R&S®ETL TV Analyzer

The universal reference receiver for broadcast signal analysis

ROHDE&SCHWARZ

Product Brochure | Version 06.00

R&S®ETL TV Analyzer At a glance

The R&S®ETL TV analyzer stands for all-in-one. The R&S®ETL combines the functionality of a TV and sound broadcasting signal analyzer, a video and MPEG TS analyzer and a spectrum analyzer in a single instrument. The R&S®ETL also contains generators to create analog video signals, audio signals and MPEG-2 transport streams.

The R&S®ETL's innovative instrument concept facilitates the flexible integration of demodulators for analog and digital TV standards as well as sound broadcasting. All of the demodulators work in realtime [1]; fast signal processing allows comprehensive, extremely accurate measurements.

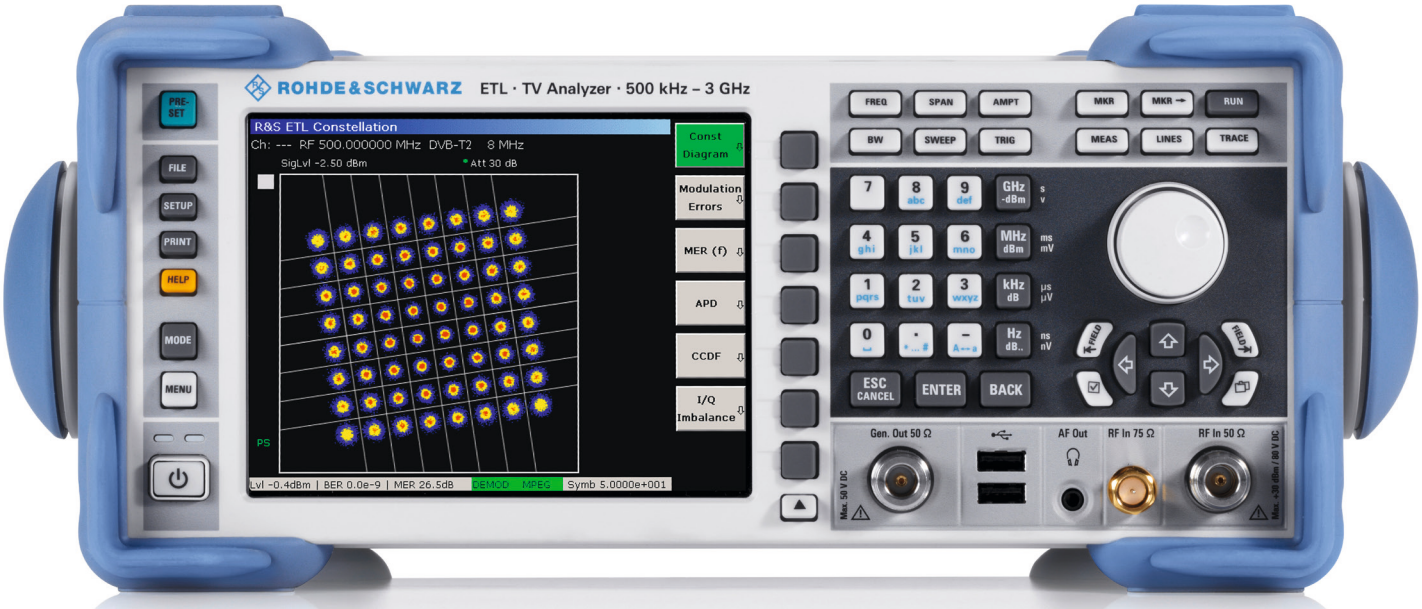
Its wide range of functions and flexible configuration make the R&S®ETL TV analyzer the universal reference for the analysis of TV signals – for TV and cable network operators, transmitter manufacturers, service technicians and regulatory authorities.

The R&S®ETL TV analyzer has primarily been designed to provide reproducible, high-quality analysis of TV and sound broadcasting signals such as are needed at the transmitter site, at the cable headend or for quality assurance during production.

The R&S®ETL is ideal for both stationary and portable use. The compact, rugged housing makes outdoor use possible, e.g. for coverage measurements within a terrestrial TV or sound broadcasting transmitter network.

Supported standards		
TV		
Digital TV	terrestrial	DVB-T/-H/-T2, ATSC/8VSB, ATSC MDTV, ISDB-T, DTMB
	cable	DVB-C, J.83/A, J.83/B, J.83/C
Analog TV	terrestrial	PAL, NTSC, SECAM
Radio		
Digital radio	terrestrial	DAB, T-DMB (CDR [1])
Analog radio	terrestrial	FM

R&S®ETL front view



Key facts

- Frequency range from 500 kHz to 3 GHz
- TV, sound broadcasting, video, audio, MPEG-2 transport stream and spectrum analysis in a single box
- FPGA and chip based realtime demodulators
- Baseband outputs
- Preselection with additional 75 Ω RF input
- Video signal generator
- Audio signal generator
- MPEG-2 transport stream generator/recorder
- Support of power sensors
- DC input and rechargeable Li-ion battery

Latest enhancements

- CDR signal analysis (PC required) [1)]
- New: R&S®TVSCAN 2.0, with significant improvements and new features
- Realtime audio and video decoding up to UHD with H.265 and AVS/AVS+ support
- IP interface for TS over IP analysis and generation
- New: FPGA based DTMB implementation for high measurement precision
- Brighter display for better readability under strong light
- SSD for faster booting and load operations

1) CDR analysis requires a PC with dedicated software and Ethernet connection to the R&S®ETL. The CDR analysis is implemented as an offline analysis. The functionality for CDR is covered by a separate flyer ("R&S®ETL-K470 CDR Signal Analysis Software", PD 5216.3566.32) and not described in this brochure.

Main applications

Acceptance testing, maintenance and servicing of TV, mobile TV, DAB and FM transmitters
▷ page 5

Quality assurance during the production of modulators and TV, DAB and FM transmitters
▷ page 6

Optimization of TV, mobile TV, DAB and FM transmitter networks
▷ page 7

R&S®ETL rear view (with options)

Benefits

Acceptance testing, maintenance and servicing of TV, mobile TV, DAB and FM transmitters

The quality of transmitter networks depends on the optimal and error-free operation of each individual transmitter. The R&S®ETL TV analyzer offers a range of functions to maintain the high quality of the network during acceptance testing, maintenance and servicing of transmitters. The same holds true for cable TV networks and their modulators used in cable headends.

Precise analysis of the signal quality at the transmitter output

The R&S®ETL's high-quality RF frontend and subsequent digital signal processing help ensure accurate, close-tolerance measurement results. A contributing factor is the R&S®ETL system performance, with a video signal-to-noise ratio of > 60 dB (analog TV) and an intrinsic MER of > 40 dB (digital TV), providing enough margin for measurements with low inherent error. The precision of the R&S®ETL can be increased by using an oven-controlled crystal oscillator (OCXO, R&S®ETL-B4 option) or external power sensors supported by the R&S®ETL.

Measurements to optimize transmitter operating parameters

The R&S®ETL measurement functions are not limited to a few key parameters. The TV analyzer also provides other measurements that help the user set up the operating parameters in an optimal way. This includes frequency spectrum, modulation parameters and output power.

Measurement of spurious emissions

Spurious emissions at the transmitter or cable headend must be measured to make sure adjacent channels are not adversely affected. One of the main advantages of the R&S®ETL is the built-in spectrum analyzer functionality that makes it possible to measure shoulder attenuation, adjacent channel power and harmonics without additional measuring equipment.

Detection of faults

The very difficult task of finding sporadic faults is easy with the R&S®ETL. Fast realtime signal processing captures even sporadic interference. The measurement log option is especially useful. Important parameters are logged even over long time periods. Deviations from nominal values are clearly shown.

Documentation of signal parameters

The R&S®ETL offers various options for documenting signal parameters. It only takes seconds to create and save screenshots, either internally or to an external storage medium. These tasks can be conveniently accomplished with the R&S®TxCheck measurement software. The software automatically measures DVB-T, DVB-T2, DVB-H, ATSC/8VSB, ISDB-$T_{(B)}$, DVB-C, J.83/A/B/C, DTMB, DAB and FM (radio) signals, evaluates the results and documents them in a report.

Remote maintenance via IP networks with the remote desktop function

A service technician is not always available at the transmitter site to quickly analyze the cause of faults. In this case, the R&S®ETL can be controlled remotely via a LAN interface. The remote desktop function allows specialists to carry out all measurements from a remote location, such as a central service center, as if they were on site.

Quality assurance during the production of modulators and TV, DAB and FM transmitters

The quality level of modulators and transmitters must be ensured in the production line, even when transmission standards frequently change. Numerous demodulators and measurement functions for various standards can be installed on the compact R&S®ETL TV analyzer multistandard platform. Users can quickly switch between these functions either manually or via the remote control interface, which provides the appropriate remote commands for all available standards. The R&S®ETL can be easily integrated into automatic measurement systems.

Reproducible analysis of the signal quality of modulators and transmitters

To reliably determine fluctuations in production quality, the quality must be checked regularly under reproducible conditions. This is one of the strong points of the R&S®ETL. Combining the measurement functions of several instruments in a single instrument ensures that measurements are always made with matching settings. All instrument settings can be saved and reloaded at any point in time.

The user can define PASS/FAIL limits for almost every measurement parameter. This makes it easier to evaluate production quality and create test logs.

Parameter list with user-definable limits

Pass	Limit	<	Results (HP)	<	Limit	Unit
Level	-60.0		-26.7		10.0	dBm
Constellation			64 QAM NH / normal			
MER (rms)	24.0		44.5		-----	dB

Optimization of TV, mobile TV, DAB and FM transmitter networks

Measurement of receive levels and signal quality at the reception site

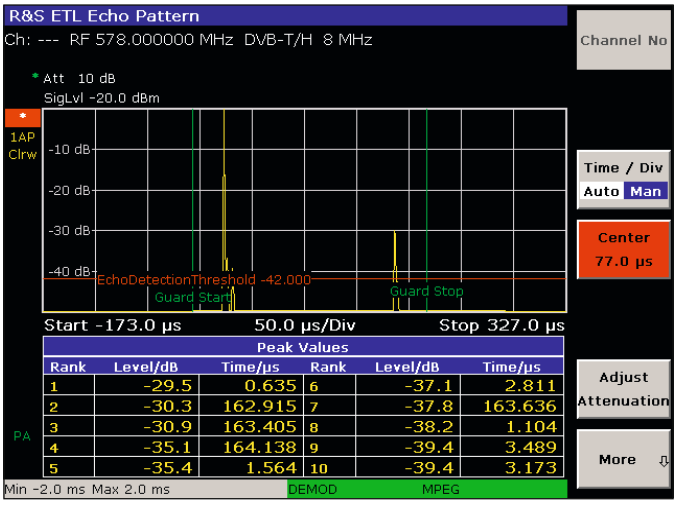
When a new broadcast transmitter network is put into operation, it is especially important that the quality of the transmitter coverage fulfills the network planning specifications. While the main criterion for analog transmitter networks is a sufficiently high receive level, digital transmitter networks have even more criteria that must be taken into account.

For field measurements, the R&S®ETL can be equipped with an internal preselection to improve receive dynamics and input sensitivity. As a result, the R&S®ETL is perfectly able to analyze all relevant signal parameters in the field.

Checking and optimizing digital single frequency networks (SFN)

All over the world, digital networks are replacing analog networks. Most digital networks are operated as single-frequency networks in order to achieve high coverage quality. The R&S®ETL's high-precision SFN measurements provide network operators with all the tools they need to check and optimize SFN networks.

Echo pattern of a DVB-T, DVB-H single-frequency network

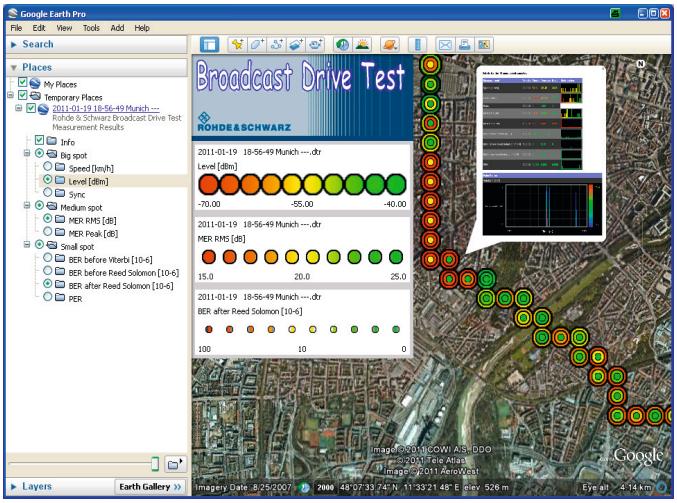


Systematic determination of receive quality in the transmission area (coverage measurement)

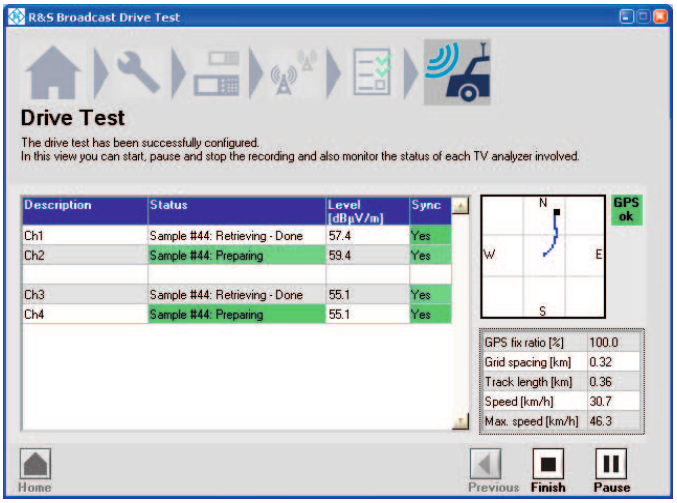
Test vehicles are often used when measuring the receive quality of the transmission area. While they are systematically driven over the entire coverage area, important signal parameters and their location are measured and logged. The R&S®BCDRIVE drive test software provides a solution that makes it possible to capture and record the signal quality while driving and export it for viewing the record on a map.

For the most common digital standards, the R&S®ETL can be integrated into the R&S®BCDRIVE drive test system to help find problematic receive locations and determine the cause of reduced signal quality.

Presentation and analysis of measurement results in the map view



Status messages at a glance during a drive test



All-in-one solution

All required measuring equipment in a compact instrument

The R&S®ETL TV analyzer can perform measurements that used to require several separate measuring instruments. The R&S®ETL combines the functionality of a TV test receiver, a spectrum analyzer, an MPEG TS analyzer and other instruments, providing users with all the tools they need in a single, compact instrument.

Short learning curve due to uniform operating concept

Integrating several T&M instruments into one makes operation considerably easier. Similar functions have similar user prompts. The uniform operating concept means that the learning curve for the R&S®ETL is very short and the risk of operator error is reduced.

Fast and comprehensive signal analysis

When an error occurs in a transmitter network, quick action is required. The R&S®ETL's comprehensive signal analysis functions allow users to quickly find the cause of errors – without any additional T&M equipment. The R&S®ETL also helps save time when performing daily routine tasks because it is fast and easy to switch between the various T&M functions; no changes need to be made to instrument settings or to the test setup.

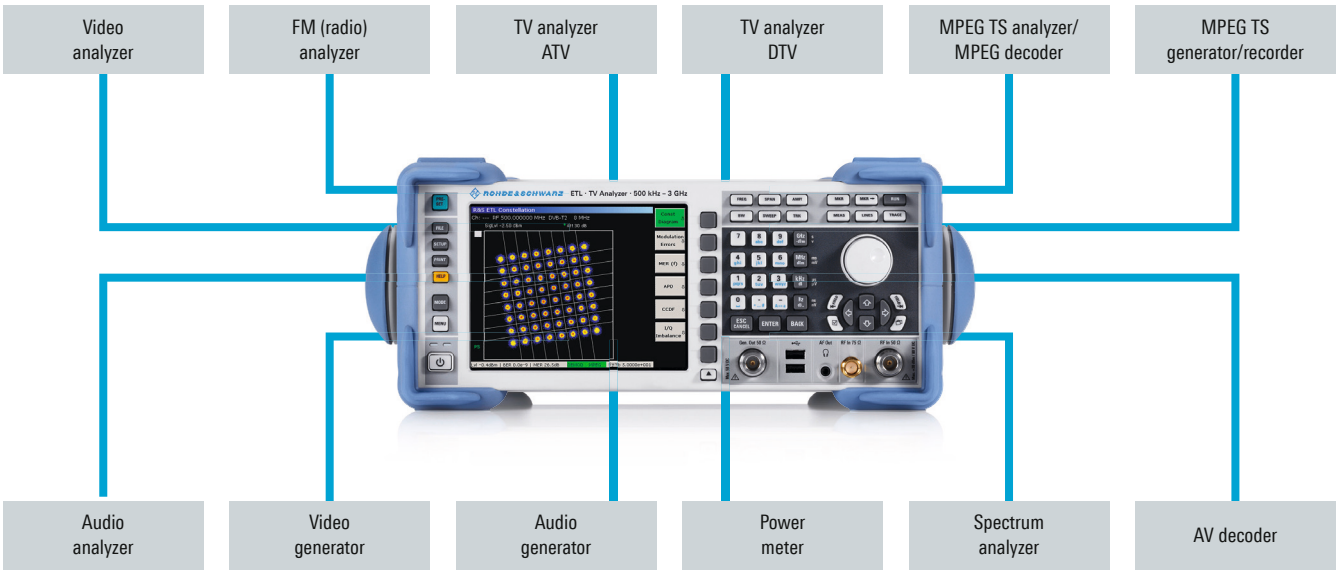
Simplified documentation of measurement results

When several T&M instruments are used to collect data, various data formats, storage media or remote commands are usually needed to document the results in a report. The all-in-one concept of the R&S®ETL makes documentation of measurement results easier because it is based on access to common storage media, uniform operation and standardized remote commands. This is illustrated by the R&S®TxCheck measurement software, which runs on the TV analyzer itself. R&S®TxCheck automatically executes the measurements the user wants, and documents the measurement results and traces in a common report.

Excellent price/performance ratio

In addition to shortening the learning curve and making everyday work more efficient, the R&S®ETL's all-in-one concept also yields an excellent price/performance ratio. Combining several T&M functions on one hardware platform substantially lowers purchase costs. Another cost-saving benefit of the all-in-one concept is the significant reduction in effort necessary for regular calibration.

All-in-one solution



FPGA based realtime demodulators

The central component in a TV analyzer is the demodulator. The demodulator determines which analyses can be carried out and in what quality. Chip based demodulators do not usually offer the required quality nor do they have the interfaces required for professional T&M applications. That's why Rohde&Schwarz uses its own FPGA based demodulators in the R&S®ETL.

Simple implementation of new standards with firmware updates

In addition to quality, another advantage of FPGA based demodulators is that they make it easy to implement new transmission standards. Usually, only a firmware update and an installation key are required. This provides a high degree of investment protection and flexibility.

Easy integration of multiple standards in a single instrument

It is not unusual for transmitter network operators in the same coverage area to broadcast different standards, often from the same site. Today, analog TV can be found adjacent to digital TV, and analog sound broadcasting adjacent to digital audio broadcasting. The R&S®ETL is an ideal, cost-effective solution for transmitter measurements. The FPGA based demodulators in the R&S®ETL allow multiple TV and sound broadcasting standards to be easily integrated, which eliminates the need for investing in several instruments. The R&S®ETL hardware can also be updated to add other standards to cover future requirements.

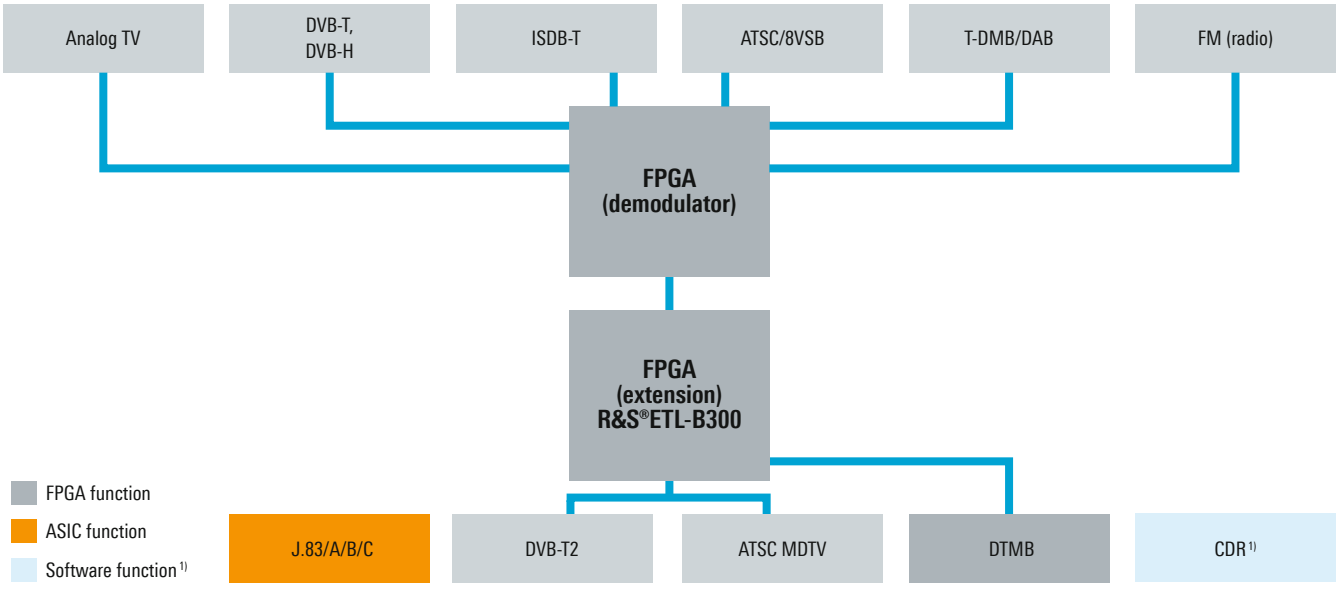
Seamless signal analysis through realtime demodulation

One of the basic principles of the R&S®ETL TV analyzer is realtime demodulation for practically seamless signal analysis to detect even sporadic interference.

Analysis and provision of baseband signals (video, audio, ETI, MPEG-2 TS)

Realtime demodulators are important for seamless signal analysis. They also allow analysis of baseband signals such as video, audio and those from a digital transport stream. Baseband signals can be analyzed internally with the R&S®ETL or externally with additional instruments. The R&S®ETL has numerous interfaces where the demodulated signals are made available.

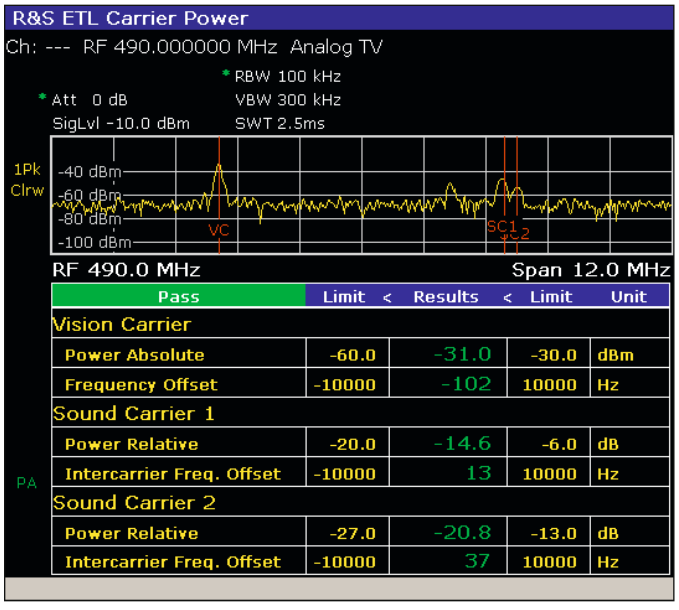
R&S®ETL multistandard platform



1) See separate flyer ("R&S®ETL-K470 CDR Signal Analysis Software", PD 5216.3566.32).

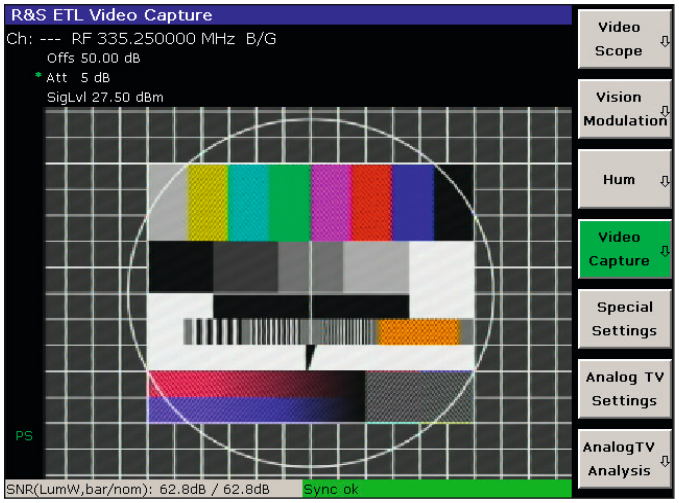
Comprehensive analysis of analog TV signals

Analog TV carrier measurement



Pass	Limit <	Results	< Limit	Unit
Vision Carrier				
Power Absolute	-60.0	-31.0	-30.0	dBm
Frequency Offset	-10000	-102	10000	Hz
Sound Carrier 1				
Power Relative	-20.0	-14.6	-6.0	dB
Intercarrier Freq. Offset	-10000	13	10000	Hz
Sound Carrier 2				
Power Relative	-27.0	-20.8	-13.0	dB
Intercarrier Freq. Offset	-10000	37	10000	Hz

Analog TV picture



The R&S®ETL standard version comes with a range of elementary measurements for analyzing analog TV signals. The video analyzer functionality needed at the transmitter site or at the cable headend can be added to the R&S®ETL.

Ideal for the transition from analog to digital TV

Digitization of terrestrial transmitter networks and cable TV networks is progressing swiftly. Usually, the transition from analog to digital TV is a step-by-step process over a long period of time.

The R&S®ETL is the ideal solution for those who need a professional analyzer for digital TV signals and still must ensure the quality of analog transmissions during the transition period.

Overview of the most important parameters

The basic version of the R&S®ETL comes with a carrier measurement facility, a video line oscilloscope and measurements for modulation depth and residual carrier. The measurement results are clearly presented, providing the user with a quick overview of the key parameters.

Measurements for evaluating modulator quality at the transmitter or cable headend

There are stringent signal quality requirements directly at the transmitter or cable headend. To help ensure the required quality, other parameters need to be checked during commissioning or regular servicing.

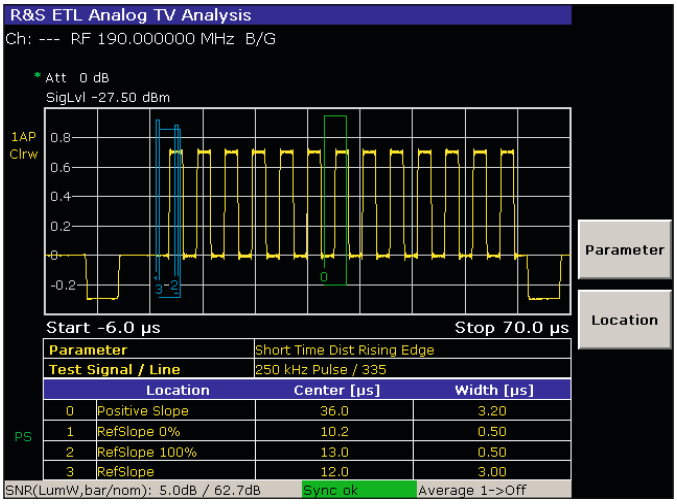
The R&S®ETL optionally offers video analyzer functionality (R&S®ETL-K202) to measure and optimize the quality of exciters and their precorrection.

TV picture for fast visual inspection of transmission links

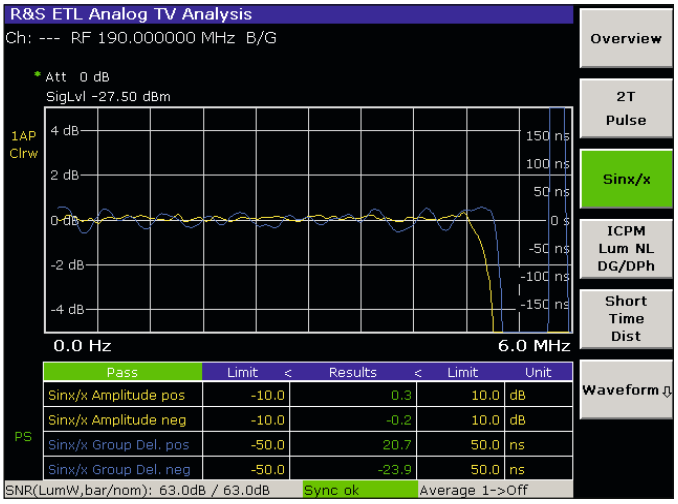
A picture is worth a thousand words or a series of signal parameters. For experienced users, a quick look at the transmitted TV picture is the first way to quickly check if a transmission link is working.

A decoder can be added to the R&S®ETL to display a TV picture on the instrument's display.

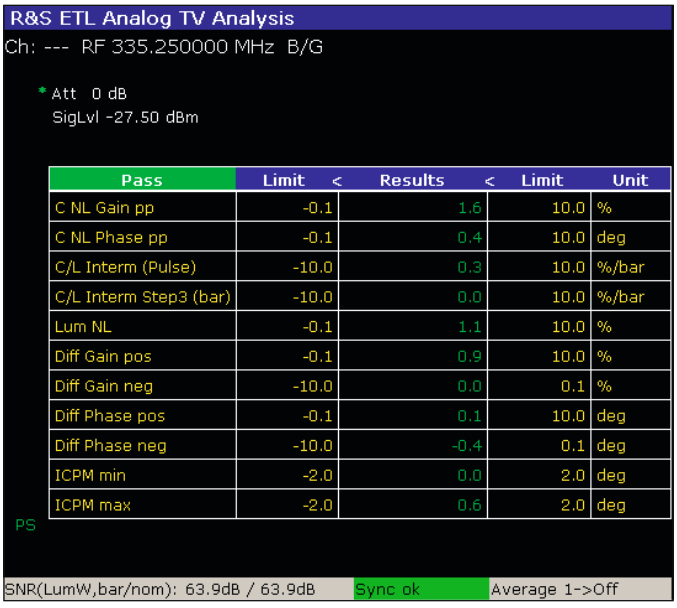
Video test line with measurement parameters



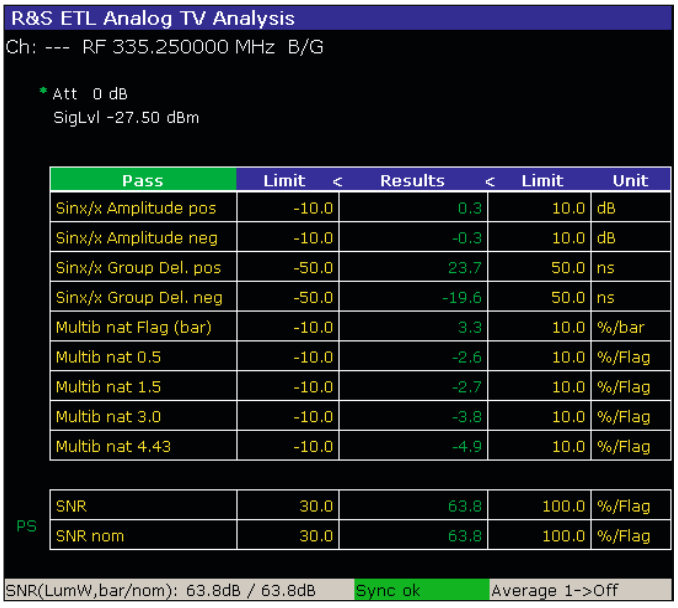
Amplitude and group delay measurement



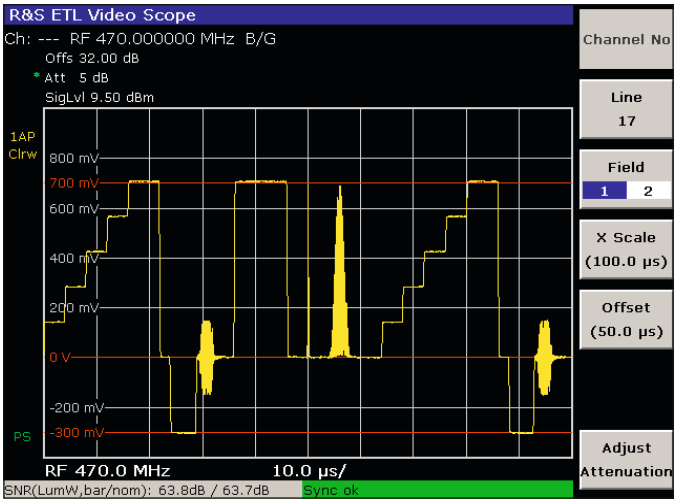
Overview of video test line parameters (part 1)



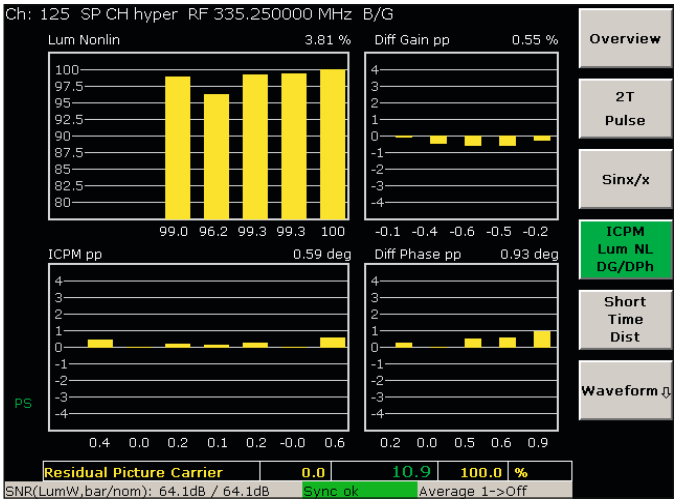
Overview of video test line parameters (part 2)



Video line oscilloscope



ICPM measurement



Comprehensive analysis of digital TV and mobile TV signals

Digitization has made the production of multimedia content much easier – from recording to postprocessing and archiving. Highly efficient digital transmission methods are used to bring such produced content to the receiver, ideally with no loss in quality. A range of parameters needs to be taken into account.

Overview of the most important parameters

The R&S®ETL TV analyzer provides users with a compact list that gives a quick overview of the key parameters. Only the parameters relevant to the selected standard are displayed. Predefined limits for almost every parameter also help personnel with little training evaluate the signal quality.

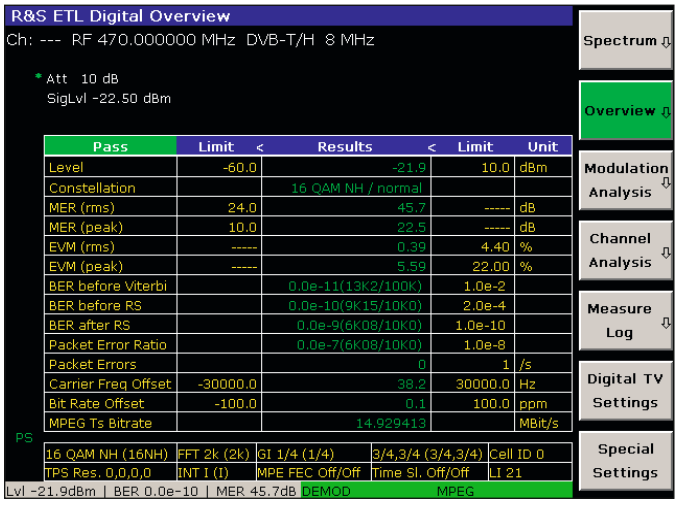
Essential parameters are permanently displayed in a footer, even after changing to another measurement. These parameters include the level, MER, bit error rate and the status fields for synchronizing to the carrier signal or the digital transport stream. As a result, users do not have to continually switch between the various measurement screens, and alignment is easier.

Spurious emissions quickly detected with integrated spectrum analyzer

For digitally modulated transmissions, it is vital to ensure that adjacent channels are not adversely affected by spurious emissions. A transmitter operator must always observe certain standard-specific criteria. Typical criteria are, for example, defined shoulder attenuation within specified frequency ranges, output-power-dependent spectrum masks and level differences defined for specific frequencies.

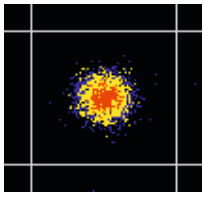
The R&S®ETL provides a choice between standard-compliant predefined measurements and the flexible use of the integrated spectrum analyzer.

The most important parameters at a glance (DVB-T, DVB-H)



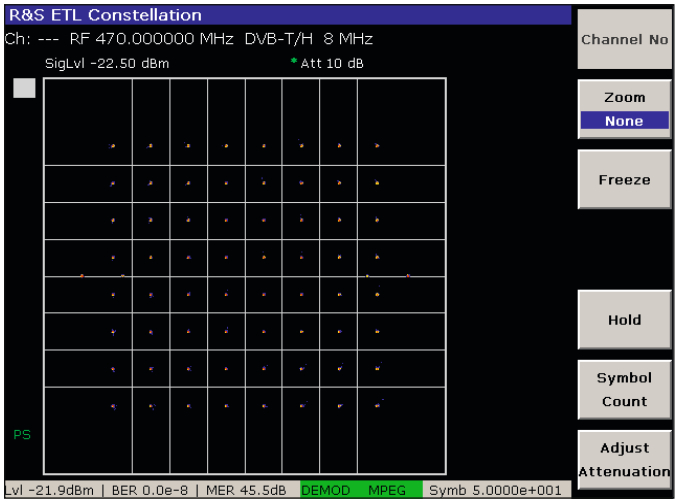
Pass	Limit	<	Results	<	Limit	Unit
Level	-60.0		-21.9		10.0	dBm
Constellation			16 QAM NH / normal			
MER (rms)	24.0		45.7		-----	dB
MER (peak)	10.0		22.5		-----	dB
EVM (rms)	-----		0.39		4.40	%
EVM (peak)	-----		5.59		22.00	%
BER before Viterbi			0.0e-11(13K2/100K)		1.0e-2	
BER before RS			0.0e-10(9K15/10K0)		2.0e-4	
BER after RS			0.0e-9(6K08/10K0)		1.0e-10	
Packet Error Ratio			0.0e-7(6K08/10K0)		1.0e-8	
Packet Errors			0		1	/s
Carrier Freq Offset	-30000.0		38.2		30000.0	Hz
Bit Rate Offset	-100.0		0.1		100.0	ppm
MPEG Ts Bitrate			14.929413			MBit/s

16 QAM NH (16NH)	FFT 2k (2k)	GI 1/4 (1/4)	3/4,3/4 (3/4,3/4)	Cell ID 0
TPS Res. 0,0,0,0	INT I (I)	MPE FEC Off/Off	Time Sl. Off/Off	LI 21

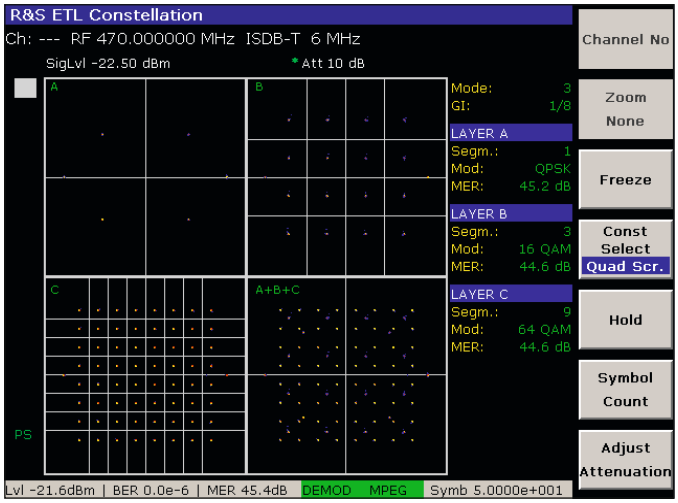


Constellation point with color display of frequency distribution of individual symbols

Constellation diagram of a DVB-T, DVB-H signal



Constellation diagram of an ISDB-T signal



Constellation diagram with high processing speed for detecting short-duration interferers

The display of the constellation diagram is an elementary measurement for digital modulation. If the constellation diagram has been accurately created in realtime, it can be used by an experienced user to determine a number of error sources for poor signal quality.

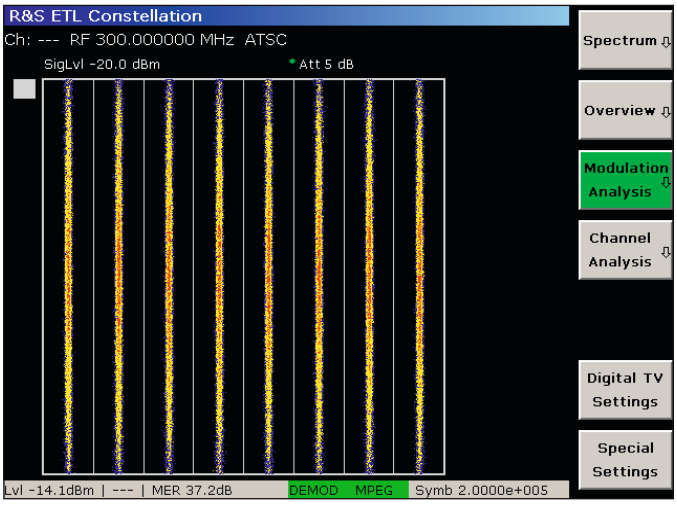
The high processing speed of the R&S®ETL makes this possible. Several million symbols per second are processed and displayed; even sporadic interference can be reliably detected. Plus, color-coding shows the distribution of symbols within their decision fields, allowing users to quickly find problems such as excessive phase or amplitude noise or other errors.

Measurements for optimizing transmitters and modulators

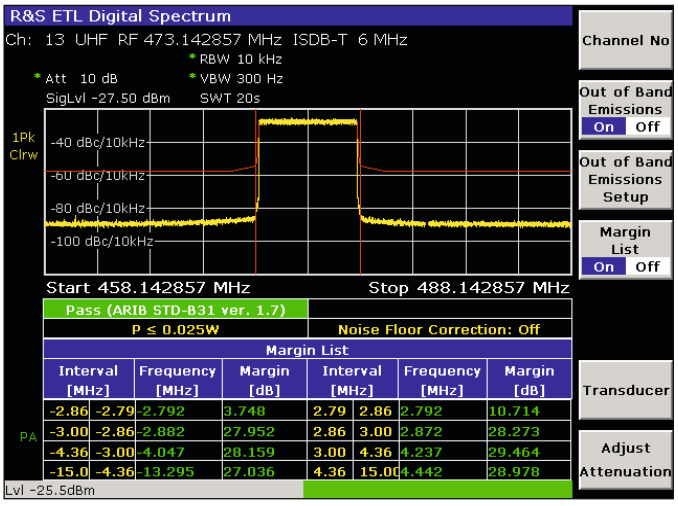
In addition to the constellation diagram, which gives users a first idea of how to optimize the transmitter or modulator at the cable headend, the R&S®ETL provides other measurements that help achieve optimum signal quality. Measurements to determine the amplitude characteristic, phase response and group delay in the transmission channel help determine whether the channel filtering and the precorrection on the transmitter have been correctly set and are functioning.

The R&S®ETL has a unique measurement function especially for modulators that work according to the orthogonal frequency division multiplex (OFDM) multicarrier method. This measurement shows any existing I/Q imbalance or I/Q phase error for each carrier. A convenient zoom function to view each carrier's MER values and a measurement to detect a central residual carrier round out the R&S®ETL TV analyzer's capability to detect the quality of digital modulators in all its details.

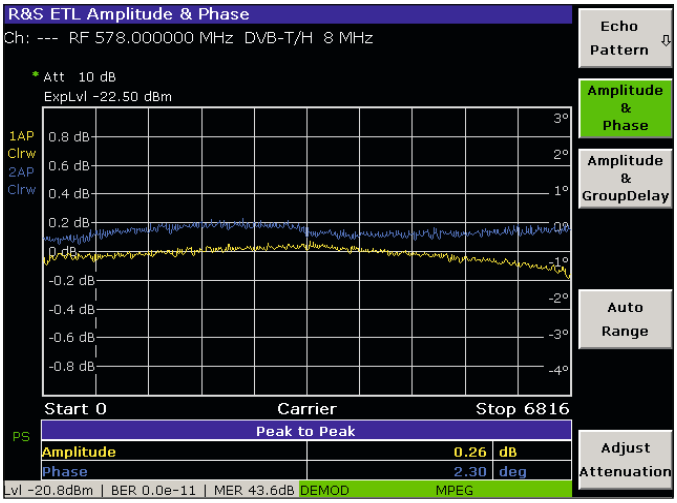
Constellation diagram of an ATSC/8VSB signal



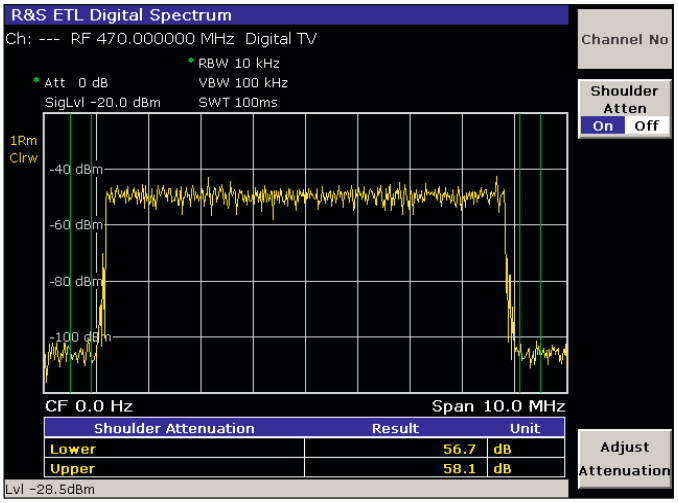
Checking spurious emissions with spectrum mask



Amplitude and phase in the useful channel



Shoulder attenuation measurement in line with ETSI TR 101290



Analysis functions for second generation TV standards: DVB-T2 and ATSC MDTV

DVB-T2

TV transmissions in HD quality or in 3D require higher bandwidths, even in terrestrial broadcasting. But the DVB-T broadcast standard is gradually approaching its limits with regard to bandwidth. The solution to this problem is DVB-T2. Improved error protection and transmission modes such as 256QAM, 32K FFT, rotated constellation, multi-PLP and MISO make it possible to take the transmission bandwidth to its theoretical limits. A TV analyzer such as the R&S®ETL with its DVB-T2 options must meet high requirements – for example, the ability to support all transmission modes as well as to provide reliable and exact information on the quality of all relevant signal parameters. The R&S®ETL, equipped with its DVB-T2 options, meets both requirements.

DVB-T2 realtime signal analysis

- Demodulation of a selected physical layer pipe (PLP) and output at the ASI output
- Decoding and representation of L1 pre- and post-signaling parameters
- Detection of short-duration interference signals

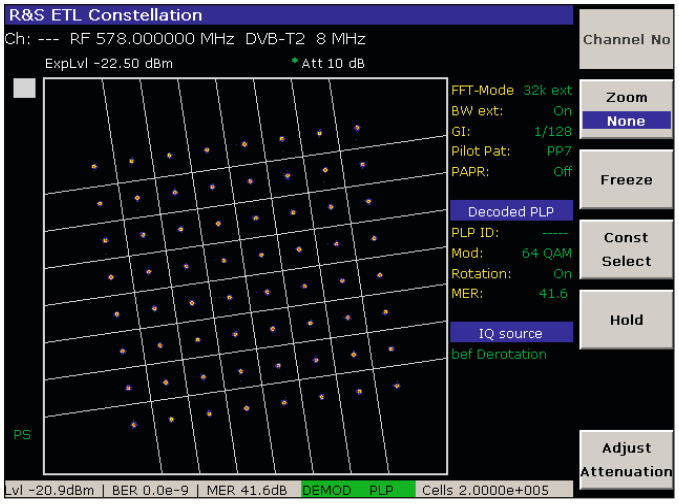
Wide-ranging analysis functions

- Reliable assessment of the quality of DVB-T2 signals
- Comprehensive information on the transmission parameters and PLP currently selected
- Detailed constellation analysis for detecting errors in modulators

Prepared for multi-PLP and MISO

- Prepared for full, future support of multi-PLP and MISO transmission modes

Constellation diagram of a DVB-T2 signal



Overview with PLP data in detail

L1-pre signalling				
Bandwidth Extension	Off	(Off)	S1 (binary)	000
Guard Interval	1/32	(1/32)	S2 (binary)	1010
Pilot Pattern	PP4	(PP4)	System ID (hex)	0x0
Transmission System	SISO	(SISO)	Cell ID (hex)	0x0
Data Symbols/Frame	59	(59)	Network ID (hex)	0x0
L1-post Constellation	QPSK	(QPSK)	Frames/Superframe	2
L1-post Size	750	(750)	Tx ID Availability (hex)	0x0
L1-post Extension	Off	(Off)	L1-post Info Size	318
L1 Repetition	Off	(Off)	Regeneration Flag	0
L1-post Code Rate	1/2		Frequencies	1
L1-post FEC Type	Short		RF Index	0
PAPR	None		CRC32 (hex)	0xCDEE31D1
Stream Type	TS only		Reserved (hex)	0x0
T2 Version	1.1.1			

L1 pre-signaling information

	Pass	Limit <	Results	< Limit	Unit
	Level	-60.0	-10.6	10.0	dBm
	Sideband		normal		
	FFT Mode		32k		
	Guard Interval		1/32		
	Carrier Freq Offset	-30000.0	635.2	30000.0	Hz
	Bit Rate Offset	-100.0	1.3	100.0	ppm
	MER (L1,rms)	24.0	46.6	-----	dB
PLP Data (Decoded PLP ID 6)					
	MER (PLP,rms)	24.0	45.3	-----	dB
	BER before LDPC		0.7e-9(60%/1e10)	1.0e-2	
	LDPC Iterations		4.7		
	BER before BCH		0.0e-9(40%/1e10)	1.0e-10	
	TS Packet Error Ratio		0.0e-6(26%/1e7)	1.0e-10	

Lvl -10.6dBm | BER 0.0e-9 | MER 45.3dB DEMOD PLP:6

ATSC MDTV

ATSC mobile digital television (ATSC MDTV) – also known as ATSC M/H (mobile/handheld) – represents a further development of the ATSC/8VSB digital terrestrial TV standard for TV reception on mobile devices such as smartphones and multimedia players. ATSC MDTV contains improvements for stable reception on moving devices and also enables the setup of single-frequency networks (SFN). The R&S®ETL analyzes the RF signal quality of an ATSC MDTV signal and also offers extensive functions for analyzing signaling parameters, the ATSC M/H frame structure and the services it carries.

ATSC MDTV realtime signal analysis

- Demodulation of an ATSC MDTV signal
- Decoding of a selected parade
- Detection of short-duration interference signals

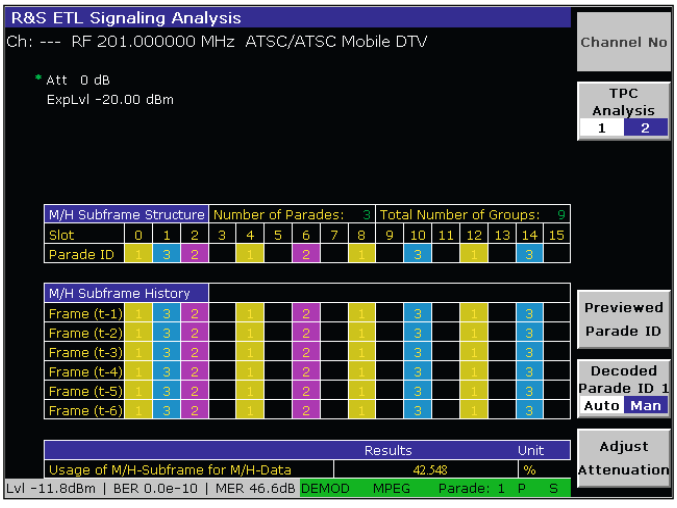
Analysis of signaling parameters and services

- Analysis and display of transmission parameter channel (TPC)
- Analysis and display of fast information channel (FIC)
- Display of dynamic occupancy of ATSC M/H subframes
- Overview of services

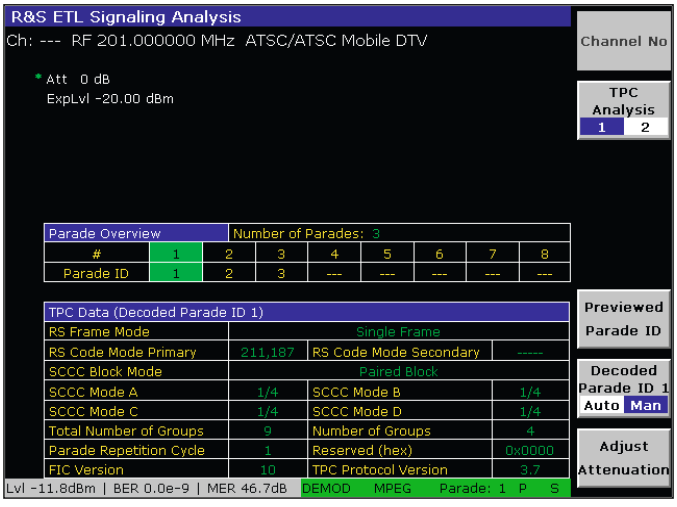
Measurements to optimize single-frequency networks

- Display of channel impulse response
- Display of frequency deviations within SFNs

Analysis of the transmission parameter channel (TPC)



Display of dynamic occupancy of ATSC M/H subframes



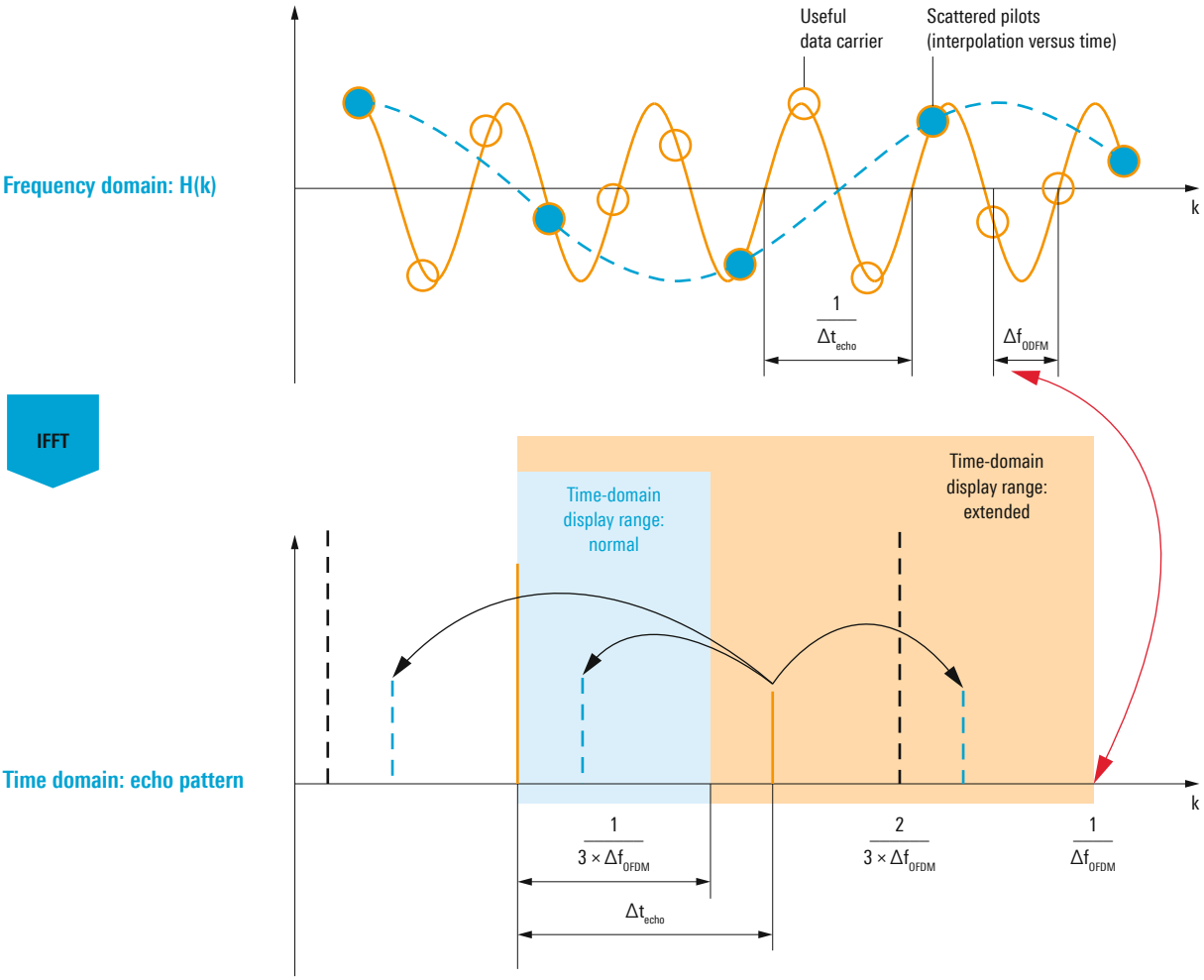
Precise analysis of digital single-frequency networks (SFN)

Transmitters that broadcast a standard based on the OFDM method, such as DVB-T, DVB-H, DVB-T2, ISDB-$T_{(B)}$, T-DMB/DAB, DTMB and the extended single-carrier standard ATSC MDTV can be combined and operated as a single-frequency network (SFN). For interference-free operation, certain criteria need to be optimized, observed and regularly monitored. These criteria are the transmitter frequency, the level and the delay at the transmitter and in the reception area. The R&S®ETL TV analyzer comes with a range of high-precision measurements that help the user set up and operate a transmitter SFN in an optimal way.

High-precision display of channel impulse response

When it comes to optimizing and monitoring an SFN, the main function of the R&S®ETL is to accurately measure the channel impulse response and display it in a clear and understandable manner. The delays in an SFN have to be set so that all the receivable transmitters at a reception site are within a guard interval. Any transmitter outside the guard interval would act as an interferer. The R&S®ETL uses green lines to show the beginning and end of a guard interval, making it easy to evaluate the timing characteristics. Impulses are measured and displayed to an accuracy of < 20 ns. A high-resolution zoom function is provided to evaluate impulses that are temporally close together.

DTV extended time domain



A special feature of the R&S®ETL is the positioning of the FFT window. To help ensure stable synchronization to the transmitter signal, especially for field measurements, the R&S®ETL tries to place all impulses above an echo detection threshold so that they are equidistant within the guard interval. For some applications, the echo detection threshold is dependent on the system optimization method selected by the user.

Simple identification of echoes using tabular lists and marker functions

If several transmitters are interconnected to form an SFN, and if there are also a large number of reflected transmitter signals at a reception site in a crowded downtown area of a city, it can be difficult to interpret a channel impulse response. To make evaluation easier, the R&S®ETL lists the ten most important echoes in a table. The list can be sorted according to receive level or delay time for a better overview. The measurement unit for the graph and the table can be set to km, miles or µs.

The measured levels are usually displayed relative to the main pulse, but sometimes this is not what the user wants. The levels can also be displayed as absolute values, which is especially helpful for coverage measurements in the field.

The R&S®ETL also has a marker function for easy echo identification. With the marker function, the receive level and delay of each echo can be precisely measured.

Extended time domain for faraway post-echoes

Normally, all impulses should be within the guard interval. The display of the channel impulse response serves to check if this is the case. But sometimes the maximum time domain that can be displayed is not sufficient to correctly display signals reflected over long distances or received due to overshoot. Therefore, impulses that lie outside the normal measurement range might be interpreted as leading impulses instead of lagging impulses. The measurement range has been expanded by a factor of three to prevent this from happening.

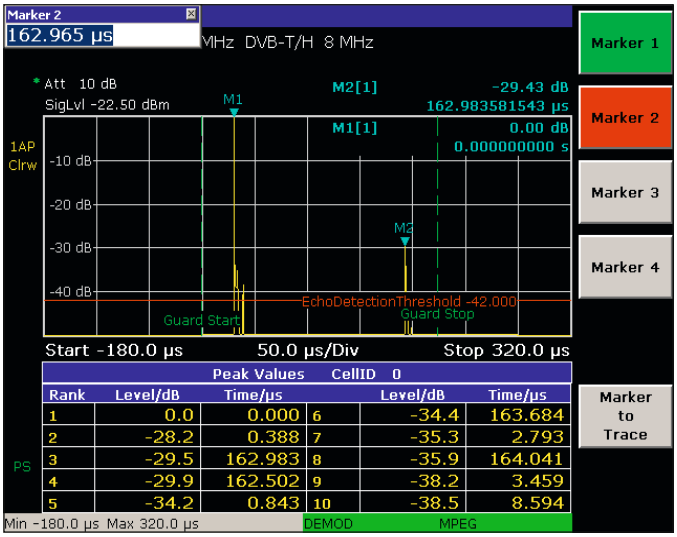
Efficient measurement of frequency drifts within an SFN

For optimum operation, all transmitters in a single-frequency network must transmit at exactly the same frequency. An incorrect reference frequency at the transmitter site or an incorrectly set transmitter frequency can violate this SFN condition. To help ensure that each SFN transmitter operates at the same transmitter frequency, the transmitter frequency at each site must be precisely measured. The measurement tolerance has to be < 1 Hz.

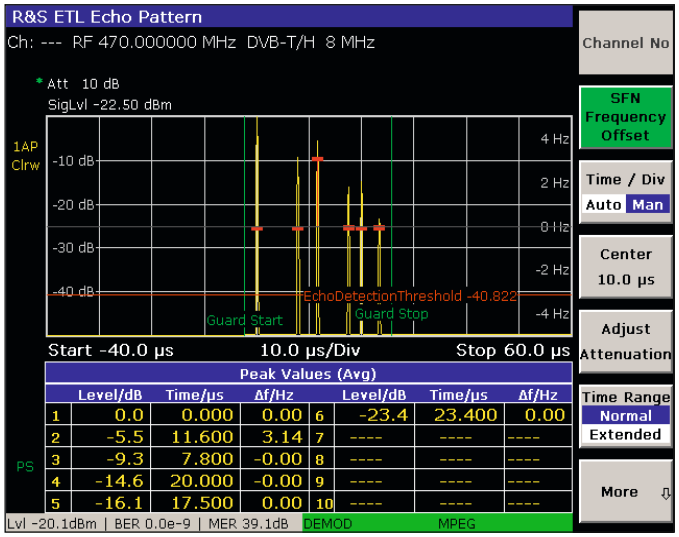
The R&S®ETL's patented SFN frequency offset measurement provides a highly accurate, efficient method of determining the frequency drift of all SFN transmitters based on a single measurement made at a central location within the network. All frequency drifts are referenced to the frequency of the main pulse. The advantage of this is that no external reference signal is needed. The accuracy of this measurement is an unprecedented 0.03 Hz.

Red markers on the impulses in the channel impulse response display show the determined frequency drifts.

DVB-T, DVB-H channel impulse response with markers



Channel impulse response with SFN frequency offset measurement (red lines)



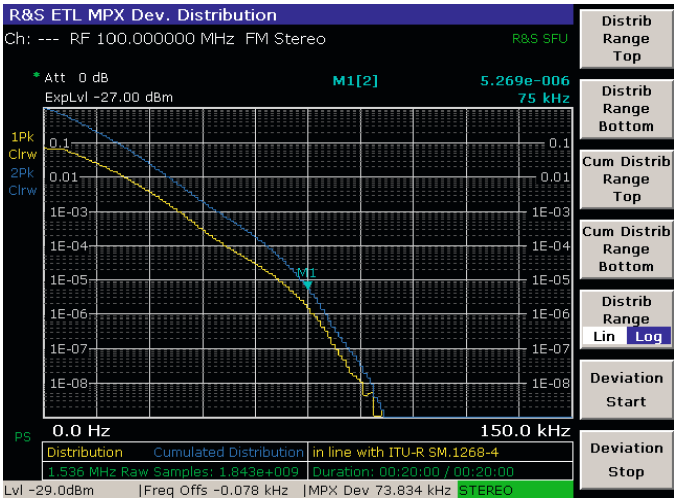
High-performance analysis of FM (radio) and audio signals

The FM options enable users to perform various tasks (such as analysis of receive level, center frequency, frequency deviation in the audio signal) and to obtain additional information about the pilot tone and carriers. To verify that the broadcasted signals comply with applicable regulations, MPX deviation measurements are done with high precision in line with ITU-R SM.1268-1/-2/-3/-4. The audio spectrum display provides a graphical overview of the modulated FM (radio) signal. The high-quality SNR measurement offers sufficient margin to verify high SNR requirements at FM radio transmitters. The integration of an audio analyzer and generator facilitates test procedures by eliminating the need for a separate instrument.

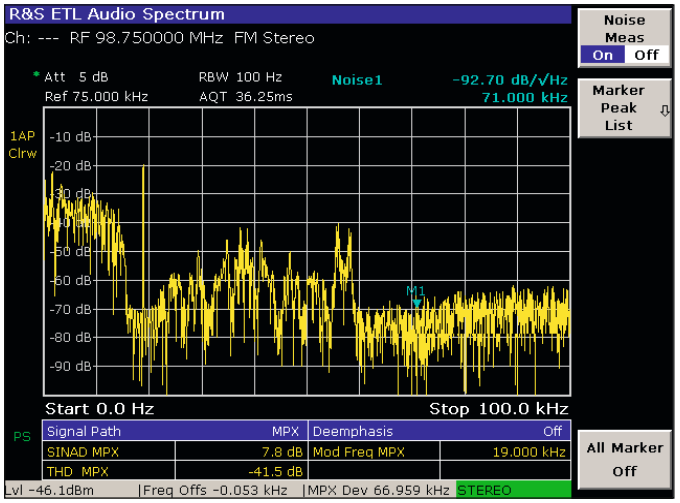
Detailed FM signal analysis with the R&S®ETL-K110 option

- Analysis and demodulation of FM broadcasting signals with extremely high accuracy
- Overview of level, frequency offset, frequency deviations, pilot information and RDS analysis
- Audio spectrum and audio oscilloscope
- Measurement of MPX power and peak deviation in line with the ITU-R SM.1268-1/-2/-3/-4 standard
- Analysis of RDS information and extended RDS analysis

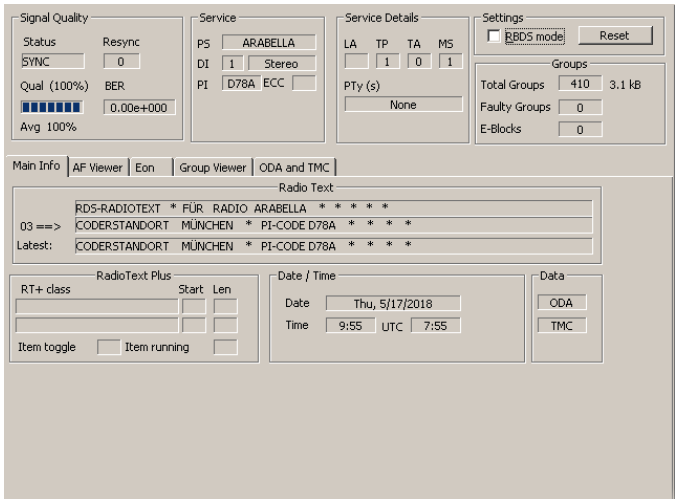
Deviation distribution measurement



FM (radio) audio spectrum



RDS analysis



High SNR measurement with the R&S®ETL-B110/ R&S®ETL-B310 options

- Extended SNR measurement performance to ≥ 80 dB for high-quality measurements at FM transmitter sites
- Higher dynamic range for measurements in the field
- Dedicated RF frontend to operate within 75 MHz to 110 MHz

Integrated high-precision audio generator with the R&S®ETL-K111 option

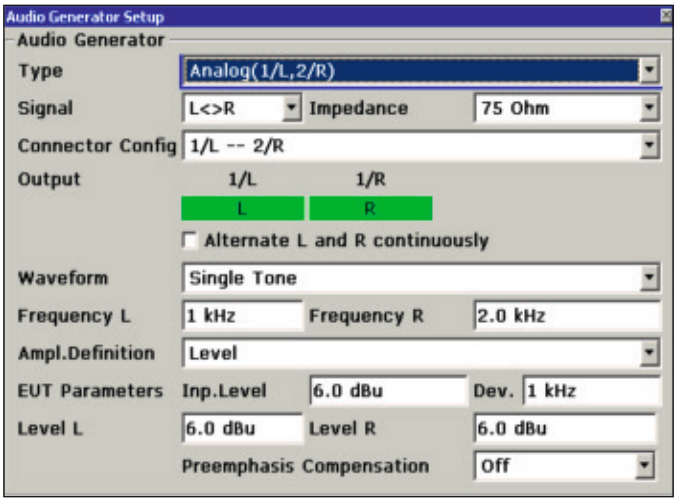
- Generation of audio test signals needed for commissioning FM exciters and transmitters after installation or service
- Generation of both normal audio and complex MPX signals that are fed into the exciter for testing
- Generation of single-tone and two-tone signals from 1 Hz to 100 kHz
- Output of stereo signals in analog or digital (AES/EBU), with extremely high precision
- Attractive, cost-effective solution

Integrated audio analysis with the R&S®ETL-K111 option

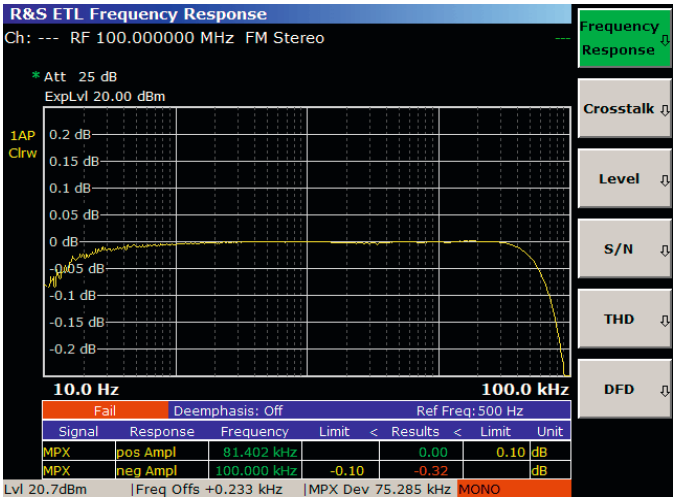
- Analysis of audio frequency response, crosstalk, total harmonic distortion (THD), dual frequency distortion (DFD)
- No need for separate audio analyzers or generators

(R&S®ETL-K111 requires the R&S®ETL-B201 universal interface option.)

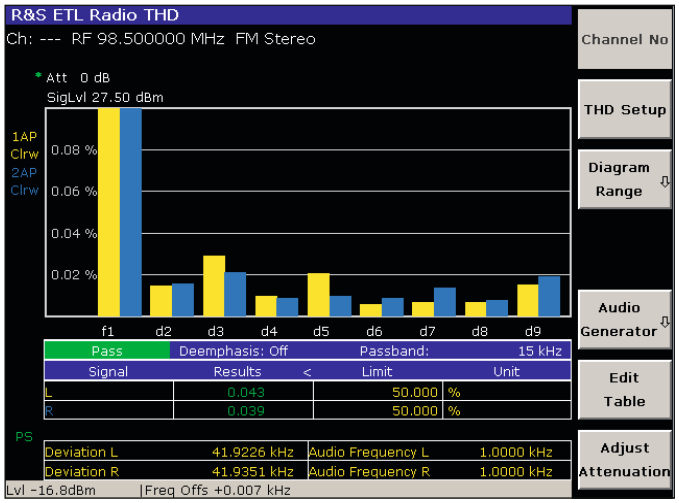
Audio generator settings



MPX frequency response



Total harmonic distortion (THD) measurement



MPEG-2 transport stream analysis

In digital television (DTV), pictures, sound and additional information are transmitted as a digital MPEG-2 transport stream. The MPEG-2 transport stream's complex structure must conform to defined rules so that it can be properly processed by the receiver. A range of MPEG options can be added to the R&S®ETL to analyze the structure of MPEG-2 transport streams in addition to the RF quality of DTV signals.

Checking of input and output signals at the transmitter or cable headend

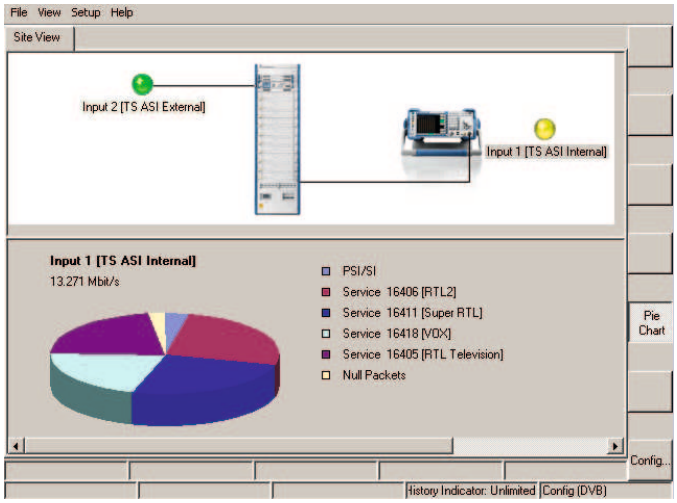
The R&S®ETL can check both the incoming and outgoing MPEG-2 transport stream at the transmitter or cable headend. The central R&S®ETL-B380 AV decoder and TS processing board has an internal and an external transport stream input. Users can quickly determine whether the fed-in signal or the modulator is the source of errors. The external transport stream can be applied via IP (R&S®ETL-K386) or ASI/SMPTE-310. In the case of IP, extensive analysis features on the IP layer are provided in addition to the transport stream analysis.

Analysis in line with ETSI TR 101290, priorities 1 to 3

The R&S®ETL-K282 MPEG analysis/monitoring software option provides basic MPEG-2 transport stream analysis functions. The software shows a clear overview of the underlying structure of the transport stream (TS) that is to be analyzed. Individual TS elements can be quickly and easily selected for more in-depth examination. The software analyzes conditions in accordance with DVB test specification TR 101290, which classifies errors into priority levels 1, 2 and 3. The same applies to the ATSC, SCTE and ISDB-$T_{(B)}$ standards, which are also covered. In addition to the parameters of priority levels 1 to 3, the software also measures the repetition rates for the individual information tables (e.g. PAT, PMT) as well as the transfer rates for the individual services, and checks whether they comply with the defined limits. Each of these parameters can also be monitored separately. If an error occurs, the software enters a message into the instrument's internally saved report and outputs the message via the R&S®ETL's LAN interface.

The R&S®ETL-K285 TS template monitoring software option provides a convenient, simple solution for comparing the selected signal to a previously selected reference transport stream. The state of the analyzed transport stream can be quickly determined. The reference TS is known as the golden transport stream. The software compares the data and table structures, program names, and much more. Unlike conventional MPEG analysis, it also detects differences that would normally go unnoticed. For example, a change in the arrangement of programs in the transport stream would not necessarily generate an error message as long as the data itself is consistent.

Parallel monitoring of two MPEG-2 transport streams



MPEG analysis in line with ETSI TR 101290

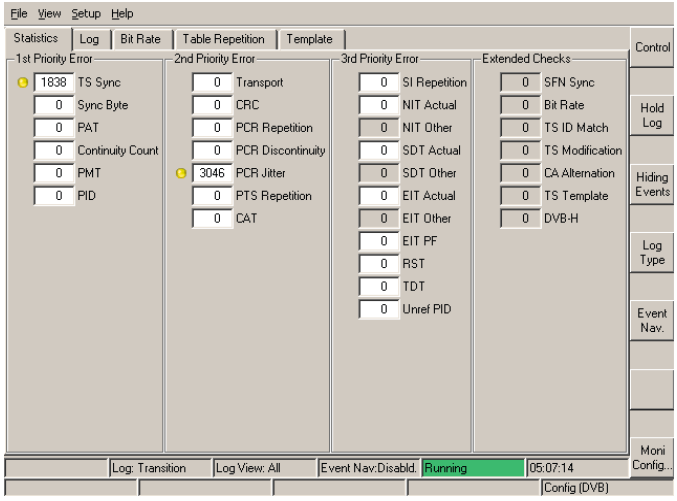


Table interpreter and in-depth analysis

For more comprehensive analysis, the R&S®ETL-K283 in-depth analysis software option provides further information about the bits and bytes in the individual TS elements. The table interpreter provides a clear, easily readable overview of the table contents, making it easier to identify faulty references between the various tables, for example. The in-depth analysis option graphically indicates whether this auxiliary information is received regularly within the applicable limits (repetition) and whether the temporal spacing is constant (e.g. PCR jitter). Tolerance violations can make it impossible for decoders in receivers and set-top boxes to output video and audio. Such problems can also disrupt lip synchronicity.

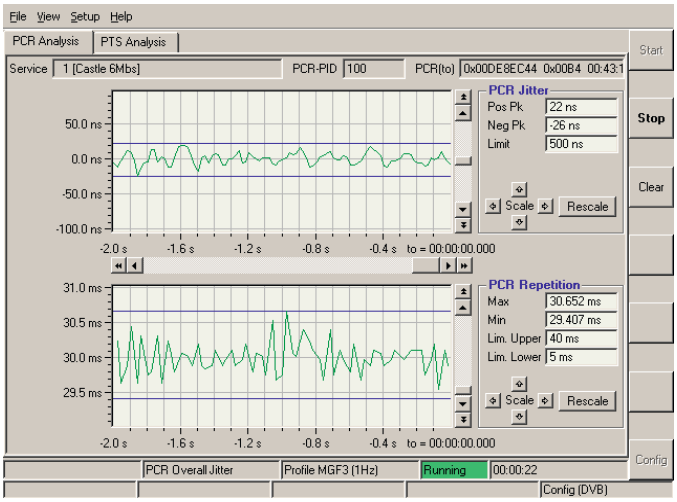
Audio and video decoding and output

The AV decoding and TS processing option (R&S®ETL-B380) supports detailed examination of the audio and video content of received MPEG-2 transport streams.

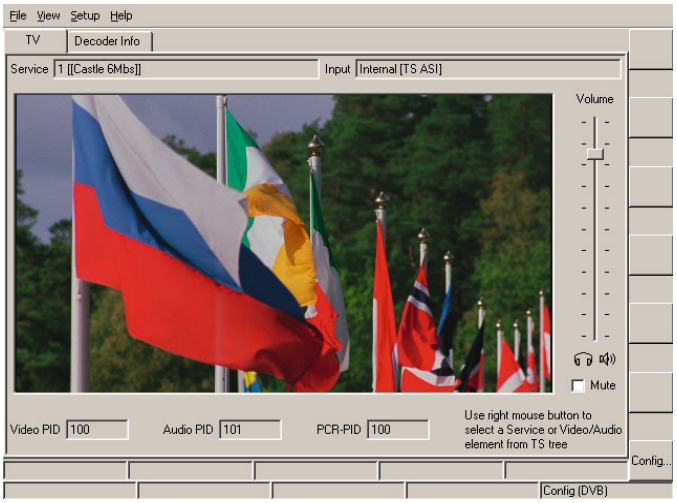
Common codecs such as MPEG-2, AVS and HEVC for video as well as Dolby Digital™ and MPEG-1 for audio are supported. The image can be output to the integrated display or, via HDMI™/CCVS, to an external display. Video signals with a resolution up to UHD (R&S®ETL-K381) are easily decoded by the hardware. Audio output runs via headphone jack, Lemo connectors and embedded in the HDMI™ signal. Encrypted programs can be decrypted using the hardware decoder in conjunction with a suitable CA module and smart card. The AV decoding and TS processing board includes a DVB common interface for this purpose.

In addition to optional, hardware based AV decoding, the integrated software decoder can be used for unencrypted MPEG-2 coded SD programs. The image appears on the R&S®ETL's integrated display. A program can also be streamed to any desired IP address in the network and decoded there. This way, HEVC coded HD programs, for example, can be displayed on a laptop using suitable decoding software.

Tracking down PCR jitter



TV display with hardware decoder



Measurements for cable TV networks

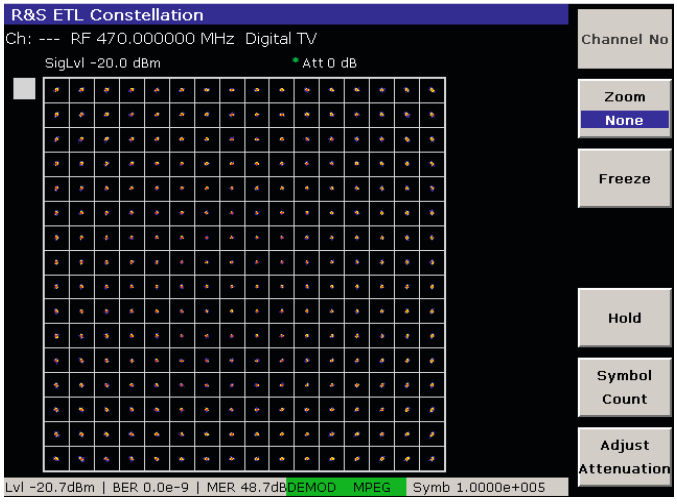
Even though digitization in cable TV networks is rapidly progressing, many programs are still transmitted in both analog and digital channels, very often together with FM (radio). The R&S®ETL offers the appropriate demodulators and specific measurements needed to reliably determine the signal quality of cable TV and FM (radio) signals. The R&S®ETL-B203 RF preselector is recommended for maximum performance when measuring cable TV systems. The R&S®ETL can measure the performance capacity in a cable network today, helping to ensure the needed performance for tomorrow's new, highly efficient transmission standards.

In addition to these measurements, comprehensive analysis functions make it possible to quickly and reliably identify problems that can occur when transmitting a "mixture" of digital and analog signals.

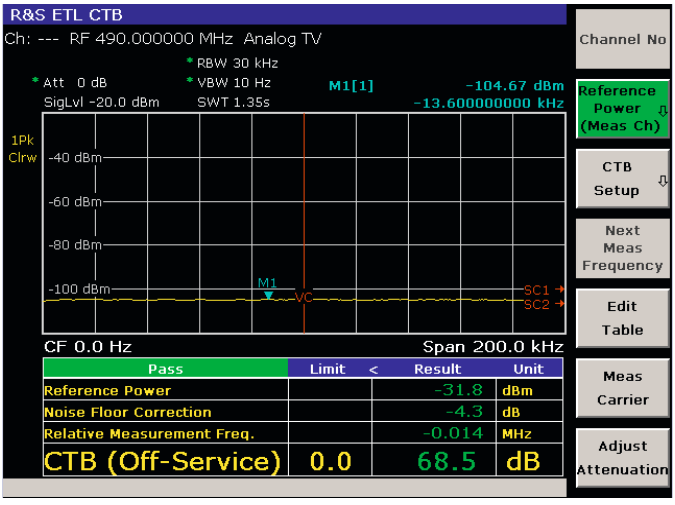
CSO, CTB and C/N

Line amplifiers that are not perfectly linear cause unavoidable intermodulation products, which reduces the S/N ratio. Second and third order intermodulation products are especially crucial for analog TV channels, because they can lead to a visible reduction in the picture quality. The R&S®ETL TV analyzer provides composite second order (CSO), composite triple beat (CTB) and carrier to noise (C/N) measurements to detect and quantify intermodulation products.

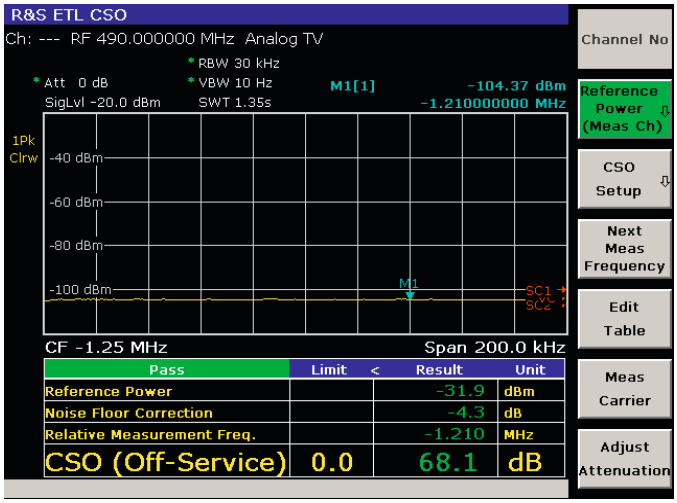
Constellation diagram of a DVB-C signal



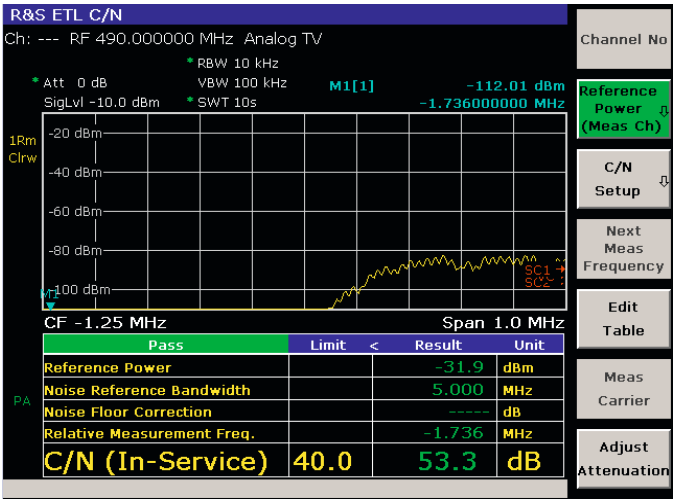
Composite triple beat (CTB) measurement



Composite second order (CSO) measurement



Carrier to noise (C/N) measurement



Frequency response measurement

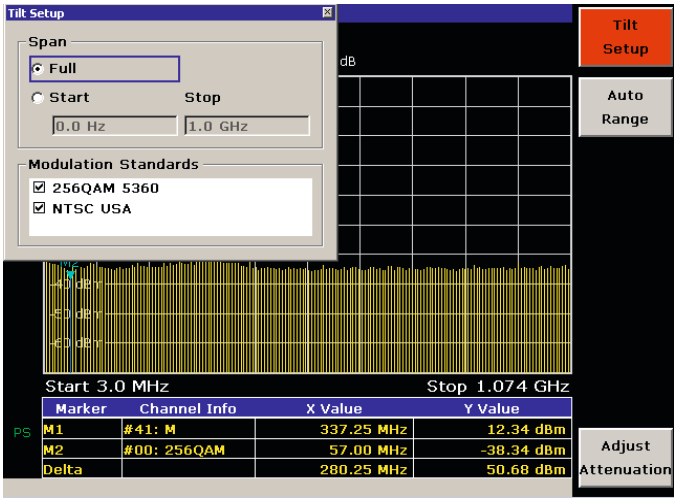
To keep the interfering intermodulation products in a cable system to a minimum, but still ensure a sufficient minimum signal level over the system's entire frequency range, the levels defined for the analog, digital and FM (radio) channels must be precisely adhered to. The TILT measurement provides a quick overview of the levels. The TILT measurement is based on a previously selected channel table and can be carried out for all or just for certain modulation standards. Markers make it easier to read the individual level values in the previously created graphic. Level differences between two selected channels are easy to measure, making it possible to determine the frequency response of a cable system.

Ingress measurement to detect interferers

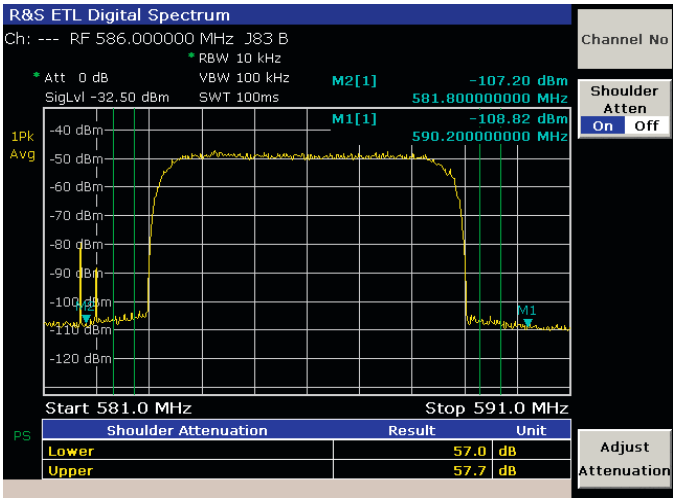
For interference-free operation of a cable TV network, it is important to prevent ingress signals because they could adversely affect the signal quality of the individual channels. Ingress prevention is gaining in importance because terrestrial data services are entering the VHF/UHF frequency range, occupying former analog TV channels.

Rohde&Schwarz has developed a special process to detect ingress signals and integrated it into the R&S®ETL. The ingress (f) measurement provides a simple way to see interfering signals that are superimposed on a useful digital signal. These interfering signals are typically difficult to recognize in the frequency spectrum and the constellation diagram. MER (f) can also be selected as the display mode. MER is well known from the analysis of OFDM based TV standards, where it has long been used to detect interferers.

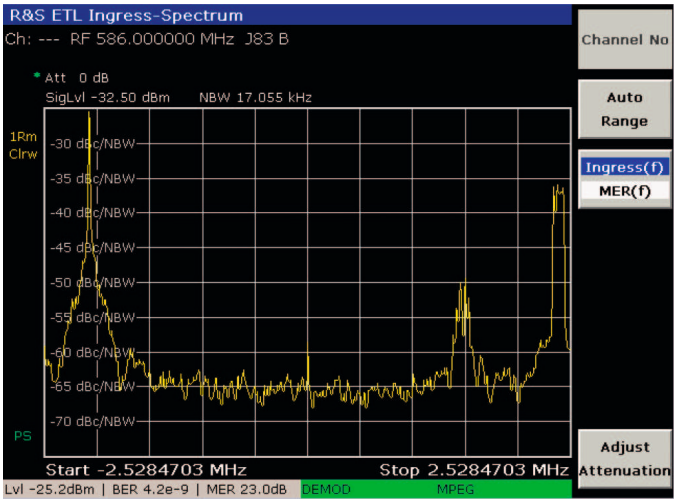
TILT measurement in a cable TV system



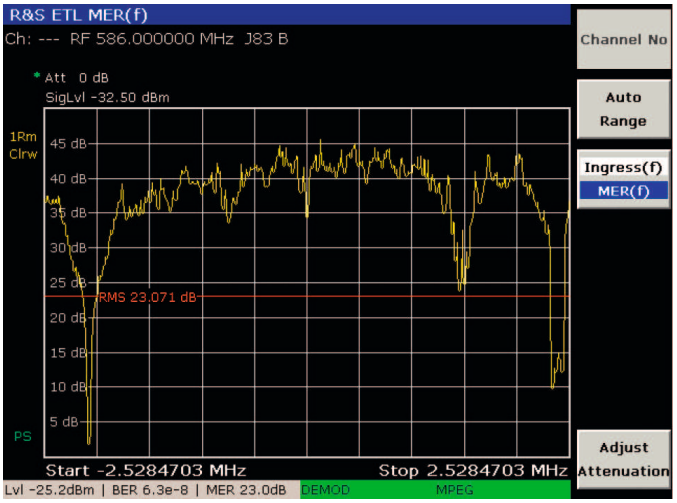
Frequency spectrum of a J.83/B signal with interferer



Ingress (f), frequency spectrum of an interfering signal that is superimposed on the useful signal



MER (f) of a J.83/B signal with superimposed interfering signal



Automatic measurements and documentation

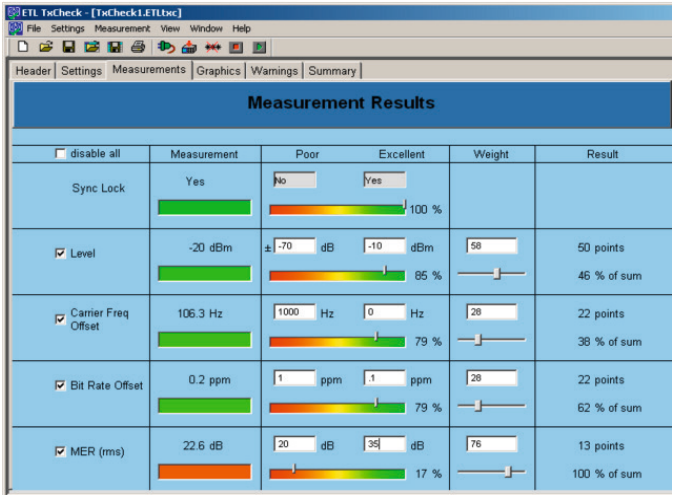
A technician's everyday tasks include measuring, evaluating and documenting the quality of the transmitted signals at the transmitter, transposer and cable headend. The R&S®ETL's all-in-one concept provides the ideal prerequisites for time-saving and effective solutions.

R&S®TxCheck measurement software for DVB-T, DVB-T2, DVB-H, ATSC/8VSB, ISDB-T$_{(B)}$, J.83/A/B/C, DTMB, DAB and FM (radio)

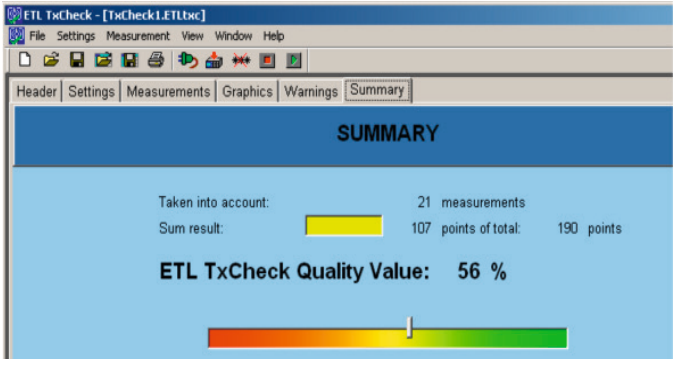
The R&S®ETL always comes with the R&S®TxCheck measurement software, which has been designed for the DVB-T, DVB-T2, DVB-H, ATSC/8VSB, ISDB-T$_{(B)}$, J.83/A/B/C DTMB, DAB and FM (radio) standards. The basis for automatic measurements is a measurement profile where the required measurements are defined. Limits and weightings can be entered for each parameter in the profile, for both individual and overall evaluation. The profiles can be adjusted to specific applications and transmitted from R&S®ETL to R&S®ETL. After a measurement profile has been selected, all R&S®ETL measurements can be automatically and reproducibly executed by simply pressing the start button. Color bars show the quality evaluation for each parameter and the overall result, allowing users to evaluate the quality at a glance, without having to go into detail.

The results, together with measurement graphics and general information about the DUT, are entered in a report. The created reports can be saved on the R&S®ETL or to an external storage medium.

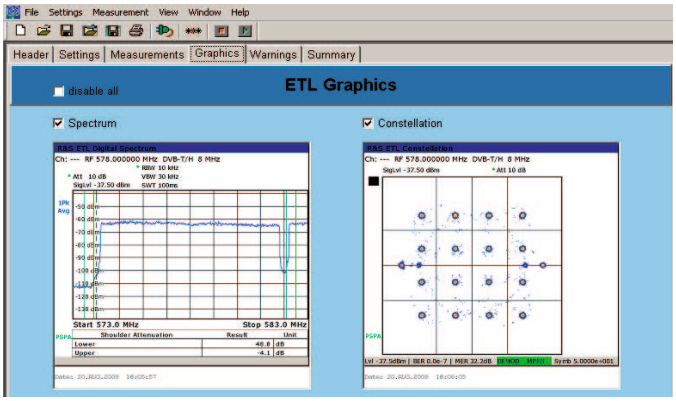
Parameter and result list of R&S®TxCheck



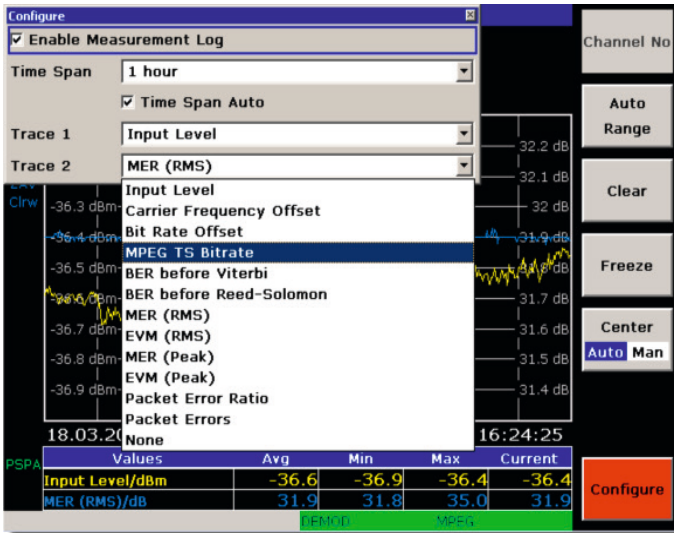
Signal quality at a glance



Measurement graphics in R&S®TxCheck



Configuration of the measurement log function



R&S®TVSCAN 2.0 measurement software for measuring cable TV systems and terrestrial networks

It is not unusual for today's cable TV systems to have well above one hundred occupied channels. Numerous terrestrial channels are also on air. It would be very time-consuming and expensive to manually measure these channels separately and record the results. These tasks can be accomplished automatically, effectively, quickly and easily with R&S®TVSCAN 2.0.

The basis for automatic measurements are the user-defined channel tables, measurements and related limits. In the channel tables, all parameters can be predefined so that the R&S®ETL is correctly set for each channel. This even includes guidelines for using the preselection and the preamplifier. Measurements are made in accordance with a selected, user-specific limit table. The parameters that are to be measured and their tolerance limits are defined here. The measurement results are stored in a database on the R&S®ETL or on a PC/network drive. Limit violations are graphically indicated. Analysis of the measurement results is supported by 2D and 3D graphs. This allows quick analysis of even big data collections, making it possible to easily identify signal degradation trends or short-term degradations.

User-definable channel table in R&S®TVSCAN 2.0 (detail)

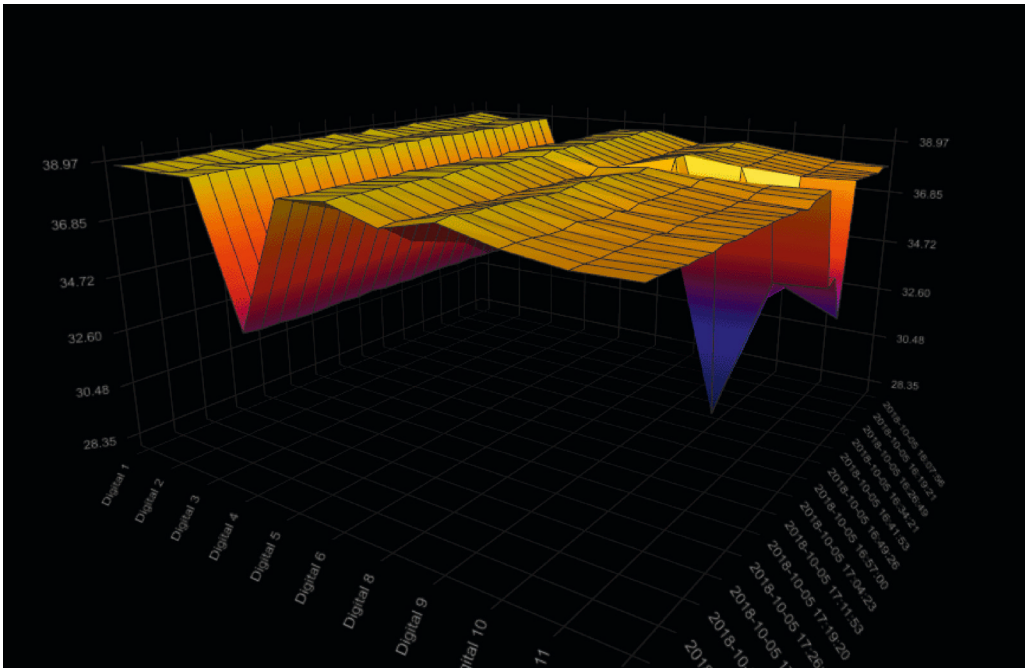
Channel (Network_section_B.channel)

	1	2	3
Channel Name	D1	D2	D3
Description			
TV Standard	DVB-C / J83/A (digital)	DVB-C / J83/A (digital)	DVB-C / J83/A (digital)
Center / Vision Carrier Frequency	586.00 MHz	594.00 MHz	602.00 MHz
Frequency Offset	0.00 Hz	0.00 Hz	0.00 Hz
Reference Level Mode	Automatic	Automatic	Automatic
Reference Level	0 dBmV	0 dBmV	0 dBmV
Pre Selector	On	On	On
Pre Amplifier	On	On	On
Attenuation	0 dB	0 dB	0 dB
Sideband Position (Spectral Inversion)	Automatic	Automatic	Automatic

Long-term documentation of measured values for DTV, DAB and FM (radio)

The R&S®ETL-K208 measurement log option is ideal for long-term documentation of measured values, e.g. for a 24-hour test. This option is also the first choice for detecting sporadic errors. After it has been activated, the measurement log runs in the background and saves essential parameters permanently in a database. During a measurement, the values for two selected parameters and a specified time domain can be graphically displayed. All parameters that are not displayed continue to be recorded. The same graphic can later be used to analyze a specific time domain. An export function for the CSV format is provided for external analysis or recording.

3D visualization of MER measurement data with R&S®TVSCAN 2.0



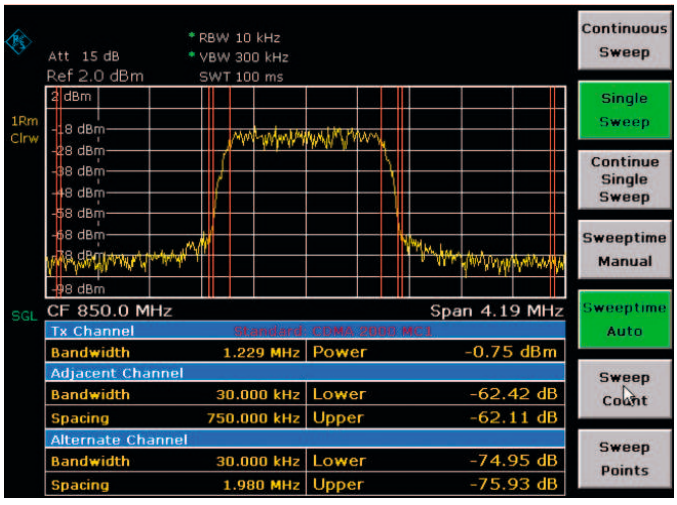
Integration of spectrum measurements in TV and sound broadcasting signal analysis

At a transmitter, at a cable headend and in the field, a spectrum analyzer is always necessary because it is a universal T&M instrument that can be used to check a series of influences and conditions that could adversely affect signal transmission. The R&S®ETL eliminates the need for a separate spectrum analyzer and test receiver. The R&S®ETL includes a complete spectrum analyzer that can be operated directly from the TV analyzer/receiver mode for all or just for certain measurements. Efficient integration of a spectrum and TV analyzer in a single instrument saves time. There is no need to connect and disconnect between two T&M instruments. Automatic measurements can be made and documentation is easier.

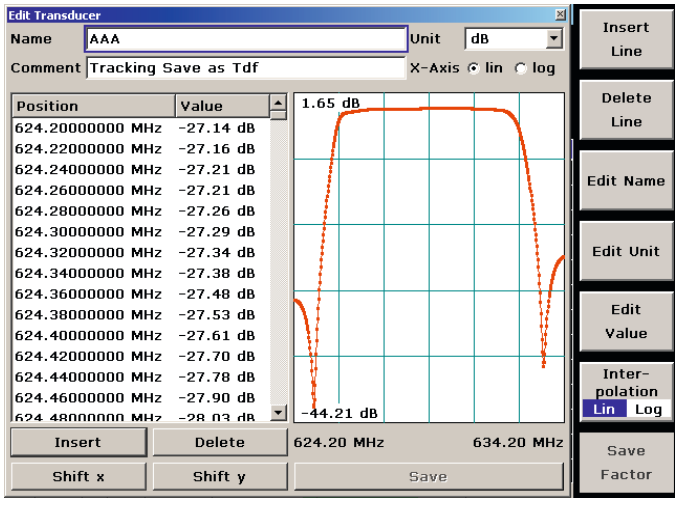
Full-featured spectrum analyzer

The R&S®ETL can operate as a full-featured spectrum analyzer. Up to four markers, including noise, phase noise and delta markers, are available in this operating mode. Various resolution and display bandwidths, as well as detectors, can be flexibly set. In addition to the normal spectrum display, other measurements that are of great interest to network providers are offered.

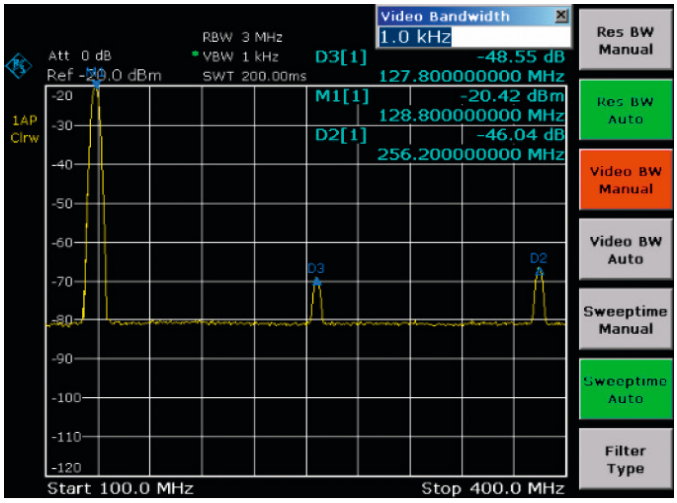
Adjacent channel power (ACP) measurement



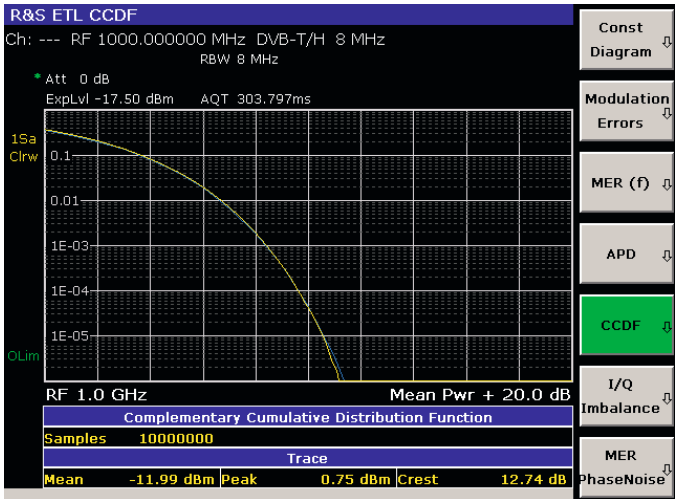
Transducer editor



Harmonics measurement



Complementary cumulative distribution function (CCDF) measurement



Measurement of transmission channel power, adjacent channel power and harmonics

It is of fundamental importance that TV signals be broadcast at a defined power, while affecting adjacent channels as little as possible. The R&S®ETL provides measurements for determining the channel power, the power in adjacent channels, and harmonics. The settings can be predefined by the user and saved for repetitive use.

Crest factor

For digital transmission standards, the output power is deliberately limited in order to operate transmitters and modulators in an energy-efficient manner. The crest factor is a measure of how the output power is limited. The crest factor can be measured and displayed in both the spectrum and TV analyzer modes. An advantage of the TV analyzer mode is that all the needed settings are predefined in line with a specific standard.

Built-in tracking generator for measuring filters and amplifiers

The R&S®ETL comes with a tracking generator as standard. The output power of the tracking generator can be set between –20 dBm and 0 dBm in 1 dB steps. The tracking generator can be used to quickly check filters and amplifiers and determine their transfer function, without the need for a separate signal source.

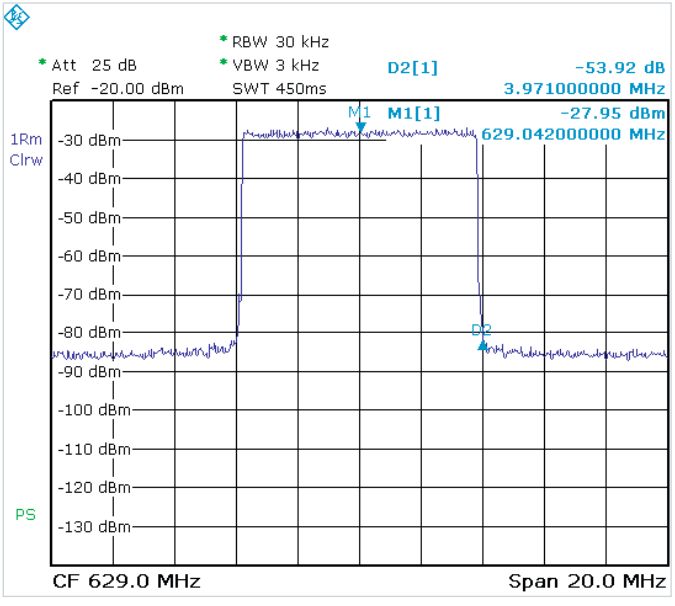
Transducer tables and antenna factors taken into account

Transducer tables can be used to correct measured values. For example, frequency-dependent attenuation and amplifier characteristics are taken into account during measurements. This function is very useful for coverage measurements in the field. Frequency-dependent antenna factors for test antennas can be conveniently entered and converted to field strength values using the measured input levels.

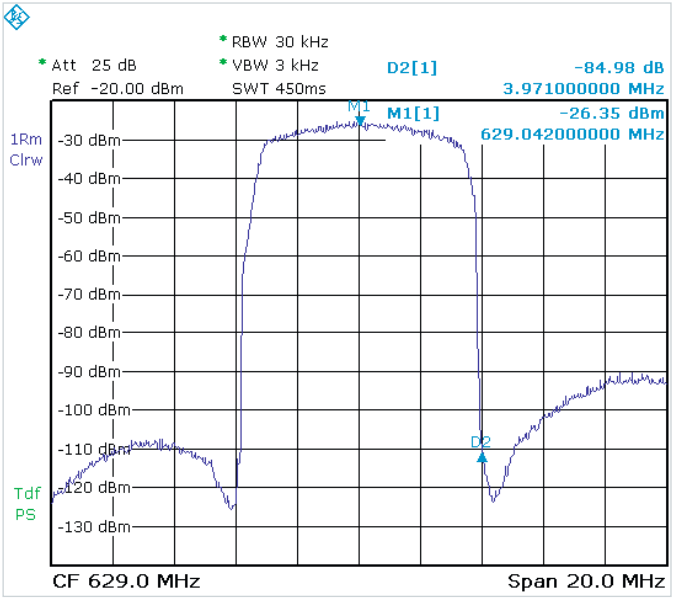
The output spectrum of a terrestrial transmitter usually has defined limits. Adherence to these limits can normally only be tested with a high-end spectrum analyzer that has a sufficiently high dynamic range. As a rule, such spectrum analyzers are too large, too heavy and do not have the TV-specific functions required for field use. The R&S®ETL is the ideal compromise.

Using the copy function, the passband characteristic of a channel filter that has been recorded by the R&S®ETL can be easily and reliably transferred to a transducer function. This transducer function is then taken into account in the transmitter's measured output spectrum. Values that would be outside the dynamic range of the R&S®ETL can be checked in this way.

Frequency spectrum without transducer function



Frequency spectrum with transducer function



Precise power measurement

At both the transmitter output and the output of a cable modulator, the output power must always be within defined limits in order to run at the optimum operating point, achieve the highest efficiency and fulfill regulatory requirements. In addition to the integrated spectrum analyzer capabilities, each demodulator also has a precise power measurement that integrates all the fractions of power in the useful channel. In the TV analyzer mode, the measured channel power is either displayed in the overview or in the bottom line of the screen. The measuring accuracy is < 1 dB (typ. < 0.5 dB).

Support for Rohde&Schwarz power sensors

When even more accuracy is needed for power measurements, the R&S®ETL supports the use of Rohde&Schwarz power sensors such as the R&S®NRP8S or R&S®NRP18T. The R&S®NRP-ZKU USB adapter can be used to connect the sensors to one of the two USB ports on the front panel of the R&S®ETL.

R&S®NRP18T thermal power sensor

Information line with displayed signal level

Lvl -21.9dBm | BER 0.0e-10 | MER 45.7dB DEMOD MPEG

Display of signal level in overview with limit monitoring

Pass	Limit <	Results (HP)	< Limit	Unit
Level	-60.0	-26.7	10.0	dBm
Constellation		64 QAM NH / normal		
MER (rms)	24.0	44.5	-----	dB

Flexible option concept

The R&S®ETL's flexible option concept means the instrument can be ideally configured to the required tasks – at any time, not only on delivery. Most of the demodulators and measurement functions are easy-to-install software options that the user can simply activate.

Modules for easy upgrading by user

A series of enhancements can be conveniently integrated as modules. A number of plug-in slots, which can be variably configured, are provided on the rear of the R&S®ETL. Users can install these enhancements themselves, which means that the TV analyzer is always available. For example, the R&S®ETL can be enhanced by adding a temperature-stabilized crystal oscillator or a DC power input and rechargeable battery. Various interface options are also available.

Interfaces for enhanced functionality

The R&S®ETL comes with numerous interfaces as standard. More interfaces can be added for certain applications. The required interface only takes minutes to install, for example a GPIB interface to connect to older measurement systems or to directly connect Rohde&Schwarz power sensors.

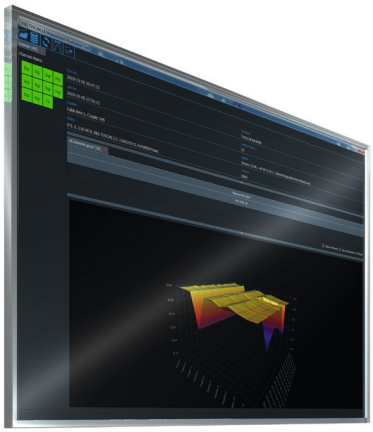
The R&S®ETL-B201 ATV, DTV, FM universal interface was specially developed for measurements on transmitters and modulators. This interface module significantly expands the functionality of the R&S®ETL. I/Q inputs are provided for most digital TV transmission standards so that, for example, RF ASICs or exciters with I/Q outputs can be directly connected and measured. A CCVS input and an MPX input make it possible to directly feed in video and MPX signals so that the signals fed into a transmitter can be directly analyzed. The R&S®ETL-B201 universal interface is also needed to use the integrated signal generator. For both analog TV and FM (radio), the interface module offers variable configurable signal outputs for stimulation of analog transmitter input stages and modulators.

R&S®ETL-B201 ATV, DTV, FM universal interface

Instrument configurations

Recommendations for instrument configurations

	Application	Installation, maintenance and servicing of transmitters			
	Function	Analog TV	Digital TV	DAB	FM (radio)
Option	**Description**				
R&S®ETL	base unit	●	●	●	●
R&S®ETL-B203	RF preselector				●
R&S®ETL-B110	high SNR FM frontend				●
R&S®ETL-Kxxx	digital TV standard		●	●	
R&S®ETL-B210	demodulator for digital cable TV				
R&S®ETL-K110	FM demodulator				●
R&S®ETL-K111	FM audio analysis/generator				●
R&S®ETL-K2x1, R&S®ETL-K3x1	SFN frequency offset				
R&S®ETL-K202	video analysis	●			
R&S®ETL-K203	video generator	●			
R&S®ETL-K208	measurement log		●	●	●
R&S®ETL-B201	ATV, DTV, ETI, FM universal interface	●		●	●
R&S®ETL-B380	AV decoder and TS processing board	●	●		
R&S®ETL-K281	HDTV, Dolby®, HE-AAC		●		
R&S®ETL-K282	MPEG analysis/monitoring		●		
R&S®ETL-K283	in-depth analysis		●		
R&S®ETL-K284	data broadcast analysis				
R&S®ETL-K285	TS template monitoring				
R&S®ETL-K381	UHD extension		●		
R&S®ETL-K386	IP input and output		●		
R&S®ETL-K280	TS generator/recorder		●		
R&S®ETL-B230	DC power supply				
R&S®ETL-B235	Li-ion battery pack				
Rohde&Schwarz power sensors	power sensor	●	●	●	●
Measurement software	automatic measurements and documentation		R&S®TxCheck		



	Installation, maintenance, service of cable headend			Coverage measurements			Installation, maintenance, service of transposer	MPEG analysis of local remultiplexer at transmitter site
	Analog TV	Digital TV	FM (radio)	Digital TV	DAB	FM (radio)	Digital TV	Digital TV
	•	•	•	•	•	•	•	•
	•	•	•	•	•	•	•	
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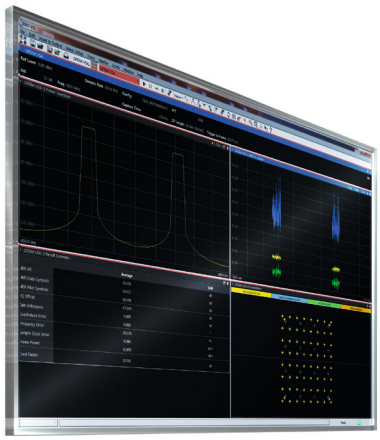
	R&S®TVSCAN 2.0	R&S®TVSCAN 2.0		R&S®BCDRIVE				



Option guide

The R&S®ETL base model supports RF analysis of analog TV signals. In addition, it offers a tracking generator and wide-ranging spectrum analysis functions. Options enhance the R&S®ETL for measuring additional standards.

Optional enhancement functions are available for all standards. The following seven steps show the entire range of options.

An electronic product configurator is available on the internet, making it easy to create and check configurations. You can find this configurator under www.rohde-schwarz.com/product/ETL

1

Activation of additional standards and related RF measurements

Standard	Required hardware option (only one per unit possible)	Standard activation (software option)
FM (radio)	1)	R&S®ETL-K110 4)
T-DMB/DAB	none	R&S®ETL-K250
ATSC/8VSB	none	R&S®ETL-K220
DVB-T/DVB-H	none	R&S®ETL-K240
ISDB-T	none	R&S®ETL-K260
DVB-C, ISDB-C, J.83/A/C	R&S®ETL-B210	R&S®ETL-K210
J.83/B	R&S®ETL-B210	R&S®ETL-K213
ATSC MDTV, ATSC/8VSB	R&S®ETL-B300 or R&S®ETL-B310 2)	R&S®ETL-K320
DVB-T2	R&S®ETL-B300 or R&S®ETL-B310 2)	R&S®ETL-K340
DTMB	R&S®ETL-B300 or R&S®ETL-B310 2)	R&S®ETL-K370 3)
CDR	see "R&S®ETL-K470 CDR Signal Analysis Software" product flyer (PD 5216.3566.32)	

2

Selection of functions for activated standards (1)

Standard	SFN frequency offset measurement	Measurement log	Audio/video decode
Analog TV	not applicable	not supported	5)
FM (radio)	not applicable	R&S®ETL-K208	no option required
T-DMB/DAB	R&S®ETL-K251	R&S®ETL-K208	not supported
ATSC/8VSB	R&S®ETL-K221	R&S®ETL-K208	R&S®ETL-B380 6): ▪ output on internal display, CCVS, audio (headphone/ Lemo) or HDMI™ ▪ CI interface included ▪ UHD requires R&S®ETL-K381 ▪ not for ATSC MDTV parades ▪ not for T2MI signals
DVB-T/DVB-H	R&S®ETL-K241	R&S®ETL-K208	
ISDB-T	R&S®ETL-K261	R&S®ETL-K208	
DVB-C, ISDB-C, J.83/A/C	not applicable	R&S®ETL-K208	
J.83/B	not applicable	R&S®ETL-K208	
ATSC MDTV, ATSC/8VSB	R&S®ETL-K321	R&S®ETL-K208	
DVB-T2	R&S®ETL-K341	R&S®ETL-K208	
DTMB	R&S®ETL-K371	R&S®ETL-K208	

Selection of functions for activated standards (2)

Standard	Audio/video/TS analysis	Audio/video/TS generation
Analog TV	R&S®ETL-K202	R&S®ETL-K203
FM (radio)	R&S®ETL-K111 (requires R&S®ETL-B201)	R&S®ETL-K111 (requires R&S®ETL-B201)
T-DMB/DAB	not supported	not supported
ATSC/8VSB	R&S®ETL-B380 6) and R&S®ETL-K282 MPEG analysis/monitoring 7) (ATSC MDTV parades not supported)	R&S®ETL-B380 6) and R&S®ETL-K280 MPEG TS generator/recorder
DVB-T/DVB-H		
ISDB-T		For optional TS libraries for R&S®ETL-K280, refer to step 3.
DVB-C, ISDB-C, J.83/A/C	Optional enhancements: ▪ R&S®ETL-K283 in-depth analysis ▪ R&S®ETL-K284 data broadcast analysis ▪ R&S®ETL-K285 TS template monitoring ▪ R&S®ETL-K382 DVB T2-MI extension ▪ R&S®ETL-K386 IP input and output	
J.83/B		
ATSC MDTV, ATSC/8VSB		
DVB-T2		
DTMB		

3

Transport stream libraries (optional enhancement for R&S®ETL-K280)

Description	Option
ISDB-T transport streams	R&S®LIB-K54
ATSC and ATSC mobile DTV streams	R&S®LIB-K56
DVB-T2 MI streams	R&S®LIB-K57
EMC streams	R&S®LIB-K58
Basic stream library	R&S®LIB-K70
Extended SDTV library	R&S®LIB-K71
Extended HDTV library	R&S®LIB-K72
3D library	R&S®LIB-K73
HEVC stream library	R&S®LIB-K78

4

Selection of software tools for activated standards

Standard	Automated measurements of multiple TV channels	R&S®TxCheck	Broadcast drive test
Analog TV	R&S®TVSCAN 2.0 (some functions require PC installation)	not supported	R&S®BCDRIVE [8] ▪ Required: R&S®ETL-B203 and R&S®ETL-K208 options ▪ Recommended: GPS receiver (R&S®TSMx-PPS2)
FM (radio)	not supported	included in base unit	
T-DMB/DAB	R&S®TVSCAN 2.0 (some functions require PC installation; ATSC MDTV parades not supported)	included in base unit	
ATSC/8VSB			
DVB-T/DVB-H			
ISDB-T			
DVB-C, ISDB-C / J.83/A/C			
J.83/B			
ATSC MDTV, ATSC/8VSB			
DVB-T2			
DTMB			

5

Further enhancements

Description	Option
RF preselector	R&S®ETL-B203
Universal DTV, ATV, FM interface	R&S®ETL-B201 [9]
SWR bridge, 5 MHz to 3 GHz	R&S®ZRB2
SWR bridge, 40 kHz to 4 GHz, 50 Ω	R&S®ZRC
OCXO reference frequency	R&S®FSL-B4
Narrow resolution filters	R&S®FSL-B7
GPIB interface	R&S®FSL-B10
AM/FM/φM measurement demodulator	R&S®FSL-K7
DC power supply, 11 V to 19 V	R&S®ETL-B230
Lithium-ion battery pack 10 Ah with battery charger	R&S®ETL-B235 [10]
GPS module	R&S®TSMx-PPS2
19" rackmount adapter	R&S®ZZA-S334
Documentation of R&S®ETL calibration values	R&S®ETL-DCV
Printout of DCV	R&S®DCV-ZP
Protective hard cover	R&S®EVS-Z6
Soft carrying bag	R&S®FSL-Z3

[1] Recommended for high SNR: R&S®ETL-B110/R&S®ETL-B310; both options require R&S®ETL-B203 preselector.
[2] R&S®ETL-B310 is recommended for high SNR measurements for standard FM; R&S®ETL-B310 requires R&S®ETL-B203 preselector.
[3] Optional enhancement via R&S®ETL-K372 DTMB extended TX measurements.
[4] Optional enhancement via R&S®ETL-K112 FM (radio) MPX deviation measurement, in line with ITU-R SM.1268-3/-4.
[5] Base unit: CCVS and audio (headphone/Lemo) out (no option required); with R&S®ETL-B380 AV decoder and TS processing: output on internal display.
[6] Not with R&S®ETL-B235 lithium-ion battery pack.
[7] Up to two times per R&S®ETL.
[8] For analog TV and FM: only level and SNR during stationary operation.
[9] Not with R&S®FSL-B5 additional interfaces.
[10] Requires R&S®ETL-B230 DC power supply; not with R&S®ETL-B380 AV decoder and TS processing.

6

Power measurements based on Rohde&Schwarz power sensors	
Description	**Option**
Activation of power sensor measurements (required)	R&S®FSL-K9
USB connection cable (required), length 1.50 m/3.00 m/5.00 m	R&S®NRP-ZKU
Power sensor selection (one required)	
Three-path diode power sensor, 10 MHz to 8 GHz, 100 pW to 200 mW, N (m)	R&S®NRP8S
Thermal power sensor, DC to 18 GHz, 300 nW to 100 mW, N (m)	R&S®NRP18T

7

Warranty options (alternative option types)	
Description	**Option**
Extended warranty, one year	R&S®WE1
Extended warranty, two years	R&S®WE2
Extended warranty with calibration coverage, one year	R&S®CW1
Extended warranty with calibration coverage, two years	R&S®CW2
Extended warranty with accredited calibration coverage, one year	R&S®AW1
Extended warranty with accredited calibration coverage, two years	R&S®AW2

Interface configuration for RF, TS and audio/video

Base unit and R&S®ETL-B203 preselector				
	Base unit[1]			**R&S®ETL-B203 preselector**
Standard	**RF 50 Ω in**	**CCVS/audio**[2] **out (demodulated signal)**	**TS ASI out (demodulated signal)**	**RF 75 Ω in**
Analog TV	●	●[3]		●
FM (radio)	●	●[4]		●
T-DMB/DAB	●			●
ATSC/8VSB	●	●[5]	●	●
DVB-T/DVB-H	●	●[5]	●	●
ISDB-T	●	●[5]	●	●
DVB-C, ISDB-C, J.83/A/C	●	●[5]	●	●
J.83/B	●	●[5]	●	●
ATSC MDTV, ATSC/8VSB	●	●[5] [6]	●[6]	●
DVB-T2	●	●[5]	●	●
DTMB	●	●[5]	●	●

R&S®ETL-B380 AV decoder and TS processing [7]				
Standard	**HDMI™ out [8] and CI support**	**TS ASI in [9]**	**TS ASI out (generator) [10]**	**TS over IP in/out [11]**
Analog TV				
FM (radio)				
T-DMB/DAB				
ATSC/8VSB	●	●	●	●
DVB-T/DVB-H	●	●	●	●
ISDB-T	●	●	●	●
DVB-C, ISDB-C, J.83/A/C	●	●	●	●
J.83/B	●	●	●	●
ATSC MDTV, ATSC/8VSB [6]	●	●	●	●
DVB-T2	●	● [12]	●	● [12]
DTMB	●	●	●	●

Additional interfaces, ETL-B201 [13]			
Standard	**I/Q baseband in**	**Serial data and clock out**	**Other**
Analog TV			● (sound IF (intercarrier) out; alternatively CCVS out [3])
FM (radio)			● (MPX in; with R&S®ETL-K111: audio out [14])
T-DMB/DAB	●	● (of selected subchannel)	● (ETI (NI, G.703, HDB3) out)
ATSC/8VSB	●	● (after demapper)	
DVB-T/DVB-H	●	● (after demapper)	
ISDB-T	●	● (of selected layer before Viterbi decoder)	
DVB-C, ISDB-C, J.83/A/C	●		● (IF (4.571428 MHz) out)
J.83/B	●		● (IF (4.571428 MHz) out)
ATSC MDTV, ATSC/8VSB	●	● (after demapper)	
DVB-T2	●		
DTMB	●		

[1] Base unit also includes tracking generator output (50 Ω) and further interfaces (PC, trigger, reference).
[2] Headphone and Lemo connector.
[3] With R&S®ETL-K203: CCVS out (demodulated signal) on R&S®ETL-B201 and CCVS out (generated signal) on R&S®ETL base unit.
[4] No CCVS output; audio selectable: mono/stereo, MPX, RDS, SCA or pilot.
[5] R&S®ETL-B380 A/V decoder and TS processing required.
[6] Not applicable for ATSC MDTV parades.
[7] Not with R&S®ETL-B235 lithium-ion battery pack.
[8] HDMI™ output deactivates all other AV output (CCVS, internal display and audio).
[9] With R&S®ETL-K282 MPEG analysis/monitoring.
[10] R&S®ETL-K280 MPEG TS generator/recorder) required.
[11] With R&S®ETL-K386 IP input and output.
[12] T2MI support with R&S®ETL-K382.
[13] Not with R&S®FSL-B5 additional interfaces; all connectors are BNC, signal format selectable.
[14] Selectable: analog, MPX or AES/EBU.

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- Uncompromising quality
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