aTen ACT6000
Advanced Communication Tester

SINE SIGNAL & NOISE GENERATOR | SELECTIVE LEVEL METER | CROSS TALK METER | SPECTRUM & NETWORK ANALYZER
LONGITUDINAL BALANCE & RETURN LOSS METER MICROINTERRUPTION & IMPULSIVE NOISE METER
VOLTAGE | RESISTANCE | CAPACITANCE METER
TDR & RESISTANCE FAULT LOCATOR
POTS DEVICE SIMULATOR

The ACT6000 has a variety of test features including transmission, metallic, and special tests. These features make it one of the most advanced Test Sets for qualifying and maintenance of advanced transmission systems. Its copper pairs can be used for various telecommunication services: POTS, ISDN, T1, E1, HDSL 1/2P, SHDSL, ADSL, ADSL2+, VDSL2, VDSLp

ERGONOMIC CHARACTERISTICS

- Color LCD High-Resolution Graphic Display
- Keypad and Function Keys
- Port Connections
- Interfaces

DATA-COMMUNICATION CHANNELS & COPPER PAIRS QUALIFICATION / CERTIFICATION

When the ACT6000 is coupled with another of its kind, they can perform easy and quick Single-End Line Tests and End-to-Line Tests. The wide measurements of the ACT6000 allow for qualification and certification on various communication carriers and copper pairs used for digital streams with bandwidth up to 6 MHz (or 35 MHz - optional). The instrument can automatically extrapolate and accurately predict the expected data rate of the copper line under testing for the ADSL, ADSL2+, VDSL2, and VDSL.

COPPER PAIRS DIAGNOSTIC & FAULTS FINDING/LOCATION

The ACT6000 can be configured for troubleshooting by using special functions and internal optional modules to localize anomalies and/or faults on the copper line and on communication systems.

FAULTS LOCATIONS

A powerful TDR allows the quick identification of not only the End-of-Line Test but also the location of possible faults or anomalies. These events could be interruptions, short circuits, insulation breakdowns, bridge-taps, split pairs, and the possible micro-interruption thanks to the Sample & Hold test modality. The Resistive Bridge - Fault Locator allows localization of various combinations of low insulation points.

DATA-AUTOMATIC SINGLE-END LINE QUALIFICATION

To start an Automatic Sequence to perform a complete set of electrics and transmission tests to qualify the line for a specific service requires the optional ASW-1 software. For the ADSL, ADSL2+, and VDSL2 services this is where the S/N Ratio and maximum BitRate estimations are added.
Once the sequence is finished (about 100 seconds) a summary table will appear on the screen with a pass/fail indication for each result using the international acceptability criteria and transmission masks - ETSI or ANSI. This will be shown in red. The results can be saved on the device and then visualized or exported on the USB pendrive or PC as .CSV file (Windows Excel compatible) or as .BMP photo of the screen.

POWER SPECTRUM DENSITY (HIGH IMPEDANCE)

The ACT6000's Spectrum Analyzer can operate on various frequency bands, readout mode, and special Front/End configuration as the High Impedance. When using the High Impedance configuration (non-intrusive mode), it is possible to perform the PSD to verify the spectrum and energy of any digital stream connecting the input instrument on active and powered lines. On the Main Distribution Frame or Street Cabinet, another PSD application is to perform a quick signals map.

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TESCOM

General

Case
ABS shielded for EMI / EMC.
Connections
- "RTX" connectors IN/OUT and "TX" OUT triple banana-jack;
- polarized connector for external supply;
- RJ-45/4 connector for headset;
- USB port for PC connector;
- USB for pen-drive connector.

Display
LCD color 320 x 240 pixel (¼ VGA) backlit.
Power Supply (Internal)
- Rechargeable battery pack (green) NiMh, with life of about 8 h. (typical), 5 h. (minimum).
- External: from 16,5 to 26,5 Vdc / max 2,5 Ah.

Dimensions and Weight
150 x 210 x 50 mm / 1,5 Kg. (batteries included).
Temperature Range
Operating: -5¸ +50° C. / Storage -20¸ +70° C.
Humidity Range
5 / 90% non-condensing.
Overvoltage Protection
In/Out RXT connectors up to 150 Vdc / 140 Vpp.
Reference Frequency Accuracy
- ±1 ppm within the operating temperature ±2 ppm/year.

Reference Level Accuracy
- ±0.025% within the operating temp. ±0.025% / year.

CE mark - EMC
Direcvtice 2004/108/CE, 89/336/EEC,
Decree 2007/194 CISPR 11, ISO
14253 and CEI EN: 61326/A1/A2,
55011, 61000-4-2, 61000-4-3,
61000-4-4, 61000-4-6, 61000-4-11.
Special Features and Setup
- Results storage on internal flash memory;
- Software update and Results
- Exportation on Pen Drive or PC;
- PC Remote interface by USB port.

Level Generator

Sine output frequency range
- base band: from 20 Hz to 25 kHz
- med. band: from 20 kHz to 6 MHz
- high band*: from 20 kHz to 35 MHz

Reference Frequency Accuracy
±1 ppm within the operating temp. ±2 ppm/year.
Reference Level accuracy
±0.025% within the operating temp. ±0.025% / year.
Frequency Resolution
1 Hz up to 9.999999 MHz;
10 Hz over 10.0 MHz.
Frequency setup mode
manual on single frequency and step mode on programmable band/steps.
Balanced output impedances
- base band: 150, 200 and 600 Ω;
- medium band: 100, 110, 120, 135, 150 Ω;
- high band *: 100 Ω.

Unbalanced out. impedances
50, 55, 60, 68 and 75 Ω by Banana/BNC optional adapt.
Output level – Base Band
- -70 ¸ +14 dBm @ 600 Ω balanced / 0.1 dB steps
- -64 ¸ +17 dBm @ 75 Ω unbalanced / 0.1 dB steps.

Output level – Medium Band
-64 ¸ +20 dBm @ 100 ¸ 150 Ω balanced / 0.1 dB steps;
-64 ¸ +17 dBm @ 50 ¸ 75 Ω unbalanced / 0.1 dB steps;
Output level – High Band *
0 dBm @ 100 Ω balanced;
Output level – High Band *
0 dBm @ 50 Ω unbalanced.
Output level accuracy
- base band: ±0.2 dB from 50 Hz to 20 kHz @ 600 Ω ;
- medium band: ±0.2 dB up to 2 MHz ±0.3 dB up to 6 MHz @ 100 Ω;
- high band: ±0.5 dB up to 10 MHz ±1 dB up to 35 MHz @ 100 Ω.

White Noise Generator
1 kHz ¸ 6 MHz / -74 ¸ -144 dBm/Hz / 0.1 dB steps. (available on Network Analyzer)

Level Meter

Frequency range
from 50 Hz to 6 MHz (two bands) base version; up to 35 MHz *
Manual tuning / resolution
- 1 Hz up to 9.999999 MHz;
- 10 Hz over 10.0 MHz.

Level measurement mode
absolute (dBm, dBV, dBu,Volt) and relative (dBr).
Reading resolution
0.1 dB
Input range
- base band: -110 ¸ +10 dBm @ 1 kHz / 600 W;
- medium band: - 120 ¸ +12 dBm @ 1 MHz / 120 W;
- high band *: -70 ¸ +5 dBm @ 10 MHz / 100 W;

Level meter accuracy
- ±0.2 dB from 100 Hz to 20 kHz @ 0 dBm / 600 W;
- ±0.2 dB up to 2 MHz, ±0.3 dB up to 6 MHz; @ 120 W;
- ±1 dB up to 10 MHz, ±1.5 dB up to 35 MHz * @ 100 W.

Noise floor (TX OFF)
- £ -140 dBm/Hz up to 6 MHz;
- £ -100 dBm/Hz up to 35 MHz *.

Frequency Meter sensitivity
£ -30 dBm - base and medium band
Input impedances balanced
- base band: 150, 200, 300, 415, 600 W and >10 kW;
- medium band: 100, 110, 120, 135 150 W and >10 kW;
- high band * 100 W and > 5 kW.

Input impedances unbalanced
- base and medium band: 50, 55, 68, 75 W and >10 kW;
- high band *: by Banana/BNC: 50 W and > 2.5 kW.

Noise filters
- base band: wide band,
- Psophometric; C-Message;

300 ¸ 3400 Hz, 20 ¸ 3400 Hz,
300 Hz ¸ 6 kHz, 20 Hz ¸ 6 kHz,
300 Hz ¸ 15 kHz, 20 Hz ¸ 15 kHz,
300 Hz ¸ 20 kHz, 20 Hz ¸ 20 kHz and 20.0 kHz flat.
- medium / high band *: E, F, G / VDSL 2 and VDSL plus.

Selective filters / notch
- base band: (200 Hz ¸ 20 kHz) pass band and notch for S/N+D (dB and %) test; Selectivity: 10 Hz @ fo <200 Hz, 5% fo @ >200Hz fo <4 kHz,200 Hz @ fo >4 kHz. Selective for telegraph. channels: 120, 240, 360, 480 Hz.
- Medium / high band (20 kHz ¸ 6 orup to 35 MHz *): 25, 100, 200, 400 Hz and 1.74, 3.1, 4.0, 8.0 and 16.0 kHz.

Spectrum and Network Analyzer

Frequency range
from 200 Hz to 6 MHz (two bands) base version; up to 35 MHz *
In / Out 1) impedances bal
- base band: 150, 200, 300, 415, 600 W and >10 kW;
- medium band: 100, 110, 120, 135, 150 W and >10 kW;
- high band * 100 W and > 5 kW.

In / Out 1) impedances unbal
base and medium band: 50, 55, 68, 75 W and >10 kW , high band *: by Banana/BNC adapter: 50 W and > 5 kW.
Level reading mode
dBm, dBV, dBu,Volt and dBr.
Measurements readout
normal, peak (max, mean or min. value),
Measurement mode
- base and medium bands: 2 Wires +/- (for Return-Loss measurement), 2 Wires +/+ (for Longitudinal Balancement measurement) and 4 Wires.
- High band *: 2 Wires for Return-loss measurement and 4 Wires.

Input range
from noise floor ÷ +12 dBm @ 100 Ω
Noise floor
≤-140 dBm/Hz.
Resolution vertical
192 pixel / 8 div.: 1, 2, 3 ¸ 20 dB / division.
Resolution marker
0.1 dB / as selected resolution (BW).
Tracking Level Generator
in sweep or single frequency in 2/4 wires mode; Output Level & Resolution are the same of Level Generator.
- **Base band range** - 200 ¸ 25000 Hz, by FFT analyzer (Kaiser window).

Span
6250 Hz (and zoom / 2), 12500 Hz and 25000 Hz.
Resolution horizontal
250 pixel / 10 div. : 625 + zoom, 1250, 2500 Hz / division.
Resolution (BW)
50, 100, 200 .. Hz (other resolutions are interpolated).

- **Medium band range** - 1 kHz to 6 MHz, by Digital SSB quad. conversion.

Span
0 ranges: from 10 to 8000 kHz, 10 per decade.
Resolution hor. on display

- 250 pixel / 10 div: 1, 2, 4, 8, 16..
- / 800 kHz / division.

Measurement hor. resol
1000 points (available on saved and exported CSV file).
Resolution (BW)
0.2, 0.5, 1, 2, 5, 8 kHz (other resolutions are Interpolated)
Max level freq. readout
up to 10 Hz resolution on 1 kHz / Div.

- **High band * range** - 20 kHz to 30 MHz, by double conversion receiver in four bands: 0.02 to 12, to 18, to 30 to 35 MHz.

Resolution horizontal
250 pixel / 10 div: 1.2, 1.8 3 and 3.6 MHz / division.

Mix measurements Generator/Meter and Network Analyzer

- **Cross-Talk (4 Wires)**

by Generator & Meter
NEXT (in Single-End mode) and FEXT (in End-to-End mode) on single frequency.
Test by Network Analyzer
NEXT (in Single-End mode on single frequency or wide band by tracking generator) and FEXT (in End-to-End mode) on single frequency or wide band using the frequency Step Generator and sample & hold Spectrum Analyzer.
Freq. range TX and RX
200 Hz ¸ 6 MHz, up to 35 MHz *
Impedances TX and RX
same of the Signal Generator & Level Meter, excluded the high impedances.
Measurement accuracy

- up to 2 MHz: ±1 dB / 0 ¸ -90 dB;
- up to 6 MHz: ±2 dB / 0 ¸ -86 dB;
- up to 35 MHz *: ±3 dB / 0 ¸ -80 dB.

Intrinsic crosstalk
<- 90 dB (by precise termination).

- **Return Loss (2 wires)**

Test by Network Analyzer
in Single-End mode on single frequency or wide band (spectral)
Freq. range TX and RX
200 Hz ¸ 6 MHz, up to 35 MHz *
Impedances TX and RX
same of the Signal Generator & Level Meter, excluded High Z.
Measurement accuracy

- up to 2 MHz: ±1 dB / 0 ¸ -50 dB;
- up to 6 MHz: ±2 dB / 0 ¸ -46 dB;
- up to 35 MHz*: ±3 dB / 0 ¸ -40 dB.

Longitudinal Balance Loss (2 Wires + Gnd)
Test by Network Analyzer
in Single-End mode on single frequency or wide band – spectral readout, by tracking generator.
Impedances TX and RX
same of the Signal Generator & Level Meter, excluded high Z.
Frequency range
200 Hz ¸ 6 MHz.
Impedances TX and RX
same of the Signal Generator & Level Meter, excluded High Z.
Measurement accuracy

- up to 2 MHz: ±1 dB / 0 ¸ -60 dB;
- up to 6 MHz: ±2 dB / 0 ¸ -56 dB.
- Single-End Insertion Loss (available on the automatic SELTest sequence) by Advanced Software ASW-1/II;

Measuring Mode / readout
by wide band FDR technology with Spectral readout.
Operating limits

- minimum line length: 50 meters;
- max. line length: 4.5 km with wires diameter of 0.4 mm.

* by internal optional module EBM30 (ACT-13)

Graphic Extrapolation
1 kHz ¸ 6 MHz or up to 30 MHz *.
Accuracy

- ±1 dB up to 2.2 MHz;
- ±2 dB up to 30 MHz *.

Operating Impedance
120 W balanced line.

Event Tests

- **Micro-Interruptions - O.62 (base band) and on medium band**

Threshold level
-3 ¸ -20 dB - 2 kHz Test Tone (default) or on programmable input frequency up to 6 MHz.
Monitoring time
4 min.¸ 24 ours.
Events indicators

- 5 Counters (0.3ms ¸ >1min);
- Event/Time ; Secs. with Events.

Readout
Tabular and Time Domain histogram representation.
Measure facilities
2 kHz reference tone output from TX connector for loopback tests.

- **Impulsive Noise O.71 (base band) or medium or high band**

Threshold level
0 ¸ -60 dBm.
Base band BW filters

- 200 ¸ 12000 Hz Flat, 600 ¸ 3000 Hz
- 300 / 500 Hz.

Monitoring time
4 min. ¸ 24 hours.
Events indicators
1 Event Counter; Event/Time Ratio; Secs. with Events.
Readout
Tabular and Time Domain Histogram representation.

Special Measurements

- **Line Immunity by White Noise injection** (available on Network Analyzer)

Bandwidth
1 kHz ¸ 6 MHz.
- **Output level range**
-70 ¸ -144 dBm/Hz @ Zref 100 W 0.1 dB Resolution.
- **Output impedance**
100, 120, 135, 150 and 1350 W (balanced).

- **TDR Fault locator**

Distance ranges
90, 180, 450, 900, 1800, 3600, 7200 m. @ 0.600 PVF.
Zoom

- vertical: -8 ¸ +77 dB;
- horizontal : 1x, 2x, 4x.

Distance res. (by marker)

- minimum range: about 0.4 meters
- maximum range: about 40 meters

Operative mode
single line, Crosstalk (4 Wires), Differential by comparison of other test saved on internal memory; Monitoring to events localization by Peak mode (Sample & Hold).
Pulse output level
short / long: 2.2 Vpp; Boost: 5.5 Vpp.
Pulse length
automatic on range selection, from 10 to 5000 ns.;
IN/OUT impedance
100, 110, 120, 135, 150 W (bal.)
TGC (autom. gain control)
0 ¸ 6 dB/km.
Propagation velocity
PVF: 0,300 to 0,999 or PV (90 to 300 m/µs)
Digital Multimeter DC / AC (by DMM – ACT-12 optional module)
Measuring mode
between a-b; a-c (Gnd); b-c (Gnd) and reverse.
DC Voltage Range
0 ¸ 140 Vdc
DC Voltage Accuracy
£2% of reading ±1 digit.
AC Voltage Range
0 ¸ 100 Vrms
AC Voltage Accuracy
£2% of read. ±1 digit / 15¸3300 Hz

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DC LOOP RESISTANCE / INSULATION
Test Voltage
£ 100 Vdc (with current limit 1mA)
Range / Accuracy
2 W ¸ 1 GW / £2% of reading ± digit;
LINE LENGTH BY LOOP RESISTANCE
Line length evaluation
as function of measured resistance
Line Gauges setting
from 0.2 to 2.5 mm or from AWG 26 to AWG 11.
Multi-section setup
up to 5 different cables type.
Line Resistance correction
from 1.01 to 1.60 x standard copper resistance.
Line Temperature setting
set from -20° ¸ +60° C.
Range / Resolution
0 to 99.999 Units (meters or feet) / 1 units.
Accuracy
derived from measured resistance.
RESISTANCE METER (real-time) (by optional module ACT-18 installed on DMM module)
Range / Resolution
0.1 W to 50 kW / 0.1 W to 999.9 W
Accuracy
±2% ±1 digit.
RESISTANCE balancement: for unbalance >5 W, shorting a-b-c.
RFL (Resistance Fault Locator)
Loop resistance
1W to 5 kW maximum.
Multi-section facility
as the setup for Loop Resistance.
Fault resistance
from 5 W to 20 MW max.
Accur. of RTF @ 1 MW
±0.5% of Loop resistance.
DC CAPACITANCE (time of DC discharge method)
Test Voltage
£ 100 Vdc
Range
> 10 nF ¸ 10 mF.
Accuracy
£ 5% of reading ± 1 digit.
AC CAPACITANCE and Q factor (by capacitive bridge)
Measuring mode
by 1 kHz tone – 1.1 Vpp.
Range / Resolution
0.1 to 3000 nF / 0.1 nF.
Accuracy
- ±1% of read. ± 1 nF @ C <500 nF;
- ±5% of reading ± 1 digit @ C >500 nF and < 3000 nF.

LINE LENGTH BY CAPACITANCE
Line length estimation
function of measured capacitance:
Line Capacitance setup
10.0 to 300.0 pF / Length Unit.
Range / Resolution
1 to 99999 Units (m. or ft.)
Accuracy
as from capacitance meas.
LINE IMPEDANCE RESPONSE
Measuring range
from 30 to 3200 Ohm in five steps.
Frequency Range
from 5 kHz to
- **POTS Subscriber Simulator** (by optional module ACT-11 installed on DMM module)

Dial Encoder
Pulse, progr. duration/ratio 100ms / 40/60%);
DTMF std. tones, progr. Level, Duration, Inter-tone.
Ring Detect. Range & Measurement
- Level: 10 ÷ 90 Vrms;
- Frequency: 15 ÷ 70 Hz.

* by Advanced Software ASW-1/II;
** by adoption of EBM 30 (ACT-13) optional module;

Ring Detector AC Load
R 7310 Ω ± 2% in series + 940nF ±10% capacitor.
Ring current self-limitation
≤ 15 mA peak ; safety fold-back limited.
On Hook / Break & Make
R = 120 Ω ±2% @ I = 100 mA; Voffset = 4 Vdc.

Automatic pre-configured SELTest sequence for line prequalification *
With **single ACT6000 - Single-End Tests on open line**, 2 or [4]
Wire mode:
Metallics: AC / DC Voltage, DC Insulation, AC / DC Capacitance, End-of-Line (TDR).
Transmissive (wide band / spectral): Noise (local), Return-Loss, Longitudinal Balance-Loss, "FDR" Insertion-loss & frequency response estimation, Noise (far-end estimation), [NEXT], and SNR prediction, Bit-Rate prediction for ADSL - ADSL2+ - VDSL2 and VDSL Plus ** masks.
Manual pre-configured SELTest **
Transmissive (wide band / spectral readout) measurements: Noise, Return-Loss, Longitudinal Balance-Loss, NEXT and PSD in high impedance (sniffer mode).
Automatic pre-configured DELTest sequence for line qualification & certification *
With two **ACT6000** (Master/Slave mode) for **End-to-End Tests**, 2 or [4] Wire mode:
Only Transmissive (wide band / spectral): Noise (bilateral), Return-Loss (bilateral), Longitudinal Balance-Loss (bilateral"LCTL"), Insertion-Loss, [NEXT and FEXT] and Bit-Rate evaluation (Up & Down stream) and SNR for ADSL - ADSL2+ VDSL2 and VDSL plus** masks.
Automatic DELTest for two unidirectional channels qualification / certification *
With **two ACT6000** (Master/Slave mode) for **End-to-End Tests,** in Base Band (Voice or Modem 56K) according to **EIA-464 4W** E&M tests. Only bilateral Noise and Insertion-Loss measurements.
Automatic POTS Telephone DELTest sequence * (by optional module ACT-11 installed on DMM module).
With **two ACT6000** (Master/Slave mode) for **End-to-End Tests**, to perform a complete qualification on POTS links, included Signalling and Transmissive tests according to M.1040 mask.
Pre-configured masks for manual SELT or SELT / DELT line tests sequences
- Wide band: **VOICE, MODEM 56k, ISDN, HDSL 1p** and **2p, E1, T1, SHDSL, ADSL, ADSL2+,** and **VDSL2-12a, VDSL2-17a, VDSL2-30a, VDSL Plus** **.**

DBPO Masks - Automatic generation of the Threshold Mask for VDSL2** related to the primary line parameters included the "ESEL" measured by ADSL2+ SELT Sequence *
Supplied Accessories (base kit):
ACT6000 Base Instrument included:
- Nylon Carrying Case with pocket for accessories;
- User Guide (English or Italian language, as requested);
- AC Power Supply and Battery Charger (Line Input: 100-220 Vac;
- Output: 20 Vdc);
- Banana-Banana + Crocodiles cables (2.30m total length);
- Ground Cable unipolar Banana-Crocodile cable;

Extra cost Accessories and Optional HW/SW Modules
- ASW-1/II - Advanced Software 1 (see the above description).
- ACT-11 POTS Module (Subscriber Simulator for POTS for signaling tests);
- ACT-12 DMM Module (Digital Multimeter for metallic tests);
- ACT-13 EBM30 Module (Extension Band for 35 MHz operation);
- ACT-14 USB Pen-Drive 8 GB;
- ACT-15 Probes to perform Medium & High Band PSD measurement on fed lines;
- ACT-16 Plug/Probes to perform Medium & High Band PSD measurements on fed lines.
- ACT-17-B 50 dB Bal. Attenuator, High Z input / 150 Ohm out.-ACT-17-U 50 dB Unbal. Attenuator High Z input / 75 Ohm out.
- ACT-18 Real Time Resistance Meter module;
- ALT-05 Headset with 2m cable and RJ-45/4 connector;
- ALT-09 Resistive Termination Set (100, 120, 150 and 600 W);
- ALT-16 Triple Banana to BNC Adapter.

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