

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 Ω +10 to -40 dBm
 600 Ω +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 Ω or high
 100 Hz to 10 kHz 600 Ω 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 Ω or high
 100 Hz to 10 kHz 600 Ω 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 Ω or High
 100 Hz to 10 kHz 600 Ω 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 Ω
 200 Hz to 10 kHz 600 Ω
 Display range 0 to 70 dB
 Accuracy at 40 dB
 200 Hz to 10 kHz ± 2 dB
 10 to 2400 kHz ± 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 & Frequ 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 (Without backlight)

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 LCD with backlight

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

Ambient temperature ranges

Reference..... 23±5°C
Rel. humidity 45% to 75%
Normal operation..... 0 to +40°C
Rel. humidity 30% to 75% *($<25\text{g/m}^3$)
Limits of operation..... -5 to +45°C
Rel. humidity 5% to 95% *($<29\text{g/m}^3$)
Storage and transport..... -40 to +70°C
Rel. humidity 95% at +45°C *($<35\text{g/m}^3$)
* 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:

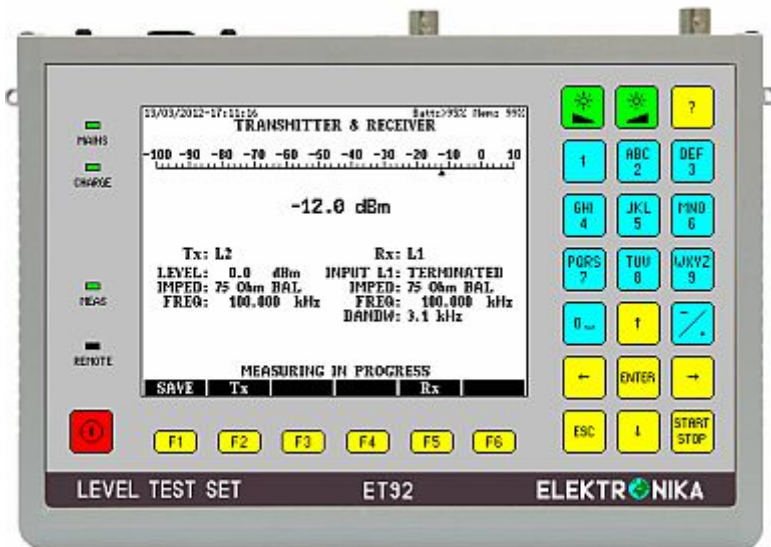
Operating Manual
Calibration Certificate
CD (xxx version)
2 Balanced Measuring Cables
2 Coaxial Measuring Cables
USB cable
Mains adapter 100 to 264 VAC
Carrying case

OPTIONS

40 dB External Attenuator Y 107-439
Group Delay Distortion
 Measurement SW437-570-000
Phase Jitter and Freq. Error Meas. SW437-560-000
Micro Interruption Measurement SW437-530-000
Spectrum referencia result SW437-590-000
Spectrogram SW set SW437-580-000
PC control program (result transfer
 and parameter editor)..... SW 437-100-000

DATA SUBJECT TO BE CHANGED WITHOUT PRIOR NOTICE

12.09.2011



FOUR INSTRUMENTS IN ONE

- 100Hz to 6 MHz Level Generator**
 For the generation of measuring voltage for the test of different FDM and tone frequency transmission systems.
- 100Hz to 6 MHz 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.
- Event Counter**
 For the simultaneous counting of Amplitude hits, Phase hits, Interruptions and Noise Impulses

APPLICATIONS

The **LEVEL TEST SET ET 92** is a hand held battery operated, multifunction measuring instrument, intended for the test of Carrier Frequency Systems, Power Line Carrier, Tone, and FSK Communications Systems.

In selective receiving mode five special bandwidths are provided for the measurement of noise, carrier leak, cross-talk and non-linear distortion. Numerous useful software options are provided to make ET 92 more effective.

- 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 92 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 92 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 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 92 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

- PC supported Spectrogram (Option)**

The purpose of Spectrogram PC program is to boost the spectrum measurement abilities of ET 92 utilizing the memory capacity of a PC. Spectrum measurements are performed in every second and the obtained results are continuously transferred to the PC via USB port to store and to display them. The large memory capacity of PC allows the storage the results of long test sequences up to 72 hours. The spectrum is displayed on a 3 dimension picture

- USB Ports for Result and Setup Transfer**

ET 92 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 92 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.

- Memory for Test Setups**

ET 92 provides 100 memory locations for user defined test setups and limit values for the evaluation of test results.

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

PC Control Program (SW Option)

The purpose of the control program is to establish data transfer between ET 92 and PC via USB interface. The program provides four functions:

- Test result transfer and post processing
- Test setup transfer and edition
- Checking the features of ET 92
- Spectrogram control

Spectral Trace as Reference (SW Option)

The obtained result of spectrum measurement can be stored and used as a reference for the subsequent measurements. The actual spectral trace and the reference are displayed together

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 k Ω Coax
Output connector	Balanced

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 μ s
Accuracy	According to ITU.O.81

Phase Jitter & Frequ 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

Simultaneous Event Counting (SW. Option)

Measurement times	5, 15, 30, 60 min
Test signal	1020 Hz, 0 to -30 dBm
Maximum count for each counter	65000

Amplitude Hit Counter (O.95)

Threshold range	2 to 9 dB
Guard interval	4 ms
Dead time	125 \pm 25 ms
Dead time after interruption (>10 dB drop)	1 s

Phase Hit Counter (O.95)

Threshold range	5 to 45 $^\circ$
Guard interval	4 ms
Dead time	125 \pm 25 ms

Interruption counter (O.61)

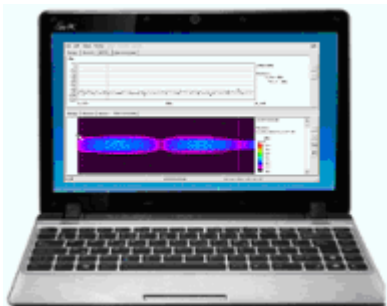
Threshold	6, 10 dB
Guard interval	2 ms
Dead time	3 \pm 1 ms

Impulsive Noise counter (O.71)

Filter	1020 Hz Notch
Guard interval	20 μ s
Dead time	125 \pm 25 ms
Threshold range	0 to -50 dBm

The **Spectrogram PC Program** is an excellent tool of ET 92 to discover the disturbers causing considerable service impairment to communication systems. The trouble shooting is usually very difficult because:

- **The disturbing signals appear in unpredictable times**
- **They appear in unpredictable frequency ranges**



In **Spectrogram** mode ET 92 performs spectrum measurements in every second. The results are directly transferred to PC via USB port or indirectly by means of a memory stick when the measurement is completed.

Utilizing the large memory capacity and large display of PC the spectrogram program shows the results in form of "Waterfall" diagram in which:

- **The time is displayed on the vertical axis**
- **The frequency is displayed on the horizontal axis**
- **The level is interpreted in form of colors**

GENERAL SPECIFICATIONS

Power supply

Internal rechargeable NIMH battery pack
Operation time .. approx. 8 hours (Without backlight)

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 LCD - TFT

Connectors

For mains or 12V car adapter 2.1/5.5 mm coaxial
Balanced connectors 4 mm banana sockets
Coaxial connectors BNC sockets
USB A USB 1.1 host port for USB stick
(FAT16, FAT32 file system supported)
USB B USB 1.1 device port to connect PC

Over voltage protection

Between a and b or ground 200V DC

Ambient temperature ranges

Reference 23±5°C
Rel. humidity 45% to 75%
Normal operation 0 to +40°C
Rel. humidity 30% to 75% *(<25g/m³)
Limits of operation -5 to +45°C
Rel. humidity 5% to 95% *(<29g/m³)
Storage and transport -40 to +70°C
Rel. humidity 95% at +45°C *(<35g/m³)
* without condensation

Dimensions 224 x 160 x 44 mm

Weight approx. 1.5 kg

ORDERING INFORMATION

LEVEL TEST SET ET 92 443-000-000

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
Carrying case
Battery (built-in)

HW Options:

40 dB External Attenuator coax Y 107-439
40 dB External Attenuator balance Y 107-448
Car lighter power adapter EAA 10 367-000-000

SW Options:

Micro Interruption Measurement SW443-530-000
Synchronous Event Counter SW443-540-000
Group Delay Distortion Meas. SW443-550-000
Phase Jitter and Frequ. Error Meas. SW443-560-000
Spectrogram SW set SW443-580-000
Spectral Trace as Reference SW443-590-000
PC Control Program SW443-100-000