



### Four instruments in one

- 100Hz to 2400 kHz Level Generator**  
 For the generation of measuring voltage for the test of FDM transmission systems up to 600 channels
- 100Hz to 2400 kHz Level Meter**  
 For selective and wideband level measurements with auto ranging
- Spectrum Analyzer**  
 For the measurement of transmission characteristics as well as cross-talks and other interference signals.
- Psophometer**  
 For noise measurement in the speech channels according to ITU-T Rec. O.41

### APPLICATIONS

The **LEVEL TEST SET ET 91** is a hand held battery operated, multifunction measuring instrument, intended for the test of Carrier Frequency Systems up to 600 channel capacity, Power Line Carrier, Audio Tone, and FSK Communications Systems.

In selective receiving mode four special bandwidths are provided for the measurement of noise, carrier leak, cross-talk and non-linear distortion.

- Comfortable Frequency Setting Modes**

Test instructions of FDM systems often specify the test frequency in format: Carrier  $\pm$  Channel Frequency. In compliance with the mentioned format ET 91 provides the separate setting of carrier and audio frequencies and so:

No frequency calculation is required!

- Comfortable Frequency Tracking Modes**

The test procedure of FDM equipment usually requires different generator and level meter frequency settings. For example:

Feeding audio frequency test signal to the input of the tested channel on the following frequencies:

1000, 1200, 1400, 1600, etc Hz

Selective level measurement at a designated test point of the tested equipment on the following frequencies:

Carrier + 1000, 1200, 1400, 1600, etc Hz or  
 Carrier - 1000, 1200, 1400, 1600, etc Hz

Using up the advantageous feature of ET 91 that the generator and the level meter are in the same instrument extremely comfortable tracking modes are provided. In these modes the selective level meter is controlled by the generator according to the above mentioned rules.

No frequency calculation is required !

Only one frequency setting is required !

- Comfortable End to End Measurements**

For the test of carrier frequency cables and voice channels in Master-Slave mode.

The Master initializes the measurements and collects the results. The Slave performs the measurements according to the Master's commands and sends back the results. The two instruments communicate over the tested line.

- High Resolution Spectrum Analyzer**

ET 91 provides a high sensitivity spectrum analyzer suitable for the measurement of transmission characteristics as well as cross-talks and other interference signals.

The obtained spectrum trace can be evaluated in four modes like: NORM, PEAK, AVG, SAVG and interpreted in dBm or dBm/Hz

- Measuring Bridge**

ET 91 provides a built in bridge to perform the measurement of Return Loss, Impedance and LCL Balance according to ITU-T Rec. O.9.

- Memory Locations for Test Setups**

To speed up routine tests ET 91 provides memory locations for 100 user defined test setups containing generator, level meter test parameters and limit values for PASS/FAIL indication

- USB Ports for Result and Setup Transfer**

ET 91 has two USB ports for data transfer:

USB A host port for USB stick

USB B device port for PC connection

The USB stick provides data transfer between a PC and ET 91 without installing a special device driver to the PC. This solution is advantageous for the user who does not have administrative right to install a special driver to his PC.

PC program for data transfer is provided.

**SPECIFICATIONS**

**Transmitter**

Transmitting Modes  
 1 FREQ (Transmitting one single frequency)  
 MTTs (Transmitting Multi Tone Test Signal)  
 Frequency Range ... 100 Hz to 2400 kHz in 1 Hz steps  
 Frequency Accuracy .....  $2 \times 10^{-6} \pm 1$  Hz  
 Balanced and Coaxial Outputs  
 10 to 2400 kHz .....  $\sim 0, 75, 135 (125), 150 \Omega$   
 100 Hz to 10 kHz .....  $\sim 0, 600 \Omega$   
 Level Range of Balanced Output  
 For all impedances ..... +10 to -40 dBm, dB  
 Level Range of Coaxial Output  
 $\sim 0, \Omega$  ..... +10 to -40 dBm, dB  
 75, 135(125), 150  $\Omega$  ..... +10 to -40 dBm  
 600  $\Omega$  ..... +4 to -40 dBm  
 Level Resolution ..... 0.1 dB  
 Level Accuracy at 0 dBm Freq.>200Hz .....  $\pm 0,3$  dB

**Selective receiver**

Receiving Modes  
 1 FREQ (Receiving one single frequency)  
 MTTs (Receiving Multi Tone Test Signal)  
 Frequency Range ..... 100 Hz to 2400 kHz  
 Frequency Accuracy .....  $2 \times 10^{-6} \pm 1$  Hz  
 Direct Frequency Setting ..... in 1 Hz steps  
 Frequency Setting in Carrier  $\pm$  Tone Format  
 Carrier Frequency ..... 4 to 2396 kHz in 1 kHz steps  
 Tone Frequency .... 100 Hz to 3,9 kHz in 1 Hz steps  
 Band width  
 200 Hz to 10 kHz ..... 20 Hz  
 10 to 2400 kHz ..... 20, 200 Hz, 1.74, 1.95, 3.1 kHz  
 Balanced and Coaxial Inputs  
 10 to 2400 kHz ..... 75, 135 (125), 150  $\Omega$  or high  
 100 Hz to 10 kHz ..... 600  $\Omega$  or high  
 Measuring Range  
 With 20 Hz band width ..... -120 to +10 dB  
 Level Resolution ..... 0.1 dB  
 Level Accuracy at 0 dBm, Freq.>200Hz .....  $\pm 0,3$  dB

**Wideband Receiver**

Balanced and Coaxial Inputs  
 10 to 2400 kHz ..... 75, 135 (125), 150  $\Omega$  or high  
 100 Hz to 10 kHz ..... 600  $\Omega$  or high  
 Selectable 3 dB Band Filters      Measuring Ranges  
 100 Hz to 4kHz ..... -100 to +10 dB  
 1200 Hz to 120 kHz ..... -90 to +10 dB  
 3 kHz to 300 kHz ..... -90 to +10 dB  
 6 kHz to 600 kHz ..... -80 to +10 dB  
 12 kHz to 1200 kHz ..... -70 to +10 dB  
 24 kHz to 2400 kHz ..... -70 to +10 dB  
 Level Resolution ..... 0.1 dB  
 Level Accuracy at 0 dBm, Freq.>200Hz .....  $\pm 0,3$  dB

**Receiver - Transmitter Tracking Mode**

The receiver is controlled by the transmitter  
 Tx Frequency ..... 100 Hz to 3,9 kHz in 1 Hz steps  
 Carrier Frequency ..... 4 to 2396 kHz in 1 kHz steps  
 Receiver Frequency = Carrier  $\pm$  Tx Frequency

**Wideband Noise Measurement**

Frequency Range ..... 100 Hz to 2400 kHz  
 Filters ..... Psophometer, 3.1, 4, 20, kHz  
 120, 300, 600, 1200, 2400 kHz  
 Measurement times ..... 1, 5, 10, 30 sec  
 1, 5, 10, 30 min  
 1, 2, 4, 8, 12, 24, 48, 72 hours  
 Evaluation  
 For 1 sec to 1 min ..... Quasi analog  
 Over 1 min ..... Histogram with 60 time slots

**Impulse Noise Measurement**

Pulse width ..... >500 ns  
 Interval size ..... 10 ms  
 Threshold range ..... 1 to 500 mV  
 Maximum count ..... 65000  
 Measurement times ..... 1, 5, 10, 30 sec  
 1, 5, 10, 30 min  
 1, 2, 4, 8, 12, 24, 48, 72 hours  
 Evaluation  
 For 1 to 30 sec ..... Numeric  
 Over 30 sec ..... Histogram with 60 time slots

**Spectrum Analyzer**

Frequency Range ..... 100 Hz to 2400 kHz  
 Line impedances  
 10 to 2400 kHz ..... 75, 135(125), 150  $\Omega$  or High  
 100 Hz to 10 kHz ..... 600  $\Omega$  or High

Frequency Range	Bandwidth & Freq. Step
2,4 MHz	500 Hz to 8 kHz
1,2 MHz	500 Hz to 4 kHz
600 kHz	500 Hz to 2 kHz
300 kHz	500 Hz to 1 kHz
20 kHz	50 Hz to 100 Hz
4 kHz	10 Hz to 20 Hz

Display range ..... down to -140 dBm/Hz  
 Number of displayed frequencies ..... 300  
 Saving of result ..... the actual content of display  
 Evaluation ..... NORM, PEAK, AVG, SAVG  
 Units ..... dB, dBm, dBm/Hz

**LCL Balance Measurement**

Impedance  
 10 to 2400 kHz ..... 75, 135 (125), 150  $\Omega$   
 200 Hz to 10 kHz ..... 600  $\Omega$   
 Display range ..... 0 to 70 dB  
 Accuracy at 40 dB  
 200 Hz to 10 kHz .....  $\pm 2$  dB  
 10 to 2400 kHz .....  $\pm 1$  dB



**Return Loss Measurement**

Nominal Impedance (Z)	
10 to 2400 kHz.....	75, 135 (125), 150 Ω
200 Hz to 10 kHz .....	600 Ω
Impedance limits .....	Z/2 to 2Z
Display range .....	0 to 40 dB
Accuracy at 20 dB	
200 Hz to 10 kHz .....	± 2 dB
10 to 2400 kHz.....	±1 dB
500 to 2400 kHz .....	±2 dB

**NEXT / LOSS Measurement**

Frequency	
Frequency Range .....	100 Hz to 2400 kHz
Resolution .....	Automatically changed with range
Output Impedances	
10 to 2400 kHz .....	75, 135 (125), 150 Ω
100 Hz to 10 kHz.....	600 Ω
Input Impedances	
10 to 2400 kHz .....	75, 135 (125), 150 Ω or High
100 Hz to 10 kHz.....	600 Ω or High
Measuring range.....	up to 80 dB

**Impedance Measurement**

Measuring range	
10 to 2400 kHz .....	50 to 400 Ω
200 Hz to 10 kHz.....	300 to 1600 Ω
Accuracy	
200 Hz to 10 kHz.....	± 10% ± 5 Ω
10 to 2400 kHz .....	±5% ± 5 Ω

**Group Delay Distortion Measurement (SW Option)**

Test signal .....	37MTT, 200 to 3700 Hz
Resolution.....	100 Hz
Z output / input.....	600 Ω
Output level .....	-30 dB/tone (-7dB peak)
Input level range .....	-60 to -20 dB/tone
Group delay distortion range .....	0 to 10 ms
Resolution.....	1 μs
Accuracy.....	According to ITU.O.81

**Phase Jitter & Freq Error Meas. (SW Option)**

Test signal.....	1020 Hz, 0 to -30 dBm
Phase Jitter measurement (O.91)	
Measuring range .....	0.2 to 30.0 degrees p-p
Filter .....	4 to 300 Hz
Frequency Error Measurement	
Measuring range .....	± 30 Hz
Resolution .....	0.1 Hz

**External Attenuator (HW Option)**

Attenuation .....	40 dB
Frequency Range .....	10 kHz to 2400 kHz
Accuracy .....	±0.5 dB
Max. input level .....	+40 dB
Input Impedance .....	>3.7 kΩ Coax
Output connector .....	Balanced
ET91 settings .....	Balanced, Unterminated, dB

**Micro Interruption Measurement (SW Option)**

Test Signal	
Frequency .....	1020 Hz
Input level .....	from 0 to -30 dBm
Impedance .....	600 Ω
Selectable Threshold	
Below the normal input level .....	3, 6, 10, 20 dB
Accuracy of Threshold	
For 3, 6, 10 dB.....	± 1 dB
For 20 dB.....	± 2 dB
Measuring time adjustable.....	4 min to 72 hours
	4, 8, 12, 24 min
	1, 2, 4, 8, 12, 24, 48, 72 hour
Interruption Categories .....	0.6 ms to 3 ms
	3 ms to 30 ms
	30 ms to 300 ms
	300 ms to 1 min
	>1 min
Evaluation .....	Relative duration, Errored sec Count & time distribution/category

**GENERAL SPECIFICATIONS****Power supply**

Internal rechargeable NIMH battery pack	
Operation time .....	approx. 8 hours

**Charging**

From 230V mains .....	with mains adapter
From 12V car battery .....	with car adapter
Fast charging time .....	less than 3 hours

**Display** ..... 320 x 240 dot TFT LCD

**Connectors**

For mains or 12V car adapter.....	2.1/5.5 mm coaxial
Balanced connectors .....	4 mm banana sockets
Coaxial connectors .....	BNC sockets
Ground connector .....	4 mm banana socket
USB A .....	USB 1.1 host port for USB stick
USB B .....	USB 1.1 device port to connect PC

**Over voltage protection**

Between a and b or ground .....	200V DC
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**Ambient temperature ranges**

Reference .....	23±5°C
	Rel. humidity 45% to 75%
Normal operation .....	0 to +40°C
	Rel. humidity 30% to 75% *(<25g/m <sup>3</sup> )
Limits of operation .....	-5 to +45°C
	Rel. humidity 5% to 95% *(<29g/m <sup>3</sup> )
Storage and transport .....	-40 to +70°C
	Rel. humidity 95% at +45°C *(<35g/m <sup>3</sup> )
* without condensation	

**Dimensions**.....224 x 160 x 44 mm

**Weight**.....approx. 1.5 kg

**ORDERING INFORMATION****LEVEL TEST SET ET 91** .....437-000-000**Including:**

Operating Manual  
 Short form Operation Instruction  
 Calibration Certificate  
 CD (xxx version)  
 2 Balanced Measuring Cables  
 2 Coaxial Measuring Cables  
 USB cable  
 USB stick  
 Mains adapter 100 to 264 VAC  
 Carrying case  
 Battery pack (built in)

**OPTIONS**

40 dB External Attenuator coax ..... Y 107-439  
 40 dB External Attenuator balance ..... Y 107-448  
 Group Delay Distortion  
   Measurement ..... SW437-570-000  
 Phase Jitter and Frequ. Error Meas. SW437-560-000  
 Micro Interruption Measurement ..... SW437-530-000  
 Spectrum referencia result..... SW437-590-000  
 Spectrogram SW set ..... SW437-580-000  
 Spectral Trace as Reference ..... SW437-590-000  
 PC control program (result transfer  
   and parameter editor) .....SW437-100-000  
 Car lighter power adapter EAA10 ..... 367-000-000

DATA SUBJECT TO BE CHANGED WITHOUT PRIOR NOTICE

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