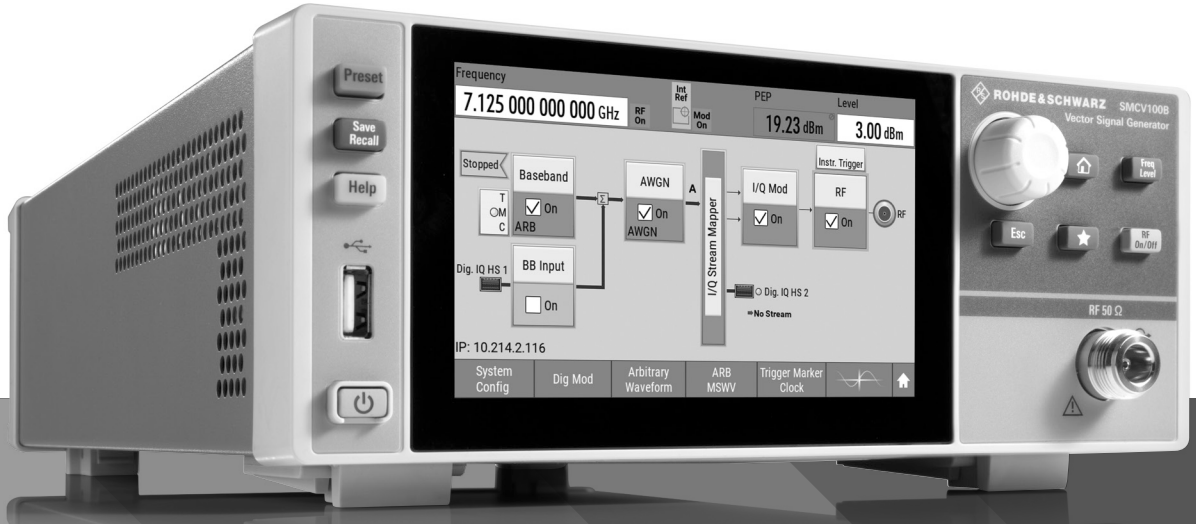
BROADCAST STANDARDS FOR THE R&S®SMCV100B VECTOR SIGNAL GENERATOR

Specifications



Data Sheet
Version 06.00

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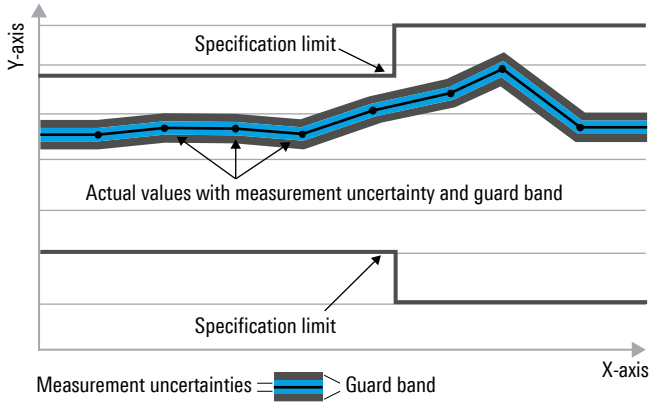
CONTENTS

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.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

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 designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Introduction

This document describes the broadcast standard options of the R&S®SMCV100B vector signal generator.
All listed broadcast standards are FPGA based whereby the signal generation is performed in real time.

Related documents

Further documents and specifications are available:

• R&S®SMCV100B Vector Signal Generator	data sheet	PD 3608.0627.22
• R&S®SMCV100B Vector Signal Generator	product brochure	PD 3608.0627.12
• R&S®SMCV100B Vector Signal Generator	product flyer	PD 3608.0627.32
• R&S®WinIQSIM2 Simulation Software	data sheet	PD 5213.7460.22
• Digital Standards for Signal Generators	data sheet	PD 5213.9434.22
• GNSS and Avionics Simulation for Rohde & Schwarz Signal Generators	data sheet	PD 3607.6896.22
• Rohde & Schwarz GNSS Solutions	fact sheet	PD 5216.1740.32

Broadcast transmission standards

Required option for all broadcast transmission standards	enable broadcast standards	R&S®SMCVB-K519

Terrestrial broadcast standards

ATSC 8VSB, ATSC-M/H (R&S®SMCVB-K161 option)

ATSC 8VSB		in line with ATSC Doc. A/53 (8VSB)
ATSC-M/H		in line with ATSC Doc. A/153 (mobile DTV)
Input	transport stream	for details, see Digital audio/video
Modulation	mode	8VSB
	bandwidth	6 MHz
	symbol rate	10.762238 Msps
	range	±5 %, settable
	pilot value	1.25
	pulse filtering	root raised cosine rolloff, α = 0.115
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [1]
Coding	input data rate	19.392658 Mbit/s
Test signals		• TS test packet (see Internal test signals) • PRBS before interleaver • PRBS before trellis • PRBS before mapper

ATSC 3.0 (R&S®SMCVB-K162 option)

ATSC 3.0		in line with ATSC A/322 [2], single subframe with single PLP [3], single or multiple subframes with single or multiple PLPs [4]
Input	transport stream [3]	for details, see Digital audio/video
	interface	Ethernet
	format	MPEG-2 TS (single PLP only)
	IP stream [3]	for details, see Digital audio/video
	interface	Ethernet
	format	ROUTE/DASH (single PLP only), MMT (single PLP only)
	STL	
	interface	on/off
	format	in line with ATSC A/324
Analyzer		ATSC 3.0 specification check and logging [5]
Modulation	modulation	COFDM
	PLP number	1 (single PLP) to 64 (multiple PLPs)
	single PLP	
	STL interface	off
	PLP number	1
	single PLP and multiple PLPs	
	STL interface	on
	PLP number	1 to 64

[1] With internal test signals.

[2] Unsupported features: MIMO, PAPR set to ACE/TR+ACE, channel bonding, L1 detail additional parity.

[3] With STL interface switched off.

[4] With STL interface switched on.

[5] Logging only with STL interface switched on.

	subframe number	1 (single subframe) to 256 (multiple subframes)
	single subframe	
	STL interface	off
	subframe number	1
	single subframe and multiple subframes	
	STL interface	on
	subframe number	1 to 256
Coding	bandwidth	6 MHz, 7 MHz, 8 MHz
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [6]
	PLP layer	core, enhanced [7]
	FEC type	BCH+16k, BCH+64k, CRC+16k, CRC+64k, 16k only, 6k only
	code rate	2/15, 3/15, 4/15, 5/15, 6/15, 7/15, 8/15, 9/15, 10/15, 11/15, 12/15, 13/15
	constellation	QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM
	PLP type	non-dispersed, dispersed [4]
	time interleaver	settable [3]
	extended interleaving	settable [3]
Subframing	MISO	off, 64, 256 coefficients
	FFT size	8k, 16k, 32k COFDM
	reduced carrier mode	settable [3]
	guard interval	192, 384, 512, 768, 1024, 1536, 2048, 2432, 3072, 3684, 4096, 4864
	pilot pattern (SISO)	3_2, 3_4, 4_2, 4_4, 6_2, 6_4, 8_2, 8_4, 12_2, 12_4, 16_2, 16_4, 24_2, 24_4, 32_2, 32_4
	pilot boost mode	settable [3]
	frequency interleaver	settable [3]
	number of data OFDM symbols	settable [3]
System	time info	settable [3]
	number of transmitters	2, 3, 4
	transmitter index	1, 2, 3, 4
	TxID address	0 to 8191
	TxID injection level	STL [4], manual
	PAPR reduction	off, tone reservation (TR) [8]
	frame mode	time aligned, symbol aligned
	frame length	settable [3]
	L1 basic FEC type	mode1, mode2, mode3, mode4, mode5
	L1 detail FEC type	mode1, mode2, mode3, mode4, mode5, mode6, mode7
	L1 detail version	settable [3]
	broadcast stream ID	settable [3]
	reduced carrier mode (preamble)	settable [3]
	pilot pattern Dx (preamble)	3, 4, 6, 8, 12, 16, 24, 32
Special functions	bootstrap minor version	settable [3]
	bootstrap emergency alert signaling	settable [3]
	STL preamble compatibility mode	in line with ATSC A/324 2018 or 2016 [4]
	STL TMP compatibility mode	in line with ATSC A/324 2018 or 2016 [4]
	ALP LMT compatibility mode	in line with ATSC A/324 2018 or 2016 [3]
Single-frequency network	network mode	SFN [4, 9], MFN
	control	STL [4], manual
Test signals		TS test packet, IP test packet (see Internal test signals)

[6] With internal test signals.

[7] Enhanced PLP layer only with STL interface switched on.

[8] If PAPR set to TR, reserved carriers modulated with 0+j0 only.

[9] SFN only supported with external ATSC 3.0 scheduler/gateway, external 1 PPS and 10 MHz reference frequency.

DVB-T/DVB-H (R&S®SMCVB-K163 option)

DVB-T/DVB-H	in line with EN 300744 and EN 302304	
Input	transport stream	for details, see Digital audio/video
Modulation	mode	COFDM
	bandwidth	5 MHz, 6 MHz, 7 MHz, 8 MHz (settable for variable bandwidth: bandwidth used from 1 MHz to 10 MHz)
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [10]
Coding	constellation	QPSK, 16QAM, 64QAM, hierarchical coding
	code rate	1/2, 2/3, 3/4, 5/6, 7/8
	guard interval	1/4, 1/8, 1/16, 1/32
	FFT mode	2k, 4k and 8k COFDM
	interleaver	native and in-depth
	TPS	in line with DVB-T/DVB-H
Special functions	Reed-Solomon encoder	can be switched off
Test signals		• TS test packet (see Internal test signals) • PRBS before convolutional encoder • PRBS after convolutional encoder

DVB-T2 (R&S®SMCVB-K164 option)

DVB-T2	in line with EN 302755 and TS 102773	v1.1.1, v1.2.1 [11] and v1.3.1 [12], incl. Annex I
	single PLP and multi PLP	v1.1.1, v1.2.1 [11]
	T2-Base single profile transmission	v1.3.1 [12]
	T2-Lite single profile transmission	v1.3.1 [12], in line with Annex I
Input	transport stream	for details, see Digital audio/video
	interface	ASI
	format	T2-MI (single PLP and multi PLP) or MPEG-2 TS (single PLP only)
	T2-MI	
	interface	on/off
	PID filter	settable [13]
	SID filter	settable [13]
	analyzer	T2 specification check and logging
Modulation	modulation	COFDM
	PLP number	1 (single PLP) to 20 (multi PLP)
	single PLP	
	T2-MI interface	off
	PLP number	1
	single PLP and multi PLP	
	T2-MI interface	on
	PLP number	1 to 20

[10] With internal test signals.

[11] Bias balancing cells and unoccupied cell filling between PLP cells not supported.

[12] Features in line with T2 v1.3.1, including Annex I (T2-Lite).

[13] With T2-MI interface switched on.

Coding	bandwidth	1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [10]
	PLP type	common, data type 1, data type 2 [13]
	baseband mode	normal (NM), high efficiency (HEM)
	ISSY	off, short, long [13]
	null packet deletion	on/off [13]
	FEC frame	normal (64k), short (16k)
	code rate	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 1/3 [12, 13], 2/5 [12, 13]
	constellation	QPSK, 16QAM, 64QAM, 256QAM
	rotation	on/off
	time interleaver	settable [14]
	frame interval (I_{jump})	≥ 1 [13]
	FFT size	1k, 2k, 4k, 8k, 16k and 32k COFDM
	extended carrier mode	on/off
	pilot pattern	PP1, PP2, PP3, PP4, PP5, PP6, PP7, PP8
	guard interval	1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
T2 system	T2 frames per superframe	settable [14]
	data symbols per T2 frame	settable [14]
	subslices per T2 frame	≥ 1 [13]
	in-band signaling	in line with T2 version [13]
	transmission system	SISO, MISO, T2-Lite SISO [13], T2-Lite MISO [13]
	MISO group	settable
	PAPR reduction	off, tone reservation (TR) [15]
	future extension frames (FEF)	off, null, noise [13, 16]
	T2 version	settable [14]
	L1 post modulation	BPSK, QPSK, 16QAM, 64QAM
	L1 repetition	on/off
	L1 post scrambled	settable in line with T2 version
	T2 base lite	on/off [13]
	cell ID	settable [14]
	network ID	settable [14]
	T2 system ID	settable [14]
Single-frequency network	network mode	SFN [13], MFN
	control	T2-MI [13], manual
Test signals		TS test packet (see Internal test signals)

[14] With T2-MI interface switched off.

[15] PAPR reduction in line with T2 version > v1.1.1 not supported yet. Reserved carriers modulated with 0+j0 only.

[16] Special feature to add noise to the FEF payload instead of null-FEF payload.

ISDB-T/ISDB-T_{SB} (R&S®SMCVB-K165 option)

ISDB-T		in line with ARIB STD-B31 version 1.7
ISDB-T_B		in line with Brazilian standard
ISDB-T_{SB}		in line with ARIB STD-B29
Input	transport stream	for details, see Digital audio/video
Modulation	mode	OFDM
	bandwidth	6 MHz, 7 MHz, 8 MHz
	number of segments	
	ARIB STD-B31	13
	ARIB STD-B29	1, 3
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [17]
Coding	control	IIP, manual
	FFT mode	2k, 4k and 8k
	guard interval	1/4, 1/8, 1/16, 1/32
	number of layers	1 to 3
	constellation	DQPSK, QPSK, 16QAM, 64QAM
	code rate	1/2, 2/3, 3/4, 5/6, 7/8
	time interleaver	
	ISDB-T	0, 1, 2, 4, 8, 16
	ISDB-T_{SB}	0, 1, 2, 4, 8, 16, 32
Earthquake early warning (EEW)		in line with ARIB STD-B31 version 2.2
	transmission channel	AC carriers of segment no. 0
	area information	56 prefectures
	epicenter information	ID, longitude, latitude, depth, occurrence time
Special functions	Reed-Solomon	can be switched off
	alert broadcasting flag	can be switched on
	AC information	PRBS, All1
	TX parameter switching indicator, TMCC next	static settings for test
Test signals		TS test packet (see Internal test signals)

DTMB (R&S®SMCVB-K166 option)

DTMB (TDS-OFDM)		in line with GB20600-2006
Input	transport stream	for details, see Digital audio/video
Modulation	mode	COFDM or single carrier
	bandwidth	6 MHz, 7 MHz, 8 MHz
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [17]
Coding	constellation	4QAM, 4QAM-NR, 16QAM, 32QAM, 64QAM
	code rate	0.4, 0.6, 0.8
	guard interval	
	PN sequences	420, 595, 945
	PN sequences 420, 945	variable/constant
	PN sequence 595	constant
	time interleaver	off, 240 symbols, 720 symbols
	FFT mode	4k COFDM
	dual pilot tone	can be switched on (single carrier)
Special functions	SI power normalization	can be switched on
Test signals		TS test packet (see Internal test signals)

[17] With internal test signals.

Satellite broadcast standards

DVB-S (R&S®SMCVB-K167 option)

DVB-S/DVB-DSNG		in line with EN 300421 and EN 301210
Input	transport stream	for details, see Digital audio/video
Modulation	mode	QPSK, 8PSK, 16QAM
	symbol rate	0.1 Msps to 60 Msps
		0.1 Msps to 90 Msps [18]
	pulse filtering	root raised cosine rolloff (α = 0.20, 0.25, 0.35)
	MER (500 MHz ≤ f ≤ 6.5 GHz)	> 38 dB (meas.) [19], (20 Msample/s, rolloff = 0.2, 8PSK)
Coding	constellation	code rate
	QPSK	1/2, 2/3, 3/4, 5/6, 7/8
	8PSK	2/3, 5/6, 8/9
	16QAM	3/4, 7/8
Special functions	Reed-Solomon encoder	can be switched off
Test signals		• TS test packet (see Internal test signals) • PRBS before convolutional encoder

DVB-S2 (R&S®SMCVB-K167 option)

DVB-S2		in line with EN 302307 part I including Annex M
	supported services	broadcast services, professional services, interactive services, DSNG
Input	transport stream	for details, see Digital audio/video
Modulation	modulation coding	
	S2-MODCOD	(1 to 28) QPSK, 8PSK, 16APSK, 32APSK
	symbol rate (all constellations)	• 0.1 Msps to 60 Msps • 0.1 Msps to 90 Msps [18]
	pulse filtering	root raised cosine rolloff (α = 0.05, 0.10, 0.15, 0.20, 0.25, 0.35)
	MER (500 MHz ≤ f ≤ 6.5 GHz)	> 38 dB (meas.) [19] (20 Msample/s, rolloff = 0.2, 8PSK)
Coding	constellation	code rate
	S2 – QPSK (normal)	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	S2 – QPSK (short)	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9
	S2 – 8PSK (normal)	3/5, 2/3, 3/4, 5/6, 8/9, 9/10
	S2 – 8PSK (short)	3/5, 2/3, 3/4, 5/6, 8/9
	S2 – 16APSK (normal)	2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	S2 – 16APSK (short)	2/3, 3/4, 4/5, 5/6, 8/9
	S2 – 32APSK (normal)	3/4, 4/5, 5/6, 8/9, 9/10
	S2 – 32APSK (short)	3/4, 4/5, 5/6, 8/9
	S2 FEC frame	• settable • normal, 64800 bit • short, 16200 bit
	pilot insertion	on/off

[18] With R&S®SMCVB-K521, R&S®SMCVB-K522 or R&S®SMCVB-K523 options.

[19] With internal test signals.

Coding modulation	mode	CCM, ACM, VCM
	ACM control	via remote control, SCPI scripts, seamless switching of parameters (modulation coding, FEC frame, pilot), PL frame by PL frame
	variable coding modulation	
	number of input streams	1 to 8 input streams, 1 external input supported, input stream 2 to 8: test TS packets
	multiple input streams (MIS)	
	input stream settings	for each input stream: individual setting of ISI, modulation coding, FEC frame, pilot
	merger	BB frame padding, if number of input streams > 1
Annex M	mode	on/off
	number of time slices	1 to 8 time slices, time slice 1: real DVB-S2 FEC, time slices 2 to 8: data slots = PRBS data symbols
	time slice settings	for each time slice: individual setting of TSN, modulation coding, FEC frame, pilot
Special function	PL scrambling sequence ID	0x00000 to 0x3FFFD hex
Test signals		TS test packet (see Internal test signals)

DVB-S2X (R&S®SMCVB-K168 option; R&S®SMCVB-K167 option required)

DVB-S2-X		in line with EN 302307 part II (DVB-S2 extensions)
	supported services	broadcast services, professional services, interactive services, DSNG, VL-SNR [20]
Input	transport stream	for details, see Digital audio/video
Modulation	constellation	
	S2-X MODCOD (normal)	(29 to 66) QPSK, 8PSK, 8APSK-L, 16APSK, 16APSK-L, 32APSK, 32APSK-L, 64APSK, 64APSK-L, 128APSK, 256APSK, 256APSK-L
	S2-X MODCOD (short)	(67 to 83) QPSK, 8PSK, 16APSK, 32APSK
	S2-X VL-SNR (set1)	(84 to 89) QPSK, π/2 BPSK
	S2-X VL-SNR (set2)	(90 to 92) π/2 BPSK
	symbol rate (all constellations)	• 0.1 Msps to 60 Msps • 0.1 Msps to 90 Msps [21]
	pulse filtering	root raised cosine rolloff (α = 0.05, 0.10, 0.15, 0.20, 0.25, 0.35)
	MER (500 MHz ≤ f ≤ 6.5 GHz)	> 38 dB (meas.) [22] (20 Msample/s, rolloff = 0.2, 8PSK)

[20] Super-frame not supported.

[21] With R&S®SMCVB-K521, R&S®SMCVB-K522 or R&S®SMCVB-K523 options.

[22] With internal test signals.

Coding	constellation	code rate (implemented MODCOD name)
	S2-X – QPSK (normal)	13/45, 9/20, 11/20
	S2-X – 8PSK (normal)	23/36, 25/36, 13/18
	S2-X – 8APSK (normal)	5/9, 26/45
	S2-X – 16APSK (normal)	1/2, 8/15, 5/9, 26/45, 3/5, 28/45, 23/36, 2/3, 25/36, 13/18, 7/9, 77/90
	S2-X – 32APSK (normal)	2/3, 32/45, 11/15, 7/9
	S2-X – 64APSK (normal)	32/45, 11/15, 7/9, 4/5, 5/6
	S2-X – 128ASK (normal)	3/4, 7/9,
	S2-X – 256APSK (normal)	29/45, 2/3, 31/45, 32/45, 11/15, 3/4
	S2-X – QPSK (short)	11/45, 4/15, 14/45, 7/15, 8/15, 32/45
	S2-X – 8PSK (short)	7/15, 8/15, 26/45, 32/45
	S2-X – 16ASK (short)	7/15, 8/15, 26/45, 3/5, 2/3
	S2-X – 32ASK (short)	2/3, 32/45
	S2-X VL-SNR – QPSK (normal)	2/9
	S2-X VL-SNR – BPSK (medium)	1/5, 11/45, 1/3
	S2-X VL-SNR – BPSK (short)	1/5, 11/45, 4/15, 1/3
	S2-X FEC frame	predefined: normal, 64800 bit, short, 16200 bit, medium, 32400 bit
	pilot insertion	on/off

Cable broadcast standards

DVB-C/ISDB-C (R&S®SMCVB-K157 option)

DVB-C, ISDB-C		in line with EN 300429 (ITU-T J.83/A) and ITU-T J.83/C
Input	transport stream	for details, see Digital audio/video
Modulation	mode	16QAM, 32QAM, 64QAM, 128QAM, 256QAM
	symbol rate	0.1 Msps to 8 Msps
	pulse filtering	root raised cosine rolloff (α = 0.13, 0.15)
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [23], (6.9 Msample/s, rolloff = 0.15, 64QAM)
Special functions	Reed-Solomon encoder	can be switched off
Test signals		• TS test packet (see Internal test signals) • PRBS before differential encoder • PRBS before mapper

J.83/B (R&S®SMCVB-K158 option)

J.83/B		in line with ITU-T J.83/B
Input	transport stream	for details, see Digital audio/video
Modulation	mode	64QAM, 128QAM, 256QAM
	bandwidth	6 MHz
	symbol rate	
	64QAM	5.056941 Msps ± 5 %
	256QAM	5.360537 Msps ± 5 %
	1024QAM	5.360537 Msps ± 5 %
	pulse filtering	root raised cosine rolloff, α = 0.18 (64QAM), α = 0.12 (256QAM, 1024QAM)
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [23], (5.056941 Msps, rolloff = 0.18, 64QAM)
Coding	data interleaver	level 1 and level 2
Special functions	Reed-Solomon encoder	can be switched off
Test signals		• TS test packet (see Internal test signals) • PRBS before Trellis encoder • PRBS before mapper

[23] With internal test signals.

Audio broadcast standards

AM/FM/RDS (R&S®SMCVB-K155 option)

Input	audio stream	for details, see Analog audio
FM	FM operating modes	stereo, mono
	audio signals	external audio input, internal audio signal generator and audio player, see Audio interface
	internal audio signal generator	
	AF frequency range	30 Hz to 15 kHz
	AF frequency response	< 0.2 dB
	preemphasis	off, 50 µs, 75 µs
FM stereo	stereo operating modes	L, R, L = R, L = –R, L ≠ R, internal RDS and DARC signal generation; MPX, DARC and RDS signals can be generated simultaneously.
	MPX frequency deviation	
	deviation	0 Hz to 100 kHz
	resolution	1 Hz
	stereo crosstalk attenuation	> 70 dB (at AF = 30 Hz to 15 kHz)
	total harmonic distortion [24]	< 0.05 % (at 60 kHz audio frequency deviation, AF = 1 kHz)
	SNR (stereo/RDS signal) [25]	at ±40 kHz audio frequency deviation
	ITU-R weighted (quasi-peak)	> 70 dB
	ITU-R unweighted (RMS)	> 76 dB
	pilot tone	
	frequency	19 kHz ± 1 Hz
	deviation	0 Hz to 15 kHz
	resolution	1 Hz
	phase offset	0° to ±180°
	resolution	0.1°
	RDS	
	subcarrier frequency	57 kHz ± 3 Hz
	deviation	0 Hz to 10 kHz
	resolution	10 Hz
	phase offset	0° to ±180°
	resolution	0.1°
	DARC	
	subcarrier frequency	74 kHz ± 4 Hz
	deviation	0 Hz to 10 kHz
	resolution	10 Hz
FM mono	mono frequency deviation	
	deviation	0 Hz to 100 kHz
	resolution	1 Hz
	total harmonic distortion [24]	< 0.1 % (at ±67.5 kHz audio frequency deviation, AF = 1 kHz) (meas.)
AM	audio signals	
	internal audio signal generator	external audio input, internal audio signal generator and audio player, see Audio interface
	AF frequency range	30 Hz to 15 kHz
	AF frequency response	< 0.2 dB (meas.)
	modulation	
	modulation depth	0 % to 100 %
	modulation resolution	0.1 %
	AM total harmonic distortion	at AF = 1 kHz
	m = 30 %	< 0.2 % (meas.)
	m = 80 %	< 0.2 % (meas.)

[24] Generator and receiver without preemphasis/deemphasis.

[25] Generator without preemphasis, receiver with deemphasis, and left/right input signal source set to audio generator.

RDS/RDBS		included in R&S®SMCVB-K155 AM/FM RDS/RDBS coder
RDS		in line with IEC 62106 and DIN EN 62106
RBDS (United States RDS standard)		in line with NRSC-4-A
Group	group sequence	up to 38 groups
Programs	program identification (PI)	0000 to FFFF hex
	program service name (PS)	up to 8 characters
	program type code (PTY)	0 to 31 decimals
	program type name (PTYN)	up to 8 characters
Traffic programs/announcements	traffic program (TP)	on/off
	traffic announcement (TA)	on/off
Music speech	music speech (MS)	music/speech
Decoder identification (DI)	dynamic PTY	on/off
	compressed PTY	on/off
	artificial head	on/off
	stereo	on/off
Clock time	clock time and date clock time (information from system time)	on/off
	offset	up to +23 h 59 min 59 s
Radio text	input line	up to 64 characters
Alternative frequencies, method A	number	up to 25 frequencies
	frequency range	87.6 MHz to 107.9 MHz
	frequency resolution	in steps of 100 kHz
Alternative frequencies, method B	number of frequency lists	up to 5
	tuning frequency	one per list
	frequencies per list	up to 12
	order per frequency	ascending or descending
	frequency range	87.6 MHz to 107.9 MHz
	frequency resolution	in steps of 100 kHz
Enhanced other network (EON)	program identification (PI)	0000 to FFFF hex
	program service name (PS)	up to 8 characters
	traffic program (TP)	on/off
	traffic announcement (TA)	on/off
	linkage actuator (LA)	on/off
	extended generic (EG) indicator	on/off
	international linkage set (ILS) indicator	on/off
	linkage set number (LSN)	000 to FFF hex
	program type code (PTY)	0 to 31 decimals
	program identification number (PIN)	0000 to FFFF hex
	alternative frequency	method A/mapped frequency
	number of frequencies	up to 25 frequencies
	mapped frequencies	up to 4 frequencies
	tuning frequency	one
	frequency range	87.6 MHz to 107.9 MHz
	frequency resolution	in steps of 100 kHz
Traffic message channel (TMC)	traffic message channel (TMC)	on/off
	group 3A variant 00 (block 3)	0000 to FFFF hex
	group 3A variant 01 (block 3)	0000 to FFFF hex
	number of 8A groups	up to 6
	group 8A block 2	00 to 1F hex
	group 8A block 3	0000 to FFFF hex
	group 8A block 4	0000 to FFFF hex

Open format	open format	on/off
	group 1A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 1B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 3A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 3B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 4B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 5A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 5B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 6A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 6B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 7A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 7B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 8A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 8B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 9A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 9B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 10B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 11A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 11B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 12A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 12B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 13A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF
	group 13B block 2/block 3/block 4	00 to 1F/ – /0000 to FFFF
	group 15A block 2/block 3/block 4	00 to 1F/0000 to FFFF/0000 to FFFF

DAB/T-DMB (R&S®SMCVB-K156 option)

T-DMB/DAB/DAB+	Korea/Europe	in line with T-DMB/EN 300401
Input	ETI stream	for details, see Digital audio/video
Transmission	modulation	COFDM
	mode	I, II, III, IV
	bandwidth	1.536 MHz
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [26]
	TII signaling	on/off
	TII main ID	0 to 69
	TII sub ID	1 to 23
Single-frequency network	network mode	SFN, MFN
	control	MID, manual

[26] With internal test signals.

DRM (R&S®SMCVB-K160 option)

DRM/DRM+		in line with ETSI ES 201980
Input	external	
	interface	Ethernet
	stream format	IPv4 UDP stream
	UDP port	0 to 65535 settable (default 8100)
	internal player	loadable file
	file format	DCP (MDI data encapsulated in DCP packets)
	analysis	display of
	audio	number of audio services
	data	number of data services
	layer type	base, enhancement
	label	label of transmitted services
Transmission	modulation	OFDM
	robustness mode	A, B, C, D, E displayed
	constellation	
	MSC	displayed
	SDC	displayed
	code rate table	displayed
	MSC	protection profile, protection level, code rate
	SDC	protection profile, protection level, code rate
	interleaver depth	
	robustness mode A, B, C, D	400 ms, 2 s
	robustness mode E	600 ms
	bandwidth	
	robustness mode A, B, C, D	4.5 kHz, 5 kHz, 9 kHz, 10 kHz, 18 kHz, 20 kHz
	robustness mode E	100 kHz
	MER (50 MHz ≤ f ≤ 1.5 GHz)	> 40 dB (meas.) [27]

[27] With internal test signals.

Digital audio/video

Internal test signals

MPEG-2 TS packet	header + 184 byte payload	00 (hex), FF (hex), PRBS (selectable)
	PID	NULL (1FFF hex)/variable
MPEG-specific TS packet	sync byte + 187 byte payload	00 (hex), FF (hex), PRBS (selectable)
IPv4 IP packet	header UDP + 1200 byte payload	00 (hex), FF (hex), PRBS (selectable)
PRBS	PRBS, in line with ITU-T O.151	$2^{23} – 1/2^{15} – 1$ (selectable)

Digital audio/video interfaces

TS serial interface

TS serial input	mode (selectable)	ASI, SMPTE 310M, ETI
	connector	BNC female, rear
	input impedance	75 Ω
	measured values	packet length, data rate, useful data rate
	ASI	
	input level	200 mV to 880 mV
	data rate	270 Mbit/s
	mode	packet or continuous
	stuffing	on/off (settable)
	stuffing packets	see MPEG-2 TS packet under Internal test signals
	SMPTE 310M	
	input level	400 mV to 880 mV
	data rate	19.392658 Mbit/s
	stuffing	on/off (settable)
	stuffing packets	see MPEG-2 TS packet under Internal test signals
	ETI	
	ETI input level	0 V to ±2.37 V (ITU-T G.703/G.704)
	ETI data rate	2048 kbit/s
	coding	HDB3

TS over IP interface

TS over IP (TSoIP) interface	IP interface	in line with IEEE 802.3 (1000BASE-T)
	connector	RJ-45 (1000BASE-T)
	data rate	10/100/1000 Mbit/s
	supported transmission protocols	IPv4
	TS over IP encapsulation	in line with Pro-MPEG Code of Practice Release 2 and SMPTE 2022-1/2
	signaling	unicast, multicast
	protocol	UDP and UDP/RTP
	time to live (TTL)	1 to 255
	multicast	IGMPv3, IGMPv2
IP flows in	maximum number	4 (simultaneous)
	maximum bit rate	up to 350 Mbit/s (for all processed IP flows)
	FEC	2D FEC, L × D ≤ 100
	FEC L	IP flow (in) port number + 2
	FEC D	IP flow (in) port number + 4
	appliance	applied automatically to IP flow (in) if FEC streams are available

ETI over IP interface

ETI over IP interface	IP interface	in line with IEEE 802.3 (1000BASE-T)
	connector	RJ-45 (1000BASE-T)
	data rate	10/100/1000 Mbit/s
	supported transmission protocols	IPv4
	ETI over IP encapsulation	in line with ETSI TS 102693
	signaling	unicast, multicast
	protocol	DCP
	time to live (TTL)	1 to 255
	multicast	IGMPv3, IGMPv2
IP flows in	maximum number	2 (simultaneous)

Transport stream player

The transport stream player is included in the R&S®SMCVB-K519 option.

Replay	file formats	TRP, BIN, ETI, T2MI, PCAP [28]
	length of transport stream packets	corresponding to externally applied/recorded transport stream
	replay time/sequence length	endless
	file format	TRP
	continuity counter	on/off (settable)
	PCR, DTS/PTS	on/off (settable)
	TDT/TOT	on/off (settable)
	not seamless	replay with cut at transition from end of file to beginning of file
	data rate	100 kbit/s to max. 350 Mbit/s
	data volume	corresponding to recorded data volume; limited only by hard disk size
Test signals	bitstream player in stop mode	head 184 payload, head 187 payload, head 200 payload, sync 187 payload, sync 203 payload, sync 207 payload
	bitstream player in play mode	• null packets • payload “00”, payload “FF”, payload “PRBS 15”, payload “PRBS 23”
Signal set	optional	For additional digital signals and broadcasting standards, see Ordering information for stream libraries.

Stream libraries (R&S®SMCVB-KSxx options)

A wide variety of libraries for different digital standards is available as a complement to the transport stream player.
For more information, see Ordering information.

[28] Replay of packet capture (PCAP) files containing IPv4 protocol streams (MMT, ROUTE/DASH, STL) for ATSC 3.0.

Analog audio

Audio interface

S/PDIF interface

S/PDIF input	connector	BNC female, rear
	input impedance	75 Ω
	sample rate	44.1 kHz

Audio player

The audio player is included in the R&S®SMCVB-K519 option.

Audio player	waveform file format	WAV
Waveform memory	play time	up to 670 s
	resolution	16 bit for AF1 and AF2
	nonvolatile memory	hard disk, USB device
Audio signals	number of signals	2 channels, AF1 and AF2
	bandwidth	DC to 15 kHz
	level	16 bit full scale in each channel, corresponding to standard deviation
	frequency response	< ±0.3 dB
Clock generation	clock rate	44.1 kHz

Audio signal generator

Audio signals	number of signals	2, can be set separately
	frequency	30 Hz to 15 kHz, in 1 Hz steps
	level	–60 dBu to +12 dBu, in 0.01 dB steps, 6 dBu corresponds to standard deviation

Ordering information

R&S®SMCVB-Bxxx = hardware option
R&S®SMCVB-Kxxx/KBxxx = software/keycode option

Designation	Type	Order No.
Options		
Baseband enhancements		
Enable broadcast standards	R&S®SMCVB-K519	1434.3690.02
Baseband options		
Baseband extension to 120 MHz RF bandwidth	R&S®SMCVB-K521	1434.3554.02
Baseband extension to 160 MHz RF bandwidth	R&S®SMCVB-K522	1434.3577.02
Baseband extension to 240 MHz RF bandwidth	R&S®SMCVB-K523	1434.4050.02
Broadcast standards		
AM/FM/RDS	R&S®SMCVB-K155	1434.3719.02
DAB/T-DMB	R&S®SMCVB-K156	1434.3731.02
DVB-C/ISDB-C	R&S®SMCVB-K157	1434.3754.02
J.83/B	R&S®SMCVB-K158	1434.3777.02
DRM	R&S®SMCVB-K160	1434.3819.02
ATSC/ATSC-MH	R&S®SMCVB-K161	1434.3831.02
ATSC 3.0	R&S®SMCVB-K162	1434.3854.02
DVB-T	R&S®SMCVB-K163	1434.3877.02
DVB-T2	R&S®SMCVB-K164	1434.3890.02
ISDB-T/T_{SB}	R&S®SMCVB-K165	1434.3919.02
DTMB	R&S®SMCVB-K166	1434.3931.02
DVB-S/DVB-S2	R&S®SMCVB-K167	1434.3954.02
DVB-S2x	R&S®SMCVB-K168	1434.3977.02
Waveform libraries (available for download at customer web)		
DAB/T-DMB waveforms	R&S®SMCVB-KV10	1434.5340.02
DRM waveforms	R&S®SMCVB-KV11	1434.5370.02
DRM+ waveforms	R&S®SMCVB-KV12	1434.5405.02
HD radio waveforms	R&S®SMCVB-KV13	1434.5434.02
XM radio waveforms	R&S®SMCVB-KV14	1434.5463.02
DVB-T2 waveforms	R&S®SMCVB-KV15	1434.5492.02
ATSC 3.0 waveforms	R&S®SMCVB-KV16	1434.5528.02
Digital TV interferer waveforms	R&S®SMCVB-KV17	1434.5557.02
Cable interferer waveforms	R&S®SMCVB-KV18	1434.5586.02
Satellite interferer waveforms	R&S®SMCVB-KV19	1434.5611.02
China digital radio waveforms	R&S®SMCVB-KV20	1434.5892.02
Transport stream libraries for broadcast standards (available for download at customer web)		
DAB/T-DMB stream library	R&S®SMCVB-KS10	1434.4896.02
DAB+ stream library	R&S®SMCVB-KS11	1434.4938.02
ISDB-T stream library	R&S®SMCVB-KS12	1434.4973.02
ATSC/ATSC and mobile DTV stream library	R&S®SMCVB-KS13	1434.5011.02
DVB-T2 MI stream library	R&S®SMCVB-KS14	1434.5057.02
EMC stream library	R&S®SMCVB-KS15	1434.5092.02
DRM stream library	R&S®SMCVB-KS16	1434.5134.02
Basic stream library	R&S®SMCVB-KS17	1434.5170.02
Extended SDTV stream library	R&S®SMCVB-KS18	1434.5211.02
Extended HDTV stream library	R&S®SMCVB-KS19	1434.5257.02
HEVC stream library	R&S®SMCVB-KS20	1434.5292.02

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Broadcast Standards for the R&S®SMCV100B Vector Signal Generator
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