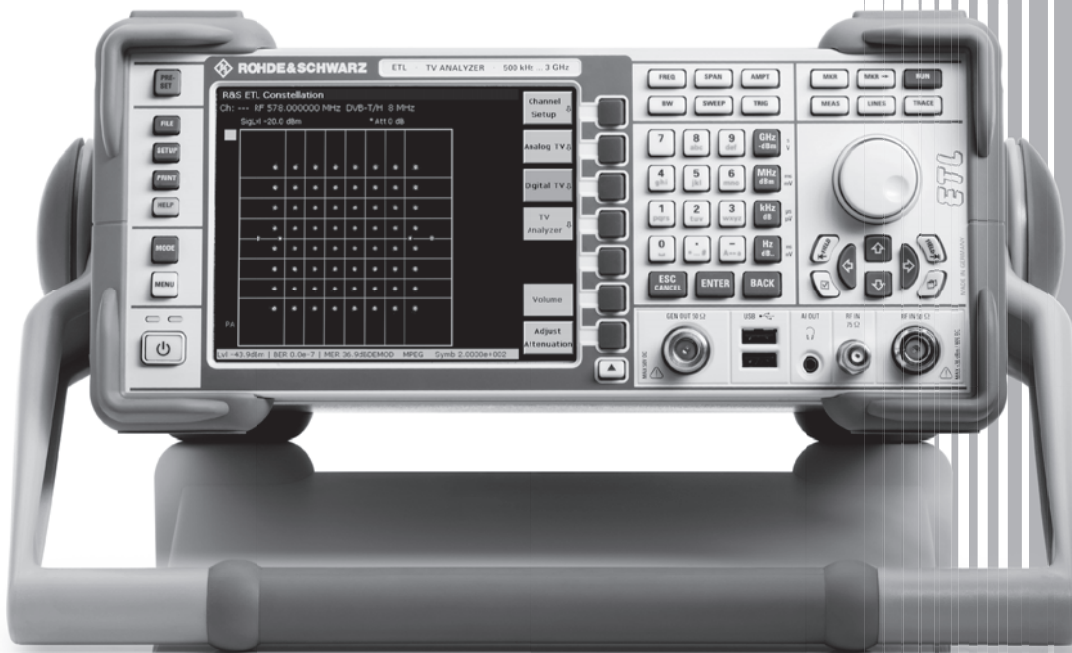


R&S® ETL TV Analyzer Specifications



75 Years of
Driving
Innovation



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Specifications

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. "Typical values" are designated with the abbreviation "typ." These values are verified during the final test but are not assured by Rohde & Schwarz. "Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production. Rohde & Schwarz equipment is designed for reliable operation up to an altitude of 3000 m above sea level, and for transport up to an altitude of 4500 m above sea level.

Part 1 – TV analyzer

Frequency

Frequency range		500 kHz to 3 GHz
Frequency resolution		1 Hz
Reference frequency, internal, nominal		
Aging per year		1×10^{-6}
Temperature drift	0 °C to +50 °C	1×10^{-6}
Reference frequency, internal, nominal		
R&S®FSL-B4 OCXO reference frequency option		
Aging per year		1×10^{-7}
Temperature drift	0 °C to +50 °C	1×10^{-7}
Spectral purity of SSB phase noise		
f = 500 MHz		
Carrier offset	1 kHz	typ. -90 dBc (1 Hz)
	10 kHz	<-98 dBc (1 Hz), typ. -103 dBc (1 Hz)
	100 kHz	<-105 dBc (1 Hz), typ. -110 dBc (1 Hz)
	1 MHz	<-125 dBc (1 Hz), typ. -130 dBc (1 Hz)

Level

Maximum rated input level		
DC voltage		80 V
CW RF power	preamplifier OFF	30 dBm (= 1 W)
CW RF power	preamplifier ON	20 dBm (= 0.1 W)
Peak RF power	preamplifier OFF	36 dBm (= 4 W), t < 3 s
Max. pulse voltage		150 V
Max. pulse energy	10 µs	10 mWs
1 dB compression of input mixer	0 dB RF attenuation, f > 200 MHz	nominal +5 dBm
Intermodulation		
Third-order intermodulation	intermodulation-free dynamic range, level 2 x -20 dBm, reference level -10 dBm, preamplifier = OFF	
	f < 30 MHz	>54 dBc (TOI +7 dBm, typ. +12 dBm)
	f ≥ 30 MHz	>60 dBc (TOI +10 dBm, typ. +18 dBm)
Second harmonic intercept (SHI)	f = 20 MHz to 3 GHz	typ. 40 dBm
Immunity to interference		
Image frequency	f + 2 x 48.375 MHz	>60 dB, typ. 80 dB
	f + 2 x 838.375 MHz	>60 dB, typ. 80 dB
	f + 2 x 7158.375 MHz	typ. 60 dB
Intermediate frequency	48.375 MHz, 838.375 MHz, 7158.375 MHz	>60 dB, typ. 80 dB
Spurious response, inherent	f > 30 MHz, without input signal, RF attenuation = 0 dB, RBW < 1 MHz	<-90 dBm
Spurious response	referenced to local oscillators	<-60 dBc
Spurious response	referenced to A/D conversion	typ. <-70 dBc
Spurious response	referenced to subharmonic of first LO (spur at 7158.375 MHz - 2 x f _{in})	typ. -60 dBc
Spurious response at mixer level <-10 dBm	referenced to harmonic of first LO (spur at f _{in} - 3579.1875 MHz)	typ. <-60 dBc

Noise figure		
	preselector (R&S®ETL-B203 option) not installed, 0 dB attenuation, typical values	27 dB (50 MHz to 1.3 GHz, preamplifier OFF) 15 dB (50 MHz to 1.3 GHz, preamplifier ON) 17 dB (1.3 GHz to 2.3 GHz, preamplifier ON) 19 dB (2.3 GHz to 3.0 GHz, preamplifier ON)
	preselector ON	see specifications of R&S®ETL-B203 RF preselector option
Level settings		
Setting range of signal level		–80 dBm to +20 dBm in steps of 0.1 dB
Units of level axis	logarithmic level display	dBm, dBmV, dBµV, dBµA, dBpW
	linear level display	µV, mV, V, µA, mA, A, pW, nW, µW, mW, W
Level measurement uncertainty		
95 % confidence level, +20 °C to +30 °C, S/N > 16 dB, 0 dB to –50 dB from reference level	50 MHz < f ≤ 3 GHz	<1.0 dB
Attenuator uncertainty		<0.3 dB
Uncertainty of signal level setting		nominal <0.1 dB

Analog TV

Standards		B/G, I, D/K, K1, M, N
Sound standards	in line with TV standard, see page 6, "Channel filter, analog TV"	IRT-A2, NICAM, BTSC, EIA-J, Korea Stereo demodulation: split carrier, intercarrier
Video bandwidth	in line with TV standard, see page 6, "Channel filter, analog TV"	4.0 MHz, 4.2 MHz, 5.0 MHz, 5.2 MHz, 5.5 MHz, 5.75 MHz and 6 MHz
Group delay correction	see page 6, "Channel filter, analog TV"	

Measurements		
		vision carrier power
		vision carrier frequency offset
		vision/sound carrier power ratio
		vision/NICAM power ratio
		vision/sound carrier frequency offset
		video S/N, weighted in line with ITU-R Rec. 567
		audio mode (in preparation)
		NICAM bit error ratio (in preparation)
		vision modulation depth, residual picture carrier
		line frequency offset
		video scope
		hum modulation
	in-service, off-service, quiet line	carrier-to-noise power ratio
	off-service	composite triple beat (CTB) ratio
	off-service, quiet line	composite second order (CSO) ratio
	vision detector	synchronous PLL sample, back porch, medium
		synchronous PLL sample, back porch, slow
		synchronous PLL, continuous, fast
		synchronous PLL, continuous, medium
		synchronous PLL, continuous, slow envelope (ultrafast)
	with R&S®ETL-B280	TV picture on display
System performance		
Video S/N	weighted in line with ITU-R Rec. 567 (1 channel)	≥60 dB

Channel filter, analog TV				
Standard	group delay characteristic	sound system	bandwidth in MHz ($f_{\text{passband}} - \text{max}$)	residual sideband in MHz
B/G	general	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	Australia	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	Denmark	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	general half	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	New Zealand	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	Norway	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	Sweden	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
	flat	FM 5.5/FM 5.742	5.0	0.75
		FM 5.5/NICAM 5.85	5.0	0.75
		FM 5.5 mono	5.0	0.75
D/K	OIRT GOST 20532-75 OIRT GOST 20532-83	FM 6.5/FM 6.742	6.0	0.75
		FM 6.5/FM 6.258	5.75	0.75
		FM 6.5/NICAM 5.85	5.2	0.75
		FM 6.5 mono	6.0	0.75
	ITU-R Report 308	FM 6.5/FM 6.742	6.0	0.75
		FM 6.5/FM 6.258	5.75	0.75
		FM 6.5/NICAM 5.85	5.2	0.75
		FM 6.5 mono	6.0	0.75
	flat	FM 6.5/FM 6.742	6.0	0.75
		FM 6.5/FM 6.258	5.75	0.75
		FM 6.5/NICAM 5.85	5.2	0.75
		FM 6.5 mono	6.0	0.75
I	flat	FM 6/NICAM 6.552	5.5	0.75
		FM 6 mono	5.5	0.75
K1	K1	FM 6.5/FM 6.742	6.0	0.75
		FM 6.5/FM 6.258	5.75	0.75
		FM 6.5/NICAM 5.85	5.2	0.75
		FM 6.5 mono	6.0	0.75
	flat	FM 6.5/FM 6.742	6.0	0.75
		FM 6.5/FM 6.258	5.75	0.75
		FM 6.5/NICAM 5.85	5.2	0.75
		FM 6.5 mono	6.0	0.75
M/N	FCC	FM 4.5 BTSC	4.0	0.75
		FM 4.5 EIA-J	4.0	0.75
		FM 4.5/FM 4.724	4.0	0.75
		FM 4.5 mono	4.0	0.75
	flat	FM 4.5 BTSC	4.2	0.75
		FM 4.5 EIA-J	4.2	0.75
		FM 4.5/FM 4.724	4.2	0.75
		FM 4.5 mono	4.2	0.75

Automatic selection depending on selected TV standard and sound system

Passband amplitude error of channel filter		
Group delay, activated	$f \leq f_{\text{passband}} - \text{max}$	≤ 0.1 dB
Group delay, flat	$f \leq f_{\text{passband}} - \text{max}$	≤ 0.05 dB

Group delay correction													
Standard	B/G							D/K			I	K1	M/N
Frequency in MHz	General	Australia	Denmark	General half	New Zealand	Norway	Sweden	OIRT GOST 20532-75	OIRT GOST 20532-83	ITU-R Report 308			FCC
group delay in ns													
0.10	0	0	0	0	0	0	0	0	0	0	0	0	0
0.25	-5		-5	-2.5		0	0	-5		-5	0	0	0
0.50						0	0	-19	-8		0	0	0
1.00	-53	-30	-53	-26.5		0	0	-40	-40	-53	0	0	0
1.50						0	0	-70			0	0	0
2.00	-90	-60	-75	-45		0	0	-80	-85	-87	0	0	0
2.25					-60	0	0				0	0	0
3.00	-75	-40	-75	-37.5	-60	0	0	-80	-92	-85	0	0	0
3.50		0					0				0	0	
3.58							0				0	0	170
3.60						20	0				0	0	
3.75	0			0	0						0	0	
3.80			0								0	0	
4.00						50		-40	-60	-50	0	0	293
4.18											0		346
4.43	170	170	170	85	170	170	175	0	-25	0	0	15	
4.70									0		0		
4.80	400	260	400	200	400	350	400				0		
5.00								80		90	0	90	
5.25											0	140	
5.50									260		0		

Passband group delay error of channel filter

$f \leq f_{\text{passband-max}} - 0.1 \text{ MHz}$	7 ns
--	------

I/Q data

Memory length	output via LAN or GPIB (R&S®FSL-B10 option)	max. 512 ksample I and Q
Sample rate		10 kHz to 65.8 MHz
Signal bandwidth	sample rate 65.833333 MHz	20 MHz

Digital TV options and standards

R&S®ETL-B210 digital demodulator for J.83/A/C (DVB-C)

The R&S®ETL-K210 option is required.

Standard	cable TV (e.g. Europe, China, Japan)	J.83/A/C (DVB-C)
QAM order		4QAM, 16QAM, 32QAM, 64QAM, 128QAM and 256QAM
Bandwidth	digitally filtered, in line with symbol rate	1 MHz to 8 MHz
Symbol rate		1 Msymbol/s to 6.995 Msymbol/s
Measurements	see R&S®ETL-K210 DVB-C/J.83/A/C firmware	

R&S®ETL-B215 digital demodulator for DTMB

Standard	terrestrial TV, China	DTMB
QAM order		4, 4-NR, 16QAM, 32QAM, 64QAM
Guard interval		PN420, PN945 (TDS OFDM)
Code rate		0.4, 0.6, 0.8
Time deinterleaver		240, 720, OFF
Modulation		TDS OFDM
Bandwidth		7.56 MHz
Measurements	see DTMB	

R&S®ETL-B216 digital demodulator for J.83/A/C (DVB-C) and DTMB

The R&S®ETL-K210 option is required for J.83/A/C (DVB-C).

Standard	cable TV (e.g. Europe, China, Japan) terrestrial TV, China	J.83/A/C, DVB-C (QAM) DTMB (TDS OFDM)
QAM order		4QAM, 16QAM, 32QAM, 64QAM, 128QAM and 256QAM (J.83/A/C, DVB-C) 4, 4-NR, 16QAM, 32QAM, 64QAM (DTMB)
Guard interval (DTMB)		PN420, PN945 (TDS OFDM)
Code rate (DTMB)		0.4, 0.6, 0.8
Time deinterleaver (DTMB)		240, 720, OFF
Bandwidth	digitally filtered, in line with symbol rate	1 MHz to 8 MHz (J.83/A/C, DVB-C) 7.56 MHz (DTMB)
Symbol rate (J.83/A/C, DVB-C)		1 Msymbol/s to 6.995 Msymbol/s
Measurements	see DTMB and R&S®ETL-K210 DVB-C/J.83/A/C firmware	

R&S® ETL-K210 DVB-C/J.83/A/C firmware

The R&S® ETL-B210 or R&S® ETL-B216 option is required for J.83/A/C (DVB-C).

Standard	cable TV (e.g. Europe, China, Japan)	J.83/A/C (DVB-C)
QAM order		4QAM, 16QAM, 32QAM, 64QAM, 128QAM and 256QAM
Bandwidth	digitally filtered, in line with symbol rate, see section channel filter	1 MHz to 8 MHz
Symbol rate		1 Msymbol/s to 6.995 Msymbol/s
Roll-off factor		0.12, 0.13, 0.15, 0.18 (selectable)
Measurements	parameter	
	level	-55 dBm (preamplifier ON) to +10 dBm for quasi-error-free (QEF, 64QAM, $f < 1$ GHz, R&S® ETL-B203 preselector not installed)
	carrier frequency offset (in Hz)	
	symbol rate offset (in Hz)	
	MER (modulation error ratio) in dB or %	
	EVM (error vector magnitude) in dB or %	
	bit error ratio before Reed-Solomon decoder	
	packet error ratio or segment error ratio	
	MPEG transport stream rate	
	constellation diagram	selectable symbol count (1 symbol to 999999999 symbols + infinite), freeze mode
	amplitude imbalance	range: -5 % to +5 %, resolution: 0.01 %
	quadrature error	range: -5° to +5°, resolution: 0.01°
	carrier suppression	range: +20 dB to +60 dB, res: 0.1 dB
	phase jitter	range: 0.00° to +2.00°, resolution: 0.1°
	signal/noise ratio	range: +20 dB to +50 dB, resolution: 0.1 dB
	shoulder attenuation in line with ETSI TR 101 290	
	amplitude/phase/group delay frequency response	
CCDF and APD with crest factor (in preparation)		
MPEG analyzer	with R&S® ETL-B280	
TV picture on display	with R&S® ETL-B280 and R&S® ETL-B281	
Measurement uncertainty (64QAM)		
Carrier frequency offset	referenced to carrier frequency	<2 ppm
Symbol rate offset	referenced to symbol rate	<2 ppm
Transport stream rate	referenced to stream rate	<2 ppm
With R&S® FSL-B4 OCXO		
Carrier frequency offset	referenced to carrier frequency	<0.2 ppm
Symbol rate offset	referenced to symbol rate	<0.2 ppm
Transport stream rate	referenced to stream rate	<0.2 ppm
With external 10 MHz reference ($f \leq 1$ GHz)		
Carrier frequency offset	referenced to carrier frequency	≤ 1 Hz
Symbol rate offset	referenced to symbol rate	≤ 0.5 Hz
MPEG transport stream rate	referenced to MPEG transport stream rate	≤ 1 Hz
Modulation error ratio (MER)	equalizer ON, 1 channel	
	18 dB to 30 dB	typ. <0.6 dB
	30 dB to 35 dB	typ. <1.0 dB
	35 dB to 40 dB	typ. <2.0 dB
System performance	signal power > -30 dBm, $f \leq 1.3$ GHz	MER
		≥ 40 dB (equalizer ON)
		36 dB (equalizer OFF, $f \geq 100$ MHz)

Error vector magnitude	EVM > 2 % to 8 %	typ. <6 % of measured value
	EVM > 1.2 % to 2 %	typ. <11 % of measured value
	EVM > 0.7 % to 1.2 %	typ. <23 % of measured value
BER before Reed-Solomon	range: 1.0×10^{-3} to 0.1×10^{-15} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Packet/segment error ratio	range: 5.0×10^{-1} to 0.1×10^{-14} , 0.0	$0.1 \times 10^{-\text{exponent}}$

Channel filter for DVB-C firmware (R&S®ETL-K210)		
Channel filter bandwidth	1.0 MHz, 2.0 MHz, 3.0 MHz, 4.0 MHz, 5.0 MHz, 5.4 MHz, 5.6 MHz, 5.8 MHz, 6.0 MHz, 6.2 MHz, 6.4 MHz, 6.6 MHz, 6.8 MHz, 7.0 MHz, 7.2 MHz, 7.4 MHz, 7.5 MHz, 7.6 MHz, 7.65 MHz, 7.7 MHz, 7.75 MHz, 7.8 MHz, 8.0 MHz, 8.2 MHz, 8.4 MHz, 9.0 MHz	automatic selection of channel filter, in line with selected symbol rate
Passband amplitude error		≤0.05 dB
Stopband attenuation		≥70 dB
Channel filter shape factor 60 dB : 0.1 dB		≤1.05

DTMB (Chinese terrestrial)

The R&S®ETL-B215 or R&S®ETL-B216 option is required.

Standard	terrestrial TV, China	DTMB
QAM order	automatic detection or manual selection	4, 4-NR, 16QAM, 32QAM, 64QAM
Bandwidth	digitally filtered, in line with symbol rate, see subsection "Channel filter"	7.56 MHz
Guard interval	automatic detection or manual selection	PN420, PN945 (TDS OFDM)
Code rate	automatic detection or manual selection	0.4, 0.6, 0.8
Time deinterleaver	automatic detection or manual selection	240, 720, OFF
Measurements	parameter level	-55 dBm (preamplifier ON) to +10 dBm for quasi-error-free (QEF, 64QAM, $f < 1$ GHz, R&S®ETL-B203 preselector not installed)
	carrier frequency offset (in Hz)	
	bit rate offset (in ppm)	
	MER (modulation error ratio) in dB or %	
	EVM (error vector magnitude) in dB or %	
	bit error ratio before LDPC decoder	TDS OFDM only
	packet error ratio or segment error ratio	
	MPEG transport stream rate	
	constellation diagram	selectable frame count (1 frame to 999999999 frames + infinite), freeze mode selectable carrier number (carrier 0 to carrier 3779) TPS or payload, selectable
	MER versus frequency	selectable carrier number (carrier 0 to carrier 3779, TPS carriers not shown)
	shoulder attenuation in line with ETSI TR 101 290	
	amplitude/phase/group delay frequency response (in preparation)	
	CCDF and APD with crest factor (in preparation)	
	echo pattern (in preparation)	
	MPEG analyzer	with R&S®ETL-B280
	TV picture on display	with R&S®ETL-B280 and R&S®ETL-B281
Measurement uncertainty		
Carrier frequency offset	referenced to carrier frequency	<2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<2 ppm
With R&S®FSL-B4 OCXO		
Carrier frequency offset	referenced to carrier frequency	<0.2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<0.2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<0.2 ppm
With external 10 MHz reference ($f \leq 1$ GHz)		
Carrier frequency offset	referenced to carrier frequency	≤ 1 Hz
Bit rate offset	referenced to MPEG transport stream rate	<0.2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	≤ 1 Hz
Modulation error ratio (MER)	18 dB to 30 dB	typ. <0.8 dB
	30 dB to 33 dB	typ. <1.5 dB
System performance	signal power > -30 dBm, $f \leq 1.3$ GHz	
	PN420 and PN945	MER ≥ 34 dB
	PN595	typ. +24 dB

Error vector magnitude	EVM > 2 % to 8 %	typ. <8 % of measured value
	EVM > 1.4 % to 2 %	typ. <15 % of measured value
BER before LDPC PN420, PN945	range: 1.0×10^{-2} to 0.1×10^{-15} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Packet/segment error ratio PN420, PN945	range: 1.0×10^{-1} to 0.1×10^{-14} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Channel filter for DTMB		
Channel filter bandwidth		7.56 MHz
Passband amplitude error		≤ 0.1 dB
Stopband attenuation		≥ 90 dB
Channel filter shape factor 90 dB : 0.1 dB		≤ 1.08

R&S® ETL-K220 ATSC/8VSB firmware

Standard	terrestrial TV in line with ATSC A/53	
VSB order		8VSB
Symbol rate		2.000000 Msymb/s to 11.000000 Msymb/s; default 10.7622378 Msymb/s
Code rate		2/3
Bandwidth	digitally filtered, in line with channel bandwidth, see subsection "Channel filter"	6 MHz
Measurements	parameter	
	level	-55 dBm (preamplifier ON) to +10 dBm for quasi-error-free (QEF, $f < 1$ GHz, R&S® ETL-B203 preselector not installed)
	carrier frequency offset (in Hz)	
	symbol rate offset (in Hz)	
	MER (modulation error ratio) in dB or %	
	EVM (error vector magnitude) in dB or %	
	bit error ratio before Reed-Solomon decoder	
	packet error ratio or segment error ratio	
	MPEG transport stream rate	
	constellation diagram	selectable symbol count (1 symbol to 999999999 symbols + infinite), freeze mode
	pilot value	range: 0.3 to 2.5
	pilot error in dB	range: -12.4 dB to +6 dB
	data signal/pilot power ratio	range: 5.3 dB to 23.7 dB
	shoulder attenuation in line with FCC	
	amplitude/phase/group delay frequency response	
	echo pattern (channel impulse response)	selectable center and time/div
	CCDF and APD with crest factor	(in preparation)
with R&S® ETL-B280	MPEG analyzer	
with R&S® ETL-B280 and R&S® ETL-B281	TV picture on display	
Measurement uncertainty (64QAM)		
Carrier frequency offset	referenced to carrier frequency	<2 ppm
Symbol rate offset	referenced to MPEG transport stream rate	<2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<2 ppm
With R&S® FSL-B4 OCXO		
Carrier frequency offset	referenced to carrier frequency	<0.2 ppm
Symbol rate offset	referenced to MPEG transport stream rate	<0.2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<0.2 ppm
With external 10 MHz reference ($f \leq 1$ GHz)		
Carrier frequency offset	referenced to carrier frequency	≤ 1 Hz
Symbol rate offset	referenced to MPEG transport stream rate	≤ 0.5 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	≤ 1 Hz
Modulation error ratio (MER)	18 dB to 30 dB	typ. <0.6 dB
	30 dB to 35 dB	typ. <1.0 dB
	35 dB to 40 dB	typ. <2.0 dB
System performance	signal power > -30 dBm, $f \leq 1.3$ GHz	MER ≥ 40 dB
Error vector magnitude	EVM > 2 % to 8 %	typ. <6 % of measured value
	EVM > 1.2 % to 2 %	typ. <11 % of measured value
	EVM > 0.7 % to 1.2 %	typ. <23 % of measured value
BER before Reed-Solomon	range: 1.0×10^{-3} to 0.1×10^{-15} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Packet/segment error ratio	range: 1.0×10^{-1} to 0.1×10^{-14} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Channel selection filter for ATSC firmware (R&S® ETL-K220)		
Channel selection filter bandwidth		6.0 MHz
Passband amplitude error		≤ 0.01 dB
Stopband attenuation		≥ 75 dB
Channel filter shape factor		≤ 1.07
75 dB : 0.01 dB		

R&S® ETL-K240 DVB-T/H firmware

Standard	terrestrial TV in line with ETSI EN 300 744	DVB-T/H
FFT mode	automatic detection or manual selection	2K, 4K, 8K
QAM order	automatic detection or manual selection	4QAM, 16QAM, 64QAM
QAM hierarchy	automatic detection or manual selection	none, alpha = 1, 2, 4
Guard Interval	automatic detection or manual selection	1/4, 1/8, 1/16, 1/32
Code rate HP, LP	automatic detection or manual selection	1/2, 2/3, 3/4, 5/6, 7/8
Interleaver mode	automatic detection or manual selection	native or in-depth
Bandwidth	digitally filtered, in line with channel bandwidth, see subsection "Channel filter"	5 MHz, 6 MHz, 7 MHz, 8 MHz
Measurements	parameter	
	level	-55 dBm (preamplifier ON) to +10 dBm for quasi-error-free (QEF, 64QAM, $f < 1$ GHz, R&S® ETL-B203 preselector not installed)
	carrier frequency offset (in Hz)	
	bit rate offset (in ppm)	
	MER (modulation error ratio) in dB or %	
	EVM (error vector magnitude) in dB or %	
	bit error ratio before Viterbi decoder	
	bit error ratio before Reed-Solomon decoder	
	packet error ratio or segment error ratio	
	MPEG transport stream rate	
	constellation diagram	selectable symbol count (1 symbol to 999999999 symbols + infinite), freeze mode, selectable carrier number (carrier 0 to carrier 6816 in case of 8K FFT)
	MER versus frequency	selectable carrier number (carrier 0 to carrier 6816 in case of 8K FFT)
	amplitude imbalance	range: -5 % to 5 %, resolution: 0.01 %
	quadrature error	range: -5° to 5°, resolution: 0.01°
	carrier suppression	range: -5 dB to +35 dB, resolution: 0.1 dB
	carrier phase	range: -180° to +180°, resolution: 0.1°
	shoulder attenuation in line with ETSI TR 101 290	
	amplitude/phase/group delay frequency response	selectable carrier number (carrier 0 to carrier 6816 in case of 8K FFT)
	echo pattern (channel impulse response)	selectable center and time/div, up to 10 echoes shown in a result chart readout of up to 200 echoes via remote results sorted by level or time/distance, extended time range up to t_{symbol} selectable zero position: main or first echo display of echo levels absolute or relative (in preparation)
	CCDF and APD with crest factor	
TPS information	FFT, QAM order, hierarchy, guard interval, code rate HP, code rate LP, interleaver mode, MPE FEC (HP), MPE FEC (LP), time slicing (HP), time slicing (LP), length indicator, cell ID, TPS reserved (frames 1 to 4)	
MPEG analyzer	with R&S® ETL-B280	
TV picture on display	with R&S® ETL-B280 and R&S® ETL-B281	

Measurement uncertainty (64QAM)		
Carrier frequency offset	referenced to carrier frequency	<2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<2 ppm
With R&S®FSL-B4 OCXO		
Carrier frequency offset	referenced to carrier frequency	<0.2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<0.2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<0.2 ppm
With external 10 MHz reference (f ≤ 1 GHz)		
Carrier frequency offset	referenced to carrier frequency	≤1 Hz
Bit rate offset	referenced to MPEG transport stream rate	≤0.5 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	≤1 Hz
Modulation error ratio (MER)		
	18 dB to 30 dB	typ. <0.6 dB
	30 dB to 35 dB	typ. <1.0 dB
	35 dB to 40 dB	typ. <2.0 dB
System performance	signal power > -30 dBm, f ≤ 1.3 GHz	MER ≥ 40 dB (system optimization stationary fast or stationary slow)
Error vector magnitude	EVM > 2 % to 8 %	typ. <6 % of measured value
	EVM > 1.2 % to 2 %	typ. <11 % of measured value
	EVM > 0.7 % to 1.2 %	typ. <23 % of measured value
BER before Reed-Solomon	range: 1.0×10^{-3} to 0.1×10^{-15} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Packet/segment error ratio	range: 1.0×10^{-1} to 0.1×10^{-14} , 0.0	$0.1 \times 10^{-\text{exponent}}$
Channel filter for DVB-T/H firmware (R&S®ETL-K240)		
Channel filter bandwidth	5.0 MHz, 6.0 MHz, 7.0 MHz, 8.0 MHz	automatic selection of channel filter, in line with selected channel bandwidth
Passband amplitude error		≤0.03 dB
Stopband attenuation		≥90 dB
Channel filter shape factor 90 dB : 0.03 dB		≤1.09

R&S® ETL-K241 DVB-T/H SFN frequency offset

DVB-T/H firmware (R&S®ETL-K240) is required		
Frequency offset of echo signal, relative to frequency of main signal	range: ±20 Hz	resolution: 0.01 Hz accuracy: 0.03 Hz
Number of echoes displayed in the result chart		up to 10
Number of echoes available via remote		up to 200

R&S® ETL-K250 T-DMB/DAB firmware

Standard	Digital audio broadcasting in line with ETSI EN 300 401 and data broadcasting - MPEG-2 TS streaming in line with ETSI TS 102 427	DAB and MPEG-2 TS streaming
Transmission mode	automatic detection or manual selection	Mode I, Mode II, Mode III
Protection level	automatic detection or manual selection	1, 2, 3, 4, 5, 1-A, 2-A, 3-A, 4-A, 1-B, 2-B, 3-B, 4-B
Bandwidth	digitally filtered, in line with channel bandwidth, see subsection "Channel filter"	1.536 MHz
Measurements	parameter	
	level	-65 dBm (preamplifier ON) to +10 dBm for quasi-error-free (QEF, $f < 1$ GHz, R&S® ETL-B203 preselector not installed) -85 dBm (preamplifier ON, preselector ON, QEF); -92 dBm typ with protection level 4-A
	carrier frequency offset (in Hz)	
	bit rate offset (in ppm)	
	MER (modulation error ratio) in dB or %	
	EVM (error vector magnitude) in dB or %	
	bit error ratio before Viterbi decoder (FIC + MSC)	
	bit error ratio before Viterbi decoder (FIC only)	
	bit error ratio before Viterbi decoder (MSC only)	
	FIB (fast information block) errors	
	bit error ratio before Reed-Solomon decoder for sub-channels containing MPEG-2 TS	
	packet error ratio for sub-channels containing MPEG-2 TS	
	MPEG transport stream rate for sub-channels with MPEG-2 TS	
	constellation diagram	selectable symbol count (1 symbol to 999999999 symbols + infinite), freeze mode, selectable carrier number (carrier -768 to carrier +768 in case of Mode I)
	MER versus frequency	selectable carrier number (carrier -768 to carrier +768 in case of Mode I)
	carrier to noise ratio	range: 10 dB to 65 dB, resolution: 0.1 dB (upper limit depending on input level)
	amplitude/phase/group delay frequency response	selectable carrier number (carrier -768 to carrier +768 in case of Mode I)
	echo pattern (channel impulse response)	selectable center and time/div, up to 10 echoes shown in a result chart readout of up to 200 echoes via remote results sorted by level or time/distance, time range: t_{symbol} selectable zero position: main or first echo display of echo levels absolute or relative
	CCDF and APD with crest factor	
	Subchannel Organization	SubChId, Data Rate, Start capacity unit (CU), Size CU, Protection Level
Ensemble Information	Ensemble Label, Time and Date (UTC), Service Labels, Service Component Labels, SubChId, Data Rate, Protection Level, Start CU, Size CU, Conditional Access flag	
input of I/Q baseband signal, output of ETI (NI, G.703, HDB3, available from January 2009), serial clock/data of selected sub-channel	with R&S® ETL-B201	

Measurement uncertainty		
Carrier frequency offset	referenced to carrier frequency	<2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<2 ppm
With R&S®FSL-B4 OCXO		
Carrier frequency offset	referenced to carrier frequency	<0.2 ppm
Bit rate offset	referenced to MPEG transport stream rate	<0.2 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	<0.2 ppm
With external 10 MHz reference (f ≤ 1 GHz)		
Carrier frequency offset	referenced to carrier frequency	≤1 Hz
Bit rate offset	referenced to MPEG transport stream rate	≤0.5 ppm
MPEG transport stream rate	referenced to MPEG transport stream rate	≤1 Hz
Modulation error ratio (MER)		
	8 dB to 30 dB	typ. <0.6 dB
	30 dB to 35 dB	typ. <1.0 dB
	35 dB to 38 dB	typ. <2.0 dB
System performance	signal power > -30 dBm, f ≤ 300 MHz	MER ≥ 40 dB
Error vector magnitude	EVM > 3 % to 40 %	typ. <6 % of measured value
	EVM > 1.8 % to 3 %	typ. <11 % of measured value
	EVM > 1,2 % to 1.8 %	typ. <23 % of measured value
BER before Viterbi	range: 1.0×10^{-2} to 0.1×10^{-14} , 0,0	$0.1 \times 10^{-\text{exponent}}$
BER before Reed-Solomon	range: 1.0×10^{-3} to 0.1×10^{-13} , 0,0	$0.1 \times 10^{-\text{exponent}}$
Packet error ratio	range: 1.0×10^{-1} to 0.1×10^{-10} , 0,0	$0.1 \times 10^{-\text{exponent}}$
Channel filter for T-DMB/DAB firmware (R&S®ETL-K250)		
Channel filter bandwidth	1.536 MHz	automatic selection of channel filter, in line with selected channel bandwidth
Passband amplitude error		≤0.01 dB
Stopband attenuation		≥85 dB
Channel filter shape factor		≤1.11
85 dB : 0.01 dB		

R&S® ETL-K208 measurement log

Measurement log for digital TV signals		
Time interval		1 minute, 2 minutes, 5 minutes, 10 minutes, 20 minutes, 30 minutes, 1 hour, 2 hours, 5 hours, 10 hours, 1 day, 2 days, 5 days, 1 day, 2 days, 5 days, 10 days, 20 days, 50 days, 100 days, 200 days, 500 days, 1000 days
Auto interval length		ON, OFF
Log parameters		input level
		carrier frequency offset
		bit rate offset
		MPEG TS bit rate
		BER before Viterbi (DVB-T/H, T-DMB / DAB)
		BER before Viterbi FIC (T-DMB / DAB)
		BER before Viterbi MSC (T-DMB / DAB)
		BER before LDPC (DTMB)
		BER before Reed-Solomon
		MER (RMS) in dB
		MER (peak) in dB
		EVM (RMS) in %
		EVM (peak) in %
		packet error ratio
		packet errors
	FIB errors (T-DMB / DAB)	
Log detectors		none
		max
		min
		auto peak
Traces for measurement log		average
Display of MPEG TS synchronization		2
		always shown at bottom of display (trace 3)

General options

R&S® FSL-K7 AM/FM/φM measurement demodulator

Measurement of analog modulation signals		
Demodulation bandwidth		100 Hz to 6.4 kHz, binary steps 12.5 kHz to 1.6 MHz, binary steps 3 MHz, 5 MHz, 8 MHz, 10 MHz, 18 MHz
Recording length	maximum	512 ksample
Recording time	demodulation bandwidth	
	100 Hz	3276.8 s
	6.4 kHz	51.2 s
	12.5 kHz	26.6 s
	1.6 MHz	200 ms
	3 MHz	100 ms
	5 MHz	50 ms
	8 MHz	25 ms
	10 MHz	12.5 ms
18 MHz	12.5 ms	
Display	frequency versus time (FM), amplitude versus time (AM), phase versus time (φM) RF power versus time, RF spectrum (FFT), AF spectrum (FFT), table with numeric values for: modulation deviation (peak, RMS), modulation frequency, carrier offset, carrier power (power of unmodulated carrier), THD, SINAD	
AF (modulation frequency)		
Range		≤9 MHz max. 0.5 × demodulation bandwidth
Resolution		5 digits
Measurement uncertainty		0.1 %
AF filters	lowpass	3 kHz, 15 kHz, 150 kHz, 5 %, 10 %, 25 % of demodulation bandwidth
	highpass	50 Hz, 300 Hz
	deemphasis	25 μs, 50 μs, 75 μs, 750 μs
AM demodulation		
Measurement range	modulation depth	0 % to 100 %
Modulation depth uncertainty	AF ≤ 1 MHz	<3 % of measured value + residual AM
Residual AM	demodulation bandwidth ≤ 200 kHz, RMS, RF ≤ 3 GHz, RF input level ≥ (RF attenuation/dB – 30) dBm	0.2 %
Distortion	10 Hz ≤ AF ≤ 100 kHz	0.3 %
FM rejection	AF ≤ 1 MHz and AF + deviation ≤ 0.5 × demodulation bandwidth	typ. 1 % + residual AM
FM demodulation		
Measurement range	frequency deviation	≤9 MHz
Deviation uncertainty	AF ≤ 1 MHz and AF + deviation ≤ 0.5 × demodulation bandwidth	<3 % of measured value + residual FM
Residual FM	demodulation bandwidth ≤ 100 kHz, RMS, RF input level ≥ (RF attenuation/dB – 30) dBm	
	RF ≤ 1 GHz	150 Hz
	RF = 3 GHz	200 Hz
Distortion	10 Hz ≤ AF ≤ 100 kHz, deviation < 400 kHz	0.3 %
AM rejection	100 Hz ≤ AF ≤ 1 kHz, modulation depth 50 %	30 Hz

φM demodulation		
AF		≤5 MHz, max. 0.5 × demodulation bandwidth
Measurement range	phase deviation	<1000 rad
Residual φM	demodulation bandwidth ≤ 100 kHz, RMS, RF = 1 GHz, highpass 300 Hz, RF input level ≥ (RF attenuation/dB – 30) dBm	5 mrad
Carrier power versus time		
Display range		noise floor to +20 dBm
Measurement uncertainty	unmodulated carrier, S/N > 16 dB, RF: 50 kHz to 3 GHz	typ. 1 dB
Max. dynamic range	demodulation bandwidth 200 kHz	typ. 75 dB
Display linearity	S/N > 16 dB	typ. 0.2 dB
AF spectrum		
Span		≤9 MHz
Resolution bandwidth		1 Hz to 10 MHz
RF spectrum		
Span		≤18 MHz
Resolution bandwidth		1 Hz to 10 MHz
Shape factor	60 dB : 3 dB	nominal 2.5
Modulation distortion		
Measurement functions		THD, SINAD
Measurement range		-100 dB to 0 dB
Resolution		0.01 dB
Measurement uncertainty		typ. 0.5 dB
AF frequency range		10 Hz to 5 MHz
Trigger		
Trigger functions		RF level, AM, FM, φM demodulation

Part 2 – Spectrum analyzer

Frequency

Frequency range		500 kHz to 3 GHz
Frequency resolution		1 Hz
Reference frequency, internal, nominal		
Aging per year		1×10^{-6}
Temperature drift	0 °C to +50 °C	1×10^{-6}
Reference frequency, internal, nominal R&S®FSL-B4 OCXO reference frequency option		
Aging per year		1×10^{-7}
Temperature drift	0 °C to +50 °C	1×10^{-7}
Frequency readout		
Marker resolution		span/500
Uncertainty		± (marker frequency × reference uncertainty + 2 % × span + 10 % × resolution bandwidth + ½ (last digit))
Frequency counter resolution		1 Hz
Count uncertainty	S/N > 25 dB	± (frequency × reference uncertainty + ½ (last digit))
Frequency span		0 Hz, 10 Hz to 3 GHz
Span uncertainty		3 %
Spectral purity of SSB phase noise		
Carrier offset		f = 500 MHz
	1 kHz	typ. -90 dBc (1 Hz)
	10 kHz	<-98 dBc (1 Hz), typ. -103 dBc (1 Hz)
	100 kHz	<-98 dBc (1 Hz), typ. -105 dBc (1 Hz)
	1 MHz	<-115 dBc (1 Hz), typ. -120 dBc (1 Hz)

Sweep time

Sweep time	10 Hz ≤ span ≤ 3.2 kHz	2.5 ms to 5 × span
	3.2 kHz < span ≤ 1.5 GHz	2.5 ms to 16000 s
	1.5 GHz < span ≤ 3 GHz	5 ms to 16000 s
Uncertainty		nominal 3 %
	span 0 Hz	1 μs to 5 μs in 125 ns steps 5 μs to 16000 s in 5 % steps

Resolution bandwidths

Sweep filters		
Resolution bandwidths		300 Hz to 10 MHz (-3 dB) in ⅓ sequence
	with R&S®FSL-B7 zero span	10 Hz to 10 MHz (-3 dB) in ⅓ sequence additionally 20 MHz (-3 dB)
Resolution bandwidth uncertainty		nominal <3 %
Resolution filter shape factor 60 dB : 3 dB		nominal <5 (Gaussian type filters)
EMI filters		
6 dB bandwidths		9 kHz, 120 kHz, 1 MHz
	with R&S®FSL-B7	200 Hz, 9 kHz, 120 kHz, 1 MHz
Bandwidth uncertainty		nominal <3 %
Shape factor 60 dB : 3 dB		nominal <6
FFT filters (in preparation)		
3 dB bandwidths	analyzer mode	300 Hz to 30 kHz in ⅓ sequence
	with R&S®FSL-B7	1 Hz to 30 kHz in ⅓ sequence
Bandwidth uncertainty		nominal 5 %
Shape factor 60 dB : 3 dB		nominal 2.5
Channel filters		
Bandwidths	300, 500 Hz; 1, 1.5, 2, 2.4, 2.7, 3, 3.4, 4, 4.5, 5, 6, 8.5, 9 kHz; 10, 12.5, 14, 15, 16, 18 (RRC), 20, 21, 24.3 (RRC), 25, 30, 50, 100, 150, 192, 200, 300, 500 kHz; 1, 1.228, 1.28 (RRC), 1.5, 2, 3, 3.75, 3.84 (RRC), 4.096 (RRC), 5 MHz (RRC = root raised cosine)	
	with R&S®FSL-B7	100 Hz, additionally 200 Hz
Video bandwidths	(one-pole lowpass RC filters)	1 Hz to 10 MHz in ⅓ sequence
Demodulation bandwidth		nominal 20 MHz

Level

Display range		displayed noise floor to +20 dBm	
Maximum rated input level			
DC voltage		80 V	
CW RF power	preamplifier OFF	30 dBm (= 1 W)	
CW RF power	preamplifier ON	20 dBm (= 0.1 W)	
Peak RF power	preamplifier OFF	36 dBm (= 4 W), $t < 3$ s	
Max. pulse voltage		150 V	
Max. pulse energy	10 μ s	10 mWs	
1 dB compression of input mixer	0 dB RF attenuation, $f > 200$ MHz	nominal +5 dBm	
Intermodulation			
Third-order intermodulation	intermodulation-free dynamic range, level 2 \times -20 dBm, reference level -10 dBm		
	$f < 30$ MHz	>54 dBc (TOI +7 dBm, typ. +12 dBm)	
	$f \geq 30$ MHz	>60 dBc (TOI +10 dBm, typ. +18 dBm)	
Second harmonic intercept (SHI)	$f = 20$ MHz to 3 GHz	typ. 40 dBm	
Displayed average noise level			
	0 dB RF attenuation, RBW = 1 kHz, VBW = 10 Hz, normalized to 1 Hz		
R&S® ETL-B203 not installed	frequency	preamplifier = OFF	
	500 kHz to 1 MHz	<-100 dBm (1 Hz)	
	1 MHz to 10 MHz	<-115 dBm (1 Hz)	
	10 MHz to 50 MHz	<-130 dBm (1 Hz)	
	50 MHz to 3 GHz	<-140 dBm (1 Hz)	
	frequency	preamplifier = ON	
	500 kHz to 1 MHz	<-115 dBm (1 Hz)	
	1 MHz to 10 MHz	<-130 dBm (1 Hz)	
	10 MHz to 50 MHz	<-145 dBm (1 Hz)	
	50 MHz to 3 GHz	<-152 dBm (1 Hz)	
	frequency	preamplifier = ON, typical values	
	500 MHz	-162 dBm (1 Hz)	
1 GHz	-160 dBm (1 Hz)		
3 GHz	-158 dBm (1 Hz)		
With R&S® ETL-B203 preselector (bypass)	frequency	preamplifier = OFF	
	500 kHz to 1 MHz	<-92 dBm (1 Hz)	
	1 MHz to 10 MHz	<-107 dBm (1 Hz)	
	10 MHz to 50 MHz	<-122 dBm (1 Hz)	
	50 MHz to 3 GHz	<-128 dBm (1 Hz)	
	frequency	preamplifier = ON	
	500 kHz to 1 MHz	<-115 dBm (1 Hz)	
	1 MHz to 10 MHz	<-130 dBm (1 Hz)	
	10 MHz to 50 MHz	<-145 dBm (1 Hz)	
	50 MHz to 3 GHz	<-152 dBm (1 Hz)	
	With R&S® ETL-B203 preselector (filter path, TV mode)	frequency	preamplifier = OFF
		500 kHz to 1 MHz	<-110 dBm (1 Hz)
1 MHz to 10 MHz		<-125 dBm (1 Hz)	
10 MHz to 50 MHz		<-140 dBm (1 Hz)	
50 MHz to 3 GHz		<-150 dBm (1 Hz)	
frequency		preamplifier = ON	
500 kHz to 1 MHz		<-120 dBm (1 Hz)	
1 MHz to 10 MHz		<-135 dBm (1 Hz)	
10 MHz to 50 MHz		<-150 dBm (1 Hz)	
50 MHz to 3 GHz		<-157 dBm (1 Hz)	
Immunity to interference			
Image frequency		$f + 2 \times 48.375$ MHz	>60 dB, typ. 80 dB
	$f + 2 \times 838.375$ MHz	>60 dB, typ. 80 dB	
	$f + 2 \times 7158.375$ MHz	typ. 60 dB	
Intermediate frequency	48.375 MHz, 838.375 MHz, 7158.375 MHz	>60 dB, typ. 80 dB	
Spurious response, inherent	$f > 30$ MHz, without input signal, RF attenuation = 0 dB, RBW < 1 MHz	<-90 dBm	
Spurious response	referenced to local oscillators	<-60 dBc	
Spurious response	referenced to A/D conversion	typ. <-70 dBc	
Spurious response	referenced to subharmonic of first LO (spur at 7158.375 MHz - $2 \times f_{in}$)	typ. +60 dBc	
Spurious response at mixer level < -10 dBm	referenced to harmonic of first LO (spur at $f_{in} - 3579.1875$ MHz)	typ. <-60 dBc	

Level display		
Logarithmic level axis		10 dB to 100 dB
Linear level axis		0 % to 100 %/10 divisions
Number of traces		4
Trace detectors		max peak, min peak, auto peak, sample, RMS, quasi peak, average
Number of measurement points	default value	501
	range	125 to 16001 in steps of about a factor of 2
Trace functions		clear/write, max hold, average, min hold, view
Setting range of reference level	logarithmic level display	-80 dBm to +20 dBm in steps of 2 dB, 5 dB or 10 dB
	linear level display	-80 dBm to +20 dBm, 0 % to 100 %
Units of level axis	logarithmic level display	dBm, dBmV, dB μ V, dB μ A, dBpW
	linear level display	μ V, mV, V, μ A, mA, A, pW, nW, μ W, mW, W
Level measurement uncertainty		
95 % confidence level, +20 °C to +30 °C, S/N > 16 dB, 0 dB to -50 dB from reference level	10 MHz < f \leq 3 GHz	<0.5 dB
Absolute uncertainty at reference frequency		<0.3 dB
Frequency response (+20 °C to +30 °C)		<0.5 dB, typ. 0.3 dB
Attenuator uncertainty		<0.3 dB
Uncertainty of reference level setting		nominal <0.1 dB
Display nonlinearity		
Logarithmic level display	S/N > 16 dB, 0 dB to -50 dB	<0.2 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	nominal <0.1 dB

Trigger functions

Trigger		
Trigger source		free run, video, external, IF power
External trigger level		TTL level

Part 3 – Transport stream analysis and monitoring

R&S® ETL-B280 MPEG processing board

Signal inputs		
TS input		
Number		1 (+ 1 internal)
Connector		BNC 75 Ω
Mode		ASI, SMPTE 310M (user-selectable)
ASI		in line with EN 50083-9 (2002) 270 Mbit/s 188 byte/204 byte/208 byte
SMPTE 310M		in line with BP 400 SMPTE 19.392658 Mbit/s 188 byte
Maximum cable length		180 m
Max. data rate across all inputs	depending on TS content	128 Mbit/s
Monitoring		
Monitoring engines	R&S® ETL-K282	1 to 2 at least one R&S® ETL-K282 option required for analysis and monitoring
Signal output		
TS output		
Connector		BNC 75 Ω
Mode		ASI, SMPTE 310M (user-selectable)
Video and audio interface		
HDMI	digital	supported by R&S® ETL-B281

R&S® ETL-K282 MPEG analysis/monitoring

The R&S® ETL-B280 option is required.

Broadcasting standard		
	independently selectable for every activated signal input	DVB ATSC SCTE
Views and function		
Site tree		status overview of all inputs definable site name definable input name
TS tree		tree display of TS structure with event indication in TS tree element
Topology		selectable background display with status display (to be positioned as required) for all enabled signal inputs TS pie chart can be added.
Background image format		GIF
Recommended image size	without pie chart (W x H) with pie chart (W x H)	580 pixels x 165 pixels 580 pixels x 380 pixels
Monitoring		realtime TS monitoring data rate analysis table repetition analysis
Monitoring		
Display of monitoring test results		
Site tree		status indication for all inputs
Input tree		status indication for all TS elements
Statistics counter		error seconds of top-level test parameter
Log view		event description with: time/date class (event, alarm, info, system) detail information PID number service number
Bit rate view		bargraph display with peak hold for each section
Table repetition view		bargraph display with peak hold for each section
Size of statistics counter		up to 9999 error seconds
Size of event log	realtime view deferred view (log to file)	1000 lines only limited by space on hard drive
Event class		configurable for each monitoring parameter alarm warning info for system events system
Limits		configurable for each applicable monitoring parameter
Alarm line		configurable for each monitoring parameter
Log type		transition (new entry by change of status only) continuous (new entry every second in case of event)

Log filter	realtime log	system + alarm system + warning system + info
Log to file scheduling		new log file every day new log file every hour new log file after 1 min to 1000 min new log file after 1000 events to 100000 events
Hiding of events		
Number of hidden event definitions		up to 200
Event filter		top-level monitoring parameter, PID
Hiding time		0 s to 99999999 s, infinite
Monitoring configuration		unlimited number of different configurations import/export feature for quick exchange global assignment (one setting for some or all inputs) single assignment (different settings for each input)

DVB monitoring measurements

TR 101 290 V1.2.1 – 1st priority monitoring		
TS synchronization	1 packet to 7 packets	loss after packets
	1 packet to 31 packets	lock after packets
Sync byte		single byte invalid successive bytes invalid
PAT	0.1 s to 9999.9 s	upper repetition period table ID scrambled
Continuity count		discontinuous packet order packet occurs more than twice packet lost incorrect use of discontinuity flag
PMT	0.1 s to 9999.9 s	upper repetition period scrambled
PID distance	0.1 s to 9999.9 s	video upper period
	0.1 s to 9999.9 s	audio upper period
	0.1 s to 9999.9 s	data upper period
	“excluding of PID” feature	up to 10 PID numbers
TR 101 290 V1.2.1 – 2nd priority monitoring		
Transport		error indicator
CRC		error in PAT error in CAT error in PMT error in NIT error in BAT error in SDT error in EIT error in TOT error in SIT error in TSMT error in MIP error in AIT
PCR discontinuity	1 ms to 99999 ms	upper limit
PCR repetition	1 ms to 99999 ms	lower period
	1 ms to 99999 ms	upper period

PCR jitter	10 ns to 999999 ns	upper limit
	profiles	MGF1 (10 MHz) MGF2 (100 MHz) MGF3 (1 Hz)
	test mode	accuracy ¹ overall jitter – including packet arrival time
PTS repetition	1 ms to 99999 ms	upper period
CAT	0.1 s to 9999.9 s	missing table ID
TR 101 290 V1.2.1 – 3rd priority monitoring		
SI repetition	1 ms to 9999 ms	PAT lower period
	limit is equal to limit of 1st priority PAT	PAT upper period
	1 ms to 9999 ms	CAT lower period
	limit is equal to limit of 1st priority CAT	CAT upper period
	1 ms to 9999 ms	PMT lower period
	limit is equal to limit of 1st priority PMT	PMT upper period
	1 ms to 9999 ms	NIT ACTUAL lower period
	0.1 s to 9999.9 s	NIT ACTUAL upper period
	1 ms to 9999 ms	NIT OTHER lower period
	0.1 s to 9999.9 s	NIT OTHER upper period
	1 ms to 9999 ms	SDT ACTUAL lower period
	0.1 s to 9999.9 s	SDT ACTUAL upper period
	1 ms to 9999 ms	SDT OTHER lower period
	0.1 s to 9999.9 s	SDT OTHER upper period
	1 ms to 9999 ms	BAT lower period
	0.1 s to 9999.9 s	BAT upper period
	1 ms to 9999 ms	EIT ACTUAL PF lower period
	0.1 s to 9999.9 s	EIT ACTUAL PRESENT upper period
	1 ms to 9999 ms	EIT ACTUAL FOLLOWING upper period
	0.1 s to 9999.9 s	EIT OTHER PF lower period
	1 ms to 9999 ms	EIT OTHER PRESENT upper period
	0.1 s to 9999.9 s	EIT OTHER FOLLOWING upper period
	1 ms to 9999 ms	RST lower period
	0.1 s to 9999.9 s	RST upper period
	1 ms to 9999 ms	TDT lower period
	0.1 s to 9999.9 s	TDT upper period
	1 ms to 9999 ms	TOT lower period
	0.1 s to 9999.9 s	TOT upper period
1 ms to 9999 ms	AIT lower period	
0.1 s to 9999.9 s	AIT upper period	
NIT actual	limit is equal to limit of SI repetition	repetition – lower period
	limit is equal to limit of SI repetition	repetition – upper period table ID
NIT other	limit is equal to limit of SI repetition	repetition – lower period
	limit is equal to limit of SI repetition	repetition – upper period
SDT actual	limit is equal to limit of SI repetition	repetition – lower period
	limit is equal to limit of SI repetition	repetition – upper period table ID
SDT other	limit is equal to limit of SI repetition	repetition – lower period
	limit is equal to limit of SI repetition	repetition – upper period
EIT actual	limit is equal to limit of SI repetition	PF repetition – lower period
	limit is equal to limit of SI repetition	present repetition – upper period following repetition – upper period
		table ID
EIT other	limit is equal to limit of SI repetition	PF repetition – lower period
	limit is equal to limit of SI repetition	present repetition – upper period following repetition – upper period
EIT present/following		section missing
RST	limit is equal to limit of SI repetition	lower period
	limit is equal to limit of SI repetition	table ID

¹ Recommended by TR 101 290 for monitoring.

TDT	limit is equal to limit of SI repetition	lower period
	limit is equal to limit of SI repetition	upper period table ID
Unreferenced PID	0.1 s to 9999.9 s	waiting period after change in PMT or CAT up to 10 PID numbers
	“excluding of PID” feature	
Extended checks I – monitoring		
TS	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Service	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Video	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Audio	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Other	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Null packet	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
PAT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
PMT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
CAT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
NIT ACTUAL	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
NIT OTHER	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
BAT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
SDT ACTUAL	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
SDT OTHER	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
EIT ACTUAL PF	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
EIT ACTUAL schedule	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
EIT OTHER PF	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
EIT OTHER schedule	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
TDT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
TOT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
RST	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
MIP	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
AIT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
For all bit rate measurements	“excluding of PID” feature separate measurement profiles for each measurement	10 PID numbers
		MGB1 (188, 1 s, 1 s)
		MGB1A (188, 1 s, 10 s)
		MGB1B (188, 1 s, 30 s)
		MGB2 (188, 100 ms, 1 s)
		MGB2A (188, 100 ms, 100 ms)
		MGB2B (188, 100 ms, 500 ms)
MGB2B (188, 1 s, 5 s)		
Extended checks II – monitoring		
SFN synchronization		presence – more than one MIP
		presence – megafame without MIP
		structure – invalid MIP TS header
		structure – inconsistent length field
	0.0 μ s to 5000000.0 μ s	structure – setting of max. delay out of range
		structure – synchronization time stamp
		structure – CRC error in MIP
		pointer – does not match location of MIP
	0 bit/s to 100000 bit/s	periodicity – unperiodic MIP insertion
		periodicity – MIP pointer not constant
		timing – max. deviation
TS ID match	0 to 65535	bit rate – inconsistency specified TS ID
TS modification		change of TS ID
		additional service
		service disappeared
		additional element
		element disappeared
		change of element stream type
CA alternation		change of PCR PID
		CA flag ON
		CA flag OFF alternation of key

ATSC and SCTE monitoring test parameter

MPEG/TS monitoring		
TS synchronization	1 packet to 7 packets	loss after packets
	1 packet to 31 packets	lock after packets
Sync byte		single byte invalid successive bytes invalid
Continuity count		discontinuous packet order packet occurs more than twice packet lost incorrect use of discontinuity flag
Transport		error indicator
CRC		error in PAT error in CAT error in PMT error in MGT error in VCT error in STT error in RRT error in EIT error in ETT error in CETT error in DET error in LTST error in DCCT error in DCCSCT
PID distance	0.1 s to 9999.9 s	video upper period
	0.1 s to 9999.9 s	audio upper period
	0.1 s to 9999.9 s	data upper period
	"excluding of PID" feature	up to 10 PID numbers
Unreferenced PID	0.1 s to 9999.9 s	waiting period after change in PMT or CAT
	"excluding of PID" feature	up to 10 PID numbers
ATSC/PSIP monitoring		
PSIP basics		base PID
MGT	1 ms to 9999 ms	repetition lower period
	1 ms to 9999 ms	repetition upper period
VCT	1 ms to 9999 ms	CVCT repetition lower period
	0.1 s to 9999.9 s	CVCT repetition upper period
	1 ms to 9999 ms	TVCT repetition lower period
	0.1 s to 9999.9 s	TVCT repetition upper period
STT	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
RRT	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
ETI	1 ms to 9999 ms	EIT-0 repetition lower period
	0.1 s to 9999.9 s	EIT-0 repetition upper period
	1 ms to 9999 ms	EIT-1 repetition lower period
	0.1 s to 9999.9 s	EIT-1 repetition upper period
	1 ms to 9999 ms	EIT-2 repetition lower period
	0.1 s to 9999.9 s	EIT-2 repetition upper period
	1 ms to 9999 ms	EIT-3 repetition lower period
	0.1 s to 9999.9 s	EIT-3 repetition upper period
	1 ms to 9999 ms	EIT-4 to 127 repetition lower period
	0.1 s to 9999.9 s	EIT-4 to 127 repetition upper period
ETT	1 ms to 9999 ms	ETT-0 to 127 repetition lower period
	0.1 s to 9999.9 s	ETT-0 to 127 repetition upper period
CETT	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
DET	1 ms to 9999 ms	DET-0 repetition lower period
	0.1 s to 9999.9 s	DET-0 repetition upper period
	1 ms to 9999 ms	DET-1 repetition lower period
	0.1 s to 9999.9 s	DET-1 repetition upper period
	1 ms to 9999 ms	DET-2 to 127 repetition lower period
	0.1 s to 9999.9 s	DET-2 to 127 repetition upper period

LTST	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
DCCT	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
DCCSCT	1 ms to 9999 ms	repetition lower period
	0.1 s to 9999.9 s	repetition upper period
PAT	0.1 s to 9999.9 s	repetition upper period table ID scrambled
CAT	0.1 s to 9999.9 s	missing table ID
Services I – monitoring		
PCR repetition	1 ms to 99999 ms	lower period
	1 ms to 99999 ms	upper period
PCR discontinuity	1 ms to 99999 ms	upper limit
PCR jitter	10 ns to 999999 ns	upper limit
	profiles	MGF1 (10 mHz) MGF2 (100 mHz) MGF3 (1 Hz)
	test mode	accuracy overall jitter – including packet arrival time
PTS repetition	1 ms to 99999 ms (700 ms)	upper period
PMT	0.1 s to 9999.9 s	upper period scrambled
Services II – bit rate monitoring		
TS	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Service	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Video	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Audio	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Other	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
Null packet	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
PAT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
PMT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
CAT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
MGT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
CVCT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
TVCT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
STT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
RRT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
EIT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
ETT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
CETT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
DET	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
LTST	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
DCCT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
DCCSCT	0 Mbit/s to 128 Mbit/s	lower/upper bit rate
For any bit rate monitoring	“excluding of PID” feature separate measurement profiles for each measurement	10 PID numbers MGB1 (188, 1 s, 1 s) MGB1A (188, 1 s, 10 s) MGB1B (188, 1 s, 30 s) MGB2 (188, 100 ms, 1 s) MGB2A (188, 100 ms, 100 ms) MGB2B (188, 100 ms, 500 ms) MGB2B (188, 1 s, 5 s)
Extended monitoring		
TS modification		change of TS ID additional service service disappeared additional element element disappeared change of element stream type change of PCR PID
TS ID match	0 to 65535	specified TS ID
CA alternation		CA flag ON CA flag OFF

R&S® ETL-K283 in-depth analysis

The R&S® ETL-K282 option is required.

Packet interpreter	applicable packet filter (combinations possible): any element of the TS tree payload unit start indicator adaptation field control	display of TS packet in hex and ASCII interpretation of TS header snapshot or continuous update
Table and PES interpreter	applicable filter: any element of the TS tree for table sections only: table ID, table ID extension, section number	interpretation of table section or PES packet header snapshot or continuous update
Header map		display of packet header, PID or symbol for up to 262000 TS packets highlighted script for TS packets with corresponding PID by selection of any element of the TS tree
TS list		extended display of the TS in tabular form with 9 columns: group, content, ID, CA, ECM PID, PID, PCR PID, rate [Mbit/s], % bandwidth (continuously updated) sorter function in 'Stop' mode
PCR analysis	applicable profiles: MGF1 (10 mHz) MGF2 (100 mHz) MGF3 (1 Hz)	graphical display of PCR overall jitter, PCR accuracy, PCR frequency drift or PCR offset (up to ten minutes) graphical display of PCR repetition (up to ten minutes) long-term determination of min./max. peak values
PTS analysis		graphical display of PTS/PCR delay (up to ten minutes) graphical display of PTS repetition (up to ten minutes) long-term determination of min./max. peak values

R&S® ETL-K284 data broadcast analysis

The R&S® ETL-K282 option is required.

Analysis of all DVB data broadcast protocols

	Data piping	Data streaming	MPE	Data carousel	Object carousel
Overview	display of used descriptors and name of tables containing the descriptors				
Interpreter	TS header	PES header	section	section (DSI, DII and DDB header)	
Raw data	content of TS packet	content of PES packet	content of section	content of DDB section	
Timing measurements	bit rate of ES	bit rate of PES	bit rate of selected section	bit rate of selected module, DSI, DII section	
	repetition time of payload_unit_start_indicators	repetition time of PES header	repetition time of selected section	repetition time of selected DII, DSI section	
				loading time of selected module	

Analysis of DVB-H services

Only for inputs that are assigned a monitoring configuration in line with DVB.

Burst timing		burst duration burst cycle time maximum and minimum of signaled Delta_T margin burst bit rate burst peak bit rate constant bit rate burst total size burst IP payload
FEC analysis		FEC usage number of rows number of padding columns number of puncturing bytes burst FEC code rate receiver on-time and off-time power saving from start DVB-H encapsulation overhead erroneous rows before and after FEC decoding frame error rate (FER) MPE frame error rate (MFER) correct IP packets before and after FEC erroneous IP packets before and after FEC IP packet error rate before and after FEC IP packet error rate before FEC from start
Decoding		display of DVB-H content via VLC zoom function (50 % to 200 %) data cache from 0.3 s to 15 s

R&S® ETL-K285 TS template monitoring

The R&S® ETL-K282 option is required.

Transport stream	0 to 65535	TS ID
	0 to 65535	network ID
	0 to 65535	orig. network ID
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
EMM	0 to 8191	PID
	mandatory, optional, not allowed	constraint
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
User private data	0 to 8191	PID
	optional, not allowed	constraint
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
Unreferenced PIDs	0 to 8191	PID
	optional, not allowed	constraint
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
	0 bit/s to 214000000 bit/s	lower bit rate
Null packets	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
Services	0 to 65535	service ID
	mandatory, optional, not allowed	constraint
		service name
	0 to 8191	PCR PID
	0 to 8191	PMT PID
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
Elementary stream	0 to 8191	PID
	mandatory, optional, not allowed	constraint
	about 50 different types (see below)	type
	yes, no	conditional access
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
Parental rating	3 letters	country code
	undefined, age [4 to 18], user-defined [16 to 256]	rating
ECMs	0 to 8191	PID
	mandatory, optional, not allowed	constraint
	0 bit/s to 214000000 bit/s	lower bit rate
	0 bit/s to 214000000 bit/s	upper bit rate
EIT present/following	1 to 999999	upper repetition period
EIT scheduled [1 to 16]	1 to 999999	upper repetition period
For any bit rate monitoring	separate measurement profiles for each element	MGB1 (188, 1 s, 1 s) MGB1A (188, 1 s, 10 s) MGB1B (188, 1 s, 30 s) MGB2 (188, 100 ms, 1 s) MGB2A (188, 100 ms, 100 ms) MGB2B (188, 100 ms, 500 ms) MGB2B (188, 1 s, 5 s)
Supported elementary stream types: Video MPEG-1, Video MPEG-2, Audio MPEG-1, Audio MPEG-2, Private Data, PES Private Date, MHEG ISO/IEC13 522, DMS ISO/IEC 13818-1, ATM Specific ITU-T Rec. H.222.1, DMS_CC ISO/IEC 13818-6 type A, DMS_CC ISO/IEC 13818-6 type B, DMS_CC ISO/IEC 13818-6 type C, DMS_CC ISO/IEC 13818-6 type D, Auxiliary ISO/IEC 13818-1, Audio ADTS ISO/IEC 13818-1, Visual ISO/IEC 14496-2, Audio LATM ISO/IEC 14496-3, PES Flex. Mux. ISO/IEC 14496-1, Section Flex. Mux. ISO/IEC 14496-1, Synchr. Download Protocol ISO/IEC 13818, PES Metadata, Section Metadata, Data Carousel Metadata, Object Carousel Metadata, Synchr. Download Protocol Metadata, IPMP Stream ISO/IEC 13818-11, Video AVC ISO/IEC14496-10, User Private Stream, VBI Data, VBI Teletext, Subtitling, Audio AC3, Audio Enhanced AC3, AIT, Audio DTS, Audio AAC, Data Piping, Data Asynchronous Streaming, Data Synchronized Streaming, Data Multiprotocol Encapsulation, Data Carousel, Data Object Carousel, Data DVB ATM Stream, Data Higher Protocol, Data System Software Update (UNT), Data IP/MAC Notification (INT), Data MHP Object Carousel, Data MHP Multiprotocol Encapsulation, Data DVB-H		

Part 4 – Video and audio decoding

The following hardware decoder options allow MPEG-2-coded and H.264-coded SD and HD video signals to be decoded. Audio decoding is also supported. An HDMI interface is available to connect an external display.

Using the R&S®ETL-B281 option, the decoded picture and the decoded sound can be output directly on the R&S®ETL.

R&S®ETL-B281 video and audio hardware decoder

The R&S®ETL-B280 option is required.

Decoding of a program selected via the GUI.

Supported video and audio formats		
Video formats	coding method	MPEG-2 (MP@ML) H.264/AVC (MP)
	resolution	480i/576i (standard definition)
Audio formats	coding method	MPEG-1/MPEG-2 layer I

R&S®ETL-K281 HDTV and Dolby upgrade

The R&S®ETL-B281 option is required.

Additionally supported formats		
Video formats	coding method	MPEG-2 (MP@HL) H.264/AVC (MP)
	resolution	1080i
		720p
		480p/576p
Audio formats	coding method	480i/576i Dolby Digital AC-3

Part 5 – Common specifications

Inputs and outputs

RF input		
Impedance		50 Ω
Connector		N female
VSWR	RF attenuation \geq 10 dB	typ. 1.5
Input attenuator		0 dB to 30 dB in 5 dB steps
Additional RF input, 75 Ω (see R&S®ETL-B203 option)		
Video output (CCVS) I out (R&S®ETL-B201 option required)		
Connector		BNC female, 75 Ω
Output level, peak–peak	CCVS	1 V
DC position of back porch		0 V
Frequency response error	within video bandwidth	\leq 0.4 dB
Group delay response error	within video bandwidth, flat group delay	\leq 12 ns
	within video bandwidth, group delay in line with standard	\leq 20 ns
2T pulse k-factor		\leq 1 %
2T pulse amplitude error		\leq 2 %
Tilt	bar	\leq 1 %
Luminance nonlinearity		\leq 2 %
Differential gain		\leq 2 %
Differential phase		\leq 1°
TS ASI output (digital TV receiver mode)		
Connector		BNC female, 75 Ω
Output level, peak–peak		0.8 V
Data rate		270 Mbit/s
AF signal output		
Connector		2 \times Lemo Triax, female, balanced, non-floating
Output impedance		$Z < 35 \Omega$
Output level	load 600 Ω	6 dBm
Signals		left/right, sound 1/sound 2, mono
S/N	signal: test pattern, weighted (ITU-R 468-3) intercarrier method	\geq 50 dB
Frequency response	deemphasis 50 μ s, 0.03 to 15 kHz	\leq 0.5 dB
Total harmonic distortion (THD)	1 kHz	\leq 0.1 %
AF output (headphone)		
Connector		3.5 mm mini jack
Output impedance		$< 100 \Omega$
Open-circuit voltage	adjustable in spectrum analyzer mode	up to 1.5 V
Tracking generator (spectrum analyzer mode)		
Tracking generator		N female, 50 Ω
Output level		-20 dBm to 0 dBm in 1 dB steps
Frequency range		1 MHz to 3 GHz
Reverse power		
DC voltage		50 V
CW RF power		30 dBm (= 1 W)
Max. pulse voltage		150 V
Max. pulse energy (10 μ s)		10 mWs
External reference		
Connector		BNC female, 50 Ω
Input level		0 dBm to +10 dBm
Output level	with R&S®FSL-B4	typ. 0 dBm
Frequency		10 MHz \pm 5 ppm
External trigger/gate input (spectrum analyzer mode)		
Connector		BNC female, 50 Ω
Input level		TTL compatible
USB and remote		
USB interface		2 \times USB 1.1, host for memory stick, mouse, keyboard
Remote interface		LAN
	R&S®FSL-B10	LAN or GPIB

General data

Remote control		
LAN interface		10/100BaseT, RJ-45
IEC/IEEE bus (GPIB)	R&S®FSL-B10	SCPI 1997.0
Display		
Resolution		640 pixels × 480 pixels
Pixel failure rate		<2 × 10 ⁻⁵
Mass memory		
Mass memory		flash disk (internal), USB memory stick (not supplied)
Data storage		>500 instrument settings and traces
Temperature		
Operating temperature range		0 °C to +45 °C
Permissible temperature range		0 °C to +50 °C
Storage temperature range		-40 °C to +70 °C
Climatic loading		+25 °C/+40 °C at 85 % relative humidity (tested in line with IEC 60068-2-30)
Mechanical resistance		
Vibration		
Sinusoidal		IEC 60068-2-6
Random		IEC 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4 procedure 1, IEC 60068-2-27
Power supply		
Input voltage range, AC, nominal		100 V to 240 V
AC supply frequency		50 Hz to 60 Hz
Input current, AC		1.8 A to 0.4 A
Power consumption		typ. 95 VA, max. 140 VA with all options
Safety		IEC 61010-1, EN 61010-1, UL 61010-1, CSA C22.2 No. 61010-1
EMC	In line with CISPR 11/EN 55011 group 1 class A (for a shielded test setup). The instrument complies with the emission requirements stipulated by EN 55011 class A. This means that the instrument is suitable for use in industrial environments. In line with EN 61000-6-4, operation in residential, commercial and business areas or in small-size companies is not covered. Thus, the instrument may not be operated in residential, commercial and business areas or in small-size companies, unless additional measures are taken to ensure that EN 61000-6-3 is complied with.	
Dimensions	W × H × D	
	with handle	408.8 mm × 158.1 mm × 465.3 mm (16.09 in × 6.22 in × 18.32 in)
	without handle	342.3 mm × 158.1 mm × 367.0 mm (13.48 in × 6.22 in × 14.45 in)
Weight	without options	<9 kg (<19.84 lb)
Recommended calibration interval		12 months
	operation with external reference	24 months

Hardware options

R&S® FSL-B5 additional interfaces

User port		
Connector		9 pin D-Sub male
Output		TTL compatible, 0 V/5 V, max. 15 mA
Input		TTL compatible, max. 5 V
Noise source control		
Connector		BNC female
Output		0 V/28 V, max. 100 mA, switchable, supply for noise source
IF/video out		
Connector		BNC female, 50 Ω
Bandwidth	IF and video out	typ. 20 MHz
Output level	video out	typ. 200 mV full scale (open circuit), linear scaling
IF frequency	IF out, TV mode	17.458333 MHz
	IF out, spectrum analyzer mode	typ. 18 MHz
Power sensor		
Connector		6 pin LEMOSA female for supported R&S®NRP-Zxx power sensors

R&S® ETL-B201 additional interface DTV

Serial Data output (DVB-T/H, ATSC, T-DMB/DAB)		
Connector		BNC female, 50 Ω
Output		TTL, R _i = 50 Ω
Serial clock output (DVB-T/H, ATSC, T-DMB/DAB)		
Connector		BNC female, 50 Ω
Output		TTL, R _i = 50 Ω
I signal input		
Connector		BNC female, 50 Ω
Input level		max. ±0.5 V
Q signal input		
Connector		BNC female, 50 Ω
Input level		max. ±0.5 V
IF output		
Connector		BNC female, 75 Ω
Output level		max. ±1.0 V
IF	output only available in DVB-C and DTMB mode	4.571428 MHz (DVB-C) 5.000 MHz (DTMB, 8 MHz channel bandwidth)
Analog TV mode		output of sound IF (intercarrier) or output of demodulated video signal (when video generator option ETL-K203 is activated), selectable
DTMB mode (option R&S®ETL-B215/216)		input of I/Q baseband signal, output of IF (5.000MHz)
DVB-C mode (option R&S®ETL-K210)		input of I/Q baseband signal, output of IF (4.571428 MHz)
ATSC mode (option R&S®ETL-K220)		input of I/Q baseband signal, serial clock/data after demapper
DVB-T/H mode (option R&S®ETL-K240)		input of I/Q baseband signal, serial clock/data after demapper
T-DMB/DAB mode (option R&S®ETL-K250)		input of I/Q baseband signal, output of ETI (NI, G.703, HDB3, available from January 2009), serial clock/data of selected sub-channel

R&S® ETL-B203 RF preselector

Additional RF input		
Impedance		75 Ω
Connector		F male F female (with F adapter, supplied)
VSWR	RF attenuation ≥ 5 dB	1.5
Input attenuator		0 dB to 55 dB in 5 dB steps
Common data for RF input (50 Ω) and additional RF input (75 Ω)		
Frequency range		500 kHz to 3 GHz
Noise figure	0 dB attenuation, including spectrum analyzer frontend	15 dB (50 MHz to 1.3 GHz, preamplifier OFF)
		9 dB (50 MHz to 1.3 GHz, preamplifier ON)
		11 dB (1.3 GHz to 2.3 GHz, preamplifier ON)
		13 dB (2.3 GHz to 3.0 GHz, preamplifier ON)
TOI	0 dB attenuation, including spectrum analyzer frontend	>−5 dBm
Maximum safe input level	DC voltage	80 V
	CW RF power (preamplifier ON)	20 dBm
	CW RF power (preamplifier OFF)	30 dBm

R&S® ETL-B209 Additional Hard Disk

Capacity		80 GByte
Interface		SATA
Position		internal
Operating conditions		7 × 24 hours, extended service wide temperature model

R&S® ETL-B230 DC power supply 11 V to 19 V

Operating input voltage range		11.0 V to 19.0 V
Maximum input power		120 W
Current consumption		typ. 6 A to 12 A
Input voltage protection, low		typ. 10.0 V
Input voltage protection, high		typ. 20.2 V
Absolute maximum input voltage		20.0 V

Ordering information

Designation TV Analyzer, 500 kHz to 3 GHz, with tracking generator	Type R&S®ETL	Order No. 2112.0004.13
Accessories supplied Power cable, quick start guide and CD-ROM (with operating manual)		

Options

Designation	Type	Order No.	Retrofittable	Remarks
Additional Interface DTV	R&S®ETL-B201	2112.0304.02	yes (customer)	SER-DAT out, SER-CLK out, I in, Q in, IF out/ETI out (same slot as R&S®FSL-B5)
RF preselector	R&S®ETL-B203	2112.0327.02	yes (service)	
Hard Disk 80 Gbyte	R&S®ETL-B209	2112.0291.02	yes (service)	
Digital Demodulator for Single Carrier	R&S®ETL-B210	2112.0104.02	yes (service)	
Digital Demodulator for DTMB	R&S®ETL-B215	2112.0156.02	yes (service)	
Digital Demodulator for Single Carrier and DTMB	R&S®ETL-B216	2112.0162.02	yes (service)	
DC Power Supply 11 V to 19 V	R&S®ETL-B230	2112.0256.02	yes (customer)	
MPEG Processing Board	R&S®ETL-B280	2112.0362.02	yes (service)	only for R&S®ETL with serial no. > 100500
Video and Audio Hardware Decoder	R&S®ETL-B281	2112.0356.02	yes (service)	requires R&S®ETL-B280
OCXO Reference Frequency	R&S®FSL-B4	1300.6008.02	yes (customer)	
Additional Interfaces	R&S®FSL-B5	1300.6108.02	yes (customer)	video out, IF out, noise source control, AUX port, R&S®NRP-Zxx power sensor (same slot as R&S®ETL-B201)
Narrow Resolution Filters	R&S®FSL-B7	1300.5601.02	yes (service)	
GPIB Interface	R&S®FSL-B10	1300.6208.02	yes (customer)	
Firmware/Software				
Measurement Log	R&S®ETL-K208	2112.0579.02		requires at least one digital TV option
DVB-C Firmware	R&S®ETL-K210	2112.0404.02		requires R&S®ETL-B210 or R&S®ETL-B216
ATSC/8VSB Firmware	R&S®ETL-K220	2112.0456.02		
DVB-T/H Firmware	R&S®ETL-K240	2112.0556.02		
DVB-T/H SFN Frequency Offset	R&S®ETL-K241	2112.0562.02		requires R&S®ETL-K240
T-DMB/DAB Firmware	R&S®ETL-K250	2112.0533.02		
HDTV and Dolby Upgrade	R&S®ETL-K281	2112.0604.02		requires R&S®ETL-B281
MPEG Analysis/Monitoring	R&S®ETL-K282	2112.0610.02		requires R&S®ETL-B280
In-Depth Analysis	R&S®ETL-K283	2112.0627.02		requires R&S®ETL-K282
Data Broadcast Analysis	R&S®ETL-K284	2112.0633.02		requires R&S®ETL-K282
TS Template Monitoring	R&S®ETL-K285	2112.0640.02		requires R&S®ETL-K282
AM/FM/ϕM Measurement Demodulator	R&S®FSL-K7	1301.9246.02		
Power Sensor Support	R&S®FSL-K9	1301.9530.02		requires R&S®FSL-B5 or R&S®NRP-Z3/4

Recommended extras

Designation	Type	Order No.
Documentation of R&S®ETL Calibration Values	R&S®ETL-DCV	2082.0490.31
19" Rackmount Adapter	R&S®ZZA-S334	1109.4487.00
Lemo Triax connector (mono) with connecting cable (open)		2067.7451.00
Soft Carrying Bag	R&S®FSL-Z3	1300.5401.00
Protective Hard Cover	R&S®EVS-Z6	5201.7760.00
Matching Pad 75 Ω, L section	R&S®RAM	0358.5414.02
Matching Pad 75 Ω, series resistor 25 Ω	R&S®RAZ	0358.5714.02
Matching Pad 75 Ω, L section, N to BNC	R&S®FSH-Z38	1300.7740.02
SWR Bridge 5 MHz to 3 GHz	R&S®ZRB2	0373.9017.52
SWR Bridge 40 kHz to 4 GHz, 50 Ω	R&S®ZRC	1039.9492.52
SWR Bridge 40 kHz to 2.5 GHz, 75 Ω	R&S®ZRC	1039.9492.72
Mouse with USB Interface, optical	R&S®PSL-Z10	1157.7060.03
Keyboard with USB Interface (US assignment)	R&S®PSL-Z2	1157.6870.04
Spare F Adapter, female/female	R&S®FSHTV-Z61	2111.7111.02

Power sensors supported by R&S®FSL-K9

Designation	Type	Order No.
USB Adapter (active) (required for using power sensors with the R&S®ETL if the R&S®FSL-B5 is not installed)	R&S®NRP-Z3	1146.7005.02
USB Adapter (passive) (required for using power sensors with the R&S®ETL if the R&S®FSL-B5 is not installed)	R&S®NRP-Z4	1146.8001.02
Average Power Sensor 10 MHz to 8 GHz, 200 mW	R&S®NRP-Z11	1138.3004.02
Average Power Sensor 10 MHz to 18 GHz, 200 mW	R&S®NRP-Z21	1137.6000.02
Average Power Sensor 10 MHz to 18 GHz, 2 W	R&S®NRP-Z22	1137.7506.02
Average Power Sensor 10 MHz to 18 GHz, 15 W	R&S®NRP-Z23	1137.8002.02
Average Power Sensor 10 MHz to 18 GHz, 30 W	R&S®NRP-Z24	1137.8502.02
Average Power Sensor 9 kHz to 6 GHz, 200 mW	R&S®NRP-Z91	1168.8004.02
Thermal Power Sensor 0 Hz to 18 GHz, 100 mW	R&S®NRP-Z51	1138.0005.02
Thermal Power Sensor 0 Hz to 40 GHz, 100 mW	R&S®NRP-Z55	1138.2008.02
Wideband Power Sensor 50 MHz to 18 GHz, 100 mW	R&S®NRP-Z81	1137.9009.02

Service options

Designation	Type	Order No.
One-Year Repair Service following the warranty period	R&S®RO2ETL	please contact your local Rohde & Schwarz sales partner
Two-Year Repair Service following the warranty period	R&S®RO3ETL	please contact your local Rohde & Schwarz sales partner
Four-Year Repair Service following the warranty period	R&S®RO5ETL	please contact your local Rohde & Schwarz sales partner
Two-Year Calibration Service	R&S®CO2ETL	please contact your local Rohde & Schwarz sales partner
Three-Year Calibration Service	R&S®CO3ETL	please contact your local Rohde & Schwarz sales partner
Five-Year Calibration Service	R&S®CO5ETL	please contact your local Rohde & Schwarz sales partner

Service you can rely on

- | In 70 countries
- | Person-to-person
- | Customized and flexible
- | Quality with a warranty
- | No hidden terms

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Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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