R&S ETL

The new generation of TV Analyzers

75 Years of Driving Innovation

ROHDE&SCHWARZ

COMPANY RESTRICTED

Key features of the R&S ETL

- **Wide range of signal analysis functions for analog and digital TV, DAB and FM (radio)**
- **Integrated spectrum analysis functions**
- **Multistandard platform**
- **Software- and chip-based demodulators**
- **All demodulators are operating in real-time**
- **Baseband outputs (Video, Audio, transport stream)**
- **High measuring accuracy and performance**

Key features

- **Instrument design optimal for portable and stationary use**
- **Compact sized and light weighted**
- **Ready for:**

  - Analog TV
  - DVB-T/-H / -T2
  - DVB-C (J.83/A/C)
  - J.83/B
  - ISDB-T
  - DTMB (GB20600-2006, China)
  - ATSC
  - T-DMB/DAB
  - FM (Radio)

Customer groups worldwide

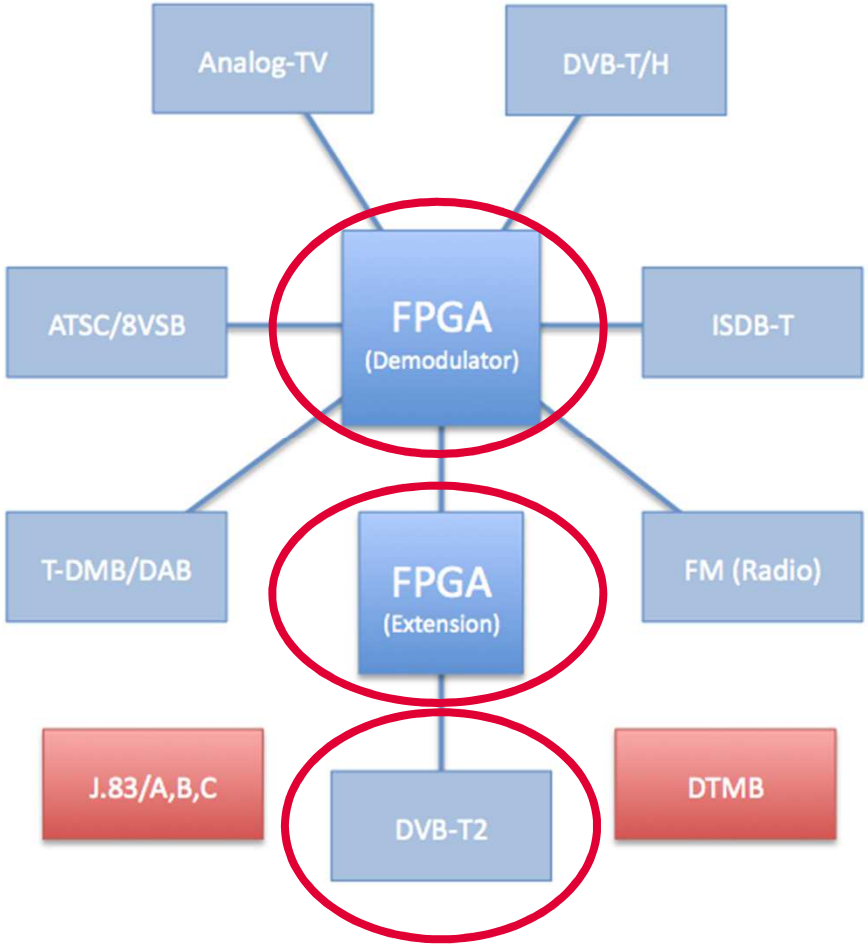
- **Terrestrial ATV and DTV network operators**
- **Mobile TV network operators**
- **Cable TV (CATV) network operators**
- **Manufacturer of TV transmitter**
- **Public authorities and organizations in charge of monitoring of terrestrial transmissions**

Applications

- **Acceptance test of TV transmitters and cable TV headends**
- **Maintenance of TV transmitters and cable TV headends**
- **Optimization of SFN networks (e.g. DVB-T/H, T-DMB/DAB)**
- **Coverage measurements**
- **Radio frequency monitoring of terrestrial transmissions**

FPGA based demodulators

Field
Programmable
Gate
Array



R&S ETL
Base unit

R&S ETL-B300
FPGA Extension

R&S ETL-K340
DVB-T2 Firmware

= software based demodulator

= hardware based demodulator

Connectivity: Baseband

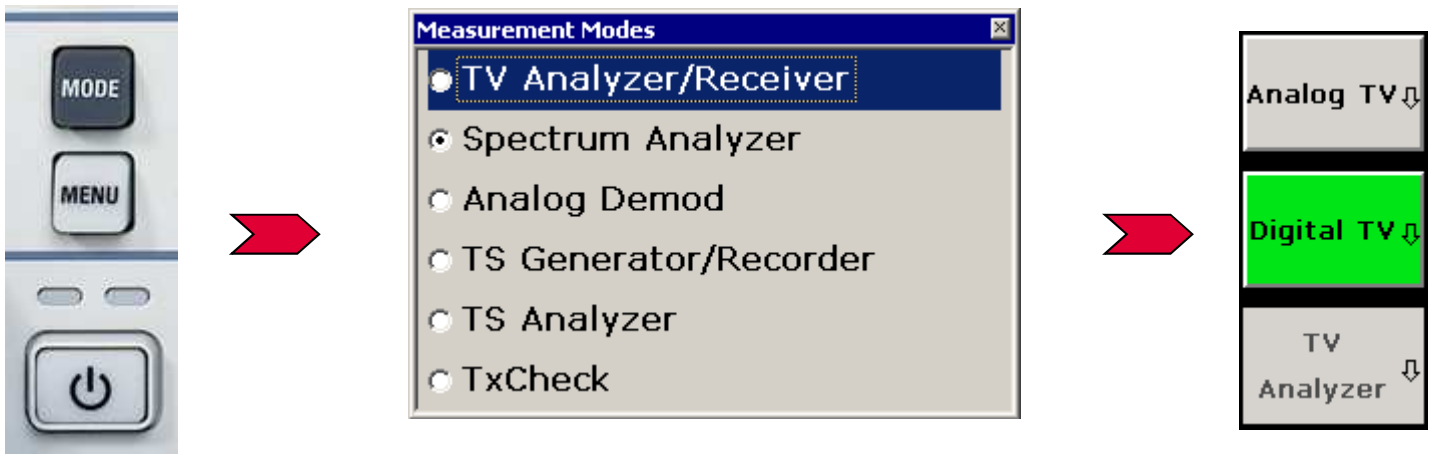
- **Video out (CCVS): 75 Ohm, BNC female**
- **AF signal output: - 2 x Lemo Triax, female, balanced**
  - headphone (front)
- **TS-ASI: 75 Ohm, BNC female**

Analysis functions

Several analyzers in one unit

- **The R&S ETL combines the functions of a TV -, spectrum -, video -, audio -, FM -, and transport stream analyzer in one unit**

- **The handover can be done easily with the “MODE” key**



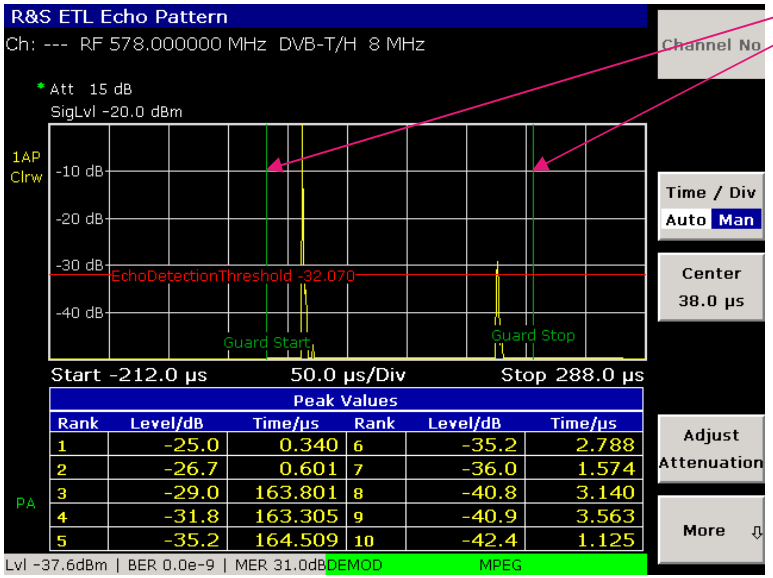
Specifications in brief

Frequency range	**500 kHz to 3 GHz (demodulation and spectrum)**
Frequency accuracy	**1×10^{-7} with R&S FSL-B4** **$1 \times 10^{-12} \pm 0.1$ Hz with GPS**
Level accuracy	**< 1 dB in TV mode** **< 0.5 dB in SA mode**

Echo pattern of single frequency network (SFN)

- **Precise SFN measurements**
- **Indication of Guard Interval (GI)**
- **Peak value table for up to 10 peaks**

Indication of the Guard Interval



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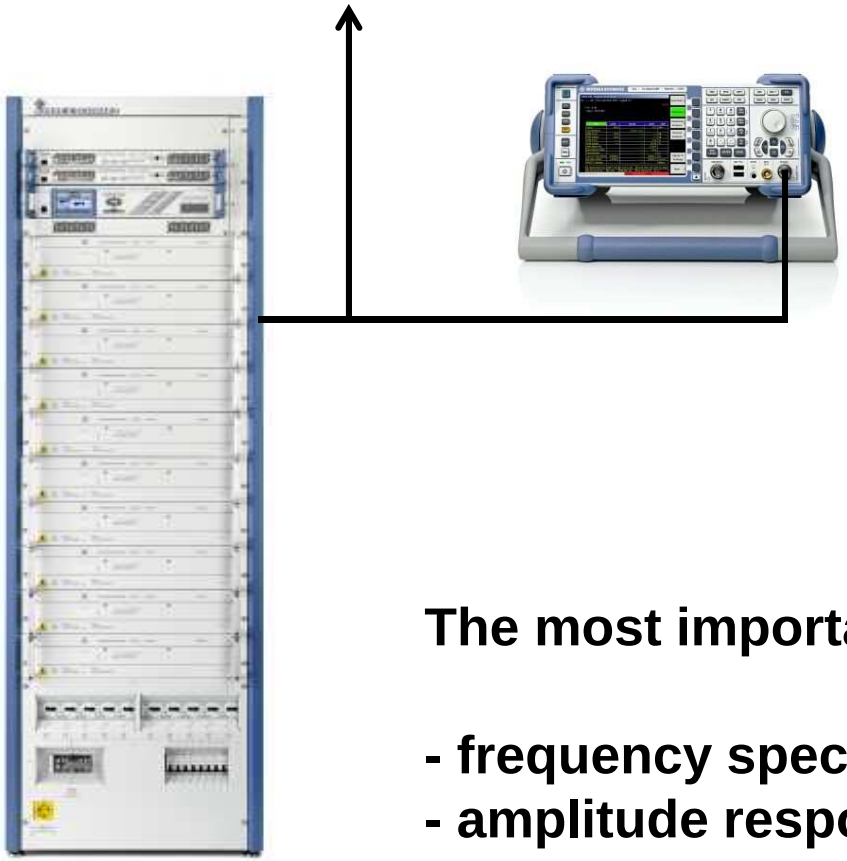
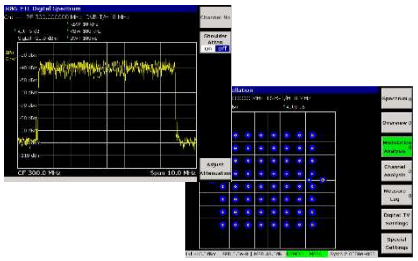
Key features of DVB-T2 analyzer

RF signal quality at the transmitter output



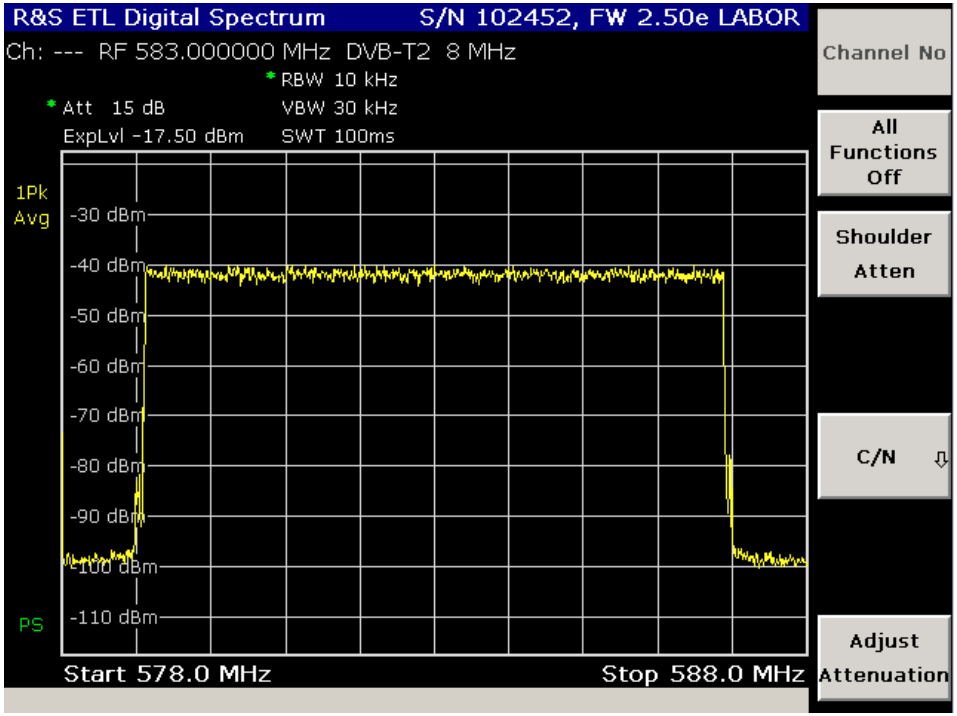
R&S ETL



The most important RF measurements are:

- **frequency spectrum after the channel filter**
- **amplitude response, group delay and phase**
- **DVB-T2 modulation parameters**
- **signal quality of modulator and amplifiers**

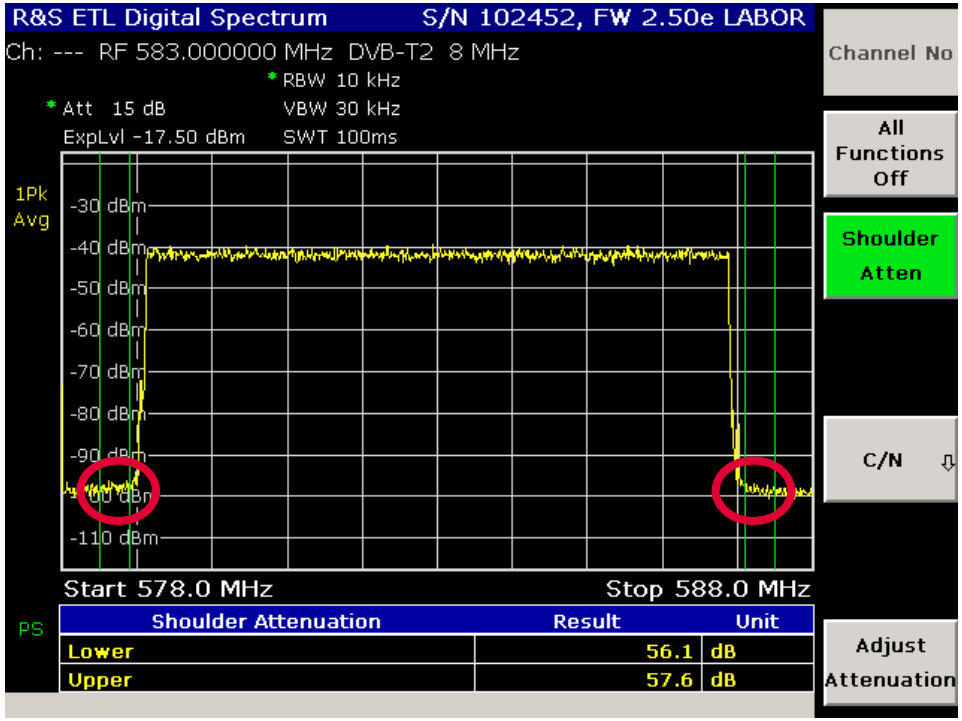
Frequency spectrum measurements



<u>Analysis of frequency spectum with</u>

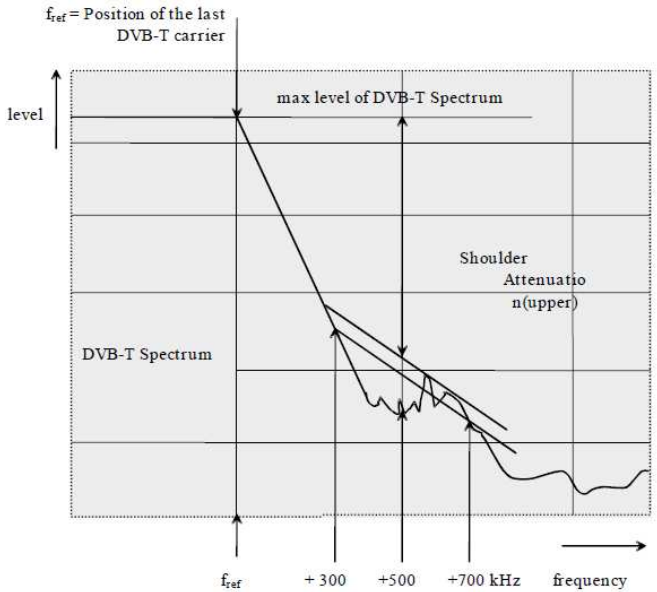
- **Spectrum Analyzer mode**
- **TV Analyzer/Receiver mode**

Frequency spectrum measurements

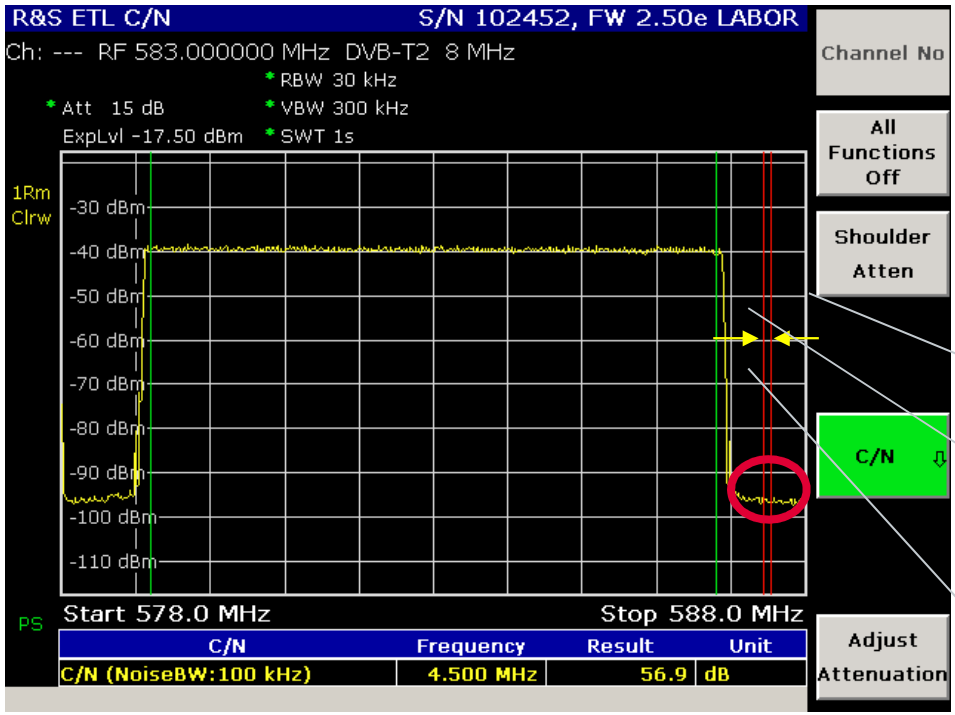


Shoulder Attenuation

- according to ETSI TR 101290

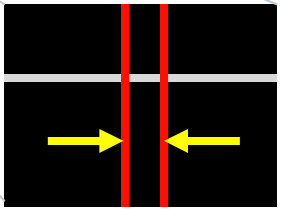


Frequency spectrum measurements

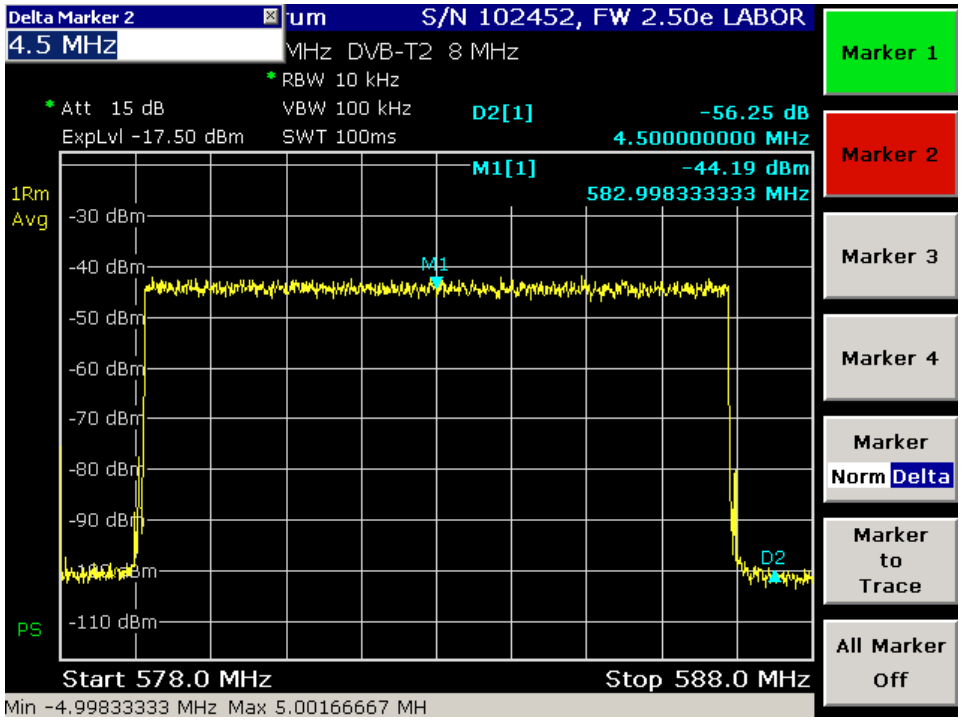


Carrier to Noise (C/N)

- changeable position of noise floor measurement
- changeable noise BW



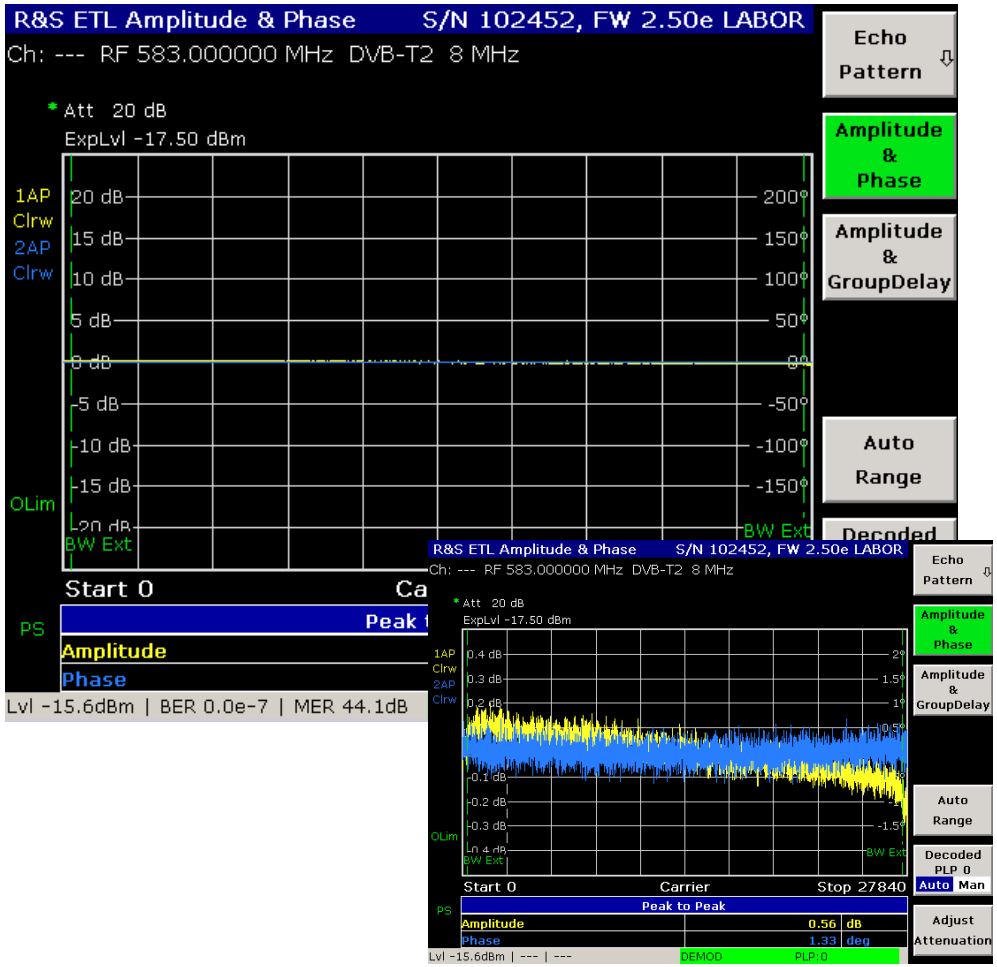
Frequency spectrum measurements



<u>Analysis of frequency spectum by markers</u>

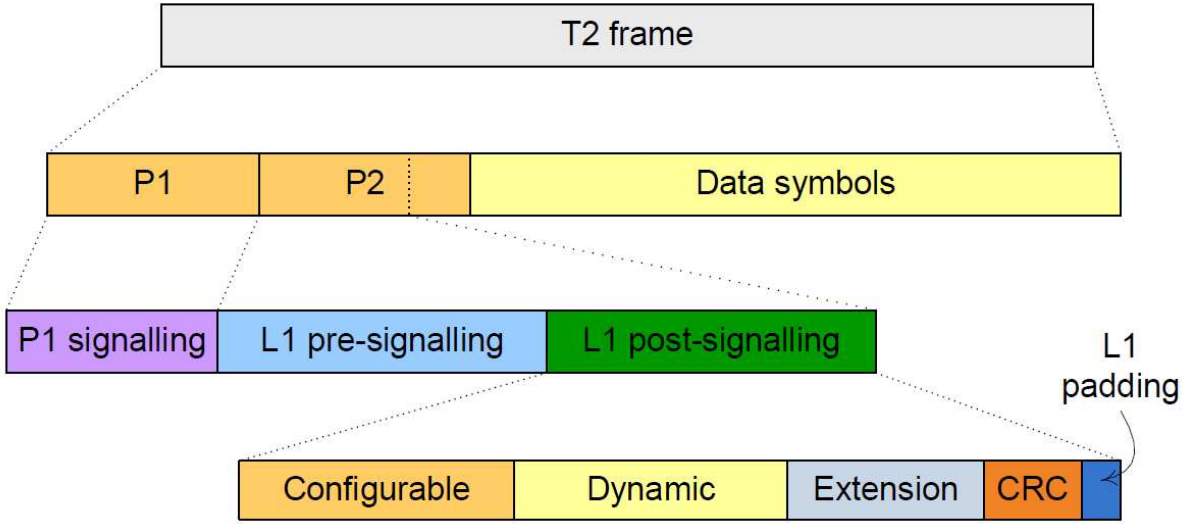
- **up to four markers**
- **absolute and delta marker**

Amplitude response, group delay, phase



- combined measurement of Amplitude, Phase and GD
- Peak to Peak list
- Auto Range function
- manual scalling (↔) and positioning of amplitude trace (↕)by cursor buttons

DVB-T2 modulation parameters



The L1 signalling structure

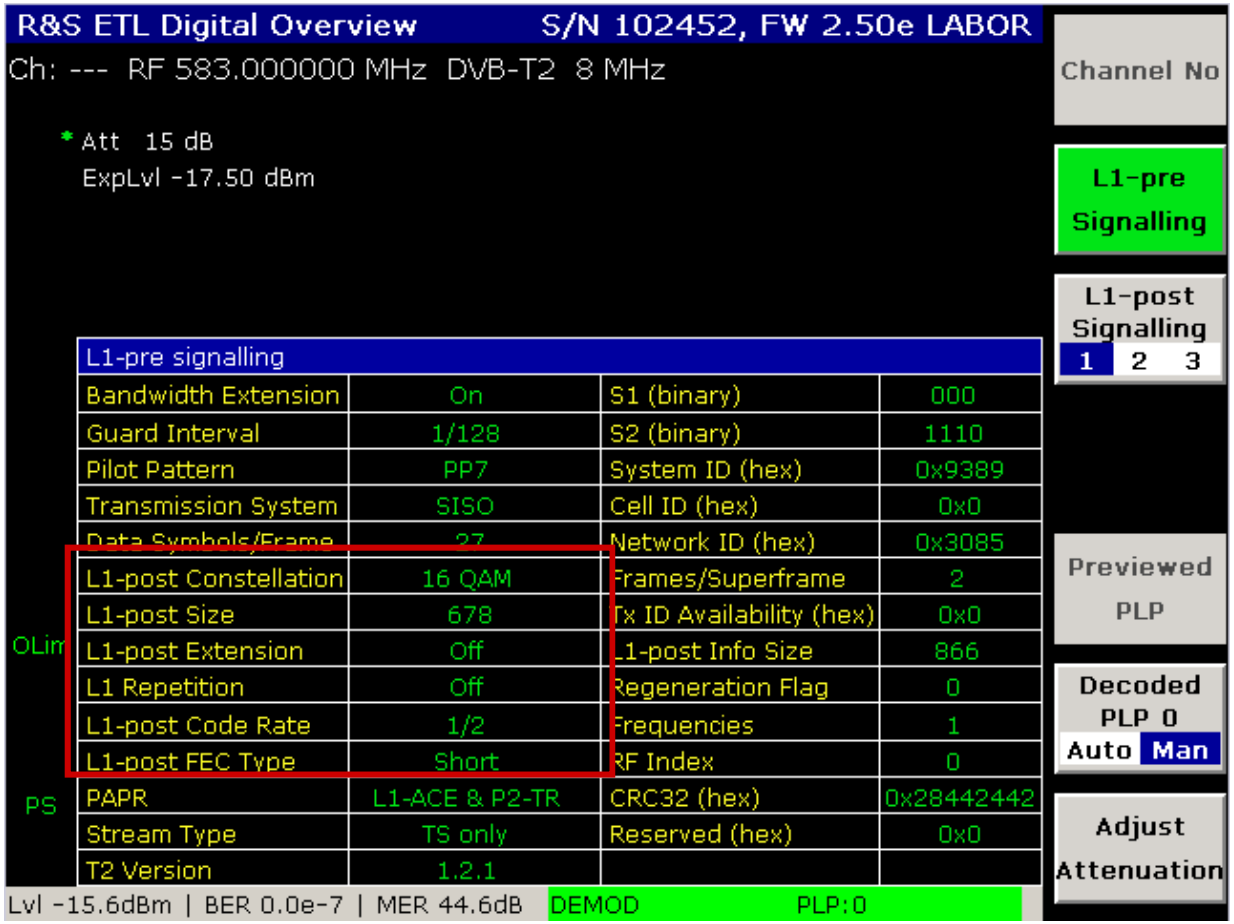
P1 signalling for synchronization, FFT mode, SISO/MISO

L1 pre-signalling Guard interval, Pilot Pattern, Cell ID, PAPR, parameters of L1-post signalling (FEC, constellation)

L1 post-signalling number of PLPs, PLP IDs, FEC and constellation of each of PLPs

PLP = Physical Layer Pipe

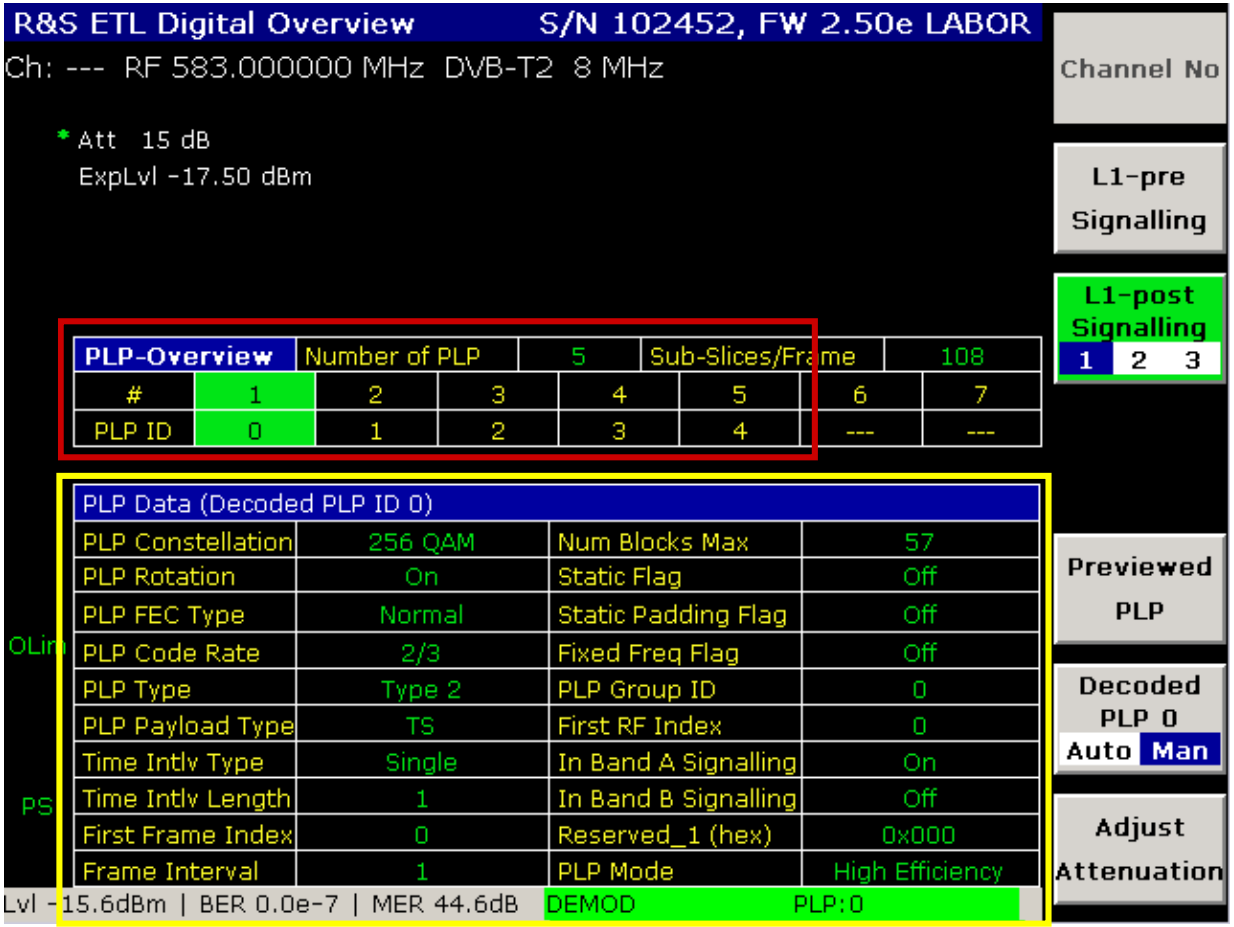
L1 pre-signalling



L1-pre signalling			
Bandwidth Extension	On	S1 (binary)	000
Guard Interval	1/128	S2 (binary)	1110
Pilot Pattern	PP7	System ID (hex)	0x9389
Transmission System	SISO	Cell ID (hex)	0x0
Data Symbols/Frame	27	Network ID (hex)	0x3085
L1-post Constellation	16 QAM	Frames/Superframe	2
L1-post Size	678	Tx ID Availability (hex)	0x0
L1-post Extension	Off	L1-post Info Size	866
L1 Repetition	Off	Regeneration Flag	0
L1-post Code Rate	1/2	Frequencies	1
L1-post FEC Type	Short	RF Index	0
PAPR	L1-ACE & P2-TR	CRC32 (hex)	0x28442442
Stream Type	TS only	Reserved (hex)	0x0
T2 Version	1.2.1		

Modulation parameters of L1 post-signalling

L1 post-signalling



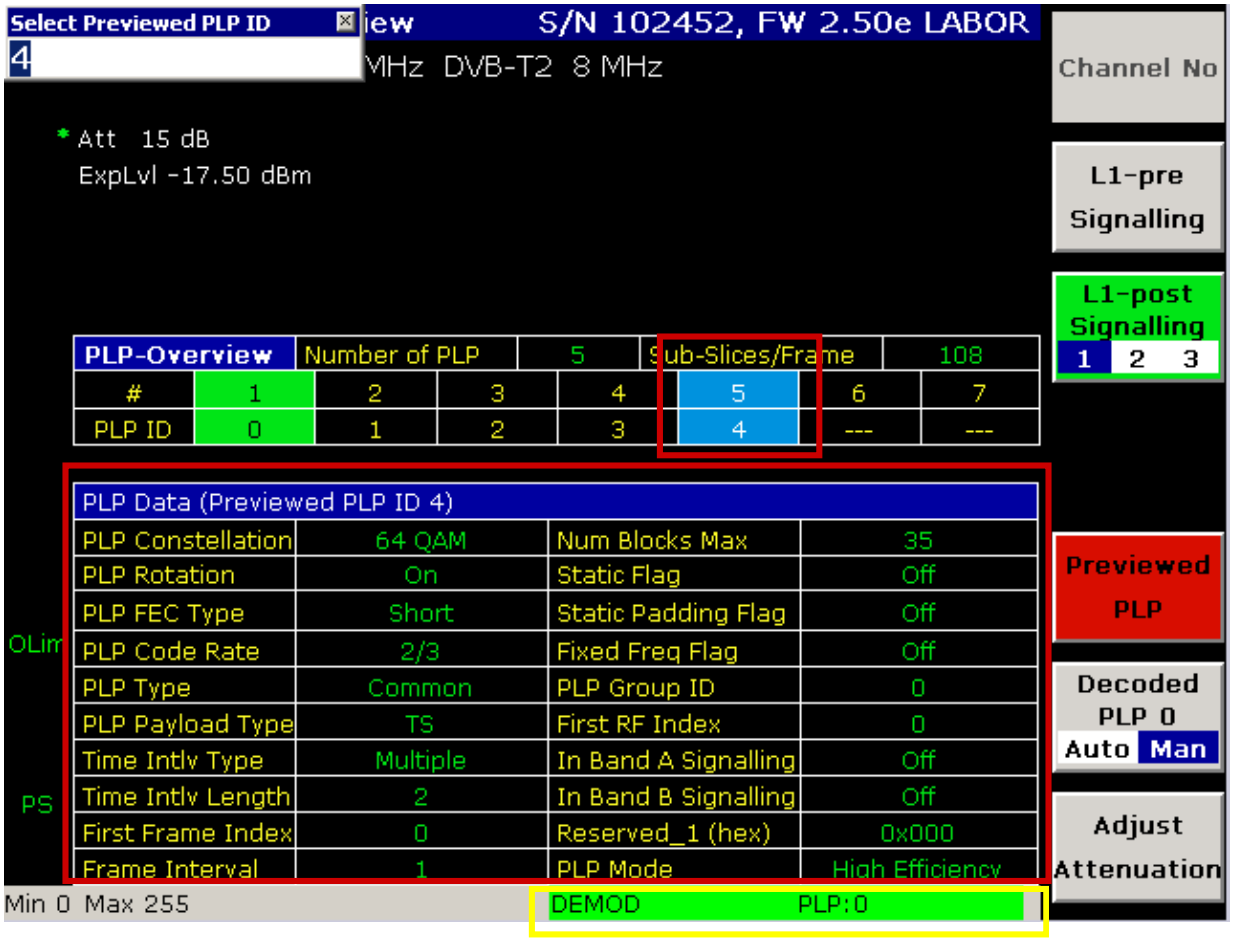
Multiple PLP with 5 PLPs **red frame**

decoding and data of PLP ID 0 (manually selected) **yellow frame**

Output of decoded PLP (in case of MPEG-2 TS)

MPEG-2 transport stream via ASI OUT of base unit

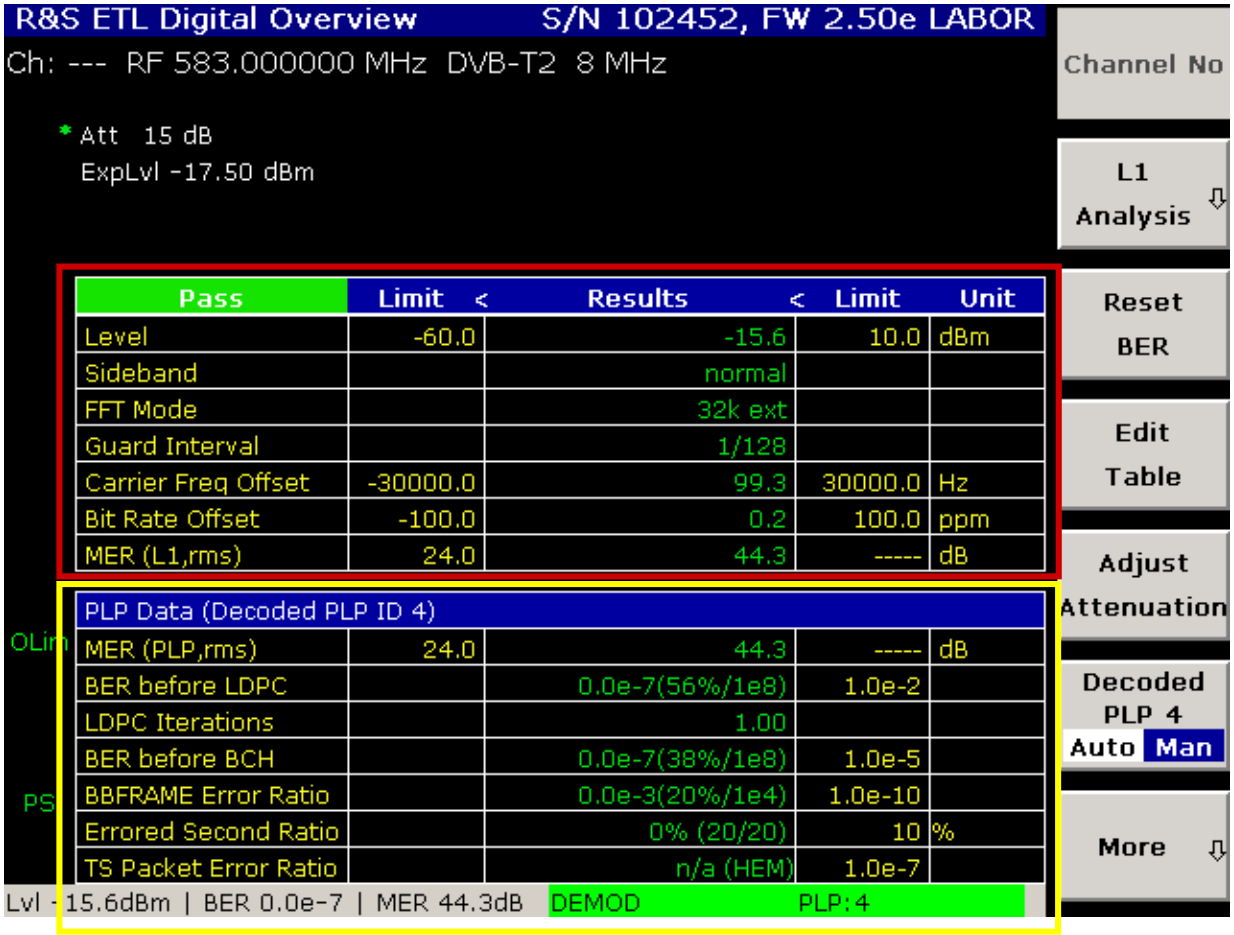
L1 post-signalling: Preview on PLP data



preview of PLP ID 4 — **red frames**

still decoding of PLP 0 (manually selected) — **yellow frame**

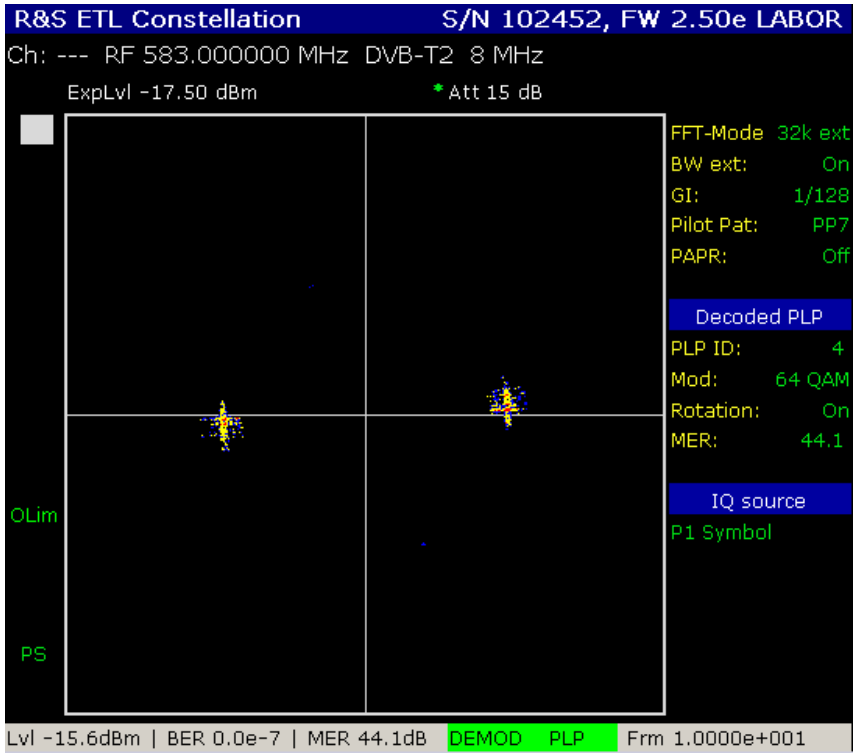
Overview



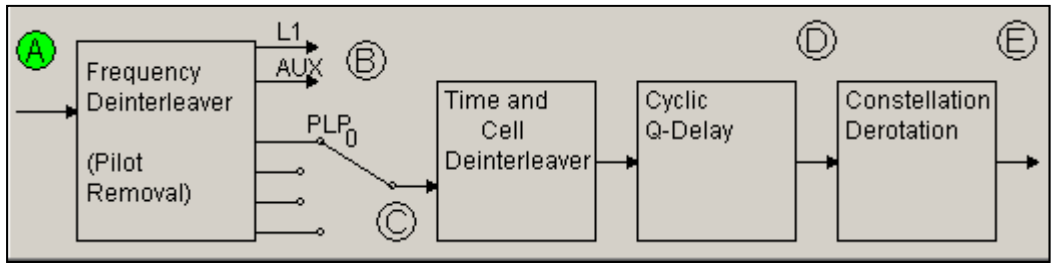
general DVB-T2 data with MER (L1, rms) **red frame**

PLP data of decoded PLP with specific MER **yellow frame**

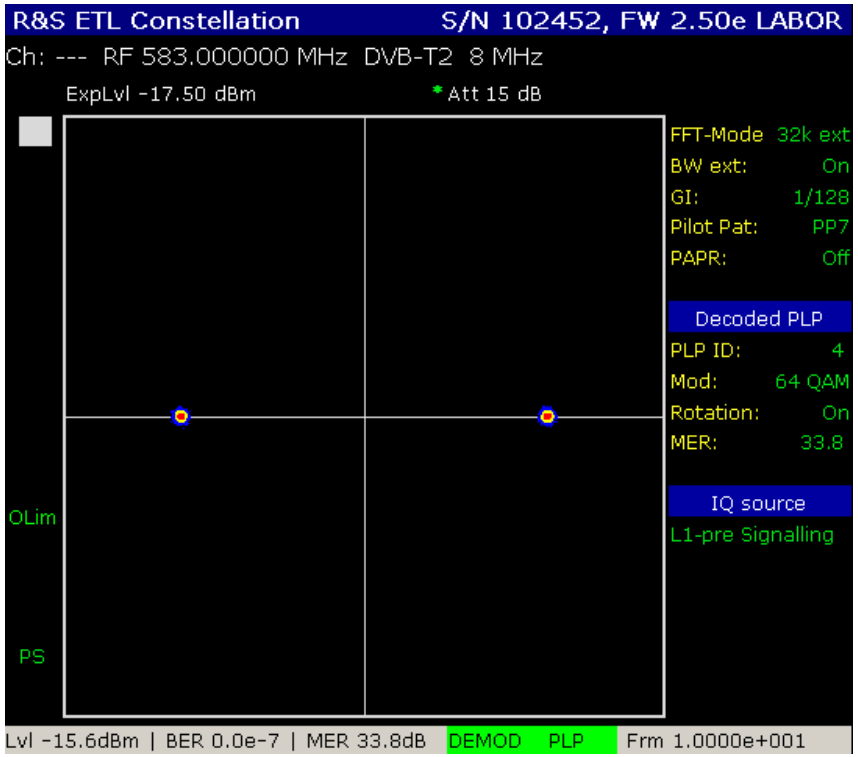
Modulation analysis by constellation diagram



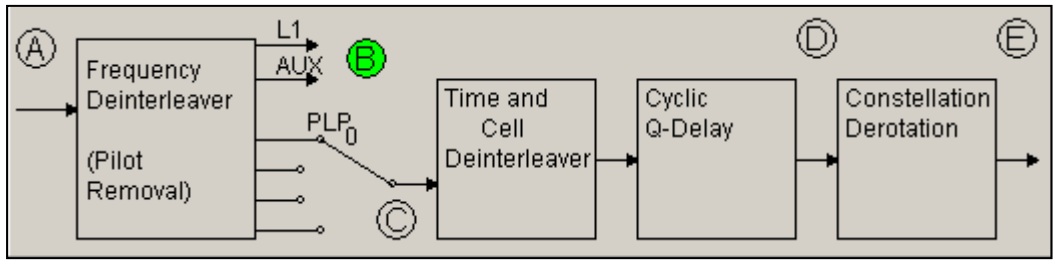
P1 Symbol



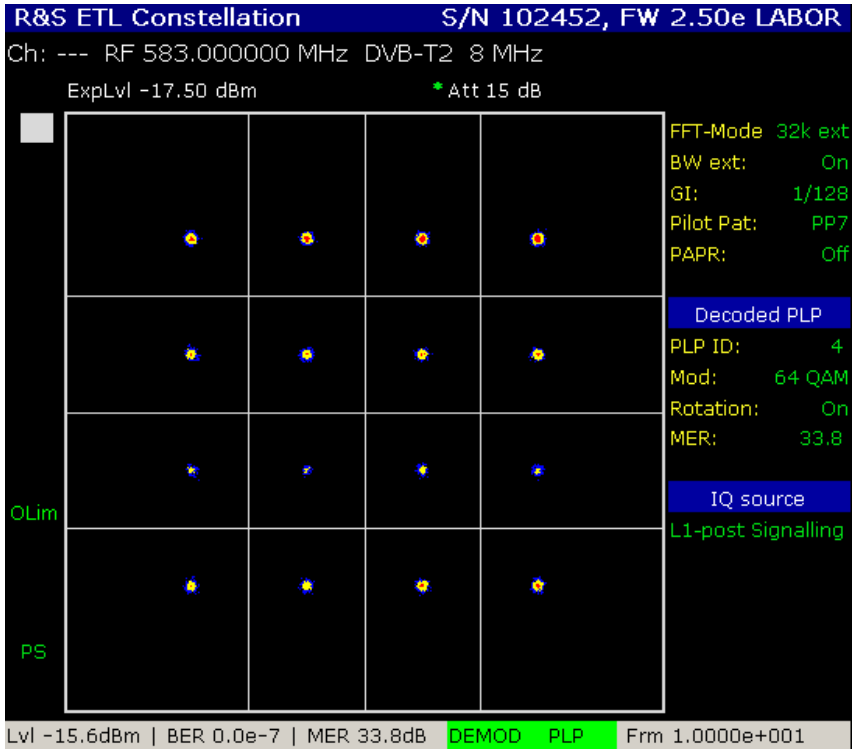
Modulation analysis by constellation diagram



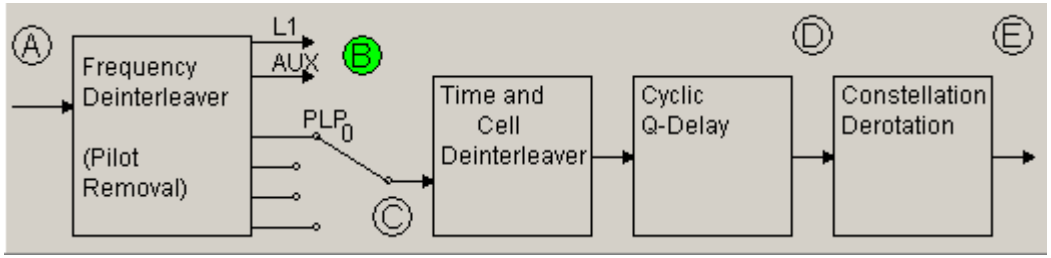
L1 pre-signalling



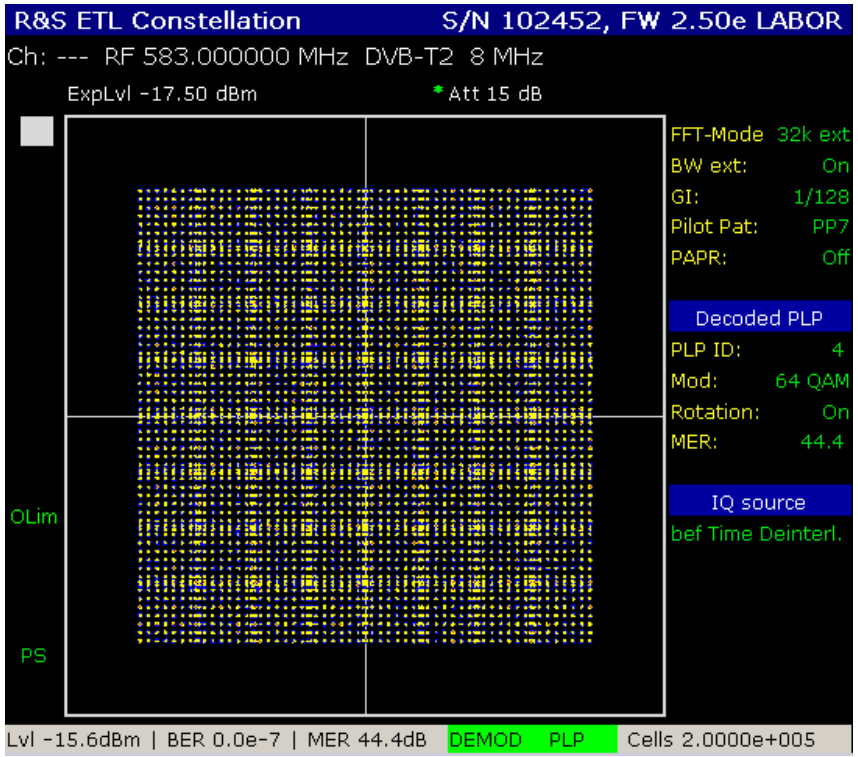
Modulation analysis by constellation diagram



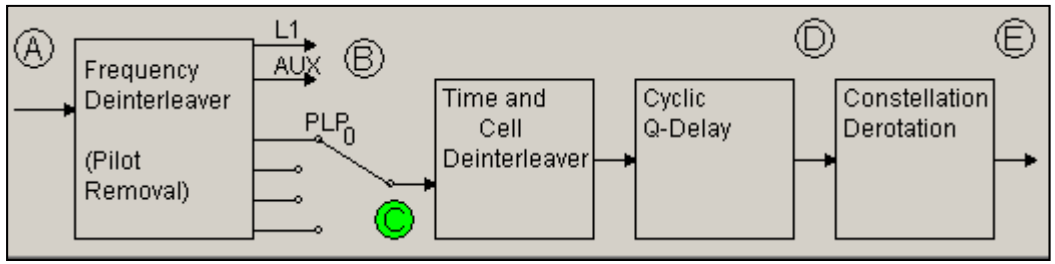
L1 post-signalling



Modulation analysis by constellation diagram

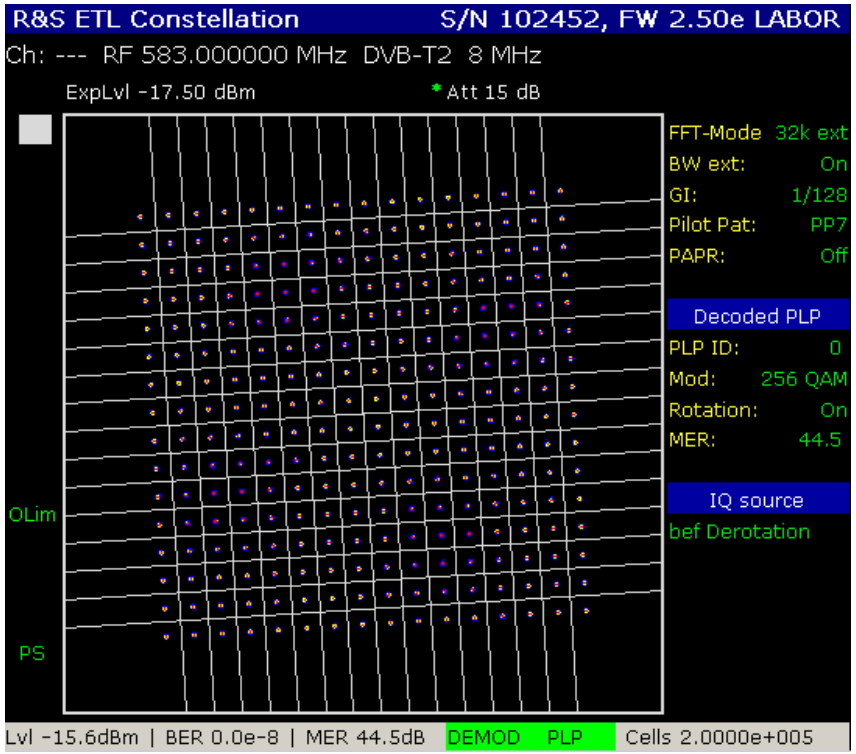


Before Time Deinterleaver



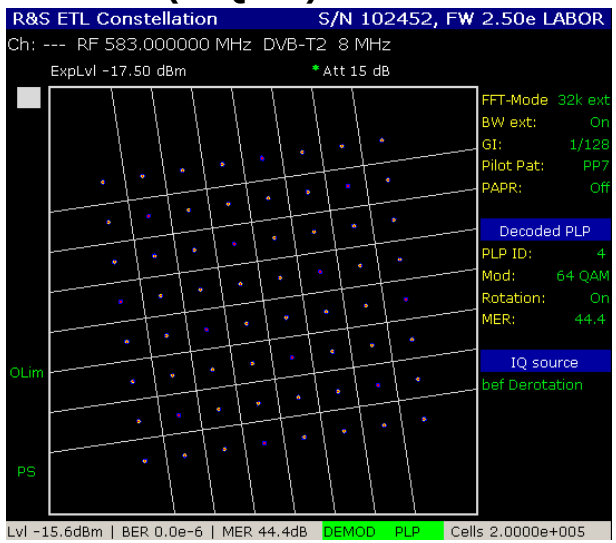
Modulation analysis by constellation diagram

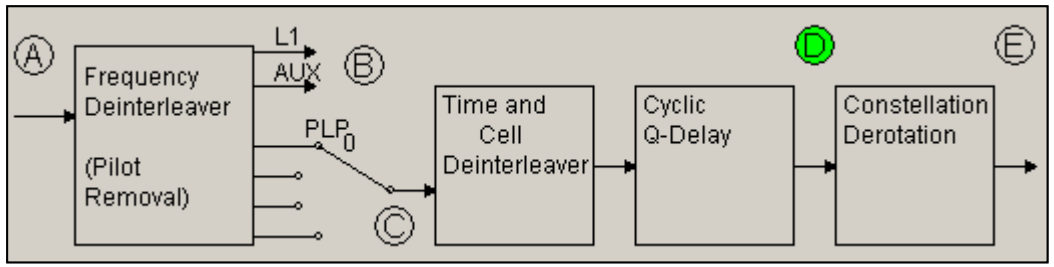
PLP ID 0 (256QAM)



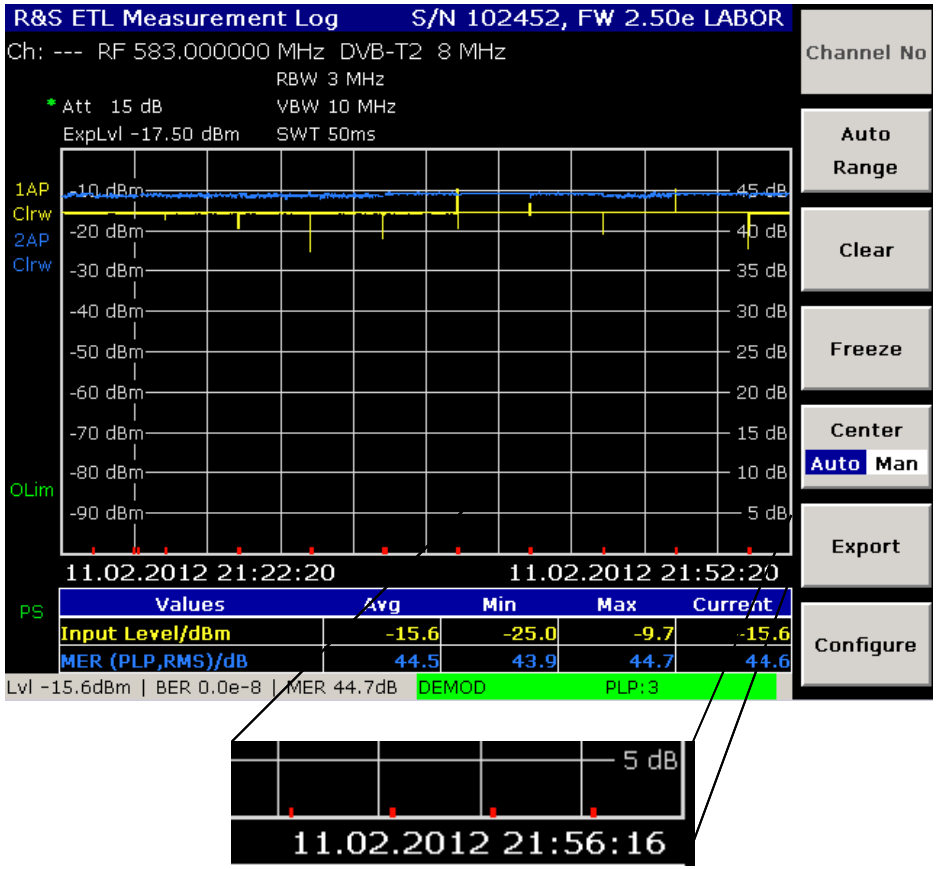
before Derotation

PLP ID 4 (64QAM)



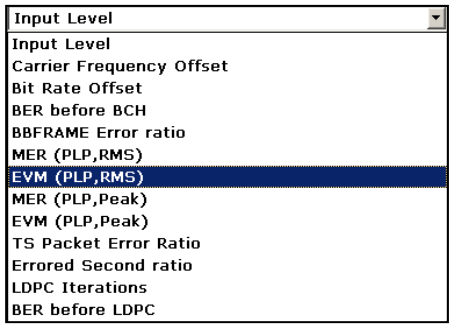


Long-term test with Measurement Log



Measurement Log R&S ETL-K208

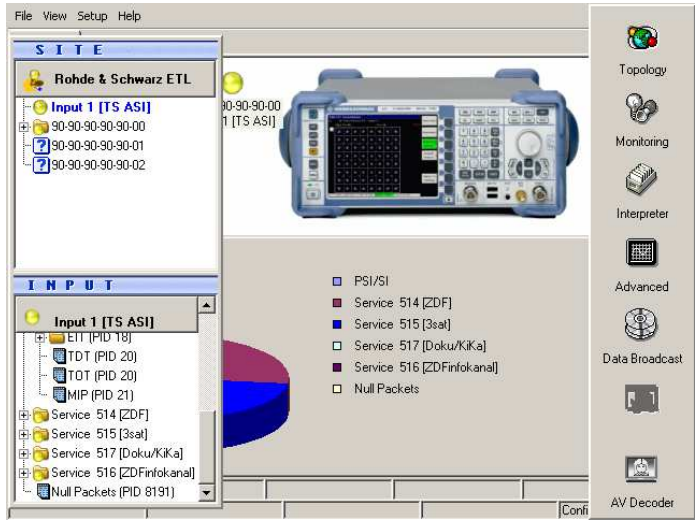
- for long-term tests (e.g. 24h)
- recording of most important DVB-T2 signal parameters
- detection of sporatic effects by min and max detector
- export function

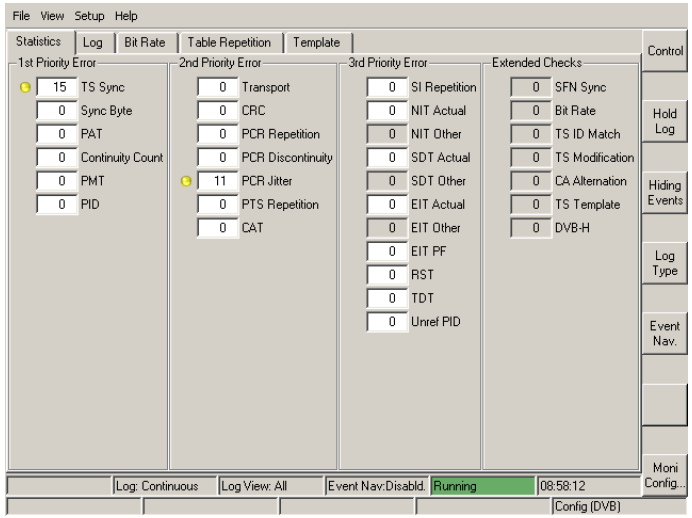


MPEG transport stream analyzer

Transport stream analyzer

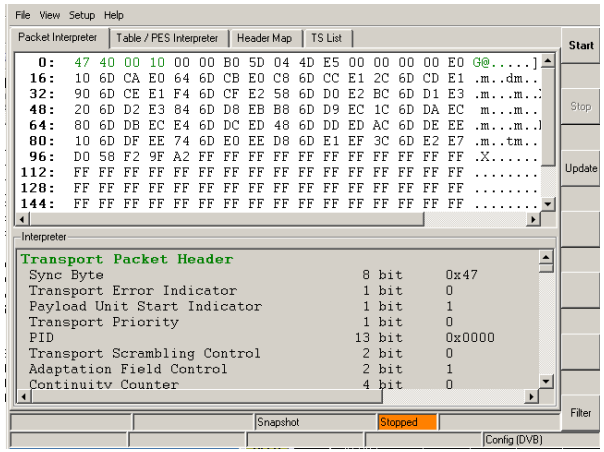
- **Analysis of the content of digital TV**

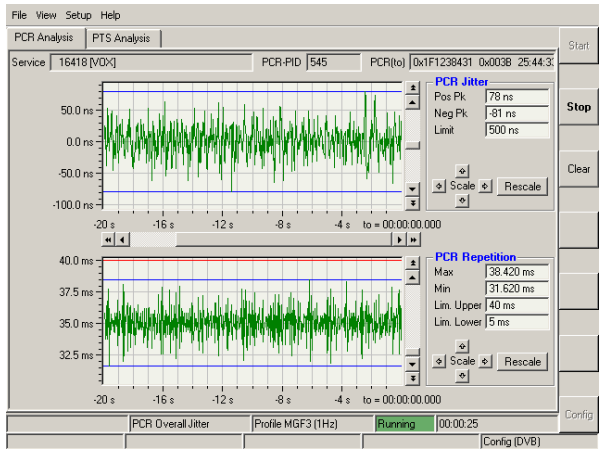




In-Depth Analysis

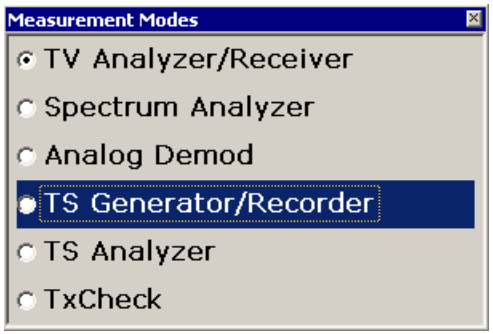
- **Table interpreter function for an in depth analysis (identification of content)**

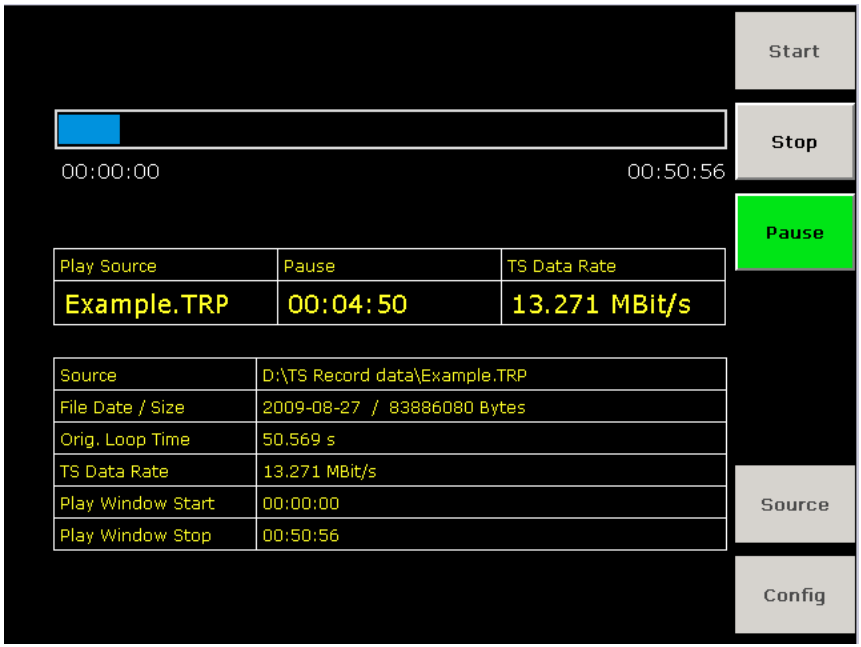




TS generator/recorder function

- **Recording of data up to 90 Mbit/s**
- **MPEG-2 TS generator for files with file format .GTS and .TRP**
- **The SD stream library [1)] is a part of the option R&S ETL-K280**

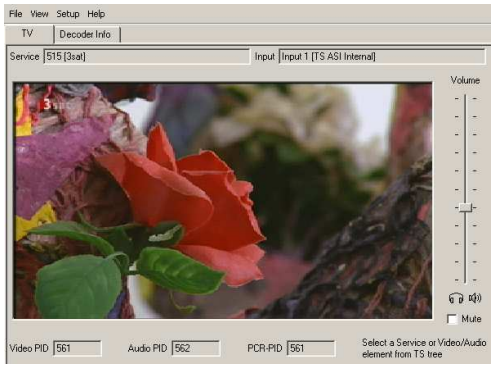




Audio Video HW Decoder

- **Decoding of MPEG-2 and H.264/AVC video content (SD)**
- **Support of HDTV**
- **Decoding of MPEG-1 and MPEG-2 layer 1 audio content**
- **Support of Dolby Digital AC-3 and HE-AAC**

ATV live picture



DTV live picture

MPEG Processing Board

- **1 x HDMI output for an external HDTV flat screen**
- **Common interface**

T-DMB/DAB firmware R&S ETL-K250

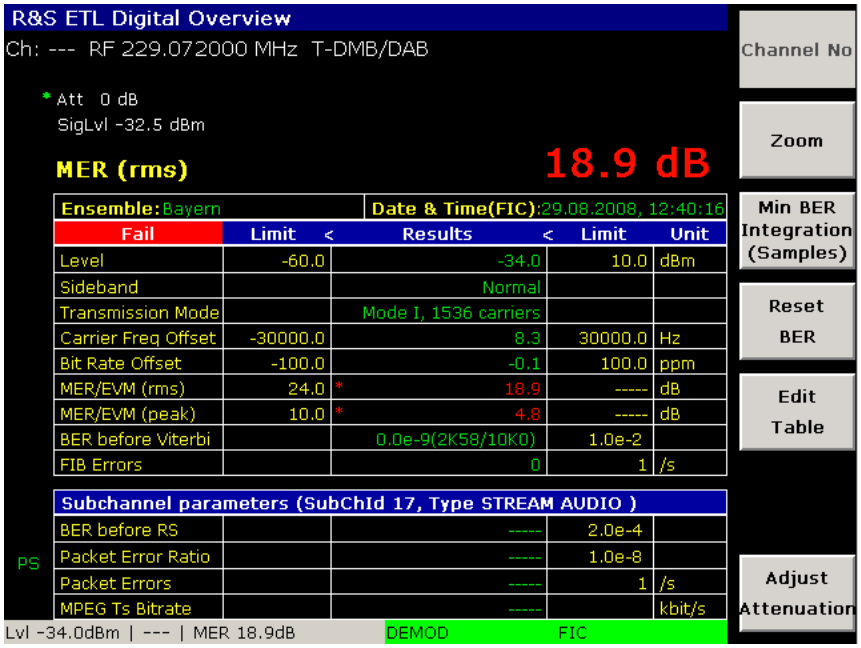
- **First high professional TV analyzer for T-DMB/DAB in the market!**
- **In depth RF signal analysis**

- **Designed for:**
  - **Commissioning and maintenance of T-DMB/DAB transmitter**
  - **Coverage applications**
  - **Quality assurance in production lines**
  - **R&D**

- **ETI interface for an external analysis on ETI streams**

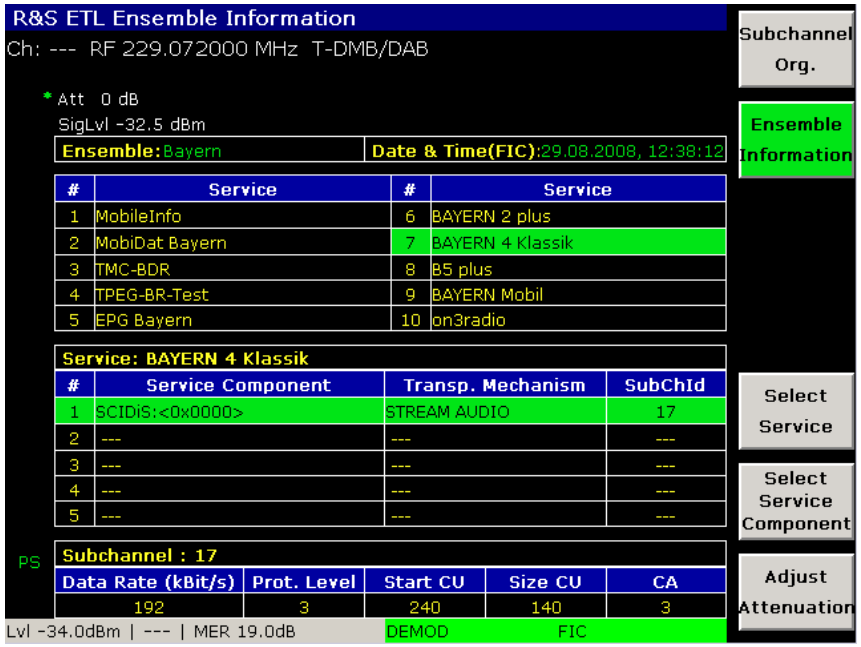
Measurements for T-DMB/DAB

- **The most important parameters in one view**
- **Sub channel parameters for T-DMB (MPEG-TS, stream data mode)**
- **Zoom function for selected parameter**



T-DMB/DAB FIC analysis

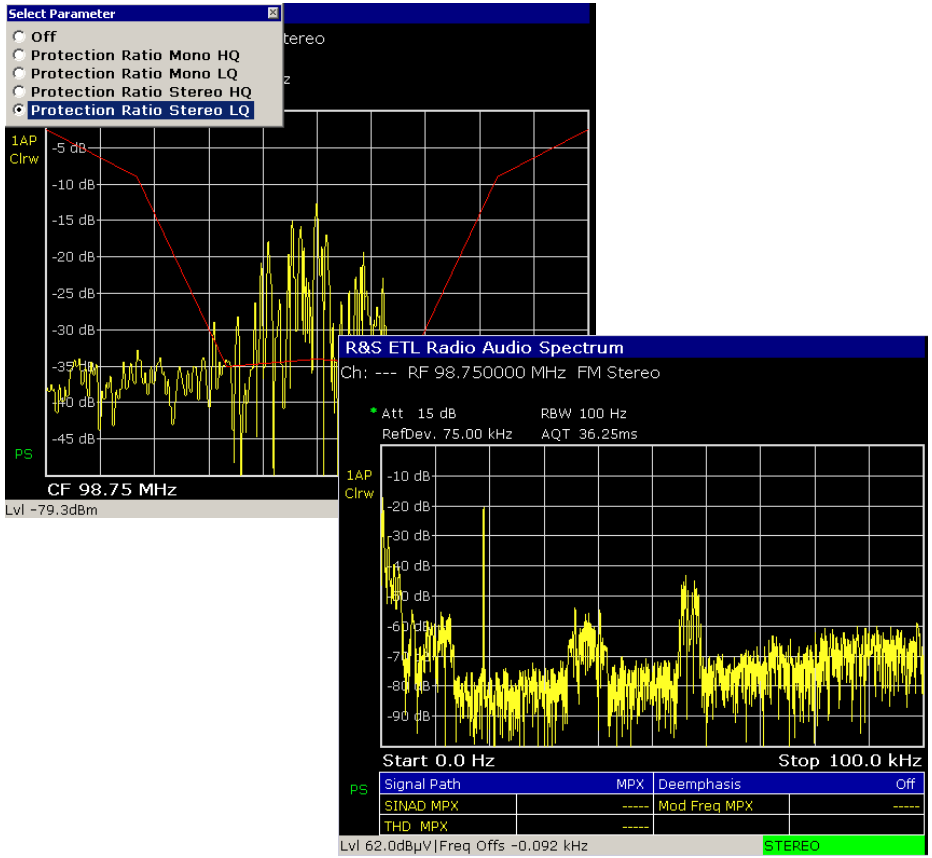
- **Structured presentation of an ensemble its services and service components with “ensemble information”**
- **Selection of a sub channel via service and service component**



FM (Radio) analyzer

RF and audio spectrum

- RF spectrum and audio spectrum
- Protection masks for stereo and mono



FM (Radio) analyzer

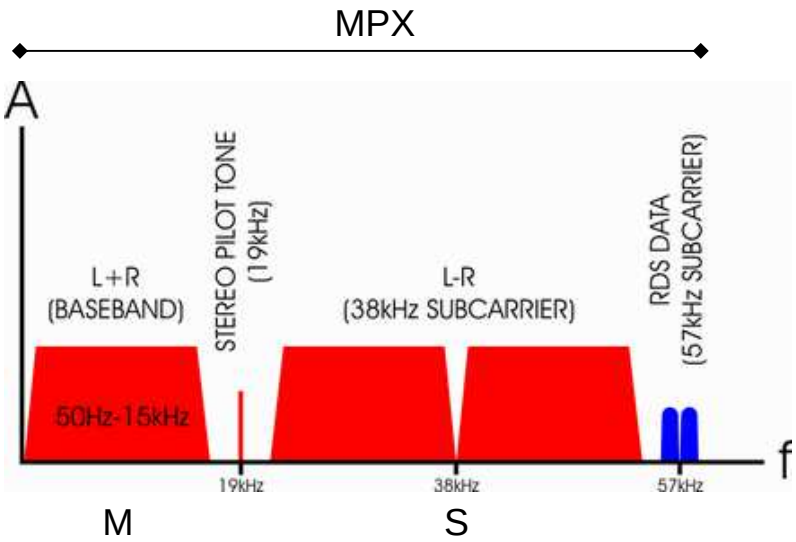
Overview

- **Compact overview about**

  - **level**
  - **carrier frequency offset**
  - **deviation of MPX, M, S and pilot, RDS, DARC**
  - **AM depth**
  - **pilot frequency offset**
  - **pilot phase offset**

	Pass	Limit <	Results	< Limit	Unit
	Level	47.0	62.0	117.0	dBµV
	Carrier Freq Offset	-30000	209	30000	Hz
	MPX Deviation	0	65924	150000	Hz
	M Deviation		47370	150000	Hz
	Pilot Deviation	0	7224	150000	Hz
	S Deviation		39109	150000	Hz
PS	AM Modulation Depth		0.7	1.0	%
	Pilot Frequency	18998.00	18999.65	19002.00	Hz
	38 kHz Phase	-3.0	0.8	3.0	°

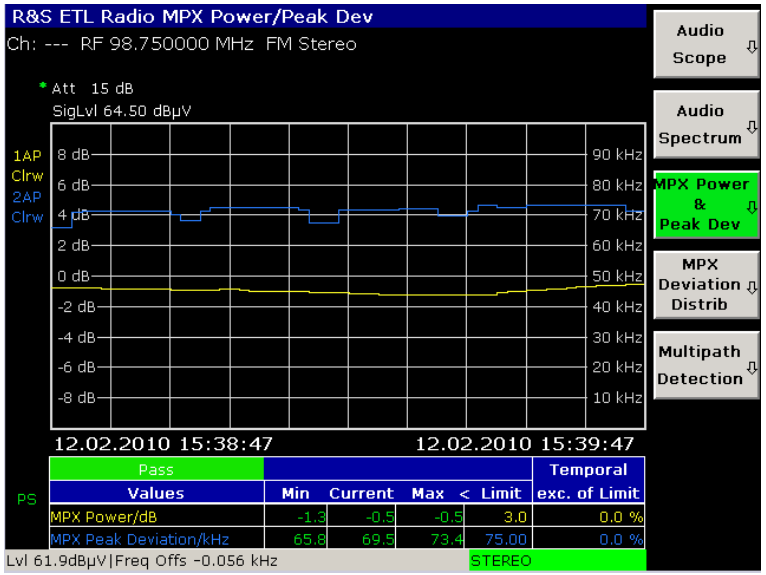
Lvl 62.0dBµV|Freq Offs +0.209 kHz STEREO



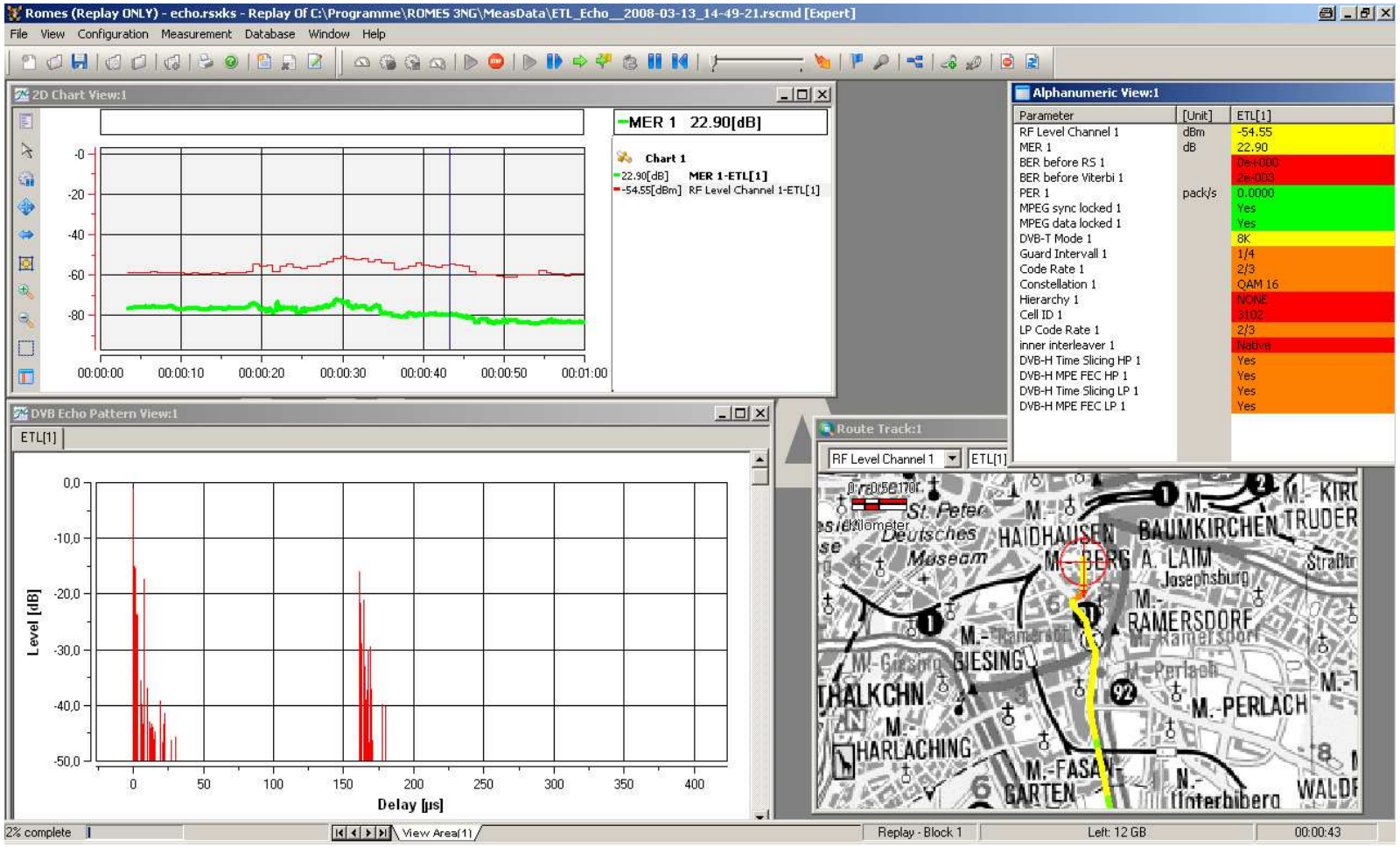
FM (Radio) analyzer

MPX Power & Peak Deviation

- **Important measurements to ensure, that the allowed channel power and channel bandwidth will be not exceeded**



Coverage measurements with R&S ROMES



75 Years of Driving Innovation
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Interfaces for an integration in monitoring systems and measurement vehicles

- **10/100 Base-T LAN**
- **USB host (for keyboard, mouse, memory stick)**
- **Ref in/out, Ext trigger/gate in**
- **GPIB interface**
- **DC interface**

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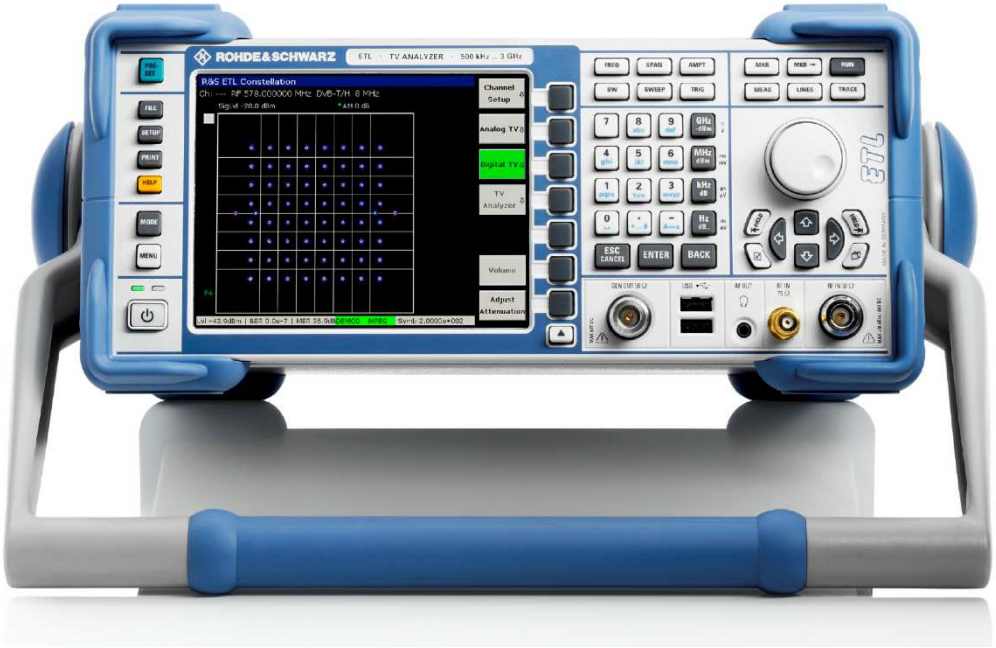

Thank you !