DMRS set (DL and UL)	0 to 3
PDSCH/PUSCH: DMRS maximum length	per user and per carrier and per BWP per DMRS set (DL and UL)	1, 2
PDSCH/PUSCH: use scrambling ID	per user and per carrier and per BWP	off, on
PDSCH/PUSCH: data scrambling ID	per user and per carrier and per BWP	0 to 1023
PDSCH/PUSCH: maximum number of codewords per DCI	per user and per carrier and per BWP	1, 2
PDSCH/PUSCH: VRB-to-PRB interleaver	per user and per carrier and per BWP	non-interleaved
PDSCH/PUSCH: MCS table	per user and per carrier and per BWP	64QAM, 256QAM, 64QAM LowSE
PDSCH/PUSCH: resource allocation	per user and per carrier and per BWP	type 1
PUCCH: additional DMRS	per user and per carrier and per BWP	off, on
PUCCH: π/2-BPSK	per user and per carrier and per BWP	off, on
PUCCH: simultaneous HARQ-ACK-CSI	per user and per carrier and per BWP	off
PUSCH: transform precoding	per user and per carrier and per BWP	off, on
PUSCH: maximum rank	per user and per carrier and per BWP	1 to 4
PUSCH: TX config	per user and per carrier and per BWP	non-codebook, codebook
PUSCH: codebook subset	per user and per carrier and per BWP	fully-and-partial-and-non-coherent, partial-and-non-coherent, non-coherent
PUSCH: MCS table (TP)	per user and per carrier and per BWP	64QAM, 256QAM, 64QAM LowSE

PUSCH UCI: state	per user and per carrier and per BWP	off, on
PUSCH UCI: mode	per user and per carrier and per BWP	UCI only, UCI+UL-SCH
PUSCH UCI: scaling alpha	per user and per carrier and per BWP	0.5, 0.65, 0.8, 1.0
PUSCH UCI: I_HARQ_offset 0/1/2	per user and per carrier and per BWP	0 to 15
PUSCH UCI: I_CSI1_offset 0/1	per user and per carrier and per BWP	0 to 18
PUSCH UCI: I_CSI2_offset 0/1	per user and per carrier and per BWP	0 to 18
Scheduling settings		
Number of allocations	per carrier and per subframe and per BWP	0 to 64
Content	per carrier and per subframe and per BWP and per allocation	CORESET, PDSCH, PUSCH, PRACH, PUCCH
Slot	per carrier and per subframe and per BWP and per allocation	0 to 15
Map type (PDSCH/PUSCH)	per carrier and per subframe and per BWP and per allocation	A, B
Format (PUCCH)	per carrier and per subframe and per BWP and per allocation	F0, F1, F2, F3, F4
Slot format	per carrier and per subframe and per BWP and per allocation	0 to 1
No. sym.	per carrier and per subframe and per BWP and per allocation	1 to 14
Sym. offset	per carrier and per subframe and per BWP and per allocation	0 to 13
No. RBs	per carrier and per subframe and per BWP and per allocation	in the respective BWP
RB offset	per carrier and per subframe and per BWP and per allocation	in the respective BWP
Modulation	per carrier and per subframe and per BWP and per allocation	BPSK, π/2-BPSK, QPSK, 16QAM, 64QAM, 256QAM
DFT-S	per carrier and per subframe and per BWP and per allocation	off, on
Power	per carrier and per subframe and per BWP and per allocation	–80 dB to +10 dB
State	per carrier and per subframe and per BWP and per allocation	off, on
Repetition	per carrier and per subframe and per BWP and per allocation	off, slot, subframe, frame
PDSCH type	per carrier and per subframe and per BWP and per allocation	DCI format 1_0, DCI format 1_1
PUSCH type	per carrier and per subframe and per BWP and per allocation	DCI format 0_0, DCI format 0_1
Modulation	per carrier and per subframe and per BWP and per allocation	BPSK, π/2-BPSK, QPSK, 16QAM, 64QAM, 256QAM
Number of codewords (PDSCH)	per carrier and per subframe and per BWP and per allocation	1, 2
DMRS length	per carrier and per subframe and per BWP and per allocation	1, 2
DMRS power	per carrier and per subframe and per BWP and per allocation	–80 dB to 10 dB
CDM groups without data	per carrier and per subframe and per BWP and per allocation	1 to 3
Number of layers	per carrier and per subframe and per BWP and per allocation	1 to 8 (PDSCH), 1 to 4 (PUSCH)
Antenna ports	per carrier and per subframe and per BWP and per allocation	1000 to 1011 (PDSCH), 0 to 11 (PUSCH)
I_MCS	per carrier and per subframe and per BWP and per allocation	0 to 28
Redundancy version index	per carrier and per subframe and per BWP and per allocation	0 to 3
Antenna ports mapping	per carrier and per subframe and per BWP and per allocation	real, imag value mapping from antenna ports to baseband outputs
Coreset settings		
Interleaving state	per carrier and per subframe and per BWP and per coreset allocation	off, on
Interleaving bundle size	per carrier and per subframe and per BWP and per coreset allocation	2, 3, 6
Interleaving shift index	per carrier and per subframe and per BWP and per coreset allocation	0 to 274

Interleaving size	per carrier and per subframe and per BWP and per coreset allocation	2, 3, 6
Precoder granularity	per carrier and per subframe and per BWP and per coreset allocation	REG bundle, all contiguous RBs
Use DMRS scrambling ID	per carrier and per subframe and per BWP and per coreset allocation	off, on
ID	per carrier and per subframe and per BWP and per coreset allocation	0 to 65535
Number of DCIs	per carrier and per subframe and per BWP and per coreset allocation	1 to 4
Usage	per DCI	C-RNTI
DCI format	per DCI	0_0, 0_1, 1_0, 1_1, custom
Search space	per DCI	USS, Type3 USS
Aggregation level	per DCI	1, 2, 4, 8, 16
CCE index	per DCI	in the whole CORESET
Content	per DCI	as of 3GPP TS 38.212
Create PDSCH	per DCI	off, on
PUCCH settings		
Group hopping	per carrier and per subframe and per BWP and per PUCCH allocation	neither, enable, disable
Hopping ID	per carrier and per subframe and per BWP and per PUCCH allocation	0 to 1024
Intra slot frequency hopping	per carrier and per subframe and per BWP and per PUCCH allocation	off, on
Second hop PRB	per carrier and per subframe and per BWP and per PUCCH allocation	0 to 272
Initial cyclic shift	per carrier and per subframe and per BWP and per PUCCH allocation	0 to 11
Payload and format specific settings	per carrier and per subframe and per BWP and per PUCCH allocation	as needed for the different PUCCH formats
PRACH settings		
PRACH subcarrier spacing	per carrier and per subframe and per BWP and per PRACH allocation	1.25 kHz, 5 kHz, 15 kHz, 30 kHz, 60 kHz, 120 kHz
Format	per carrier and per subframe and per BWP and per PRACH allocation	0, 1, 2, 3, A1, A2, A3, B1, B2, B3, B4, C0, C2
Restricted set	per carrier and per subframe and per BWP and per PRACH allocation	unrestricted, type A, type B
Logical root sequence	per carrier and per subframe and per BWP and per PRACH allocation	0 to 837
Zero correlation zone	per carrier and per subframe and per BWP and per PRACH allocation	0 to 15
Preamble index	per carrier and per subframe and per BWP and per PRACH allocation	0 to 63

5G NR closed-loop BS test

For the R&S®SMW-K145 option.

For each K145 option, a K144 option must also be installed on the respective instrument.

General description	This option enhances the K144 option (5G New Radio digital standard) to support realtime processing of feedback commands for HARQ feedback in order to be able to perform uplink closed-loop base station tests in line with 3GPP TS 38.141. The K145 option requires the K144 option. Therefore, all general parameters of the K144 options are also valid for the K145 option, unless stated otherwise in the sections below.	
Closed loop feedback configuration		
Closed loop feedback mode	switches on closed loop feedback processing and selects the mode	off, serial, serial 3 × 8; serial and serial 3 × 8 is only possible if number of carriers is 1
Connector	specifies the connector to be used for the feedback commands	depends on the respective Rohde & Schwarz instrument
Additional user delay (in units of slots)	used for the determination of the points in time when the instrument expects the feedback commands	–20.00 to –1.00

Baseband selector	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, 1.6 Mbps, 1.92 Mbps
Changes in the parameter ranges of parameters that are also present without the K145 option (These changes apply only if the closed loop feedback functionality is used.)		
Filter mode	in case closed loop feedback mode is serial or serial 3 × 8	off

Verizon 5GTF signals

For the R&S®SMW-K118 option.

Predefined configurations		Downlink_Config_{1-4}, Uplink_Config_{1-4}
General settings		
Downlink		
Scheduling		manual, AutoDCI
CA		
Phys. cell ID		0 to 503
N_ID^CSI		0 to 503
Rel. power (CSI)		–80 dB to 10 dB
Signals		
P-SYNC power		–80 dB to 10 dB
S-SYNC power		–80 dB to 10 dB
E-SYNC power		–80 dB to 10 dB
Number of antenna ports (BRS)		1, 2, 4 or 8
BRS transmission period		1 slot, 1 subframe, 2 subframes, 4 subframes
Antenna ports		
Antenna ports		AP 0-7 (xPBCH), AP 16-31 (CSI-RS), AP 300-313 (PSS, SSS, ESS)
Frame configuration		
General		
Number of configurable subframes		1 to 48
User configuration		
State		on/off
TX modes		mode 1, mode 2, mode 3
Antenna mapping		AP 8-15 (xPDSCH), AP 60/61 (DL PCRS), AP 107/109 (xPDCCH)
UE ID		0 to 503
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1
Subframe configuration		
Modulation		QPSK, 16QAM, 64QAM, 256QAM
No. RB		4 to 100
No. sym.		1 to 11
Offset RB		0 to 96
Offset sym.		1, 2
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1
Rel. power		–80 dB to 10 dB
Content type		xPDSCH, CSI-RS, xPDCCH, xPBCH
Enhanced settings		
Precoding	TX mode 1	none
	TX mode 2	TX diversity
	TX mode 3	TX diversity, spatial multiplexing
Antenna ports (precoding)	xPBCH	AP 0 to 7
	xPDSCH	AP 8 to 15
	xPDCCH	AP 107/109
N_SCID	xPDSCH	0, 1
N_ID (DMRS)	xPDSCH	N_ID^Cell, N_ID^DMRS
N_ID^DMRS	xPDSCH	0 to 503
AP configuration (DL PCRS)	xPDSCH	none, 60, 61, 60/61
Rel. power (DL PCRS)	xPDSCH	–80 dB to 10 dB

N_ID (DL PCRS)	xPDSCH	N_ID^Cell, N_ID^DMRS
N_ID^PCRS	xPDSCH	0 to 503
Antenna ports (CSI)	CSI-RS	AP 16/17, AP 18/19, AP 20/21, AP 22/23, AP 24/25, AP 26/27, AP 28/29, AP 30/31
xPDCCH		
Rel. power		–80 dB to 10 dB
Dummy CCE xREGs		data, DTX
Dummy CCE data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1
User		User1, User2, User3, User4
DCI format		A1, A2, B1, B2
xPDCCH format		0 to 3
xPDCCH symbol		0, 1
CCE index		0 to 14
Content	can be set according to V5G.213 specification	bit data
Uplink		
General settings		
Physical cell ID		0 to 503
Frame configuration		
No. of xPUCCH configuration		1 to 48
No. of xPUSCH configuration		1 to 48
User configuration		
UE ID/n_RNTI		0 to 65535
UE power		–80 dB to 10 dB
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1
Channel coding		on/off
Relative UE baseband power		–80 dB to 10 dB
Subframe configuration		
Modulation		QPSK, 16QAM, 64QAM, 256QAM
No. RB		4 to 100
No. offset	depends on no. RB	0 to 96
Rel. power		–80 dB to 10 dB
n_xPUCCH^2	xPUCCH	0 to 15
RE mapping Index k_i	xPUSCH	0 to 4
N_ID (DMRS)	xPUSCH	N_ID^Cell, N_ID^DMRS
N_ID^DMRS	xPUSCH	0 to 503
UL PCRS state	xPUSCH	on/off
Rel. power (UL PCRS)	xPUSCH	–80 dB to 10 dB
N_ID (UL PCRS)	xPUSCH	N_ID^Cell, N_ID^DMRS
N_ID^PCRS	xPUSCH	0 to 503
Code rate	xPUSCH, depends on modulation, RBs	$^1/_2$, $^2/_3$, $^3/_4$, $^5/_6$
Transport block size	xPUSCH, according to V5G.212	see table in V5G.212

EUTRA/LTE digital standard

For the R&S®SMW-K55, R&S®SMBVB-K55 and R&S®SMBV-K55 options.

EUTRA/LTE digital standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
General settings		
RF frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
RF output level		default: –30 dBm, user-selectable in entire output level range of respective Rohde & Schwarz instrument
Test case wizard	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); the maximum length depends on the available ARB memory options and the configured LTE settings, e.g. the channel bandwidth and the filter settings	
Mode	restricts the user interface to certain LTE/cellular IoT features for simplicity or enables access to all features according to the installed options	only available if EUTRA as well as cellular IoT option(s) are installed in the instrument

Baseband filter	EUTRA/LTE filter with different optimization modes	best EVM, best ACP, best ACP (narrow), best EVM (no upsampling); for some LTE configurations, the filter is configured automatically
	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 part • restart (ARB) • user period • on/off period • system frame number restart
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.8.12.0 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 cell specific antenna configuration	1, 2, 4 transmit antennas, SISO + BF
Simulated antenna	simulated antenna, not available for R&S®SMBVB-K55 For SMW “coupled” system configurations, and “coupled per entity” system configurations, the simulated antennas are determined automatically.	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	up to 60
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, All0, All1
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
State	sets state of selected allocation	on/off
Enhanced settings PBCH		
Scrambling state		on/off
Channel coding state	enables channel coding (FEC)	on/off
MIB (including SFN)	activates automatic MIB generation for PBCH	on/off

SFN offset	sets starting system frame number encoded in MIB	0 to 1020, in steps of 4
SFN restart period	SFN counter is restarted after specified period	sequence length
MIB spare bits	sets the MIB spare bits	pattern of 10 bits
Transport block size		1 to 100000
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 4 OFDM symbols
PHICH power	determines power of a single PHICH symbol	–80 dB to +10 dB, in steps of 0.01 dB
Number of PHICH groups		0 to 112
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 0.01 dB
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, All0, All1
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 users that can be distributed over the entire frame configuration 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.	
Transmission mode	selects the downlink transmission mode	user, mode 1 to mode 7
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, All0, All1
Configure dummy data		
Dummy data modulation		QPSK, 16QAM, 64QAM
Dummy data source		PN9, PN11, PN15 to PN 23, data list, pattern, All0, All1

Dummy data power	determines power of dummy data allocations	–80 dB to +10 dB, in steps of 0.01 dB
Uplink simulation		
Additional 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
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
A/N-SRS simultaneous TX	enables simultaneous transmission of SRS and PUCCH	on/off
Resource allocation uplink		
Select user equipment	Up to 8 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		
3GPP release		release 8/9, LTE-Advanced
UE ID/n_RNTI	user equipment identifier (n_RNTI) for selected user equipment	0 to 65535
Override cell ID	possibility to override the cell ID for individual users	on/off
Cell ID		0 to 503
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, A1-6, A1-7, 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, A12-1, A12-2, A12-3, A12-4, A12-5, A12-6, A13-1, A13-2, A13-3, A13-4, A13-5, A13-1 (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 for layer 0 in the enhanced settings for PUSCH.	0, 2, 3, 4, 6, 8, 9, 10
Data source	determines data source used for PUSCH of selected UE	PN9, PN11, PN15 to PN 23, data list, pattern, All0, All1
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
Transmit trigger type 0 SRS	enables the transmission of SRS trigger type 0	always on if “3GPP release” is “release 8/9”
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		
Cyclic shift field	for DRS	0 to 7
n(2)_DMRS,0	sets for layer 0 the part of the DMRS index which is part of the uplink scheduling assignment	0, 2, 3, 4, 6, 8, 9, 10
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 A/N bits		0 to 20
ACK/NACK pattern		0, 1
Number of RI bits		0 to 512
RI pattern		0, 1
Number of CQI bits		0 to 1024
CQI pattern		0, 1
Transport block size UL-SCH		1 to 253440
Redundancy version index UL-SCH		0 to 3

Enhanced settings for PUCCH		
n_PUCCH	sets PUCCH index	range depends 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®SMW-K69 option.

For each K69 option, a K55 or K115 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. Alternatively, this option enhances the K115 option (Cellular IoT standard) to support realtime processing of feedback commands for HARQ feedback in order to be able to perform IoT uplink closed-loop base station tests in line with 3GPP TS 36.141. The K69 option requires the K55 or K115 option. Therefore, all general parameters of the K55 and K115 options 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). In case of option K69 with option K55, two types of commands are supported: binary commands (for HARQ feedback) and serial commands (for HARQ feedback, timing adjustment and timing advance). In case of option K69 with option K115, serial commands for HARQ feedback are supported.	
Uplink realtime feedback configuration for UE1		
Realtime feedback mode	switches on realtime feedback processing and selects the mode	
	UE 3GPP release “release 8/9” and “LTE Advanced”	off, binary, serial, serial 3 × 8
	UE 3GPP release “NB-IoT” and “eMTC”	off, serial, serial 3 × 8

Redundancy version sequence (only available for UE 3GPP release “release 8/9” and “LTE”)	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 (only available for UE 3GPP release “release 8/9” and “LTE”)	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 and only available for UE 3GPP release “release 8/9” and “LTE”)	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 (only available for UE 3GPP release “release 8/9” and “LTE”)	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	depends on the respective Rohde & Schwarz instrument
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 (in units of subframe)	used for the determination of the points in time when the instrument expects the feedback commands	
	range if binary realtime feedback mode is selected and distance mode is “3GPP”	–1.00 to +2.99
	range if binary realtime feedback mode is selected and distance mode is “direct response”	1.00 to 6.99
	range if UE 3GPP release is “release 8/9” or “LTE Advanced” and serial realtime feedback mode or serial 3x8 realtime feedback mode is selected	–1.00 to +1.99
	range if UE 3GPP release is “NB-IoT” or “eMTC”	–18.00 to –0.3
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 (only available for UE 3GPP release “release 8/9” and “LTE”)	simulation of block errors	off, first HARQ process, all HARQ processes
Block error rate (only available for UE 3GPP release “release 8/9” and “LTE”)		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
	filter mode	realtime

EUTRA/LTE, 5G NR log file generation

For the R&S®SMW-K81 option.

EUTRA/LTE

For each K81 option, a K55 option and/or K115 option must also be installed on the respective instrument.

General description	This option enhances the K55 and/or K115 option(s) (EUTRA/LTE digital standard, Cellular IoT) 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). The actual availability of logging points and channels also depends on the presence of other EUTRA/LTE options.	
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, PMCH, PCFICH/PHICH/PDCCH	
Uplink	PUSCH including UCI, PUCCH, PUSCH DRS, PUCCH DRS, SRS	
Note: In case of configured NB-IoT (Cat-NB1) or eMTC (Cat-M1) signals, the respective channels are logged, where applicable.		
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.	

5G NR

For each K81 option, a K144 option must also be installed on the respective instrument.

General description	This option enhances the K144 option (5G New Radio) to generate logging files that contain intermediate results from the signal processing. The intermediate results are stored in json-files either in bit stream or I/Q sample format, depending on the type of logging point.	
General settings		
Logging state		off, on
Output path	The output path the logging files are stored to is user-selectable.	

EUTRA/LTE release 9 and enhanced features

For the R&S®SMW-K84, R&S®SMBVB-K84 and R&S®SMBV-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) • MIB SFN generation independent from the ARB sequence length (only for SMW with standard baseband R&S®SMW-B10) 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 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
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
Transmission mode	selects the downlink transmission mode	transmission mode range is extended by transmission mode 8
DCI format	selects the DCI format	DCI format range is extended by format 2B
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 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 [6]	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
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 [7]	0 to 7 frames

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

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

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 [7]	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, All0, All1
MIB SFN generation independent from the ARB sequence length		
SFN restart period (not available for the R&S®SMBV-K84 option, not available for the R&S®SMBVB-K84 option, not available for R&S®SMW-B9 wideband baseband)	SFN counter is restarted after specified period	sequence length, 3GPP (1024 frames)

EUTRA/LTE release 10/LTE-Advanced

For the R&S®SMW-K85, R&S®SMBVB-K85 and R&S®SMBV-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) • DL transmission mode 9 for up to 8 layer beamforming • PUCCH format 3 • Simultaneous PUSCH and PUCCH transmission • Noncontiguous PUSCH transmission (uplink resource allocation type 1) • PUSCH transmission mode 2 (uplink MIMO) • Aperiodic SRS (SRS trigger 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 with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
Downlink simulation		
CSI reference signals		
This option enables the generation of DL CSI reference signals. References to the official 3GPP TS 36.331 v.10.8.0 specification are abbreviated as 36.331.		
General CSI settings		
ZeroPowerCSI-RS (HEX)	(from 36.331, CSI-RS-Config) each bit set to '1' in this bitmap enables the corresponding CSI-RS configuration to be used for zero transmission power	0x0000 to 0xFFFF
Subframe config (I_CSI-RS)	(from 36.331, CSI-RS-Config) defines the subframes that contain the ZeroTXPower CSI-RS	0 to 154
CSI-RS state	enables the transmission of CSI reference signals in the cell	on/off
Number of CSI-RS antenna ports	(from 36.331, CSI-RS-Config) defines the number of antenna ports used for CSI-RS; the antenna ports are mapped to the physically available antennas in the "AP mapping" panel	1, 2, 4, 8
CSI-RS configuration	(from 36.331, CSI-RS-Config) Note: The range of valid configurations depends on the cyclic prefix, duplex mode and number of CSI antenna ports.	0 to 31
Subframe config (I_CSI-RS)	(from 36.331, CSI-RS-Config) defines the subframes that contain the CSI-RS	0 to 154
CSI-RS power	sets the CSI-RS EPRE in relation to the cell-specific RS (CRS)	–8.00 dB to +15.00 dB
Configure user/PDSCH enhanced settings for CSI		
CSI awareness	defines whether the receiving UE is aware of the CSI-RS or not; PDSCH coding and mapping are adjusted accordingly	on/off
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 × secondary vells/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, or the instrument's signal routing and system configuration. References to the official 3GPP TS 36.331 v.10.8.0 specification are abbreviated as 36.331.		
General CA settings		
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 in 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 or not the CIF (carrier indicator field) is present 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
PHICH N_g		1/6, 1/2, 1, 2, custom
PHICH duration		normal, extended
Power	sets the power offset of the SCell relative to the PCell	–80.00 dB to +10.00 dB
Delay	configures a time delay of the SCell relative to the PCell	0 to 700000 ns
State	activates/deactivates this cell	on/off
CA settings in the downlink user configuration		
Activate CA	activates/deactivates CA support for the user	on/off
UL carriers	activates/deactivates the associated uplink carriers for the downlink carriers	on/off
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
DL transmission mode 9 for up to 8 layer beamforming		
This option enables the generation of downlink signals dedicated to UE that is set to transmission mode 9. In order to support this mode, the DCI format 2C is introduced. The way that the (logical) antenna ports are mapped to the (physical) TX antennas of the signal generator is configurable.		
Transmission mode	selects the downlink transmission mode	transmission mode range is extended by transmission mode 9
DCI format	selects the DCI format	DCI format range is extended by format 2C
Uplink simulation		
General configuration		
This option enables the generation of uplink signals in line with EUTRA release 10.		
3GPP release	selects the functionality for a user equipment	release 8/9, LTE-Advanced
Number of configurable uplink subframes	independently configurable for PUSCH and PUCCH if a user equipment is a configured LTE-Advanced 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 LTE-Advanced user equipment.		
Modulation/format (for the PUCCH of a configured LTE-Advanced 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 LTE-Advanced user equipment in the same subframe.		
Content	For a configured LTE-Advanced user equipment, both channel types are available for configuration in the same subframe.	PUCCH, PUSCH
Noncontiguous PUSCH transmission (uplink resource allocation type 1)		
This option enables the generation of PUSCH with noncontiguous 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 an LTE-Advanced 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 an LTE-Advanced 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 an LTE-Advanced 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 an LTE-Advanced 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
PUSCH transmission mode 2 (uplink MIMO)		
This option enables the generation of PUSCH with transmission mode 2 (uplink MIMO)		
Transmission mode	transmission mode for PUSCH, only available for LTE-Advanced user equipment	1 (spatial multiplexing not possible), 2 (spatial multiplexing possible)
Maximum number of antenna ports for PUSCH		1, 2, 4
Activate DMRS with OCC for one antenna port		on/off
Number of antenna ports for SRS		1, 2, 4
Number of antenna ports for PUCCH format 1/1a/1b		1, 2
Number of antenna ports for PUCCH format 2/2a/2b		1, 2
Number of antenna ports for PUCCH format 3		1, 2
Precoding scheme	for PUSCH	none, spatial multiplexing
Number of codewords	for PUSCH	1, 2
Number of layers	for PUSCH	1, 2, 4
Number of used antenna ports	for PUSCH	1, 2, 4
Codebook index	for PUSCH	depends on the codewords/layers/antenna ports configuration
Cyclic shift field	for PUSCH DRS	0 to 7
Transport block size	for PUSCH codeword 1	1 to 100000
Redundancy version index	for PUSCH codeword 1	0 to 3
n_PUCCH antenna port 201	for PUCCH	range depends on cell-specific settings
Aperiodic SRS (SRS trigger type 1)		
This option enabled the generation of SRS signals according to SRS trigger type 1 (aperiodic SRS).		
Transmit trigger type 0 SRS	enables the transmission of SRS trigger type 0 in addition to SRS trigger type 1	always on for a release 8/9 user equipment; on/off for an LTE-Advanced user equipment
Configuration sets for trigger type 1	individual SRS configuration sets for trigger type 1 SRS transmissions	DCI0, DCI1A/2B/2C/2D, DCI4Set1, DCI4Set2, DCI4Set3
Number of transmissions	number of scheduled SRS transmissions for a specific configuration set	0 to 50
Subframes for transmissions	subframes in which SRS transmissions are scheduled for a specific configuration set	the range depends on the configured ARB sequence length

LTE release 11 and enhanced features

For the R&S®SMW-K112, R&S®SMBVB-K112 and R&S®SMBV-K112 options.

For each K112 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 11 and enhanced features, including the following features: • Release 11 special subframe configurations 9 (normal cyclic prefix) and 7 (extended cyclic prefix) • PUCCH format 3 for periodic CSI • Uplink carrier aggregation including mixed TDD settings • Mixed TDD settings for downlink carrier aggregation • "Auto Sequence" PDSCH scheduling mode for automatic scheduling of downlink transmissions according to long HARQ patterns • Enhanced PDCCH (EPDCCH) • Transmission mode 10, DCI format 2D, scrambling settings for CoMP/eICIC/feICIC The K112 option requires the K55 option. Therefore, all general parameters of the K55 option are also valid for the K112 option, unless stated otherwise in the sections below.	
EUTRA/LTE digital standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
Release 11 special subframe configurations		
This option enables the generation of TDD signals with special subframe configuration 9 and normal cyclic prefix, as well as of TDD signals with special subframe configuration 7 and extended cyclic prefix.		
TDD special subframe config	defines the special subframe configuration for TDD (frame structure type 2)	0 to 9 For values 8 and 9, only the normal cyclic prefix is allowed. For values 0 to 7, the normal and the extended cyclic prefixes are allowed.
PUCCH format 3 for periodic CSI		
This option enables the generation of PUCCH format 3 with up to 22 information bits before channel coding, independently of the duplexing mode. This is necessary for transmitting periodic CSI reports by means of PUCCH format 3.		
Number of A/N + SR + CSI bits	defines the number of PUCCH format 3 information bits before channel coding	0 to 22
Uplink carrier aggregation		
This option enables the generation of uplink carrier aggregation signals with up to five component carriers (1 × primary cell/PCell and 4 × 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, or the instrument's signal routing and system configuration. References to the official 3GPP TS 36.331 v.10.8.0 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	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 in MHz	defines the frequency shift for this SCell relative to the PCell	
	range	depends on the respective Rohde & Schwarz instrument
	resolution	1 MHz
UL/DL config	in case of TDD: UL/DL config of this uplink component carrier	0 to 6
Special SF config	in case of TDD: special subframe configuration of this uplink component carrier	0 to 9
n(1)_DMRS	sets the broadcast part of the DMRS index for the SCell	0 to 11
SRS SF config	SRS subframe configuration for the SCell	0 to 15
SRS BW C_SRS	SRS bandwidth configuration for the SCell	0 to 7
Delay	configures a time delay of the SCell relative to the PCell	0 s to 700 000 ns

State	activates/deactivates this cell	on/off
Cell	in the user equipment configuration and the user equipment's antenna port mapping table	PCell, SCell 1, SCell 2, SCell 3, SCell 4
Cell	in the subframe configuration	PCell, SCell 1, SCell 2, SCell 3, SCell 4
Power	for a specific cell (in the antenna port mapping table)	–80 dB to 10 dB
Mixed TDD settings for downlink carrier aggregation		
This option enables the usage of different tdd settings (uplink downlink configuration, special subframe configuration) in individual component carriers for downlink carrier aggregation, in line with EUTRA release 11.		
UL/DL config	in case of TDD: UL/DL config of this downlink component carrier	0 to 6
Special SF config	in case of TDD: special subframe configuration of this downlink component carrier	0 to 9
Auto sequence PDSCH scheduling mode		
This option enables the use of the "Auto Sequence" PDSCH scheduling mode. This mode allows easy configuration of downlink transmissions according to long HARQ patterns. In the "Manual" and "Auto/DCI" scheduling modes, which are also available without the K112 option, the maximum HARQ pattern length is limited by the maximum number of configurable downlink subframes. In the "Auto Sequence" scheduling mode, this limitation does not apply.		
PDSCH scheduling	determines the PDSCH scheduling mode	manual, auto/DCI, auto scheduling
Number of configurable subframes	determines the number of independent subframe configurations	not available in "Auto Sequence" PDSCH scheduling mode (because the subframe configurations are determined automatically in this mode)
DCI format	PDCCH settings	In the "Auto Sequence" PDSCH scheduling mode, only one downlink DCI and one uplink DCI can be configured per user and cell (in this mode, downlink and uplink DCIs are determined automatically from these template DCIs).
Parameters for autofill sequences		
Autofill DL sequence	determines whether the autofill feature creates entries in the downlink auto sequence tables	off, on
Number of HARQ process IDs	determines the number of downlink HARQ process IDs available for the autofill feature	1 to 15
Starting NDI (downlink)	determines whether the autofill feature starts with NDI 0 or 1 in the downlink auto sequence tables	off, on
Number of HARQ transmissions (downlink)	determines the number of HARQ transmissions in each downlink HARQ process before a retransmission is scheduled	1 to 32
Skip process at unused subframes	determines whether the HARQ process IDs are skipped in unused subframes	off, on
Subframes to use	determines which downlink or special subframes should be used for downlink transmission	off, on (per subframe)
Autofill UL sequence	determines whether the autofill feature should create entries in the uplink auto sequence tables	off, on
Number of HARQ transmissions (uplink)	determines the number of HARQ transmissions in each uplink HARQ process before a retransmission is scheduled	1 to 32
Starting NDI (uplink)	determines whether the autofill feature starts with NDI 0 or 1 in the uplink auto sequence tables	off, on
Parameters for downlink auto sequence tables		
MCS mode	determines the MCS mode	manual, fixed, target code rate
Target code rate	determines the target code rate	0 to 1
Target modulation	determines the target modulation	QPSK, 16QAM, 64QAM
MCS (for fixed MCS mode)	determines the MCS for fixed MCS mode	0 to 31
RV coding sequence	determines the sequence of redundancy versions used for HARQ transmissions	sequence of values 0 to 3

Subframe	subframe number of an actual downlink transmission	range depends on available ARB memory
MCS (for manual MCS mode)	MCS of an actual downlink transmission	0 to 31
HARQ process	HARQ process ID of an actual downlink transmission	0 to 15
NDI	NDI of an actual downlink transmission	off, on
Parameters for uplink auto sequence tables		
Vary UL TX power and RBA	determines whether the TPC commands and the ressource block asignments can vary inside the uplink DCI transmissions	off, on
Subframe	subframe number of an actual uplink DCI transmission	range depends on available ARB memory
RBA	determines the ressource block assignment of an actual uplink DCI transmission	range depends on channel bandwidth
NDI	determines the NDI of an actual uplink DCI transmission	off, on
PUSCH TPC	determines the PUSCH TPC of an actual uplink DCI transmission	0 to 3
Enhanced PDCCH (EPDCCH)		
This option enables the use of the Enhanced PDCCH (EPDCCH) channel in the PDSCH scheduling modes “Auto/DCI” and “AutoSequence”		
Parameters in the user configuration		
Activate EPDCCH	activates the EPDCCH for this user	off, on
Set 1 / 2 state	activates the EPDCCH set 1 / 2	off, on
Set 1 / 2 transmission type	determines the transmission type for EPDCCH set 1 / 2	localized/distributed
Set 1 / 2 number of PRB pairs	determines the number of PRB pairs for EPDCCH set 1 / 2	2, 4, 8
Set 1 / 2 resource block assignment	determines the resource block assignment for EPDCCH set 1 / 2	range depends on channel bandwidth and other EPDCCH settings
Set 1 / 2 n^EPDCCH_ID	determines the users specific EPDCCH identifier for EPDCCH set 1 / 2	0 to 503
Set 1 / 2 rel. EPDCCH power	determines the relative EPDCCH power of EPDCCH set 1 / 2	–80 dB to +10 dB
Antenna port mapping for antenna ports 107 to 110	configures the antenna port mapping for the EPDCCH antenna ports 107 to 110	complex mapping values where real and imaginary parts range from –1.0 to 1.0
Parameters in the DCI configuration		
(E)PDCCH	selects whether the DCI is transmitted in the PDCCH or EPDCCH set 1 or EPDCCH set 2	PDCCH, EPDCCH Set 1, EPDCCH set 2
Transmission mode 10, DCI format 2D, scrambling settings for CoMP/eICIC/feICIC		
This option enables the use of downlink transmission mode 10, DCI format 2D and scrambling settings for CoMP, eICIC, feICIC.		
Parameters in the user configuration		
Transmission mode	selects the downlink transmission mode	transmission mode range is extended by transmission mode 10
Use DMRS scrambling identities	activates the usage of alternative DMRS scrambling identities for individual downlink carriers	off, on
DMRS scrambling identity 1	configures the DMRS scrambling identity 1	0 to 503
DMRS scrambling identity 2	configures the DMRS scrambling identity 2	0 to 503
Parameters in the DCI configuration		
DCI format	selects the DCI format	DCI format range is extended by format 2D

EUTRA/LTE release 12

For the R&S®SMW-K113, R&S®SMBVB-K113 and R&S®SMBV-K113 options.

For each K113 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 12, including the following features: • 256QAM modulation for PDSCH, downlink dummy resource elements and PMCH • Downlink test models for 256QAM in line with 3GPP TS 36.141 v.12.9.0 • DCI format 1C for eIMTA-RNTI • Mixed duplexing for uplink and downlink carrier aggregation • Further DL MIMO enhancements (enhanced 4TX codebook) • Sidelink (D2D) The K113 option requires the K55 option. Therefore, all general parameters of the K55 option are also valid for the K113 option, unless stated otherwise in the sections below.	
EUTRA/LTE digital standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
256QAM modulation for PDSCH, downlink dummy resource elements and PMCH		
This option enables the generation of downlink signals with 256QAM modulation in the PDSCH channel, the PMCH channel, as well as in the dummy OFDM resource elements.		
Parameter	**Condition**	**Range**
Modulation	dummy data configuration	QPSK, 16QAM, 64QAM, 256QAM
MCS table 2	downlink user configuration	on/off
Modulation	PDSCH allocation	QPSK, 16QAM, 64QAM, 256QAM
Use table 2	PMCH configuration	on/off
Downlink test models for 256QAM in line with 3GPP TS 36.141 v.12.9.0		
This option enables the configuration and generation of the 256QAM test models in line with 3GPP TS 36.141 v.12.9.0 for FDD as well as TDD.		
Parameter	**Condition**	**Range**
EUTRA test models (downlink)	in line with 3GPP TS 36.141 v.12.9.0 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, E-TM2a, E-TM3.1a
DCI format 1C for eIMTA-RNTI		
This option enables the generation of downlink DCI format 1C in case of eIMTA-RNTI.		
Parameter	**Condition**	**Range**
eIMTA-RNTI	downlink user configuration for TDD	1 to 65523
User	PDCCH DCI configuration	user1 eIMTA, user2 eIMTA, user3 eIMTA, user4 eIMTA
UL/DL configuration	DCI 1C configuration in case of eIMTA-RNTI	pattern of 0 or 1, length 12
Mixed duplexing for uplink and downlink carrier aggregation		
This option enables the usage of different duplexing modes (FDD, TDD) in individual component carriers for uplink and downlink carrier aggregation, in line with EUTRA release 12.		
Duplexing	duplexing of this component carrier	FDD, TDD
Further DL MIMO enhancements (enhanced 4TX codebook)		
This option enables the usage of the enhanced 4TX codebook, in line with EUTRA release 12.		
Use alternative codebooks	in case of 4TX	off, on
Sidelink		
This option enables the configuration and generation of D2D signals in line with EUTRA release 12.		
Parameters in the sidelink table in the user configuration		
Parameters in the common tab		
State		off, on
Mode		communication, discovery
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN 23, data list, pattern, All0, All1
Restart data every transmission		off, on
Communication mode		
Parameters in the resource pool control tab		
Control period	FDD: {40;80;160;320} TDD UL/DL config 0: {70:140;280} TDD UL/DL config 1-5: {40;80;160;320} TDD UL/DL config 6: {60;120;240}	60, 40, 70, 80, 120, 140, 160, 240, 280, 320 subframes
Offset indicator		0 to 319 subframes
PRB start	range depends on the signal bandwidth	0 to number of RBs – 1
PRB end	range depends on the signal bandwidth	0 to number of RBs – 1
PRB number	range depends on the signal bandwidth	1 to number of RBs

Control subframe bitmap	must always contain at least two “1”	FDD: 40 bit TDD config 0: 42 bit TDD config 1: 16 bit TDD config 2: 8 bit TDD config 3: 12 bit TDD config 4: 8 bit TDD config 5: 4 bit TDD config 6: 30 bit
Parameters in the resource pool data tab		
Offset indicator	depends on the control period from control resource pool	0 to 319 subframes
PRB start	range depends on the signal bandwidth	0 to number of RBs – 1
PRB end	range depends on the signal bandwidth	0 to number of RBs – 1
PRB number	range depends on the signal bandwidth	1 to number of RBs
Control subframe bitmap	must always contain at least one “1”	FDD: 40 bit TDD config 0: 42 bit TDD config 1: 16 bit TDD config 2: 8 bit TDD config 3: 12 bit TDD config 4: 8 bit TDD config 5: 4 bit TDD config 6: 30 bit
TRPT subset	must always contain at least one “1”	FDD: 3 bit TDD config 0: 5 bit TDD config 1: 3 bit TDD config 2: 3 bit TDD config 3: 4 bit TDD config 4: 3 bit TDD config 5: 3 bit TDD config 6: 4 bit
Hopping parameter		0 to 504
Number of subbands		1, 2, 4
RB offset	range depends on the signal bandwidth	0 to 98
Parameters in the synchronization tab		
Synchronization state		off, on
In-coverage flag		off, on
SLSS ID	range depends on in-coverage flag	0 to 335
Sync offset indicator		0 to 39
Parameters in the SCI config tab		
Number of SCI config		0 to 49
SL TX mode		1, 2
PSCCH period		0 to 99
n_PSCCH	range depends on the control resource pool	
SCI format		0
Frequency hopping flag		off, on
RBA and hopping resource allocation	range depends on the signal bandwidth	0 to 8191
Time resource pattern (ITRP)		0 to 127
Modulation and coding scheme		0 to 28
Timing advance indication		0 to 2047
Group destination ID		0 to 225
Parameters in the allocation table		
Content		PSCCH, PSSCH, PSBCH
SF	Subframes where the transmission occurs	
Modulation		QPSK, 16QAM
DRS – cyclic shift		0 to 7
Scrambling – state		off, on
Channel coding – state	for PSSCH and PSBCH only	off, on
Channel coding – number of physical bits	for PSSCH and PSBCH only	
Channel coding – transport block size index	for PSSCH only	0 to 26
Channel coding – transport block size	for PSSCH and PSBCH only	0 to 75376
Physical bits	number of physical bits	
Power		–80.000 to +10.000 dB
State		off, on
Conflict		off, on

Discovery mode		
Parameters in the resource pool table		
Control period		32, 64, 128, 256, 512, 1024 frames
Offset indicator		0 to 10239 subframes
PRB start	range depends on the signal bandwidth	0 to number of RBs – 1
PRB end	range depends on the signal bandwidth	0 to number of RBs – 1
PRB number	range depends on the signal bandwidth	1 to number of RBs
PRB index	range depends on the signal bandwidth	0 to number of RBs
Control subframe bitmap	must always contain at least one “1”	FDD: 40 bit TDD config 0: 42 bit TDD config 1: 16 bit TDD config 2: 8 bit TDD config 3: 12 bit TDD config 4: 8 bit TDD config 5: 4 bit TDD config 6: 30 bit
Number of retransmissions		0 to 3
Number of repetitions		1 to 50
N(1)_PSDCH		1 to 200
N(2)_PSDCH		1 to 10
N(3)_PSDCH		1, 5
Subframe index		0 to 209
Parameters in the synchronization tab		
Synchronization state		off, on
In-coverage flag		off, on
SLSS ID	range depends on in-coverage flag	0 to 335
Sync offset indicator		0 to 39
Parameters in the allocation table		
Number of transmissions		0 to 100
Content		PSDCH, PSBCH
SF		
Discovery type		1, 2B
PSDCH period		0 to 100
n_PSDCH/n’	range depends on the resource pool and the discovery type	off, on
SF	subframes where the transmission occurs	
Modulation		QPSK
DRS – cyclic shift		0 to 7
Scrambling – state		off, on
Channel coding – state		off, on
Channel coding – number of physical bits		
Channel coding – transport block size	for PSSCH and PSBCH only	0 to 75376
Physical bits	number of physical bits	
Power		–80.000 to +10.000 dB
State		off, on
Conflict		off, on
Parameters in the antenna port mapping table		
AP 1000 SL	appears if sidelink is active	off, on
AP 1010 PSBCH	appears if sidelink is active	off, on
AP 1020 SL Sync	appears if sidelink is active	off, on

LTE releases 13, 14 and 15

For the R&S®SMW-K119 and R&S®SMBVB-K119 options. (LTE releases 13 and 14 only for the R&S®SMBV-K119 option.)

For each K119 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 releases 13, 14 and 15, including the following features: • 256QAM modulation for PUSCH • FRCs according to releases 13 and 14 • DL LAA (frame structure type 3, DRS for LAA, DCI1C for LAA) (R&S®SMW-K85 is also required) • PUCCH formats 4 and 5 • Special subframe configuration 10 (PUSCH in special subframe) • Enhancements for DCI formats 2C/2D (dmrsAltTable/semiOpenLoop) • SRS Enhancements (extra UpPTS symbols for SRS) • Enhanced uplink DMRS (ul-DMRS-IFDMA) • PRACH restricted set type B • V2X	
EUTRA/LTE digital standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
256QAM modulation for PUSCH		
This option extends the LTE carrier aggregation feature of the R&S®SMW-K85 option for generation of uplink signals with 256QAM modulation in the PUSCH channel.		
Modulation	PUSCH allocation	QPSK, 16QAM, 64QAM, 256QAM
FRCs according to releases 13 and 14		
FRC	selects the FRC	A1-1, A1-2, A1-3, A1-4, A1-5, A1-6, A1-7 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 A12-1, A12-2, A12-3, A12-4, A12-5, A12-6 A13-1, A13-2, A13-3, A13-4, A13-5, A13-6 A17-1, A17-2, A17-3, A17-4, A17-5, A17-6 (The actual range depends on the configured bandwidth and cyclic prefix settings of the general settings dialog.)
Downlink LAA		
This option enables the configuration and generation of signals for downlink LAA SCells (frame structure type 3), including DRS for LAA and DCI Format 1C for LAA.		
Duplexing	SCells in the downlink carrier aggregation table, in case of PDSCH scheduling modes “Auto/DCI” or “Auto Sequence”	FDD, TDD, LAA
DRS state	only for SCells with duplexing “LAA”	off, on
DRS periodicity		40, 80, 160 ms
DRS offset		range depends on DRS periodicity
DRS duration		1 to 5 ms
DRS pattern		range depends on DRS periodicity
CSI-RS part of DRS		off, on
DRS zero power CSI-RS	up to 5 zero power CSI-RS configurations	0 to FFFF
DRS I_CSI_RS	up to 5 CSI-RS configurations	0 to 154
Number of LAA bursts		0 to 10
Starting subframe		0 to 9999
Starting symbol		s0 or s7
Burst duration		1 ms to 10 ms
Number of ending symbols		3, 6, 9, 10, 11, 12, 14
LAA DCI 1C mode		manual, n-1, n, (n-1)&n
(E)PDCCH format		2 or 3
(e)FD-MIMO		
This option enables the configuration and generation of CSI-RS for FD-MIMO (release 13) and eFD-MIMO (release 14).		
CSI-RS in DwPTS		off, on
Number of CSI-RS configurations		1, 2, 3, 4, 5, 7
Number of CSI-RS antenna ports per CSI-RS configuration	possible values depend on “Number of CSI-RS configurations”	1, 2, 4, 8

CDMType		CDM2, CDM4, CDM8
Frequency density		1, $^1/_2$, $^1/_3$
Transmission comb	possible values depend on “Frequency density”	0, 1, 2
PUCCH formats 4 and 5		
This option enables the configuration and generation of signals for PUCCH formats 4 and 5.		
Modulation/format		F1, F1a, F1b, F2, F2a, F2b, F3, F4, F5
M_RB		depends on n n_PUCCH antenna port 100
n_oc		0 to 1
Number of A/N + SR + CSI bits	length	1 to 64 for F4 and F5
Cyclic shift field		0 to 7, one-to-one correspondence with N(1)_DMRS
N(1)_DMRS		0, 2, 3, 4, 6, 8, 9, 10 one-to-one correspondence with cyclic shift field
N(2)_DMRS		0, 6
	for F4	always 0
	for F5	
	when n_oc = 0	0
	when n_oc = 1	6
Special subframe configuration		
TDD special subframe configuration	only selectable if duplexing mode is set to TDD	0 to 10
PUSCH in UpTPS state	only selectable if TDD special subframe configuration is set to 10	on/off
Less DMRS		on/off
Number of symbols	possible values depend on “Cyclic Prefix” and “Less DMRS”	1 to 6
Enhancements for DCI formats 2C/2D		
This option enables the configuration of the higher layer parameters *dmrsAltTable* and *semiOpenLoop*		
Parameters in the user configuration		
DMRS alt. table	selects whether *dmrsAltTable* is true or not on each cell	off, on
Semi open loop	selects whether *semiOpenLoop* is true or not on each cell	off, on
SRS enhancements		
This option enables to configure and generate SRS enhanced in Rel. 13 (*srs-UpPtsAdd* / *transmissionCombNum*)		
Parameters in the SRS tab in the user configuration		
srs-UpPtsAdd	only configurable if duplexing mode is set to TDD	0, 2, 4
Transmission Comb Num K TC		2, 4
Enhanced uplink DMRS		
This option enables to configure and generate PUSCH transmissions with enhanced DMRS in Rel. 14 (*ul-DMRS-IFDMA*)		
Parameter in the DRS tab in the user configuration		
Enhanced DMRS	only configurable in case of LTE-A	off, on
Parameter in the DRS tab in the enhanced settings of a PUSCH allocation		
Bit for DMRS mapping table	only configurable if enhanced DMRS is set to on	off, on
PRACH restricted set type B		
This option enables to configure and generate PRACH signals with restricted set type B in Rel. 14		
Parameter in the PRACH tab in the general settings		
PRACH restricted set		unrestricted set, restricted set type A, restricted set type B
V2X		
This option enables to configure and generate V2X signals in Rel. 14.		
Parameter in the sidelink tab in the user configuration		
Parameters in the common tab		
State		off, on
Mode		communication, discovery, V2X communication
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN 23, data list, pattern, All0, All1
Restart data every transmission		off, on
V2X communication mode		
Parameters in the resource pool tab		
Offset indicator		0 to 319

Subframe bitmap length		10, 16, 20, 30, 40, 50, 60, 100 FDD: 16, 20, 100 TDD config 0: 60 TDD config 1: 40 TDD config 2: 20 TDD config 3: 30 TDD config 4: 20 TDD config 5: 10 TDD config 6: 50
Subframe bitmap	must contain one “1” at least	
Adjacent PSCCH/PSSCH		off, on
Number of subchannels	range depends on the signal bandwidth	1, 3, 5, 8, 10, 15, 20
Subchannel size	range depends on the signal bandwidth	if adjacent PSCCH/PSSCH is TRUE, {5, 6, 10, 15, 20, 25, 50, 75, 100}; if adjacent PSCCH/PSSCH is FALSE, {4, 5, 6, 8, 9, 10, 12, 15, 16, 18, 20, 30, 48, 72, 96}
Start RB subchannel	range depends on the signal bandwidth	0 to number of RBs – 1
Start RB PSCCH pool	range depends on the signal bandwidth	0 to number of RBs – 1
Parameters in the synchronization tab		
Synchronization state		off, on
In-coverage flag		off, on
SLSS ID	range depends on in-coverage flag	0 to 335
Sync offset indicator		0 to 159
Parameters in the SCI config tab		
Number of SCI config		0 to 49
SL TX mode		3, 4
Start SF	depends on the resource pool parameters and the synchronization state	
Subchannel	depends on the number of subchannels	0 to 19
SF	subframes where the transmission occurs	
SCI format		1
Priority		0 to 7
Resource reservation		0 to 12
Freq. resource location of initial TX and ReTX	range depends on the number of subchannels	
Time gap between initial TX and ReTX		0 to 15
Modulation and coding scheme		0 to 28
Retransmission index		off
Parameters in the allocation tab		
Content		PSCCH, PSSCH, PSBCH
SF	subframes where the transmission occurs	
Modulation		QPSK, 16QAM
DRS – cyclic shift		0 to 7
Scrambling – state		off, on
Channel coding – state	for PSSCH and PSBCH only	off, on
Channel coding – number of physical bits	for PSSCH and PSBCH only	
Channel coding – transport block size index	for PSSCH only	0 to 26
Channel coding – transport block size	for PSSCH and PSBCH only	0 to 75376
Physical bits	number of physical bits	
Power		–80.000 to +10.000 dB
State		off, on
Conflict		off, on
V2X RMCs	in line with TS 36.521	A 8.2.1, A 8.2.2, A 8.2.3

Cellular IoT standard

For the R&S®SMW-K115, R&S®SMBVB-K115 and R&S®SMBV-K115 options.

General description	This option contains the support for the LTE release 13 cellular IoT variants NB-IoT (narrowband IoT, Cat-NB1) and eMTC (enhanced machine type communication, Cat-M1). • NB-IoT and eMTC downlinkand uplink signal generation • NB-IoT modes inband, guard band and standalone Although the K115 option (cellular IoT standard) does not depend on the K55 option (EUTRA/LTE digital standard), the cellular IoT standard shares configuration parameters with the EUTRA/LTE digital standard where applicable. Therefore, all general parameters of the K55 option are also valid for the K115 option, unless stated otherwise in the sections below.	
Cellular IoT standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
General settings		
Mode	restricts the user interface to certain LTE / cellular IoT features for simplicity or enables access to all features according to the installed options	only available if EUTRA as well as cellular IoT option(s) are installed in the instrument
Uplink simulation		
Physical settings		
Channel bandwidth	determines the channel bandwidth used	200 kHz, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Number of resource blocks	The number of resource blocks is automatically set in line with the selected channel bandwidth.	
Number of eMTC narrowbands	The number of eMTC narrowbands is automatically set in line with the selected channel bandwidth.	
Cell specific settings		
eMTC Valid subframes	The eMTC valid subframes are configurable freely.	on/off
Signals – NB-IoT-DRS		
Group hopping	activates reference signal group hopping	on/off
Use base sequences	only selected base sequences are used	on/off
Delta sequence shift for NPUSCH		0 to 29
Three tone cyclic shift		0 to 2
Six tone cyclic shift		0 to 3
Three tone base sequence		0 to 11
Six tone base sequence		0 to 13
Twelve tone base sequence		0 to 29
eMTC-PUSCH settings		
Narrowband hopping	enables or disables the PUSCH hopping between narrowbands	on/off
Hopping offset		1 to 15 narrowbands
eMTC-PRACH settings		
Hopping offset	PRACH hopping offset as number of resource blocks	1 to 110
Restricted set (high speed mode)		on/off
CE Level	different coverage extension levels are defined	0, 1, 2, 3
PRACH config		0 to 63
Frequency offset		0 to 94
Hopping		on/off
Number of repetitions	PRACH repetitioins	1, 2, 4, 8, 16, 32, 64 and 128
Starting subframe periodicity in ms		2, 4, 8, 16, 32, 64, 128 and 256
NB-IoT-NPRACH settings		
Preamble format		0,1
NPRACH configuration		0, 1, 2
Periodicity		40 ms to 2560 ms
Starting time in ms		8, 16, 32, 64, 128, 256, 512, 1024
Number of repetitions	number of NPRACH repetitions	1, 2, 4, 8, 16, 32, 64 and 128
Number of subcarriers	setting number of subcarriers	12, 24, 36, 48
Subcarrier offset	offset between the subcarriers	0, 2, 12, 18, 24, 34, 36

UE specific settings		
3GPP release	selects the functionality for a user equipment	the range is extended by the values eMTC and NB-IoT
UE specific settings for eMTC users		
CE level	coverage extension level	0, 1 or 2, 3
Narrowband hopping interval	number of consecutive subframes for which the narrowband remains the same	
	CE level 0, 1	1, 2, 4, 8
	CE level 2, 3	2, 4, 8, 16
Number of transmissions		1 to 20
PUSCH settings (allocation table of eMTC users)		
Modulation		QPSK, 16QAM and 64QAM
Start subframe		0 to 9999
Repetitions	CE level 0, 1	1, 2, 4, 8, 16, 32
	CE level 2, 3	1, 4, 8, 16, 32, 64, 128, 192, 256, 384, 512, 768, 1024, 1536, 2048
No. of absolute subframes	total number of subframes including repetitions and invalid subframes	read only
Start narrowband		0 to 15
Number of resource blocks (RB)		1 to 6
Offset VRB	variable offset inside one narrowband	0 to 5
Power		–80 dB to 10 dB
Starting redundancy version index (rv_idx)		0, 1, 2, 3
PUCCH settings (allocation table of eMTC users)		
Format	CE level 0, 1	
	FDD	1, 1a, 2, 2a, 2b
	TDD	1, 1a, 1b, 2, 2a, 2b
	CE level 2, 3	
	FDD	1, 1a
	TDD	1, 1a
Start subframe		0 to 9999
Repetitions	CE level 0, 1	1, 2, 4, 8
	CE level 2, 3	4, 8, 16, 32
Number of absolute subframes	total number of subframes including repetitions and invalid subframes	read only
Number of resource blocks (RB)		read only and equal to 1
PRACH settings (for eMTC users in mode PRACH)		
Number of preamble attempts		1 to 40
CE level		0 to 3
Starting subframe		calculated from other PRACH parameters
Ncs config		0 to 15
Logical root sequence index		0 to 838
Sequence index (v)		0 to 63
Delta t		–500 µs to 500 µs
Power		–80 dB to 10 dB
UE specific settings for NB-IoT users		
NPUSCH+SRS simultaneous TX		on, off
DRS power offset		–80 dB to 10 dB
Disable group hopping		on, off
Subcarrier spacing		3.75 kHz and 15 kHz
Mode		in-band, guard band and stand alone
Resource block index		0 to 99
Number of transmissions		1 to 20
NPUSCH settings (allocation table of NB-IoT users)		
NPUSCH format		F1 and F2
Modulation		π/2 BPSK, π/4 QPSK and QPSK
Start subframe		0 to 133329
Number of repetitions		1, 2, 4, 8, 16, 32, 64, 128
Number of resource units	format 1	1, 2, 3, 4, 5, 6, 8, 10
	format 2	1
Subcarrier indication field	valid only at 15 kHz	0 to 18
ACK/NAK res. field	valid only at 3.75 kHz	0 to 47
Power		–80 dB to 10 dB
Starting redundancy version index (rv_idx)		0 or 2
NPRACH settings (for NB-IoT users in mode PRACH)		
Number of preamble attempts		1 to 30
NPRACH configuration		0, 1, 2

Starting subframe		0 to 133329
n init		0 to 11
NB-IoT downlink simulation		
Physical settings		
Channel bandwidth	determines the channel bandwidth used	200 kHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
General NB-IoT settings		
Activate NB-IoT	enable or disable the NB-IoT DL	on/off
LTE cell	enables or disables LTE channels	on/off
Gap configuration	enables or disables gap configuration	on/off
Gap threshold	different types of carriers	32, 64. 128, 256
Gap periodicity	specifies the periodicity in subframes	64, 128, 256, 512
Gap duration coefficient		1/8, 1/4, 3/8, 1/2
CRS sequence info	depends on the channel bandwidth	3 MHz: 6, 7
		5 MHz: 5, 6, 7, 8
		10 MHz: 19, 20, 21, 22, 23, 24, 25, 26
		15 MHz: 0 to 13
		20 MHz: 14 to 31
RB index	depends on the channel bandwidth	3 MHz: 2, 12
		5 MHz: 2, 7, 17, 22
		10 MHz: 4, 9, 14, 19, 30, 35, 40, 45
		15 MHz: 2, 7, 12, 17, 22, 27, 32, 42, 47, 52, 57, 62, 67, 72
		20 MHz: 4, 9, 14, 19, 24, 29, 34, 39, 44, 55, 60, 65, 70, 75, 80, 85, 90, 95
		3 MHz: 2, 12
Delta f to DC	The frequency offset can be entered only for guard band.	–100 MHz to 100 MHz
NCellID		0 to 503
NCellID group		0 to 167
Identity		0 to 2
Valid subframes	bitmap for valid subframes	standalone: 0 to 9
		inband: 0 to 40
Common search space	common search space parameters	paging (type 1): R_{max}: 1, 2, 4, 8, 16, 32, 64 random access (type 2): R_{max}: 1, 2, 4, 8, 16, 32, 64; G: 1.5, 2, 4, 8, 16, 32, 48; alpha offset: 0, 1/8, 3/8, 1/4
State		on/off
Frame configuration general settings		
Users		1 to 4
UE specific search space	UE specific search space config params	R_{max}: 1, 2, 4, 8, 16, 32, 64; G: 1.5, 2, 4, 8, 16, 32, 48; alpha offset: 0, 1/8, 3/8, 1/4
NB-IoT DCI config	DCI configuration	
Allocation wrap-around		on/off
User		user 1 to 4, P-RNTI,RA-RNTI
UE_ID/n_RNTI	UE_ID of user or n_RNTI of NPDCCH	0 to 65535
DCI format	different DCI formats	N0, N1, N2
Search space		UE specific, type 1 common, type 2 common
DCI N0 configuration		
Subcarrier indication field (Isc)		0 to 47
Resource assignment field (Iru)		0 to 7
Scheduling delay field (Idelay)		0 to 3
Modulation and coding scheme (Imcs)		0 to 10
Redundancy version		0, 1
Number of NPUSCH repetitions field		0 to 7
New data indicator		on/off
Repetitions of DCI subframe		0 to 3
Number of resource units (Nru)		1, 2, 3, 4, 5, 6, 8, 10
Repetitions of NPDCCH(R)		1, 2, 4, 8
DCI N1 configuration		
NPDCCH order indicator		on/off
Scheduling delay field (Idelay)		0 to 7

Resource assignment field (Isf)		0 to 7
Scheduling delay field (Idelay)		0 to 3
Modulation and coding scheme (Imcs)		0 to 10
Number of NPDSCH repetitions field		0 to 15
New data indicator		on/off
HARQ-ACK resource field		0 to 15
Repetitions of DCI subframe		0 to 3
Transport block size		16 to 680
Number of NPDSCH subframes (Nsf)		1 to 10
Distance from NPDCCH to NPDSCH	distance between control and shared channel, zero is used for NPDSCH manual scheduling	standard, minimum and zero
DCI N2 configuration		
Flag for paging/direct indication		on/off
Scheduling delay field (Idelay)		0 to 7
Resource assignment field(Isf)		0 to 7
Modulation and coding scheme (Imcs)		0 to 10
Number of NPDSCH repetitions field		0 to 15
New data indicator		on/off
HARQ-ACK resource field		0 to 15
Repetitions of DCI subframe		0 to 3
Transport block size		16 to 680
Number of NPDSCH subframes (Nsf)		1 to 10
Start subframe	depends on the search space config and valid subframe bitmap	0 to 66659
NPDCCH format		0, 1
Number NCCEs		1, 2
NB-IoT allocation		
Content type	supported channels	NPBCH, NPDCCH, NPDSCH, NPDSCH, SIB1-NB
Modulation		QPSK
Enhanced settings – NPBCH		
Precoding scheme		none, TX diversity
Scrambling		on/off
SFN offset		0 to 1020
Scheduling SIB1		0 to 11
NPDSCH repetition carrying SIB1		4, 8, 16
Starting frame carrying SIB1		0, 16, 32, 48
MIB spare bits		1 to 11
Transport block size/payload		34
Enhanced settings – NPDCCH		
Precoding scheme		none, TX diversity
Scrambling		on/off
UE ID/n_RNTI		0 to 65535
Channel coding		on/off
Enhanced settings – NPDSCH		
Precoding scheme		none, TX diversity
Scrambling		on/off
UE ID/n_RNTI		0 to 65535
Channel coding		on/off
Subframe list	subframe list is displayed	
Start symbol	indicates the first symbol	0, 1, 2, 3
Data source		All0, All1, PN seq, pattern, DList
Power		–80 dB to 10 dB
State		on/off
Enhanced settings – NPDSCH SIB1-NB		
Precoding scheme		none
Scrambling		on/off
UE ID/n_RNTI		0 to 65535
Channel coding		on/off
Transport block size index		0 to 11
Transport block size	displayed, based on transport block index	
Subframe list	subframe list is displayed	

Start symbol	start symbol is displayed	
Data source		All0, All1, PN seq, pattern, DList
Power		–80 dB to 10 dB
State		on/off
Uplink FRCs		
FRC state	If activated, several parameters are set in line with the fixed reference channel definitions in 3GPP TS 36.141 and TS 36.521.	on/off
Uplink FRC	selects the FRC	36.141: A14-1, A14-2, A14-3, A14-4, A15-1, A15-2, A16-1, A16-2, A16-3, A16-4, A16-5; 36.521: A2.4-1, A2.4-2, A2.4-3, A2.4-4, A2.4-5, A2.4-6, A2.4-7 (The actual range depends on the configured bandwidth and cyclic prefix settings of the general settings dialog.)
FRC repetitions	selects different repetitions	1, 2, 16, 64
NB-IoT test models (downlink)		
Test models	in line with 3GPP TS 36.141 release 13	N-TM_Standalone, N-TM_Inband_SamePCI, N-TM_Inband_DifferentPCI, N-TM_Guardband, N-TM_Guardband_With_E_TM1_1, N-TM_Inband_With_E_TM1_1
eMTC uplink SRS settings		
SRS state	enables sending of sounding reference signals	on/off
Transmit trigger type 0 SRS	enables the transmission of SRS trigger type 0	
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 Num k_TC	SRS transmission comb number	2, 4
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 23
Aperiodic SRS (SRS trigger type 1)		
This option enables the generation of SRS signals according to SRS trigger type 1 (aperiodic SRS).		
Transmit trigger type 0 SRS	enables the transmission of SRS trigger type 0 in addition to SRS trigger type 1	
Configuration sets for trigger type 1	individual SRS configuration sets for trigger type 1 SRS transmissions	DCI 6-0A/1A
Number of transmissions	number of scheduled SRS transmissions for a specific configuration set	0 to 50
Subframes for transmissions	subframes in which SRS transmissions are scheduled for a specific configuration set	the range depends on the configured ARB sequence length
eMTC downlink simulation		
Physical settings		
Channel bandwidth	determines the channel bandwidth used	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
General eMTC settings		
Bitmap subframes	valid subframes	10, 40
Starting symbol		1, 2, 3 ,4
Scheduling information SIB1-BR		0 to 18
PBCH repetitions	enables/disables repetitions	on/off
Number of narrowbands for hopping		2, 4
Hopping offset		0 to 7
Hopping interval for CE mode A	number of consecutive subframes staying on the same narrowband	FDD: 1, 2, 4, 8; TDD: 1, 5, 10, 20
Hopping interval for CE mode B	number of consecutive subframes staying on the same narrowband	FDD: 1, 2, 4, 16; TDD: 5, 10, 20, 40

RA hopping	enables/disables hopping for random access	on/off
RA starting NB	sets the first used narrowband	0 to 15
Paging hopping	enable/disable hopping	on/off
Paging starting NB	sets the first used narrowband	0 to 15
Common search space	common search space parameters	paging (type 1): R_{max}: 1, 2, 4, 8, 16, 32, 64, 128, 256; random access (type 2): R_{max}: 1, 2, 4, 8, 16, 32, 64, 128, 256; search space start subframe: 1, 1.5, 2, 2.5, 4, 5, 8, 10, 20; max repetitions of PDSCH for CE mode A: 16, 32; max repetitions of PDSCH for CE mode B: 192, 256, 384, 512, 768, 1024, 1536, 2048
Frame configuration general settings		
Users		1 to 4
eMTC DCI config	DCI configuration	
User		user 1 to 4, P-RNTI, RA-RNTI
UE_ID/n_RNTI	UE_ID of user or n_RNTI of NPDCCH	0 to 65535
DCI format	different DCI formats	3, 3A, 6-0A, 6-0B, 6-1A, 6-1B, 6-2
Search space		UE specific, type 0 common, type 1 common, type 2 common
DCI 6-0A configuration		
PUSCH frequency hopping		on/off
Resource block assignment		0 to 255
Modulation and coding scheme		0 to 15
Repetition number		0 to 3
HARQ process number		0 to 7
New data indicator		on/off
Redundancy version		0 to 3
TPC command for PUCCH		0 to 3
Downlink assignment index		0 to 3
CSI request		on/off
SRS request		on/off
DCI 6-0B configuration		
PUSCH frequency hopping		on/off
Resource block assignment		0 to 255
Modulation and coding scheme		0 to 15
Repetition number		0 to 7
HARQ process number		0 to 1
New data indicator		on/off
Redundancy version		0 to 3
TPC command for PUCCH		0 to 3
Downlink assignment index		0 to 3
CSI request		on/off
SRS request		on/off
DCI 6-1A configuration		
Mode		PDSCH/PRACH
PUSCH frequency hopping		on/off
Resource block assignment		0 to 255
Modulation and coding scheme		0 to 15
Repetition number		0 to 3
HARQ process number		0 to 7
New data indicator		on/off
Redundancy version		0 to 3
TPC command for PUCCH		0 to 3
Downlink assignment index		0 to 3
CSI request		on/off
SRS request		on/off
HARQ-ACK resource offset		0 to 3
DCI 6-1B configuration		
Mode		PDSCH/PRACH
Resource block assignment		0 to 15

Modulation and coding scheme		0 to 10
Repetition number		0 to 7
Subframe repetition number		0 to 2
DCI 6-2 configuration		
Flag for paging/direct indication		on/off
Direct indication information		0 to 255
Modulation and coding scheme		0 to 10
Repetition number		0 to 7
Subframe repetition number		0 to 2
eMTC allocation		
Content type	supported channels	PBCH, MPDCCH, PDSCH-SIB1-BR, PDSCH
Modulation		QPSK
Enhanced settings – PBCH		
MIB		on/off
Scrambling		on/off
SFN offset		0 to 1020
Scheduling information SIB1-BR		0 to 18
MIB spare bits		1 to 5
Transport block size/payload		24
Start symbol	indicates the first symbol	0, 1, 2, 3
No. RB	number of resource blocks displayed	
Offset VRB	the value is displayed	
Enhanced settings – PDSCH		
Precoding scheme		none, TX diversity
Scrambling		on/off
UE ID/n_RNTI		0 to 65535
Channel coding		on/off
Start subframe	start subframe is displayed	
Num Abs. SF	number of absolute subframes are displayed	
Start NB	start narrowband	
Start symbol	indicates the first symbol	0, 1, 2, 3
No. RB	number of resource blocks displayed	
Offset VRB	the value is displayed	
Phys. bits	number of physical bits displayed	
Data source		All0, All1, PN seq, pattern, DList
Power		–80 dB to 10 dB
State		on/off
Enhanced settings – PDSCH SIB1-BR		
Precoding scheme		none, TX diversity
Scrambling		on/off
Transport block size index		1 to 18
Channel coding		on/off
Start subframe	start subframe is displayed	
Num Abs. SF	number of absolute subframes are displayed	
Start NB	start narrowband	
Start symbol	indicates the first symbol	3
No. RB	number of resource blocks displayed	
Offset VRB	the value is displayed	
Phys. bits	number of physical bits displayed	
Data source		All0, All1, PN seq, pattern, DList
Power		–80 dB to 10 dB
State		on/off

Cellular IoT release 14

For the R&S®SMW-K143 and R&S®SMBVB-K143 options.

General description	This option enhances the LTE cellular IoT variants NB-IoT (narrowband IoT) and eMTC (enhanced machine type communication) according to release 14, i.e. Cat-NB2 and Cat-M2 The K143 option requires the K115 option. Therefore, all general parameters of the K115 option are also valid for the K143 option, unless stated otherwise in the sections below.	
Cellular IoT standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
General settings		
Uplink simulation		
Physical settings		
Wideband config	to enable or disable the wideband configuration	on/off
Number of eMTC widebands	The number of eMTC widebands is automatically set in line with the selected channel bandwidth.	
Cell specific settings		
Retuning symbols	retuning symbols between narrowbands/widebands	0, 1, 2
eMTC-PRACH settings		
PRACH restricted set (high speed mode)		unrestricted, restricted type A and restricted type B
UE specific settings		
PUSCH settings (allocation table of eMTC users)		
Start wideband		0 to 3
Repetitions		12, 24
Number of resource blocks (RB)		3, 6, 9, 12, 15, 18, 21, 24
Offset VRB	variable offset inside one wideband	0, 3, 6, 9, 12, 15, 18, 21
PUCCH settings (allocation table of eMTC users)		
Number of resource blocks (RB)		read only and equal to 3
Repetitions		64, 128
NPUSCH settings		
Transport block size index		0 to 13
NB-IoT downlink simulation		
General NB-IoT settings		
NPRS		
NPRS state		on/off
NPRS parameter		PART A/PART B/PART A+B
NPRS power		–80 dB to 10 dB
NPRS ID		0 to 4095
NPRS sequence information		0 to 174
NPRS bitmap		10,40
NPRS bitmap config		depends on the bitmap
NPRS mutinginfo A		2 to 16
NPRS period		160 ms, 320 ms, 640 ms,1280 ms
NPRS start subframe		0, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8
NPRS number of subframes		10 ms, 20 ms, 40 ms, 60 ms, 80 ms, 160 ms, 320 ms, 640 ms, 1280 ms
NPRS mutinginfo B		
Antenna port 2006 (AP 2006)	used only when NPRS is enabled	
Frame configuration general settings		
UE category		NB2
NB-IoT DCI config	DCI configuration	
DCI N0 configuration		
HARQ process number		0 to 1
DCI N1 configuration		
HARQ process number		0 to 1
NB-IoT allocation		
Enhanced settings – NPDSCH		
Modulation and coding scheme		inband: 0 to 10, standalone/guardband: 0 to 13

eMTC downlink simulation		
Physical settings		
Wideband config	to enable or disable the wideband configuration	on/off
Number of eMTC widebands	The number of eMTC widebands is automatically set in line with the selected channel bandwidth.	
eMTC DCI config		
Resource block assignment flag	enabled only when wideband config is 20 MHz	on/off

Cellular IoT release 15

For the R&S®SMW-K146 and R&S®SMBVB-K146 options.

General description	This option enhances the LTE cellular IoT variants NB-IoT (narrowband IoT) and eMTC (enhanced machine type communication) according to release 15. The K146 option requires the K115 option. Therefore, all general parameters of the K115 option are also valid for the K146 option, unless stated otherwise in the sections below.	
Cellular IoT standard		in line with 3GPP release 15: TS 36.211 v.15.6.0, TS 36.212 v.15.6.0, TS 36.213 v.15.6.0
General settings		
Duplexing		FDD, TDD
General uplink settings		
Physical settings		
TDD UL/DL configuration		1 to 5
TDD special subframe config		0 to 10
Cell settings		
NB-IoT bitmap subframes		10 and 40
NPRACH premable format FDD		2
NB-IoT-NPRACH settings TDD		
Preamble format		0, 1, 0–A, 1–A
NPRACH configuration		0, 1, 2
Periodicity		80, 160, 320, 640, 1280, 2560, 5120, 10240
Starting time in ms		10, 20, 40, 80, 160, 320, 640, 1280, 2560, 5120
Number of repetitions	number of NPRACH repetitions	1, 2, 4, 8, 16, 32, 64 ,128, 256 and 512
Number of subcarriers	setting number of subcarriers	12, 24, 36, 48
Subcarrier offset	offset between the subcarriers	0, 2, 12, 18, 24, 34, 36
TDD-NPUSCH settings		
NPUSCH format		F1 and F2
Modulation		π/2 BPSK, π/4 QPSK, QPSK
Start subframe		2 to 66659
Number of repetitions		1, 2, 4, 8, 16, 32, 64, 128
Number of resource units	format 1	1, 2, 3, 4, 5, 6, 8, 10
	format 2	1
Subcarrier indication field	valid only at 15 kHz	0 to 18
ACK/NAK resource field	valid only at 3.75 kHz	0 to 47
Power		–80 dB to 10 dB
Starting redundancy version index (rv_idx)		0 or 2
NB-IoT downlink TDD		
Physical settings		
TDD UL/DL configuration		1 to 5
TDD special subframe configuration		0 to 10
Cell settings		
NB-IoT bitmap subframes		10 and 40
Enhanced settings – NPBCH		
Scheduling SIB1		0 to 15
NPUSCH F2-FDD		
Scheduling request (SR) support		on/off

OneWeb user-defined signal generation

For the R&S®SMW-K130 option.

General settings		
RF frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
RF output level		default: –30 dBm, user-selectable in entire output level range of respective Rohde & Schwarz instrument
Sequence length	sequence length can be entered in frames (10 ms each); the maximum length depends on the available ARB memory options and the configured OneWeb settings, e.g. the channel bandwidth and the filter settings	
Mode		predefined and user defined modes
Baseband filter	standard	root cosine with roll off 0.085
	other	see data sheet of respective Rohde & Schwarz instrument, “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		restart
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Link direction		downlink, uplink
Physical layer mode	downlink	SC-TDM
	uplink	SC-FDMA

Downlink simulation		
Physical settings		
Channel bandwidth		250 MHz
Sampling rate		230.4 MHz
Cell ID		0 to 255
RA-RNTI		1 to 240
Downlink reference signal structure		
Reference signal power	power of reference symbol	0.00 dB
P-SYNC power	determines the power of the primary synchronization signal	–80 dB to +10 dB, in steps of 0.001 dB
Global MIMO configuration	simulated cell specific antenna configuration	1
Number of configurable subframes	determines the number of configurable subframes; the subframe configurations are used periodically Note: P-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 sequence length.
Allocation table		
Code word	Up to 2 code words can be configured.	1/1, 1/2, 2/2
Modulation	determines modulation scheme used	QPSK, 8PSK, 16QAM
Number of resource blocks (RB)	defines size of selected allocation in terms of resource blocks	1 to 1152
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
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, PN16, PN20, PN21 to PN 23, data list, pattern, All0, All1
Power	determines power of selected allocation	–80 dB to +10 dB, in steps of 0.001 dB
Content type	determines type of selected allocation	PDSCH, PDCCH, PBCH
State	sets state of selected allocation	on/off
Enhanced settings PBCH		
Scrambling state		on/off
Channel coding state	enables channel coding (FEC)	on/off

MIB (including SFN)	activates automatic MIB generation for PBCH	on/off
SFN offset	sets starting system frame number encoded in MIB	0 to 1020, in steps of 4
MIB spare bits	sets the MIB spare bits	pattern of 16 bit
Transport block size		32
Enhanced settings PDSCH		
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
Transport block size		16 to 850656
Redundancy version index		0 to 3
IR soft buffer size		31296 to 458400
Configuration of PCFICH, PDCCH		
State	enables PCFICH, PDCCH	on/off
PCFICH power	determines power of PCFICH	–80 dB to +10 dB, in steps of 0.001 dB
PCFICH scrambling state		on/off
PCFICH CFI		1 to 12
PDCCH power		–80 dB to +10 dB, in steps of 0.001 dB
PDCCH scrambling state		on/off
PDCCH format		0 to 4
User		user1 to user4, P-RNTI, SI-RNTI, RA-RNTI
Number of CCEs		depends on selected PDCCH format
CCE Index		0 to 599
Data source PDCCH		PN9, PN11, PN15 to PN 23, data list, pattern, All0, All1
DCI format		0, 1ow, 1a, 2ow, 3, 3a, 3ow
Search spaces		auto, common, UE-specific
DCI format 0 configuration		
Carrier indicator field		0 to 7
Resource block assigment		0 to 8191
Modulation, coding scheme and redundancy version		0 to 31
New data indicator		on/off
TPC command for PUSCH		0 to 3
Cyclic shift for DMRS		0 to 11
CSI/CQI request		0 to 3
SRS request		0 to 1
DCI format 1OW configuration		
Resource block assignment		0 to 1048575
Modulation and coding scheme		0 to 31
HARQ process number		0 to 63
New data indicator		on/off
Redundancy version		0 to 3
TPC command for PUCCH		0 to 3
DCI format 1A configuration		
Mode		PDSCH, PRACH
Resource block assignment		0 to 26564
Modulation and coding scheme		0 to 31
HARQ process number		0 to 63
New data indicator		on/off
Redundancy version		0 to 3
TPC command for PUCCH		0 to 3
SRS request		0 to 1
Preamble index		0 to 63
PRACH mask index		0 to 15
DCI format 2OW configuration		
Resource block assignment		0 to 524287
TPC command for PUCCH		0 to 3
HARQ process number		0 to 63
MCS for a first transmission		0 to 31
MCS for a retransmission		0 to 3
New data indicator		on/off
Redundancy version		0 to 3
DCI format 3 configuration		
TPC command		pattern of 64 bits

DCI format 3a configuration		
TPC command		pattern of 64 bits
Configure user	The configure user dialog makes it possible to define and configure up to four scheduled users that can be distributed over the entire frame configuration 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.	
Transmission mode	selects the downlink transmission mode	mode 1OW, mode 2OW
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, PN16, PN20, PN21, PN 23, data list, pattern, All0, All1
UE category		1 to 5

Uplink simulation		
General settings		
Channel bandwidth	determines the channel bandwidth used	20 MHz
FFT size		2048
Number of resource blocks		100
Cell ID		0 to 255
Physical cell ID group		0 to 167
Physical layer ID		0 to 2
SFN offset		0 to 4095
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
PRACH configuration		0 to 47
Restricted set		on/off
PRACH frequency offset		0 to 94
Number of RBs used for PUCCH		0 to 100
Delta shift		1 to 3
N(1)_cs	if number of RBs used for PUCCH is 0	always 0
	otherwise	0 to 6, 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
A/N-SRS simultaneous TX	enables simultaneous transmission of SRS and PUCCH	on/off
Carrier aggregation settings		
Activate carrier aggregation		on/off
Cell index		0, 1
Phy cell ID		0 to 503
Bandwidth	bandwidth of the SCell	20 MHz
Delta f in MHz	defines the frequency shift for this SCell relative to the PCell	
Setting range		depends on the respective Rohde & Schwarz instrument
Setting resolution		0.1 MHz
Duplexing		FDD
n(1)_DMRS	sets the broadcast part of the DMRS index	0 to 11
SRS subframe configuration		0 to 15
SRS bandwidth configuration		0 to 7
Delay(ns)	configures a time delay of the SCell relative to the PCell	0 to 700000
State	activates/deactivates this cell	on/off
Resource allocation uplink		
Select user equipment	Up to 4 UEs can be configured individually and allocated to the subframes.	

Number of configurable subframes	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
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
Allocation table		
Content type	UE can be set to PUSCH or PUCCH or PUACH	PUSCH, PUCCH, PUACH
Modulation	determines the modulation scheme used if content type is PUSCH or PUACH or the PUCCH format if content type is PUCCH	QPSK, 8PSK, 16QAM or format 1, 1a, 1b, 2, 2a, 2b, 3
Number of resource blocks (RB)	defines size of selected allocation in terms of resource blocks	1 to 100
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 99
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
Data source	determines data source used for PUSCH or PUACH of selected UE	PN9, PN11, PN15,PN16, PN20, PN21, PN 23, data list, pattern, All0, All1
Scrambling state	valid for both PUSCH and PUACH	on/off
Channel coding state	enables channel coding (FEC) and multiplexing of control and data information valid for both PUSCH and PUACH	on/off
Channel coding mode PUSCH	selects whether data, control information or both is transmitted on the PUSCH	UL-SCH only, UCI + UL-SCH, UCI only
Channel coding mode PUACH		UL-SCH only
DRS power offset	sets power of DRS relative to power level of PUSCH/PUACH/PUCCH allocation of corresponding subframe	–80 dB to +10 dB, in steps of 0.001 dB
SRS state	enables sending of sounding reference signals	on/off
Transmit trigger type 0 SRS	enables the transmission of SRS trigger type 0	
SRS power offset	sets power of SRS relative to power level of corresponding UE	–80 dB to +10 dB, in steps of 0.001 dB
SRS cyclic shift	cyclic shift used for SRS	0 to 11
Configuration index I_SRS	SRS configuration index	0 to 636 for FDD
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		
Cyclic shift field	for DRS	0 to 7
n(2)_DMRS,0	sets for layer 0 the part of the DMRS index which is part of the uplink scheduling assignment	0, 2, 3, 4, 6, 8, 9, 10
Transport block size UL-SCH		1 to 253440
Redundancy version index UL-SCH		0 to 3
Enhanced settings for PUCCH		
n_PUCCH	sets PUCCH index	range depends 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
Enhanced settings for PUACH		
Cyclic shift field	for DRS	0 to 7
n(2)_DMRS,0	sets for layer 0 the part of the DMRS index which is part of the uplink scheduling assignment	0, 2, 3, 4, 6, 8, 9, 10
Transport block size UL-SCH		1 to 253440
Redundancy version index UL-SCH		0 to 3
Settings for PRACH		
Power ramping settings		
PRACH power ramping state		on/off
Transition time		0.0 to 30.0 µs, in steps of 0.01 µs
Preamble format	set indirectly by PRACH configuration	0
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.	–500.00 µs to +500.00 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

OneWeb reference signals

For the R&S®SMW-K355 option.

Reference waveforms for both R&S®SMW-B9 and -B10 (wideband and standard baseband)	HY11-H9951-2_2.0_RL_8PSK_1CC_1cl_736371.1831.wv
	HY11-H9951-2_2.0_RL_8PSK_2CC_1cl_736371.1817.wv
	HY11-H9951-2_2.0_RL_16QAM_1CC_1cl_736371.1833.wv
	HY11-H9951-2_2.0_RL_16QAM_2CC_1cl_736371.1823.wv
	HY11-H9951-2_2.0_RL_QPSK_1CC_1cl_736371.1827.wv
	HY11-H9951-2_2.0_RL_QPSK_2CC_1cl_736371.18.wv
	HY11-HA563-1_1.0_RL_8PSK_1CC_2cl_736408.2524.wv
	HY11-HA563-1_1.0_RL_8PSK_2CC_2cl_736408.2531.wv
	HY11-HA563-1_1.0_RL_16QAM_1CC_2cl_736408.2521.wv
	HY11-HA563-1_1.0_RL_16QAM_2CC_2cl_736408.2528.wv
	HY11-HA563-1_1.0_RL_QPSK_1CC_2cl_736408.2518.wv
	HY11-HA563-1_1.0_RL_QPSK_2CC_2cl_736408.2527.wv
	HY11-HA674-1_1.0_RL_8PSK_1CC_TDD_736523.4025.wv
	HY11-HA674-1_1.0_RL_16QAM_1CC_TDD_736523.4179.wv
	HY11-HA674-1_1.0_RL_QPSK_1CC_TDD_736523.4201.wv
	HY11-HA674-2_1.0_RL_8PSK_2CC_TDD_736523.4383.wv
	HY11-HA674-2_1.0_RL_16QAM_2CC_TDD_736523.441.wv
	HY11-HA674-2_1.0_RL_QPSK_2CC_TDD_736523.4217.wv

Reference waveforms for R&S®SMW-B9 only (wideband baseband)	HY11-H9878-2_2.0_FL_8psk_736399.8358.wv
	HY11-H9878-2_2.0_FL_16qam_736399.8052.wv
	HY11-H9878-2_2.0_FL_qpsk_736399.837.wv
	HY11-HA610-1_1.0_FLwvfm736292.5983.8psk.notch.wv
	HY11-HA610-1_1.0_FLwvfm736292.5996.qpsk.notch.wv
	HY11-HA610-1_1.0_FLwvfm736345.2465.16qam.notch.wv
	OneWeb_RL_6Carrier_8PSK_channel1.wv
	OneWeb_RL_6Carrier_8PSK_channel2.wv
	OneWeb_RL_6Carrier_8PSK_channel3.wv
	OneWeb_RL_6Carrier_8PSK_channel4.wv
	OneWeb_RL_6Carrier_8PSK_channel5.wv
	OneWeb_RL_6Carrier_8PSK_channel6.wv
	OneWeb_RL_6Carrier_8PSK_channel7.wv
	OneWeb_RL_6Carrier_8PSK_channel8.wv
	OneWeb_RL_6Carrier_QPSK_channel1.wv
	OneWeb_RL_6Carrier_QPSK_channel2.wv
	OneWeb_RL_6Carrier_QPSK_channel3.wv
	OneWeb_RL_6Carrier_QPSK_channel4.wv
	OneWeb_RL_6Carrier_QPSK_channel5.wv
	OneWeb_RL_6Carrier_QPSK_channel6.wv
	OneWeb_RL_6Carrier_QPSK_channel7.wv
	OneWeb_RL_6Carrier_QPSK_channel8.wv
	OneWeb_RL_48Carrier_8PSK.wv
	OneWeb_RL_48Carrier_QPSK_v4.wv

3GPP FDD digital standard

For the R&S®SMW-K42, R&S®SMBVB-K42 and R&S®SMBV-K42 options.

WCDMA 3GPP FDD digital standard		in line with 3GPP release 11
RF frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
RF output level		default: –30 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Signal generation modes		
Signal generation modes	In standard mode, the signal contains precalculated parts that repeat according to the configured ARB sequence length and/or parts that are generated by realtime hardware and therefore do not necessarily repeat according to the configured ARB sequence. In all-offline mode, the signal parts (if configured) that would be generated by realtime hardware in standard mode are still contained (emulated, precalculated) and therefore are also repeated according to the configured ARB sequence length.	On the R&S®SMBV100A and R&S®SMBV100B, standard mode is used. On the R&S®SMW200A with standard baseband (R&S®SMW-B10), standard mode is used in baseband A and B, and all-offline mode is used in baseband C and D. On the R&S®SMW200A with wideband baseband (R&S®SMW-B9), all-offline mode is used.
Realtime signal parts and precalculated ARB signal parts	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.) repeat according to the configured ARB sequence length. In uplink mode, the DPCCH and one DPDCH of one mobile station can be generated in realtime; further channels and mobile stations (three user-configured ones and up to 128 of identical configuration) repeat according to the configured ARB sequence length.	
ARB sequence length	The sequence length of the precalcuated ARB part can be entered in frames (10 ms each); the max. length depends on the available baseband option.	
Generate waveform file	signal filtered and saved as ARB waveform file	
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		
Applications for realtime calculation	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 for data lists for data and TPC field	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), tests with user-generated data	
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 for channel coding	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 non-ideal propagation conditions • 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 for bit error insertion	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 for block error insertion	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)	
Test case wizard		
Configuration assistant for easy setup of test cases in line with TS 25.141	not available for the R&S®SMBV-K42 option and the R&S®SMBVB-K42 option	
Channel and code domain configuration		
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
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 for OCNS	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 for additional user equipment	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
Power 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 with respect to 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, All0, All1, 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		All0, All1, pattern (length: 1 bit to 64 bit), data lists
TPC pattern readout mode	application mode for TPC pattern	continuous, single + All0, single + All1, 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 to 1023
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 with respect to 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, All0, All1, 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, All0, All1, 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 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	All0, All1, pattern (length: 1 bit to 64 bit), data lists
	TPC pattern readout mode (application mode for TPC pattern)	continuous, single + All0, single + All1, 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, All0, All1, 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, scheduling list
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®SMW-K83, R&S®SMBVB-K83 and R&S®SMBV-K43 options.
For each K83/K43 option, a K42 option must also be installed on the instrument.
Note for R&S®SMW200A and R&S®SMBV100B users: The R&S®SMW-K83 option includes 3GPP FDD enhanced MS/BS tests, including HSDPA as well as 3GPP HSUPA and 3GPP HSPA+.

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 K83/K43 option. Dynamic power control is not available in all-offline mode.	
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 K83/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 K83/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. In all-offline mode, advanced mode is always on.
	HS-SCCH type	type 1 (normal)
	data source	PRBS: 9, 11, 15, 16, 20, 21, 23, All0, All1, 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 (not available in all-offline mode)		
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 K83/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 and the R&S®SMBVB-K83 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 60 dB
	down range	0 dB to 60 dB

Uplink simulation	
HS-DPCCH (high speed dedicated physical control channel)	
Enhancements	The K42 option does not support HSDPA for the uplink. The K83/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 NodeBs supporting HSDPA

Ranges	compatibility mode	up to release 7, release 8 and later, release 8 and later RT release 8 and later RT is not supported in all-offline mode.
	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 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 row	
	HARQ-ACK from interval	range depends on the inter-TTI distance
	HARQ-ACK to interval	range depends on the inter-TTI distance
	HS-DPCCH1 HARQ-ACK 1	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
	HS-DPCCH1 PCI/CQI 1 type	DTX, CQI
	CQI	0 to 30
	power offset PCI/CQI	–10 dB to +10 dB
Power reference		RMS power, first DPCCH, PRACH message part, last PRACH preamble, first HARQ-ACK, first PCI/CQI
Dynamic power control (not available in all-offline mode)		
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 K83/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 and the R&S®SMBVB-K83 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 60 dB
	down range	0 dB to 60 dB
Uplink test models (in line with TS 34.121) for the R&S®SMW-K83 or the R&S®SMBVB-K83 option		
3GPP release 6 test models		TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP release 8 test models		TS 34.121, table C.10.1.4, subtests 1 to 4, TS 34.121, table C.11.1.3, subtests 1 to 5, TS 34.121, table C.11.1.4, subtest 1
Uplink test models (in line with TS 34.121), Rohde & Schwarz instruments with K43/K45/K59 options		
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®SMW-K83, R&S®SMBVB-K83 and R&S®SMBV-K45 options.

For each K83/K45 option, a K42 option must also be installed on the instrument.

Note for R&S®SMW200A and R&S®SMBV100B users: The R&S®SMW-K83 option includes 3GPP FDD enhanced MS/BS tests, including HSDPA as well as 3GPP HSUPA and 3GPP HSPA+.

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 K83/K45 option.	
Downlink simulation		
HSUPA channels (E-AGCH, E-RGCH, E-HICH)		
Enhancements	In downlink, the K83/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, nonserving 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. This in not supported in all-offline mode, and also not for the R&S®SMBV-K45 or the R&S®SMBVB-K83 option.	
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 The “I only” and “Q only” modes are only available for R&S®SMBV-K45.
	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, All0, All1, pattern (length: 1 bit to 64 bit), data lists
E-DCH scheduling	E-DCH TTI	2 ms, 10 ms
	number of 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 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 (not in all-offline 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, All0, All1, 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, not available for the R&S®SMBVB-K83 option, not available in all-offline mode): feedback (TTL) connected to an input connector	
	always use redundancy version 0	on/off
	maximum number of retransmissions	0 to 20
	ACK definition	high, low
	connector	depends on the respective Rohde & Schwarz instrument
	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)
Power reference		RMS power, first DPCCH, PRACH message part, last PRACH preamble, first E-DCH
Uplink test models (in line with TS 34.121) for the R&S®SMW-K83 or the R&S®SMBVB-K83 option		
3GPP release 6 test models		TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP release 8 test models		TS 34.121, table C.10.1.4, subtests 1 to 4, TS 34.121, table C.11.1.3, subtests 1 to 5, TS 34.121, table C.11.1.4, subtest 1
Uplink test models (in line with TS 34.121), R&S®SMBV100A with K43/K45/K59 options		
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®SMW-K83, R&S®SMBVB-K83 and R&S®SMBV-K59 options.

R&S®SMBV-K59 option: A 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.

Note for R&S®SMW200A and R&S®SMBV100B users: The R&S®SMW-K83 option includes 3GPP FDD enhanced MS/BS tests, including HSDPA as well as 3GPP HSUPA and 3GPP HSPA+.

R&S®SMW-K83, R&S®SMBVB-K83 options: For each K83 option, an R&S®SMW-K42 option must also be installed on the instrument.

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 K83/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 K83/K59 option, unless stated otherwise in the sections below.	
Downlink simulation		
Downlink continuous packet connectivity (CPC): HS-SCCH-less operation (all instruments except the R&S®SMW200A: 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 K83/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 (all instruments except the R&S®SMW200A: 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 K83/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 (all instruments except the R&S®SMW200A: requires the K43 option)		
Enhancements	The K43 option does not support MIMO. The K83/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 (all instruments except the R&S®SMW200A: requires the K43 option)		
Enhancements	The K43 option supports simulation of F-DPCH channels with slot format 0 only. The K83/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 (all instruments except the R&S®SMW200A: 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 K83/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 (all instruments except the R&S®SMW200A: requires the K45 option)		
Enhancements	The K45 option supports E-DPDCH channels with BPSK modulation only. The K83/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, DC-HSDPA, 4C-HSDPA and 8C-HSDPA (all instruments except the R&S®SMW200A: 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 K83/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 enabled	0 to 7
	secondary cell active	0 to 7
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 enabled is 0	ranges for parameters in each 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 secondary cell enabled is > 0 and secondary cell active is > 0	ranges for parameters in each row	
	physical HS-DPCCH channels	HS-DPCCH 1, HS-DPCCH 2, depending on the “MIMO mode”, “secondary cell active” and “secondary cell enabled” settings
	HS-DPCCH slot format	0 to 1, depending on the “MIMO mode”, “secondary cell active” and “secondary cell enabled” settings
	HARQ-ACK	DTX and all HARQ-ACK combinations of 3GPP TS 25.212, depending on the “MIMO mode”, “secondary cell active” and “secondary cell enabled” settings
	CQI type	DTX, CQI, composite CQI, type A single TB, type A dual TB, type B, depending on the “MIMO mode”, “secondary cell active” and “secondary cell enabled” settings
	$CQI/CQI_s/CQI_1$	0 to 30
	CQI_2	0 to 30
Uplink DPCCH with 4 TPC bits (all instruments except the R&S®SMW200A: 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 K83/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 and uplink user scheduling feature (all instruments except the R&S SMW200A: requires the K45 option)		
Enhancements	The K83/K59 option enables simulation of the UL-DTX CPC feature for mobile station 1. In addition, the K83 option enables flexible scheduling of uplink transmission for mobile station 1 by means of a user-generated user scheduling file (not available in all-offline mode, and also not for the R&S®SMBVB-K83 option.).	
Ranges in the UL-DTX / user scheduling configuration dialog	state	off, on
	mode	UL-DTX, user scheduling User scheduling is not available in all-offline mode or for R&S®SMBVA-K59 or for R&S®SMBVB-K83.
	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) for the R&S®SMW-K83 or the R&S®SMBVB-K83 option		
3GPP release 6 test models		TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP release 8 test models		TS 34.121, table C.10.1.4, subtests 1 to 4, TS 34.121, table C.11.1.3, subtests 1 to 5, TS 34.121, table C.11.1.4, subtest 1
Uplink test models (in line with TS 34.121), R&S®SMBV100A with K43/K45/K59 options		
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®SMW-K40, R&S®SMBVB-K40 and R&S®SMBV-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	depends 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	All0, All1, 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®SMW-K41, R&S®SMBVB-K41 and R&S®SMBV-K41 options.

For each K41 option, a K40 option must also 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.	
ol 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)
Vamos timing offset jitter (for GMSK)	for R&S®SMW200A with R&S®SMW-B14	random timing jitter in range of –1, 0, +1 symbol period
Vamos frequency offset jitter (for GMSK)	for R&S®SMW200A with R&S®SMW-B14	random frequency jitter with settable range
	setting range	μ = 0 Hz to 9999.9 Hz, σ = 0 Hz to 9999.9 Hz

CDMA2000® digital standard

For the R&S®SMW-K46, R&S®SMBVB-K46 and R&S®SMBV-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 depends 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 (depends on radio configuration)
	reverse link	4 mobile stations with a maximum of 8 code channels each (depends 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		All0, All1, 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		All0, All1, 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.	All0, All1, 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		All0, All1, 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®SMW-K47, R&S®SMBVB-K47 and R&S®SMBV-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
Sequence length (reverse link)	sequence length entered in slots (1.67 ms each), max. length depends 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	All0, All1, 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	All0, All1, pattern (up to 64 bit), PN 9 to PN 23, data lists
	append FCS	on/off

1xEV-DO Revision B digital standard

For the R&S®SMW-K87, R&S®SMBVB-K87 and R&S®SMBV-K87 options.

For each K87 option, a K47 option must also be installed on the respective instrument.

General parameters	This option enhances the K47 option (1xEV-DO Revision A) to support 1xEV-DO Revision B. The K87 option requires the K47 option (1xEV-DO Revision A). Therefore, all general parameters of the K47 option are also valid for the K87 option, unless stated otherwise below.	
1xEV-DO digital standard	Revision B	in line with 3GPP2 C.S0024-B 3.0
Frequency	band class 0 to band class 21	410 MHz to 2690 MHz

Forward link parameters		
Physical layer subtype		0&1, 2 or 3
Reverse activity bit (MAC)	MAC index	4 to 127
Other users count	simulates additional MAC users	1 to 360
Settings for each forward link traffic channel		
Rate index	subtype 3	1 to 28
Packet size		128 bit to 12288 bit
Data rate	depends on rate index and packet size	4.8 kbps to 4915.2 kbps
MAC index	subtype 3	4 to 383
DRC lock (MAC)	period, subtype 3	0, 4
	length	1, 4, 8, 16, 32, 64
Multicarrier parameters		
Multicarrier state		on/off
	An activated multicarrier provides up to 16 concurrent carriers. Each carrier is modulated according to the signal configuration settings. Carrier frequencies can be set via the CDMA channel number or by directly specifying the RF center frequency.	
Band class	band class selection defines the CDMA channel number frequencies	• band class 0 (800 MHz band) • band class 1 (1900 MHz band) • band class 2 (TACS band) • band class 3 (JTACS band) • band class 4 (Korean PCS band) • band class 5 (450 MHz band) • band class 6 (2 GHz band) • band class 7 (upper 700 MHz band) • band class 8 (1800 MHz band) • band class 9 (900 MHz band) • band class 10 (secondary 800 MHz band) • band class 11 (400 MHz European PAMR band) • band class 12 (800 MHz PAMR band) • band class 13 (2.5 GHz IMT-2000 extension band) • band class 14 (US PCS 1.9 GHz band) • band class 15 (AWS band) • band class 16 (US 2.5 GHz band) • band class 17 (US 2.5 GHz forward link only band) • band class 18 (700 MHz public safety band) • band class 19 (lower 700 MHz band) • band class 20 (L band) • band class 21 (S band)
Number of carriers		1 to 16
CDMA channel number		depends on selected band class
Center frequency		depends on selected band class

TD-SCDMA digital standard (3GPP TDD LCR)

For the R&S®SMW-K50, R&S®SMBVB-K50 and R&S®SMBV-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	depends 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
Basic midamble code ID	automatic selection depending on scrambling code	0 to 127
Phase rotation	selects the phase rotation of the DwPTS	auto, S1, S2
Time delay	enters the delay of the signal of the selected cell compared to cell 1	cell 2, 3 and 4
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
		HS-PDSCH QPSK/16QAM/64QAM: 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; E-PUCH QPSK/16QAM: 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)	
	high speed shared information channel (HS-SICH)	
	enhanced physical uplink shared channel QPSK (E-PUCH QPSK)	
	enhanced physical uplink shared channel 16QAM (E-PUCH 16QAM)	

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 All0, All1, 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		All0, All1, pattern (length: 1 bit to 64 bit), data lists
TPC readout mode		continuous, single + All0, single + All1, 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 All0, All1, 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®SMW-K51, R&S®SMBVB-K51 and R&S®SMBV-K51 options.

For each K51 option, a K50 option must also 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, 16QAM and 64QAM modulation), HS-SICH, HSDPA and HSUPA
	insertion of bit and block errors possible
Modulation	QPSK, 8PSK, 16QAM and 64QAM

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 physical downlink shared channel 64QAM (HS-PDSCH 64QAM)	
	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, RMC PLCCH, HSDPA, user
	uplink	RMC 12.2 kbps, RMC 64 kbps, RMC 144 kbps, RMC 384 kbps, RMC HS-SICH, HSUPA, user
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)	

TETRA release 2 digital standard

For the R&S®SMW-K68 and R&S®SMBV-K68 options.

TETRA release 2 digital standard		in line with ETSI EN 300392-2 digital standard (V3.2.1) and TETRA conformance testing specification ETSI EN 300394-1 (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®SMW200A 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)		All0, All1, 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

Wireless connectivity standards

IEEE 802.11a/b/g/n/j/p digital standard

For the R&S®SMW-K54, R&S®SMBVB-K54 and R&S®SMBV-K54 options.

IEEE 802.11a/b/g/n/j/p digital standard		in line with IEEE 802.11-2012
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, 10 Msample/s, 20 Msample/s, 40 Msample/s
	range	depends on the respective Rohde & Schwarz instrument
Baseband filter		spectral mask in line with IEEE 802.11-2012, chapter 18.3.9.3 for LEGACY 10 MHz and 20 MHz modes, IEEE 802.11-2012, chapter 20.3.20.1 for high throughput (HT) modes
	CCK and PBCC	spectral mask in line with IEEE 802.11-2012, chapter 17.4.7.4
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 [8], file, off
Frame block configuration		
Frame blocks (rows in table)		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-10 MHz, 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

[8] Only if “Configure baseband B from baseband A” coupling is selected.

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
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 [9] 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

IEEE 802.11ac digital standard

For the R&S®SMW-K86, R&S®SMBVB-K86 and R&S®SMBV-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 802.11a/b/g/n/j/p) to support IEEE 802.11ac modes. The K86 option requires the K54 option (IEEE 802.11a/b/g/n/j/p). 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/D1.2
General settings		
Bandwidth	R&S®SMW-K86	
	with R&S®SMW-B10 installed	20 MHz, 40 MHz, 80 MHz
	with R&S®SMW-B10 and R&S®SMW-K522 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	with R&S®SMW-B9 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	R&S®SMBVB-K86	
	standard	20 MHz, 40 MHz, 80 MHz
	with R&S®SMBVB-K523 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	R&S®SMBV-K86	
	with R&S®SMBV-B10 installed	20 MHz, 40 MHz, 80 MHz
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
Sample rate	standard, R&S®SMW-K86	
	with R&S®SMW-B10 installed	20 Msample/s, 40 Msample/s, 80 Msample/s
	with R&S®SMW-B10 and R&S®SMW-K522 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	with R&S®SMW-B9 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	standard, R&S®SMBVB-K86	20 Msample/s, 40 Msample/s, 80 Msample/s
	with R&S®SMBVB-K523 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	standard, R&S®SMBV-K86	
	with R&S®SMBV-B10 installed	20 Msample/s, 40 Msample/s, 80 Msample/s
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	range	depends on the respective Rohde & Schwarz instrument

[9] 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.

Baseband filter		spectral mask in line with IEEE P802.11ac/D1.2, chapter 22.3.18, for very high throughput (VHT) modes
Transmit antenna setup	number of antennas	1 to 8
Frame block configuration		
Transmit mode	physical mode = MIXED MODE	
	R&S®SMW-K86	
	with R&S®SMW-B10 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz
	with R&S®SMW-B10 and R&S®SMW-K522 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz, VHT-80+80 MHz, VHT-160 MHz
	with R&S®SMW-B9 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz, VHT-80+80 MHz, VHT-160 MHz
	R&S®SMBVB-K86	
	standard	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz
	with R&S®SMBVB-K523 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz, VHT-80+80 MHz, VHT-160 MHz
	R&S®SMBV-K86	
	with R&S®SMBV-B10 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz, VHT-80+80 MHz, VHT-160 MHz
Settings for OFDM		
PSDU parameters	multi-user MIMO	With a minimum of 2 spatial streams configured, multi-user MIMO can be activated. N STS and group ID can be set individually for each of the 4 available users.
	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
	number of spatial streams	1 to 8
	number of space-time streams	1 to 8
	PSDU modulation/space stream	BPSK, QPSK, 16QAM, 64QAM, 256QAM
	data length	0 byte to 65495 byte for VHT frames
	raw data rate	up to 6933.33 Mbps

IEEE 802.11ax digital standard

For the R&S®SMW-K142, R&S®SMBVB-K142 and R&S®SMBV-K142 options.

For each K142 option, a K54 option must also be installed on the respective instrument.

General parameters	This option enhances the K54 option (IEEE 802.11a/b/g/n/j/p) to support IEEE 802.11ax modes. The K142 option requires the K54 option (IEEE 802.11a/b/g/n/j/p). Therefore, all general parameters of the K54 option such as frame block configuration or PSDU parameters are also valid for the K142 option, unless stated otherwise below.	
IEEE 802.11ax digital standard		in line with IEEE P802.11ax/D1.0
General settings		
Bandwidth	R&S®SMW-K142	
	with R&S®SMW-B10 installed	20 MHz, 40 MHz, 80 MHz
	with R&S®SMW-B10 and R&S®SMW-K522 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	with R&S®SMW-B9 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	R&S®SMBVB-K142	
	standard	20 MHz, 40 MHz, 80 MHz
	with R&S®SMBVB-K523 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
	R&S®SMBV-K142	
	with R&S®SMBV-B10 installed	20 MHz, 40 MHz, 80 MHz
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	20 MHz, 40 MHz, 80 MHz, 160 MHz
Sample rate	standard, R&S®SMW-K142	
	with R&S®SMW-B10 installed	20 Msample/s, 40 Msample/s, 80 Msample/s

	with R&S®SMW-B10 and R&S®SMW-K522 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	with R&S®SMW-B9 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	standard, R&S®SMBVB-K86	20 Msample/s, 40 Msample/s, 80 Msample/s
	with R&S®SMBVB-K523 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	standard, R&S®SMBV-K86	
	with R&S®SMBV-B10 installed	20 Msample/s, 40 Msample/s, 80 Msample/s
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	20 Msample/s, 40 Msample/s, 80 Msample/s, 160 Msample/s
	range	depends on the respective Rohde & Schwarz instrument
Baseband filter		spectral mask in line with IEEE P802.11ax/D1.0, chapter 28.3.18, for high efficienty (HE) modes
Transmit antenna setup	number of antennas	1 to 8
Frame block configuration		
Transmit mode	physical mode = MIXED MODE	
	R&S®SMW-K142	
	with R&S®SMW-B10 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz
	with R&S®SMW-B10 and R&S®SMW-K522 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz, HE-80+80 MHz, HE-160 MHz
	with R&S®SMW-B9 or R&S®SMW-B9 and R&S®SMW-K526 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz, HE-80+80 MHz, HE-160 MHz
	R&S®SMBVB-K142	
	standard	HE-20 MHz, HE-40 MHz, HE-80 MHz
	with R&S®SMBVB-K523 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz, HE-80+80 MHz, HE-160 MHz
	R&S®SMBV-K142	
	with R&S®SMBV-B10 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz
	with R&S®SMBV-B10 and R&S®SMBV-K522 installed	HE-20 MHz, HE-40 MHz, HE-80 MHz, HE-80+80 MHz, HE-160 MHz
Settings for OFDM/OFDMA		
PPDU parameters	number of spatial streams	1 to 8
	number of space-time streams	1 to 8
	link direction	downlink, uplink
	PPDU format	HE SU, HE MU, HE trigger based, HE extended range SU
	guard	0.8 µs, 1.6 µs, 3.2 µs
	HE-LTF symbol duration	3.2 µs, 6.4 µs, 12.8 µs
	max. PE duration	0 µs, 8 µs, 16 µs
	SIG-B DCM	on/off
	SIG-B MCS	0 to 5
	beam change	on/off
	BSS color	0 to 63
	TXOP duration	0 to 127
	spatial reuse	0 to 15
	doppler	on/off
	RU allocation selection	00000000 to 11011yyy
	number of MU-MIMO users	1 to 8
	max. total number of users	138
	STA ID	0 to 2074
	RU type	26-tone, 52-tone, 106-tone, 242-tone, 484-tone, 996-tone, 2x996-tone
	TXBF	on/off
	MCS	0 to 11
	PPDU modulation	BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
	channel coding	off, BCC, LDPC
	code rate	1/2, 2/3, 3/4, 5/6
	DCM	on/off
	number of MPDUs per A-MPDU	1 to 64

	data length of each MPDU	0 byte to 16384 byte
	raw data rate	up to 9607.8 Mbps

IEEE 802.11ad digital standard

For the R&S®SMW-K141 option.

IEEE 802.11ad digital standard		in line with IEEE 802.11ad-2012
General settings		
Frame type		data
DMG phy mode		control, single carrier
Generate waveform file	filtering of data generated in ARB mode and saving it as waveform file	
Marker modes		restart, frame, frame active part, frame inactive part, pulse, pattern, on/off ratio
Triggering		see data sheet of R&S®SMW200A, "wideband baseband generator" section
Chip/sample rate	standard	1.76 GHz for control, single carrier
	range	400 Hz – 3 GHz
Baseband filter		spectral mask in line with IEEE 802.11ad-2012, chapter 21.3.2
Clipping		vector or scalar clipping, applied before filtering
Sequence length		1 frame to 20000 frames (depends on frame duration)
Idle time	time between two successive frames (PPDUs)	
	range	0 s to 10 ms with 0.1 µs resolution
PPDU parameters	MAC header	activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, sequence control, QoS control
	frame check sequence	activating or deactivating a 32 bit (4 byte) checksum for protecting MAC header and user data (frame body)
	preamble/header active	The preamble/header can be turned on or off.
Settings for PHY mode single carrier		
MCS	modulation and coding scheme	1 to 12
Modulation		π/2-BPSK, π/2-QPSK, π/2-16QAM
Channel coding		LDPC
Code rate		1/2, 3/4, 5/8, 13/16
Scrambler		on/off
Scrambler init		00 to 7F
Data length		1 byte to 262107 byte
Training length		0 to 16
Turnaround		on/off
Last RSSI		–68 dBm to –42 dBm
Settings for PHY mode control		
MCS	modulation and coding scheme	0
Modulation		DBPSK
Channel coding		LDPC
Code rate		3/4
Scrambler		on/off
Scrambler init		00 to 7F
Data length		14 byte to 987 byte
Training length		0 to 16
Turnaround		on/off

IEEE 802.16 WiMAX™ digital standard

For the R&S®SMW-K49 and R&S®SMBV-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		All0, All1, 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		All0, All1, pattern (up to 64 bit), PN 9 to PN 23, data lists

NFC A/B/F digital standard

For the R&S®SMW-K89 and R&S®SMBV-K89 options.

NFC A/B/F digital standard	If “Technology” is set to “NFC-A”, “NFC-B” or “NFC-F”, signals are generated in line with the NFC Forum™ specifications “NFCForum-TS-DigitalProtocol-1.0” and “NFCForum-TS-Analog-1.0”. If “Technology” is set to “EMV type A” or “EMV type B”, signals are generated in line with “Book D: Contactless Communication Protocol”, version 2.2, from EMVCo, LLC.	
General settings		
RF frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
RF output level		default –30 dBm, user-selectable in entire output level range of respective Rohde & Schwarz instrument
Clipping	setting of clipping value relative to highest peak in percent; clipping reduces the crest factor	
	clipping level	1 % to 100 %
Marker		• restart • pulse • pattern • on/off ratio
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Technology		NFC-A, NFC-B, NFC-F, EMV type A, EMV type B
Divisor	for NFC-F only	2 (212 kbps), 4 (424 kbps)
Transmission mode		for “NFC-A”, “NFC-B” or “NFC-F”: poll, listen; for “EMV type A” or “EMV type B”: “PCD to PICC”, “PICC to PCD”
Modulation settings		
Bit rate		depending on technology and divisor: NFC-A and EMV type A: 105.938 kbit/s, NFC-B and EMV type B: 105.938 kbit/s, NFC-F with divisor 2: 211.875 kbit/s, NFC-F with divisor 4: 423.750 kbit/s
Baseband output	only for transmission modes “listen” and “PICC to PCD”	on/off
Slope		on/off
RLC curve	only for activated “slope”	on/off
Tfall 90 % to 5 % (t1 to t2)	only for activated “slope”, only for NFC-A poll and EMV type A PCD to PICC	0 s to 2.70 µs
Trise 5% to 90 % (t3)	only for activated “slope”, only for NFC-A poll and EMV type A PCD to PICC	0 s to 1.30 µs
Tlow (t2)	only for activated “slope”, only for NFC-A poll and EMV type A PCD to PICC	0.40 s to 3.10 µs
Tfall 90 % to 10 %	only for activated “slope”, not for NFC-A poll or EMV type A PCD to PICC	range depends on technology, divisor and transmission mode
Trise 10 % to 90 %	only for activated “slope”, not for NFC-A poll or EMV type A PCD to PICC	range depends on technology, divisor and transmission mode
Overshoot of rising slope (VOU)	only for activated “RLC curve”	0 % to 42 %
Undershoot of falling slope (VOU)	only for activated “RLC curve”	0 % to 42 %
Modulation depth	only for NFC-A poll and EMV type A PCD to PICC	0 % to 100 %

Modulation index	not for NFC-A poll or EMV type A PCD to PICC, not for activated “baseband output”	0 % to 100 %	
Inverse modulation	only for NFC-B listen and NFC-F listen and EMV Type B PICC to PCD	on/off	
Sample rate		range depends on technology, divisor and transmission mode	
Sequence configuration			
Number of command blocks		1 to 100	
Command types	for NFC-A poll	ALL_REQ SENS_REQ SDD_REQ SEL_REQ SLP_REQ RID RALL READ_Type1 WRITE-E WRITE-NE RSEG READ8 WRITE-E8	WRITE-NE8 READ_Type2 WRITE_Type2 SECTOR_SELECT RATS DATA_Type4A ATR_REQ PSL_REQ DEP_REQ DSL_REQ RLS_REQ IDLE BLANK
	for NFC-B poll	ALLB_REQ SENSB_REQ SLOT_MARKER SLPB_REQ	ATTRIB DATA_Type4B IDLE BLANK
	for NFC-F poll	SENSF_REQ CHECK UPDATE ATR_REQ PSL_REQ	DEP_REQ DSL_REQ RLS_REQ IDLE BLANK
	for NFC-A listen	SENS_RES SDD_RES SEL_RES RID RALL READ_Type1 WRITE-E WRITE-NE RSEG READ8 WRITE-E8 WRITE-NE8	READ_Type2 ACK NACK ATS DATA_Type4A ATR_RES PSL_RES DEP_RES DSL_RES RLS_RES IDLE BLANK
	for NFC-B listen	SENSB_RES SLPB_RES ATTRIB	DATA_Type4B IDLE BLANK
	for NFC-F listen	SENSF_RES CHECK UPDATE ATR_RES PSL_RES	DEP_RES DSL_RES RLS_RES IDLE BLANK
	for EMV type A PCD to PICC	WUPA REQA ANTICOLLISION SELECT HLTA	RATS DATA_Type_A IDLE BLANK
	for EMV type B PCD to PICC	WUPB REQB HLTB ATTRIB	DATA_Type_B IDLE BLANK
	for EMV type A PICC to PCD	ATQA ANTICOLLISION SAK ATS	DATA_Type_A IDLE BLANK
	for EMV type B PICC to PCD	ATQB HLTB ATTRIB	DATA_Type_B IDLE BLANK

Repetition		0 to 9999
Power offset		–20 dB to +20 dB
Duration	for command types “IDLE” and “BLANK”	0 s to 1 000 000 µs
	for all other command types	determined automatically
Frame configuration		depends on command type

Bluetooth® EDR/low energy digital standard

For the R&S®SMW-K60, R&S®SMBVB-K60 and R&S®SMBV-K60 options.

Basic rate + EDR		
Bluetooth® version		version 4.2
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		depends on available ARB memory
Data sources (in all data mode)		All0, All1, 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	All0, All1, 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		version 4.2
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		depends 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	200 kHz to 300 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	All0, All1, 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	All0, All1, 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 to 255 byte
Payload CRC		calculated automatically

Bluetooth® 5.x digital standard

For the R&S®SMW-K117, R&S®SMBVB-K117 and R&S®SMBV-K117 options.

For each K117 option, a K60 option must also be installed on the respective instrument.

Bluetooth® low energy		
Bluetooth® low energy version		version 5.0
Channel types		advertising, data
Supported packet types		ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_SCAN_IND, SCAN_REQ, SCAN_RSP, CONNECT_IND, ADV_EXT_IND, AUX_ADV_IND, AUX_CHAIN_IND, AUX_SYNC_IND, AUX_SCAN_REQ, AUX_SCAN_RSP, AUX_CONNECT_REQ, AUX_CONNECT_RSP, DATA, CONTROL_DATA, TEST PACKET
Packet format		LE 1M, LE 2M, LE coded
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 for LE 1M and LE coded modes, 2FSK, 500 kHz deviation, 2 MHz symbol rate for LE 2M mode
	2FSK frequency deviation	200 kHz to 300 kHz for LE 1M and LE coded modes, 400 kHz to 600 kHz for LE 2M mode
	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 1250 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
	modulation index modes	standard, stable
Settings for advertising channel		
Corrupted CRC every packet		off, on
Advertising event interval		0.9 ms to 6.4 s
Advertising event delay		0 ms to 10 ms
Data whitening		supported
Packet editor features	advertiser's address type	public, random
	initiator's address type	public, random
	scanner's address type	public, random
	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_IND packets
	payload data sources	All0, All1, PRBS 9 to PRBS 23, pattern, data list
	payload CRC	calculated automatically
	CONNECT_IND parameters	
	transmit window size	1.25 ms to 5 ms
	transmit window offset	0 s to 7.5 ms
	connection event interval	7.5 ms to 6.4 s
	slave latency	0 to 5 events
	LL connection timeout	100 ms to 32 s
	hop length	5 to 16
	sleep clock accuracy	0 ppm to 500 ppm

Settings for data channel		
Bluetooth® controller role		master, slave
Corrupted CRC every second packet		off, on
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
Symbols per a bit		S = 2, S = 8 for LE coded mode
Packet editor features	access address	user-definable
	NESN start value	0 or 1
	SN start value	0 or 1
	payload data sources	All0, All1, PRBS 9 to PRBS 23, pattern, data list
	payload CRC	calculated automatically
	LL_CONNECTION_UPDATE_IND parameters	
	transmit window size	1.25 ms to 6.25 ms
	transmit window offset	0 ms to 7.5 ms
	connection event interval	7.5 ms to 6.4 s
	slave latency	0 to 5 events
	LL connection timeout	100 ms to 32 s
	connection instant	0 or 1 events
Settings for test packets		
Packet interval		625 µs to 12.5 ms, in steps of 625 µs for LE 1M and LE 2M modes 1.875 ms to 15 ms, in steps of 625 µs for LE coded mode
Symbols per a bit		S = 2, S = 8 for LE coded mode
Payload type		PRBS 9, PRBS 15, pattern 11110000, 10101010, 11111111, 00000000, 00001111, 01010101
Payload length		37 byte to 255 byte
Payload CRC		calculated automatically

LoRa digital standard

For the R&S®SMW-K131, R&S®SMBVB-K131 and R&S®SMBV-K131 options.

LoRaWAN™		
LoRaWAN™ version		version 1.1
General settings		
Bandwidth		7.8125 kHz, 10.4167 kHz, 15.625 kHz, 20.8333 kHz, 31.25 kHz, 41.667 kHz, 62.5 kHz, 125 kHz, 250 kHz, 500 kHz
Idle interval		0 µs to 1000000 µs
Sequence length		depends on available ARB memory
Oversampling		1 to 32
Sample rate variation		400 Hz to 20 MHz
Modulation, coding, header and payload parameters		
Conding rate		0, 1, 2, 3, 4
Spreading factor		6 to 12
Encoder state		on, off
Interleaver state		on, off
Payload data length		1 byte to 255 byte
Payload data source		All0, All1, PRBS 9 to PRBS 23, pattern, data list
Payload CRC		on, off
Payload reduced coding mode		on, off
Sync mode		public, private
Unmodulated preamble length		6 to 8
Header state		on, off
Burst mode		on, off
Compressed mode		on, off
Reserved bit		on, off

Impairments		
State		on, off
Symbol timing error		–300 ppm to +300 ppm
Frequency offset		–200 kHz to +200 kHz
Frequency drift		
State		on, off
Type		linear, sine
Deviation		–200 kHz to +200 kHz
Rate		160 kHz to 1600 Hz

Broadcast standards

DVB-H/DVB-T digital standard

For the R&S®SMW-K52 and R&S®SMBV-K52 options.

DVB-H/DVB-T digital standard		in line with ETSI EN 300744 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		nonhierarchical
Sequence length	number of superframes	min.: 1, max.: depends 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.	All0, All1, 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

DVB-S2/DVB-S2X digital standard

For the R&S®SMW-K116 and R&S®SMBV-K116 options.

DVB-S2/DVB-S2X digital standard		in line with ETSI EN 302307-1 v.1.4.1 and ETSI EN 302307-2 v.1.1.1
General settings		
Frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
Output level		user-selectable in entire output level range of respective Rohde & Schwarz instrument
Number of frames		min.: 1; max.: depends on baseband generator memory
VL-SNR mode		on/off
Baseband filter	standard	root cosine
	roll off range	low, high
	roll off factor	0.05, 0.1, 0.15, 0.2, 0.25, 0.35
Symbol rate		min.: 100 symbol/s; max.: up to 600 Msymbol/s, depends on baseband generator bandwidth
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, frame start, pulse, pattern, on/off ratio
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Signal path parameters		
Stream type		transport, GP, GC, GSE-HEM
Input data		All0, All1, pattern, PN 9, PN 11, PN 15, PN 16, PN 20, PN 21, PN 23, data list, data from file (see below)
	transport stream	transport stream file (.GTS, .TS, .TRP)
	GSE-HEM	GSE file
BB scrambler	state	on/off
Outer coder	state	on/off
Inner coder	state	on/off
Code type		normal, medium, short

MODCOD	for DVB-S2	
	QPSK 1/4, QPSK 1/3, QPSK 2/5, QPSK 1/2, QPSK 3/5, QPSK 2/3, QPSK 3/4, QPSK 4/5, QPSK 5/6, QPSK 8/9, QPSK 9/10, 8PSK 3/5, 8PSK 2/3, 8PSK 3/4, 8PSK 5/6, 8PSK 8/9, 8PSK 9/10, 16APSK 2/3, 16APSK 3/4, 16APSK 4/5, 16APSK 5/6, 16APSK 8/9, 16APSK 9/10, 32APSK 3/4, 32APSK 4/5, 32APSK 5/6, 32APSK 8/9, 32APSK 9/10	
	for DVB-S2X	
	QPSK 13/45, QPSK 9/20, QPSK 11/20, 8APSK 5/9-L, 8APSK 26/45-L, 8PSK 23/36, 8PSK 25/36, 8PSK 13/18, 16APSK 1/2-L, 16APSK 8/15-L, 16APSK 5/9-L, 16APSK 26/45, 16APSK 3/5, 16APSK 3/5-L, 16APSK 28/45, 16APSK 23/36, 16APSK 2/3-L, 16APSK 25/36, 16APSK 13/18, 16APSK 7/9, 16APSK 77/90, 32APSK 2/3-L, 32APSK 32/45, 32APSK 11/15, 32APSK 7/9, 64APSK 32/45-L, 64APSK 11/15, 64APSK 7/9, 64APSK 4/5, 64APSK 5/6, 128APSK 3/4, 128APSK 7/9, 256APSK 29/45-L, 256APSK 2/3-L, 256APSK 31/45-L, 256APSK 32/45, 256APSK 11/15-L, 256APSK 3/4, QPSK 11/45, QPSK 4/15, QPSK 14/45, QPSK 7/15, QPSK 8/15, QPSK 32/45, 8PSK 7/15, 8PSK 8/15, 8PSK 26/45, 8PSK 32/45, 16APSK 7/15, 16APSK 8/15, 16APSK 26/45, 16APSK 3/5, 16APSK 32/45, 32APSK 2/3, 32APSK 32/45	
Pilot state		on/off
PL scrambler		on/off
Scrambler sequence		0 to 6

DAB/T-DMB digital standard

For the R&S®SMBV-K53 option.

DAB/T-DMB digital standard		in line with ETSI EN 300401 v.1.3.3 (with restrictions, see below)
Ensemble transport interface		in line with ETSI ETS 300799 (with restrictions, see below)
General settings		
Source data	FIC and CIFs, each filled with	All0, All1, 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.
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 standars

For the R&S®SMBV-K56 option.

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		All0, All1, 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)		
	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		All0, All1, 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)		
	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®SMBV-K57 option.

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®SMBV-K58 option.

Sirius digital standard		in line with Sirius Satellite Radio, 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		All0, All1, 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 [10]

[10] R&S®SMBV-K58 requires R&S®SMBV-B10/R&S®SMBV-B55/R&S®SMBV-B92.

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		All0, All1, 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 [10]
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

Other standards and modulation systems

OFDM signal generation

For the R&S®SMW-K114 and R&S®SMBVB-K114 options.

Modulation type		OFDM, f-OFDM, UFMC, FBMC, GFDM
General settings		
Physical settings		
Total number of subcarriers		64 to 16384
Occupied number of subcarriers		1 to 0.86 × total number of subcarriers
Sequence length	OFDM, f-OFDM	1 symbol to 2400 symbols
	UFMC, FBMC, GFDM	1 symbol to 150 symbols
Subcarrier spacing		1 to x Hz, x is calculated as follows: total number of subcarriers / max. sampling rate (depends on baseband options of the respective Rohde & Schwarz instrument)
Cyclic prefix length		1 to total number of subcarriers
Cyclic prefix no. symbols	OFDM, f-OFDM	0 to sequence length
Alt. cyclic prefix length	OFDM, f-OFDM	1 to total number of subcarriers
Alt. cyclic prefix no. symbols	OFDM, f-OFDM	0 to (sequence length – cyclic prefix no. symbols)
Filter settings		
Filter type	OFDM	none, user
	f-OFDM	soft truncation, user, none
	UFMC	Dolph-Chebyshev, user
	FBMC	root raised cosine, user
	GFDM	raised cosine, root raised cosine, Dirichlet, rectangular, user
Filter length	OFDM, f-OFDM, UFMC	1 to 2048
Stopband attenuation	UFMC	–80 dB to 10 dB
Rolloff factor	GFDM	0.0 to 1.0
Windowing method	f-OFDM	none, Hanning, Hamming

Cut transient response	f-OFDM, FBMC	on/off
Load user filter	OFDM, f-OFDM, UFMCselected filter type: user	.dat/.iqw filter coefficient file
Modulation-specific configuration		
Number of subbands	OFDM, f-OFDM, UFMC	1 to occupied number of subcarriers
Datablock size	GFDM	1 to sequence length, must be a common divisor of sequence length
Allocation settings		
User		
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1
Relative power ρ		–80 dB to 10 dB
State		on/off
Allocations		
Number of allocations		500
Modulation		BPSK, QPSK, 16QAM, 64QAM, 256QAM, SCMA, custom I/Q
No. SC		1 to occupied number of subcarriers
No. sym.		1 to sequence length
Offset SC		0 to (occupied number of subcarriers – no. SC)
Offset sym.		0 to (sequence length – no. sym.)
Data source		PN9, PN11, PN15, PN16, PN20, PN21, PN23, pattern, data list, All0, All1, I/Q source
Relative power ρ		–80 dB to 10 dB
Content type		data
Content type	OFDM, f-OFDM	data, pilot, reserved
SCMA configuration		
Spreading factor K		4 (fixed)
Codebook size M		4 (fixed)
Number of layers J		6 (fixed)
SCMA layer mapping		
LayerX		User0 to User5, one user can be allocated to multiple layers
Relative power ρ		0.0 dB (fixed)
Export path for XML settings	Sets the path for saving OFDM settings in XML format. These files can be used for for measurements with a Rohde & Schwarz signal analyzer, for example R&S®VSE-K96.	

Multicarrier CW signal generation

For the R&S®SMW-K61, R&S®SMBVB-K61 and R&S®SMBV-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 depends on number of carriers and bandwidth of baseband generator	
	R&S®SMW-K61	
	with R&S®SMW-B10	1 Hz to 120 MHz
	with R&S®SMW-B10 and R&S®SMW-K522	1 Hz to 160 MHz
	with R&S®SMW-B9	1 Hz to 500 MHz
	with R&S®SMW-B9 and R&S®SMW-K525	1 Hz to 1000 MHz
	with R&S®SMW-B9 and R&S®SMW-K527	1 Hz to 2000 MHz
	R&S®SMBVB-K61	
	standard	1 Hz to 120 MHz
	with R&S®SMBVB-K523	1 Hz to 240 MHz
	with R&S®SMBVB-K524	1 Hz to 500 MHz
	R&S®SMBV-K61	
	with R&S®SMBV-B10	1 Hz to 120 MHz
	with R&S®SMBV-B10 and R&S®SMBV-K522	1 Hz to 160 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
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Marker		unchanged, restart, pulse, pattern, ratio
RF frequency response	see data sheet of respective Rohde & Schwarz instrument, "Signal performance for digital standards" section	
Suppression of unwanted carriers		

Baseband power sweep

For the R&S®SMW-K542 option.

State		on/off
Shape		linear ramp, stair step, triangle, constant
Slope		ascending, descending
Sweep power range		
Total setting range	range plus pre-sweep	0 dB to +50.00 dB
Sweep setting range		0 dB to +50.00 dB
Pre-sweep setting range		0 dB to +20.00 dB
Setting resolution		0.01 dB
Sweep time range		
Setting range		1 µs to 20 s
Setting resolution		5 ns
RF blanking time		
Setting range		5 ns to 1 ms
Setting resolution		depends on derived sampling rate, possible minimum: 5 ns
Fall time range		
Setting range		5 ns to 1 s
Setting resolution		depends on derived sampling rate, possible minimum: 5 ns

Ordering information

Digital standards for the R&S®SMW200A vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMW-K40	1413.3684.02
EDGE Evolution	R&S®SMW-K41	1413.3732.02
3GPP FDD	R&S®SMW-K42	1413.3784.02
CDMA2000®	R&S®SMW-K46	1413.3884.02
1xEV-DO Rev. A	R&S®SMW-K47	1413.3932.02
IEEE 802.16	R&S®SMW-K49	1413.3984.02
TD-SCDMA	R&S®SMW-K50	1413.4039.02
TD-SCDMA enhanced BS/MS tests	R&S®SMW-K51	1413.4080.02
DVB-H/DVB-T	R&S®SMW-K52	1413.6090.02
IEEE 802.11 (a/b/g/n/j/p)	R&S®SMW-K54	1413.4139.02
EUTRA/LTE	R&S®SMW-K55	1413.4180.02
Bluetooth® EDR	R&S®SMW-K60	1413.4239.02
Multicarrier CW signal generation	R&S®SMW-K61	1413.4280.02
TETRA release 2	R&S®SMW-K68	1413.4439.02
LTE closed-loop BS test	R&S®SMW-K69	1413.4480.02
EUTRA/LTE, 5G NR log file generation	R&S®SMW-K81	1413.4539.02
3GPP FDD HSPA/HSPA+, enhanced bs/ms tests	R&S®SMW-K83	1413.4580.02
EUTRA/LTE release 9 and enhanced features	R&S®SMW-K84	1413.5435.02
EUTRA/LTE release 10 (LTE-Advanced)	R&S®SMW-K85	1413.5487.02
IEEE 802.11ac	R&S®SMW-K86	1413.5635.02
1xEV-DO rev. B	R&S®SMW-K87	1413.6519.02
NFC A/B/F	R&S®SMW-K89	1413.6619.02
LTE release 11 and enhanced features	R&S®SMW-K112	1413.8505.02
EUTRA/LTE release 12	R&S®SMW-K113	1414.1933.02
OFDM signal generation	R&S®SMW-K114	1414.1985.02
Cellular IoT	R&S®SMW-K115	1414.2723.02
DVB-S2/DVB-S2X	R&S®SMW-K116	1414.2630.02
Bluetooth® 5.0	R&S®SMW-K117	1414.3336.02
Verizon 5GTF signals	R&S®SMW-K118	1414.3465.02
LTE release 13, 14 and 15	R&S®SMW-K119	1414.3542.02
OneWeb user-defined signal generation	R&S®SMW-K130	1414.3788.02
LoRa	R&S®SMW-K131	1414.6464.02
IEEE 802.11ad	R&S®SMW-K141	1414.1333.02
IEEE 802.11ax	R&S®SMW-K142	1414.3259.02
Cellular IoT release 14	R&S®SMW-K143	1414.6064.02
5G New Radio	R&S®SMW-K144	1414.4990.02
5G NR closed-loop BS test	R&S®SMW-K145	1414.6506.02
Cellular IoT release 15	R&S®SMW-K146	1414.6564.02
OneWeb reference signals	R&S®SMW-K355	1414.3742.02
Baseband power sweep	R&S®SMW-K542	1413.9876.02

Digital standards for the R&S®SMBV100B vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMBVB-K40	1423.7724.02
EDGE Evolution	R&S®SMBVB-K41	1423.7730.02
3GPP FDD	R&S®SMBVB-K42	1423.7747.02
CDMA2000®	R&S®SMBVB-K46	1423.7760.02
1xEV-DO Rev. A	R&S®SMBVB-K47	1423.7776.02
TD-SCDMA	R&S®SMBVB-K50	1423.7782.02
TD-SCDMA enhanced BS/MS tests	R&S®SMBVB-K51	1423.7799.02
IEEE 802.11 (a/b/g/n/j/p)	R&S®SMBVB-K54	1423.7824.02
EUTRA/LTE	R&S®SMBVB-K55	1423.7830.02
Bluetooth® EDR	R&S®SMBVB-K60	1423.7853.02
Multicarrier CW signal generation	R&S®SMBVB-K61	1423.7860.02
3GPP FDD HSPA/HSPA+, enhanced BS/MS tests	R&S®SMBVB-K83	1423.7899.02
EUTRA/LTE release 9 and enhanced features	R&S®SMBVB-K84	1423.7901.02
EUTRA/LTE release 10 (LTE-Advanced)	R&S®SMBVB-K85	1423.7918.02
IEEE 802.11ac	R&S®SMBVB-K86	1423.7924.02
1xEV-DO Rev. B	R&S®SMBVB-K87	1423.7930.02
NFC A/B/F	R&S®SMBVB-K89	1423.7947.02
LTE release 11 and enhanced features	R&S®SMBVB-K112	1423.8037.02
EUTRA/LTE release 12	R&S®SMBVB-K113	1423.8043.02
OFDM signal generation	R&S®SMBVB-K114	1423.8050.02
Cellular IoT	R&S®SMBVB-K115	1423.8066.02
Bluetooth® 5.0	R&S®SMBVB-K117	1423.8089.02
LTE release 13, 14 and 15	R&S®SMBVB-K119	1423.8108.02
LoRa	R&S®SMBVB-K131	1423.8720.02
IEEE 802.11ax	R&S®SMBVB-K142	1423.7901.02
Cellular IoT release 14	R&S®SMBVB-K143	1423,8637.02
5G New Radio	R&S®SMBVB-K144	1423.8608.02
Cellular IoT release 15	R&S®SMBVB-K146	1423.8808.02

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 Rev. A	R&S®SMBV-K47	1415.8090.02
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 802.11 (a/b/g/n/j/p)	R&S®SMBV-K54	1415.8160.02
EUTRA/LTE	R&S®SMBV-K55	1415.8177.02
XM Radio™	R&S®SMBV-K56	1415.8183.02
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
1xEV-DO Rev. B	R&S®SMBV-K87	1415.8719.01
NFC A/B/F	R&S®SMBV-K89	1419.1690.02
LTE release 11 and enhanced features	R&S®SMBV-K112	1419.1719.02
EUTRA/LTE release 12	R&S®SMBV-K113	1419.2921.02
Cellular IoT	R&S®SMBV-K115	1419.1583.02
DVB-S2/DVB-S2X	R&S®SMBV-K116	1427.8002.02
Bluetooth® 5.0	R&S®SMBV-K117	1427.8083.02
LTE releases 13 and 14	R&S®SMBV-K119	1427.8148.02
LoRa	R&S®SMBV-K131	1419.1783.02
IEEE 802.11ax	R&S®SMBV-K142	1427.8048.02