TEMPO COMMUNICATIONS

ACT6000

Advanced Communication Tester

User Guide

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ACT6000 Advanced Communication Tester

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1. General Description

The **ACT6000** combines various kinds of transmission, metallic and special tests. It can be considered to be the most advanced Test Set today for qualifying and maintenance of advanced transmission systems and copper pairs used for various telecommunication services: from VOICE to VDSL.

One of **ACT6000's** most interesting features is the new high resolution color graphic display, a real "window" on the most advanced measurements' world.
The alphanumeric keypad, as well as the function-keys, grant to the instrument a high operating level. Moreover, take note that, due to its accurate and intuitive "Human Machine and Graphics User Interface", this instrument needs the help of the user's manual to arrange and carry out unusual measurements and/or settings.

One **ACT6000**, suitably configured, can perform easily and quickly "Single-End Line Tests" or very accurate "End-to-End Tests" together with another **ACT6000**. The wide range of measurements of the **ACT6000** allows the qualification and certification of various communication carriers and copper pairs used for digital streams with a frequency span up to 6 MHz (or 35 MHz optional); moreover, the instrument can automatically extrapolate the ADSL and VDSL maximum expected data rate of the copper line under test.

ACT6000 can be configured for in-depth analysis, by special functions and internal optional modules. The complete adoption of these modules allows the simple and fast finding of anomalies and/or faults on the copper line and communication systems.

Package

The package of the instrument (base version) contains: the soft-pack carrying case, this User Guide, the AC / DC battery-charger, Banana/Crocodile cables and Ground Cable. Make sure that, on receipt, this pack and its contents have not been damaged by bumps or careless handling. For possible shipment of the instrument for repair or calibration it is suggested to use the original pack.

Instrument identification

The Part-Number, Serial Number, Hardware Configuration, and date of production or Calibration are pointed out on the factory label applied on the rear panel.

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2. Safety and Conformity Information

The ACT6000 is intended for use by qualified personnel only.

The use of this tester is allowed in internal or external environments within the normal human range of climatic characteristics (temperature and damp. It is recommended to work with this tester within declared temperature limits (-5 ÷ +50°) and not in contact with water, because it is not waterproof.

The ACT6000, like all the Tempo instruments, is "CE" certified for full electromagnetic compatibility and safety. The stage In/Out (RTX connector) of the ACT6000 is designed for use with circuits that have a maximum of 150 Vdc or peak AC wire-to-wire, or 75 Vdc or peak AC wire-to-ground.

Warning ! The stage output of the instrument "TX connector" is not protected !

Failure to comply with these precautions or with specific warnings in this guide violates the safety standards of design, manufacture, and intended use of the tester.

Tempo assumes no liability for the customer's failure to comply with these requirements. If this product is used in a manner not specified by the Tempo the protections provided by the product may be impaired.

The **RTX** connector of the ACT6000 has an automatic protection device to protect against over-voltage; over specified limits the protection activates and on the following message appears on the display:

WARNINGS!

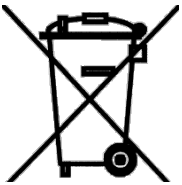
OVER VOLTAGE PROTECTION

VERIFY LINE CONNECTIONS - PUSH ANY KEY TO RESTORE

To restore the operation of the instrument, after verifying the correct state of the line, press any key. In every case, to ensure correct galvanic isolation of the instrument during the execution of high impedance measurements Insulation or DC capacitance, disconnect from the instrument: **External AC/DC Battery Charger.**

2.1. Community directive 2002/96/EC

Community directive 2002/96/EC for introduction in the market and to disposal of "WEEE" (waste electrical and electronic equipments) containing "RoSH" materials damaging to the environment and detrimental to human health.



Tempo declares that all the materials, components, products supplied are fully compliance with RoHS & Weee Directives. Nevertheless, the disposal of this equipment cannot be disposed as waste but it has to be returned to the producer or to its official distribution network which will arrange to carry out a separate collection.

In order to comply with what is mentioned above is stated that:

- even if the equipment does not contain dangerous elements listed on RoHS directives, improper use could be detrimental to human health and damaging to the environment; - the meaning of the symbol shown below and affixed on the equipment is to remind that the same cannot be disposed of as “waste”;
- penalties are to be expected in case of an abusive disposing of the equipment.

3. Functions and measurements type

3.1. Functions

The main functions of the ACT6000 are: Generator & Meter; Spectrum and Network Analyzer; TDR fault locator.

To the above are added the following functions:

▪ DMM plug & play module, for metallic measurements: AC/DC Voltage, DC Resistance / Insulation, RFL, AC/DC Capacitance and Impedance response.

▪ POTS-SUB plug & play module, for manual Subscribe Simulator and automatic Telephone DELT sequence.

▪Instrument Configuration (General Setup, Display, Date, Hour, Cable type, Software up-date etc.)

▪ File Manager utility for files storage, management and export.

3.2. Measurement types

● **Transmissive measurements:**

- ▪ Signal and white noise generation
- ▪ Selective Level and Frequency measurements
- ▪ Noise measurement (wide and weighted band)
- ▪ Power Spectral Density in high impedance and “DPBO” test.
- ▪ Return Loss measurement
- ▪ Longitudinal Balance Loss measurement
- ▪ Crosstalk Loss measurement
- ▪ Insertion Loss measurement
- ▪ S/N and Distortion (on base band) measurement

● **Events test:**

- ▪ Impulsive Noise long term measurement;
- ▪ Micro-interruptions long term measurement;

● **TDR Fault location:**

▪ TDR real time measurement for faults and line length location; ▪ TDR long term measurement to intermittent faults location.

By the adopting of the DMM optional module:

▪ AC – DC Voltage;
▪ AC – DC Capacitance;
▪ DC – Resistance, Balancement, Insulation and RFL (Resist. Fault Location); ▪ AC Impedance response.

● **Automatic measurements** on pre-configured transmissive masks (ETSI or ANSI):

▪ Single-End and End-to-End automatic test sequences for copper pair and POTS link qualification and certification by the **ASW-1/II** (optional software).

3.3. Measure Saving & Export

All the results of the performed measurements can be saved on internal memory exportable to the external USB Pen-Drive or PC (by the specific PC Utility) in **.CSV** * format.
It is also possible to export the screenshot in **.BMP** format.

The above mentioned **PC Utility** (Windows compatible) is free for download on https://www.tempocom.com/products/act6000 and useful to direct software uploading, editing and direct uploading of Data Cables and Threshold Limits, and the downloading of the CSV files saved on internal memory.

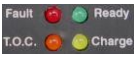
● **Advanced Software 1/II (optional)**
The adoption of the **ASW-1/II** adds some automatic measurements according to the preconfigured standard ETIS and ANSI masks on which are pointed-out the threshold limits and “Pass” / “Fail” indications:

- **Automatic Single-End Sequence** to perform the copper lines pre-qualification, with length within 50 and 4,500 meters.
- **Manual Single-End Measurements** shown in real-time.
- **Automatic End-to-End Sequence** to perform the qualification also on very long lines or voice/data cannels, using a couple of ACT6000s.
- **Automatic Telephone End-to-End Sequence** to perform the POTS link qualification using a couple of ACT6000s.

3.4. Power Supply and Battery charge

When using the instrument without external supply, it is possible to check continuously the state of charge of the batteries, thanks to the  icon.

An acoustic beep indicates the low batteries charge.
The ACT6000 is fitted with a polarized socket "**SUPPLY**" for the connection to the AC Power Supply Adapter for battery charge.
When the right DC voltage is supplied to the above mentioned socket, the charging status is shown by the led on top panel:



Green led "**Ready**" or "*prompt to charge*" and yellow led "**Charge**" or "*batteries on charge",* at the final phase of charge, orange led "**T.O.C.**" or "*Top of Charge*". The lighting of the red led "**Fault**" means a temperature alarm of the batteries or related charger circuits.

Note The CSV files are compatible with the Windows Excel application to visualize and to edit graphics and data base.*

4. Technical Specifications

General

Case .....: ABS shielded for EMI / EMC compatibility.
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 and RS232 (to service);
· USB for pen-drive connector.
Display .....: LCD color 320 x 240 pixel (1/4 VGA) backlit.
Power supply (internal) .....: · rechargeable battery pack (green) NiMh, with life of about 8 hours (typical), 5 hours (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: 0 □ +45° 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 ……: Directive 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 Export on Pen Drive;
● PC Remote interface by USB port.

Level Generator

Sine output frequency range .....: · base band: from 20 Hz to 22 kHz;
· medium band: from 20 kHz to 6 MHz;
· high band (optional): 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 output 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 (opt.) .: · 0 dBm @ 100 Ω balanced;
Output level – High Band (opt,) .: · 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.

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 30 MHz.
Frequency Meter sensitivity…… : □ -40 dBm for 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; by Banana/BNC adapter · high band *: 50 W and >5 kW.

Noise filters……..…… : · base band: wide band, Psophometric; C-Message;
300 □ 3400 Hz, 20 □ 3400 Hz, 300 Hz □ 6.0 kHz, 20 Hz
□ 6.0 kHz, 300 Hz □ 15 kHz, 20 Hz □ 15.0 kHz, 300 Hz
□ 20.0 kHz, 20 Hz □ 20.0 kHz and 20.0 kHz flat.
· medium / high band *: E, F, G / VDSL 1 – 2 and 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. chann.: 120, 240, 360, 480 Hz.
· Medium / high band * (20 kHz □ 6 or up to 35 MHz):
25, 100, 200, 400 Hz and 1.74, 3.1, 4.0, 8.0, 16.0 kHz.

** By EBM30 optional module (ACT-13)*

Spectrum and Network Analyzer

Frequency range .....: from 200 Hz to 6 MHz (two band) base version; up to 35 MHz 1)
Input / Out* impedances balance:· base band: 150, 200, 300, 415, 600 W and >10 kW;
· medium band: 100, 110, 120, 135, 150 W and >10 kW;
· high band 1) 100 W and > 5 kW.
Input / Out* impedances unbal.. : · base and medium band: 50, 55, 68, 75 W and >10 kW *by Banana/BNC adapter* · high band 1): 50 W and > 5 kW.
Level reading mode .....: absolute (dBm, dBV, dBu,Volt) and relative (dBr).
Measurements readout .....: normal, peak (max, mean or minimum value),
Measurement mode…… .....: base and medium bands:
2 Wires +/- (for Return-Loss measurement);
2 Wires +/+ (for Longitudinal Balance measurement); and 4 Wires (separate RX and TX).
High band 1): 2 Wires for Return-loss meas. / 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 same of Level Generator.
White Noise Generator…… : 1 kHz □ 6 MHz / -74 □ -144 dBm/Hz / 0.1 dB steps

· **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 .....: 30 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 frequency readout ...: up to 10 Hz resolution on 1 kHz / Division.
· **High band** * range .....: 20 kHz to 35 MHz, by double conversion receiver in four bands: 0.02 to 12, to 18, to 30 and 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)**

Test 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 on wide band using the frequency Step Generator and sample & hold Spectrum Analyzer.

1) by EBM30 optional module (ACT-13)

Frequency 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 / between 0 □ -90 dB;
· up to 6 MHz: □2 dB / between 0 □ -86 dB;
· up to 35 MHz *: □3 dB / between 0 □ -80 dB. Intrinsic crosstalk…….. : <- 90 dB (with precise resistive load).

· **Return Loss (2 wires)**

Test by Network Analyzer .....: in Single-End mode on single frequency or wide band – spectral readout, by tracking generator.

Frequency range TX and RX ..: 200 Hz □ 6 MHz, up to 30 MHz *

Impedances TX and RX .....: same of the Signal Generator & Level Meter, excluded the high impedances.

Measurement accuracy .....: · up to 2 MHz: □1 dB / between 0 □ -50 dB;

· up to 6 MHz: □2 dB / between 0 □ -46 dB;

· up to 30 MHz *: □3 dB / between 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 the high impedances.

Frequency range .....: 200 Hz □ 6 MHz.

Measurement accuracy .....: · up to 2 MHz: □1 dB / between 0 □ -60 dB;

· up to 6 MHz: □2 dB / between 0 □ -56 dB.

· **Single-End Insertion Loss** *(available on the automatic SELTest sequence)* **

Measuring Mode / readout .....: by FDR technology on High-Band / Spectral readout.

Operating limits .....: · minimum line length: 50 meters;

· max. line length: 4.5 km on Ø wires 0.4 mm.

Graphic Extrapolation .....: 1 kHz □ 6 MHz or up to 35 MHz *.

Accuracy .....: □1 dB up to 2.2 MHz; □2 dB up to 35 MHz *.

* *by internal optional module EBM30 (ACT-13)* **
by optional Advanced Software ASW 1/II

Event Tests

· **Micro-Interruptions - O.62** in **base band** and **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** in **base 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)
- Output level range .....: -70 ¸ -144 dBm/Hz @ Zref 100 W - 0.1 dB Resolution.
- Output impedance .....: 100, 120, 135, 150 and 1350 W (balanced).
- Band width .....: 1 kHz □ 6 MHz.

· **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 resolution (by marker) : · minimum range: about 0.4 meters (or 1 foot);
· maximum range: about 40 meters (or 100 feet). Operative mode…… : single line (2 wires), Crosstalk (4 Wire), Differential by relative comparison with other line; Monitoring to events localization by Peak mode (Sample & Hold).
Pulse output level…….. : short and 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 (balanced) TGC (automatic 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 / Accuracy ..: 0 □ 140 Vdc / □2% of reading □1 digit.
AC Voltage, Range / Accuracy ..: 0 □ 100 Vrms / □2% of reading □1 digit / 15□3300 Hz.
DC LOOP RESISTANCE / INSULATION
- Test Voltage .....: □100 Vdc (with current limit 1mA max).
- Range Loop Res./ Accuracy ...: 2 □ □ 5 K□ / □2% of reading □ digit.
- Range Insulation / Accuracy ...: 2 □ □ 1 G□ / □2% of reading □ digit.

LINE LENGTH BY LOOP RESISTANCE
- Line length evaluation/ accur. .: (as function of measured loop 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 kUnits (meters or feet) / 1 units.

RESISTANCE METER (real time) (by optional module ACT-18 installed on DMM module)
Range / Resolution / Accuracy ..: 0.1 □ to 50 k□ / 0.1 □ up to 999.9 □ / □2% □1 digit.

RESISTANCE balance / acc.….: shorting a-b-c (gnd) / with >5 □ unbalance.
RFL (Resistance Fault Locator)
- Loop resistance .....: 1□ to 5 k□ maximum.
- Multi-section facility .....: as the setup for Loop Resistance.
- Fault resistance .....: from 5 □ to 20 M□ max.
- Accuracy of RTF @ 1 M□. .....: □0.5% of Loop resistance.

DC CAPACITANCE (time of DC discharge method)
- Test Voltage .....: □ 100 Vdc.
- Range / Accuracy .....: > 10 nF □ 10 □F / □ 5% of reading □ 1 digit.

AC CAPACITANCE and Q factor (by capacitive bridge)
Measuring mode.....: by 1 kHz tone – 1.1 Vpp between: a-b;.
Range / Resolution .....: 0.1 to 3000 nF / 0.1 nF.
Accuracy .....: ±1% of reading ± 1 nF @ C <500 nF;
±5% of reading ± 1 digit @ C >500 nF and < 3000 nF.

LINE LENGTH BY CAPACITANCE
Line length estimation .....: (as function of measured capacitance):
Line Capacitance setup .....: 10.0 to 300.0 pF / Length Unit.
Range / Resolution / Accuracy ..: 1 to 99999 Units (m. or ft.) / as from capacitance meas.

LINE IMPEDANCE RESPONSE
Measuring range .....: from 30 to 3200 Ohm in five steps.
Frequency Range .....: from 5 kHz to 5 MHz in four steps. Accuracy
.....: ±5 % ±5 Ω.

· **POTS Subscriber Simulator** (by optional module ACT-11 installed on DMM module)
Dial Encoder .....: · Pulse, progr. duration/ratio (100 ms / 40/60%);
· DTMF std. tones, progr. Level, Duration, Inter-tone.
Ring Detect. Range & Meas .....: Level: 10 ÷ 90 Vrms; Frequency: 15 ÷ 70 Hz.
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 specs.: R = 120 Ω ±2% @ I = 100 mA; Voffset = 4 Vdc.

Automatic pre-configured SELTest sequence for line pre-qualification *
With **single ACT6000** - **Single-End Tests on open line,** 2 or [4] Wire mode:
Metallics: AC / DC Voltage, DC Insulation, AC / DC Capacitance, Q, End-Of-Line (TDR).
Transmissive (wide band / spectral): Noise (local), Return-Loss, Longitudinal BalanceLoss, "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 (sniffer mode).

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

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 BitRate evaluation (Up & Down stream) and SNR for ADSL - ADSL2+ - VDSL2 - VDSL Plus** masks.

Automatic pre-configured Telephone DELTest sequence * (with two ACT6000 in Master/Slave mode) **for POTS link qualification** *** by Signaling and Transmissive tests according to the **M.1040** voice 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** **.
For **VOICE** and **MODEM 56K** is allowed the special DELT modality "**EIA-464 4W E&M**" to perform the Insertion-Loss and Noise level on special PCM systems with separate TX and RX unidirectional channels.

DBPO Masks - Automatic generation of the Threshold Mask for VDSL related to the primary line parameters included the "ESEL" measured by ADSL2+ SELT Sequence *

Notes:
* *by Advanced Software ASW-1/II;*
** *by adoption of EBM 30 (ACT-13) optional module;*
*** *by adopting the ACT-11 "POTS –SUB" Module installed on the ACT-12 "DMM Module".*

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 Balanced Attenuator, High Z input / 150 Ohm output;
- **ACT-17-U** 50 dB Unbalanced Attenuator High Z input / 75 Ohm output, included coaxial cable tests BNC/BNC 75 Ohm;
- **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, 135, 150 and 600 W);
- **ALT-16** Triple Banana to BNC Adapter, included coaxial cable tests BNC/BNC 75 Ohm.

5. Commands and Connections description

ACT6000 Front Panel

5.1. Front panel Commands description

1- (Power) Key for switching On/Off.
A short press of this key switches ON the instrument, while a long press switches Off.

2- (Hold) Key for the temporary freezing of the measurement. This command allows access to a “Save” function to store and/or export the file measurement.

3- (Talk) Key for enabling the intercom circuit; this command enables only the microphone, as the headphone is always enabled. This command switch the Line Hook-Off / Hook-On when the POTS Subscriber Simulator is activated.

4- Commands group ◄ ►▲▼ plus selection function (as “Enter”), for menu selection and parameters setting.

5- Keys group for the setting of alpha-numerical parameters.

6- (Clear) Key for cancellation, it enables the ability to export the screen shot In BMT format to the USB Pen-Drive.

7- (Enter) Key for selection / confirmation.

8- (Escape) Key for exit and return to previous state.

9- Function keys group (the associated function is highlighted in the relevant area of the display).

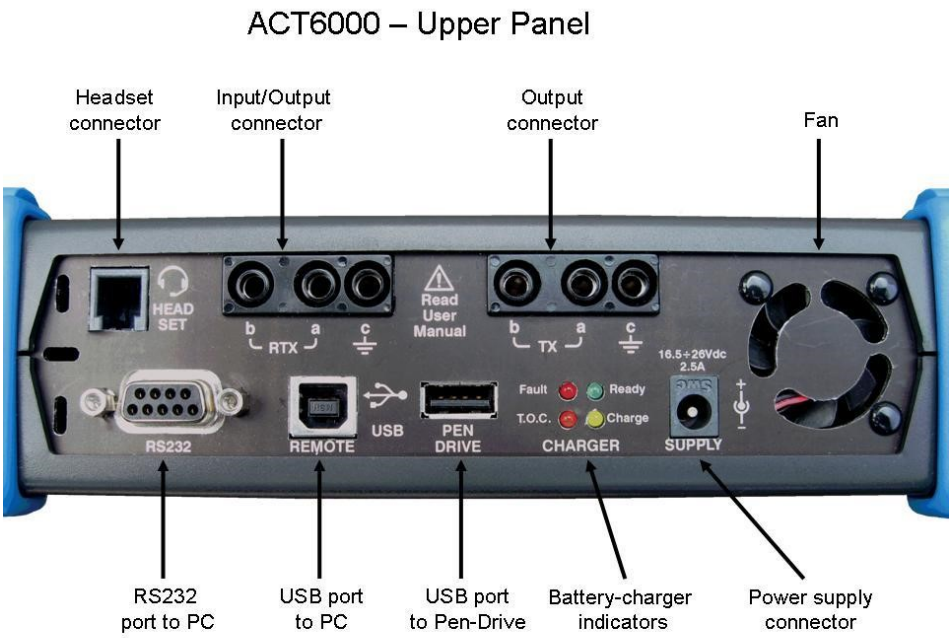
10- Multi-functional key for temporary adjustment of the brightness / contrast of the display and for switching On/Off of the internal loudspeaker.

11- 

Key for software release and instrument information.

BATT. Rubber corner protection of the battery compartment.

5.2. Upper panel Connections Description

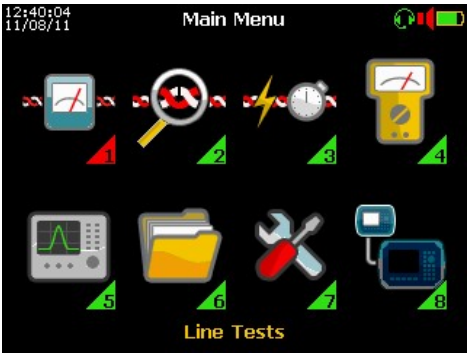


6. Use mode (frequent commands, menu hierarchy ..)

Frequent Commands

The ACT6000's human interface is very intuitive due to the displayed info.
The function keys (***F1*** - ***F5***), allows various configurations or facilities related to the specific menu.

Wen turned on, the Main Menu is displayed where the various types of selectable measurements or functions and other configuration menus are shown.
On the Main Menu the date & time are shown battery status, loudspeaker /headset enable.



The selection of any item is made by the use of the arrows ▲▼ of the commands group or by pressing the associated number on the keypad.

In most of the active menus it is possible to adjust the LCD brightness / contrast and volume loudspeaker through the key and the ▲▼of the commands group.

When a menu is selected, by the commands group, to access the next menu it is necessary to confirm the choice with the (Enter key; if the selection takes place by the keypad, the entry to the next menu is straight forward.

Return to a previous menu is always allowed by the F1 (Escape) key.

By pushing the "Photo" key, the measurement can be temporarily frozen and a special function-key will be enabled to save the measurement on the internal memory. By pushing the F1 key the measurement will be reactivated.

Where possible, pushing the (Cancel) key allows the immediate upload the screenshot to the Pen-Drive or PC (image in BMP format).

Note:
Depending on the software release or the unavailability of some functions or internal optional modules the related selection may not be available.

Menu Hierarchy

Main Menu
From this main menu, by selecting the icon-number with the arrows and confirming with "Enter" it is possible to access the available functions. Quick access is possible by typing on the keypad the number of the icon.

1- Line Tests Access the sub-menu for automatic and pre-configured copper pairs qualification in SELT or DELT mode and POTS services.

2 - TDR Fault locator Access the TDR sub-menu to find the End-of-Line and possible faults on copper pairs.

3 – Event tests Access the sub-menu to monitor events such as microinterruptions or impulsive noise on copper pairs and other lines types.

4 – Multimeter Access the sub-menu for metallic measurements such as voltage, resistance, insulation, RFL, capacitance and impedance of copper pairs and other devices.

5 – Signal Analyzer Access the sub-menu for signal generation, selective measurements, spectral or network analysis on copper pairs or other lines or devices.

6 – File Manager Access the sub-menu for management and export of filed measurements.

7 – Config. & Utility Access the sub-menu for the initial setup of the instrument (date/hour, display.. and measurement parameters).

8 – Slave mode
Special configuration to set the instrument as Slave to perform some automatic and pre-configured End-to-End tests on copper pairs and lines.

7. LINE TESTS Pre-configured SELT Sequences (by ASW 1/II)

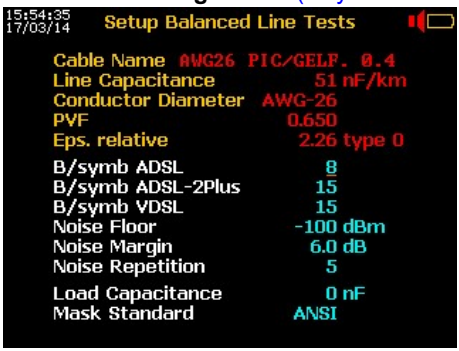
By the "**Advanced Software 1**" and **DMM module** it is possible to perform a complete and automatic line qualification with single ACT6000 placed on C.O. MDF or Street Cabinet.

To perform this test is necessary disconnect any xDSL or active device (modem, router or cordless) at the opposite side (user side) of the line to be test.

Connect the line to the **a** - **b** points and "earth" (GND) reference to the **c** point of the **RTX** connector; if Cross-Talk measurement is needed, connect the second line to the **a** - **b** point of the **TX** connector. Disconnect the AC/DC battery charger !

Before the Test Configuration is suggested to verify (by **TDR** in manual mode …see at page 27) the **correct the echo of the "end line"** from which it is possible to verify the congruence of the presumed line length after the selection of the preponderant cable type (…see **8. Cable Setup** at page 48).

Instrument Configuration (only if necessary…) From the **Main Menu** select and enter on the "**7. Config & Utility**" menu, then select and enter on the "**1. BALANCED LINE TEST**":

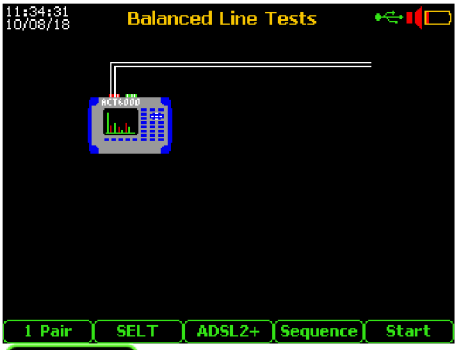


- Verify the selected Cable type from the Cable Setup menu: Cable Name, Line Capacitance/km, Conductor Diameter, PVF (for the TDR) and the Eps relative.
- the Bit/Symb for the right ADSL or VDSL* Bit-Rate evaluation.
- the presumed far-end Noise Floor.
- the Noise Margin for the right ADSL or VDSL* Bit-Rate evaluation.
- the Noise measurement repetition **.
- the ETSI or ANSI standard masks.

*Note * with the adoption of the EBM30 – ACT-13 optional module.*

*** Increasing the Noise Repetition test, from 1 (short time) to 60 (long time), the accuracy of the final RMS Noise measurement will be increased.*

To increase the accuracy of the SELT Insertion-Loss is suggested to adjust (before) the correct copper resistance value (Ohm/km) of the line under test by the R-Set (page 30).



Voice
Modem56k
ISDN
HDSL 1p
HDSL 2p
SHDSL
E1
T1
ADSL
ADSL2+
VDSL2-12
VDSL2-17
VDSL2-30
VDSL Plus

By ***F3*** key it is possible to select the transmissive measurements related to the specific mask and threshold limits (with pass/fail indication):

- **VOICE, ISDN**, **HDSL**, **SHDSL**, **E1** and **T1** on Base and Medium Band referring to the right limited band and single reference frequency i.e. by Nyquist formula.

- **ADSL**, **ADSL2+, VDSL2** and **VDSL Plus** on Medium or High Band *(if the EBM30 module is installed)* referring to the right limited band and frequency marked on 300 kHz for ADSL, 1.1 MHz for ADSL2+, 6 MHz for VDSL2-12, 8 MHz for VDSL2-17, 15 MHz for VDSL2-30 and 17.5 MHZ for VDSL Plus.

Test configuration

From the **Main Menu**, select and enter the **1. Line Tests** item, then select and enter on **1. BALANCED LINE TESTS**, and:

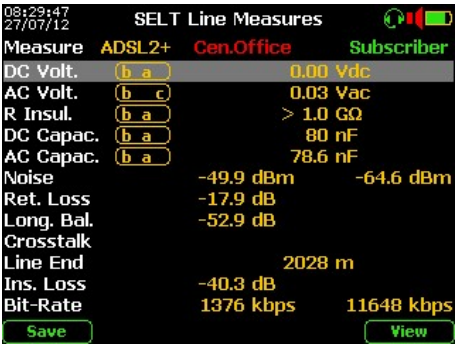
by ***F1*** key select **1** or **2 Pair** mode. **2 Pairs** performs the NEXT (Near Cross Talk) measurement. In this case the tracking reference signal (to disturb) is available on the TX connector.

Automatic SELT start

Push the ***F5*** "**Start**" key to perform the Single-End-Line-Test sequence.

Warning! During the sequence don't manage the line (a-b) or "ground" (c) connections.

Test results *(after about 90 seconds from the start)*



During the test sequence it is shown step by step that any single electric value can be measured between **a - b** and **c** points. For the low extraneous AC/DC Voltages * and low Resistive Insulation (among **a-b-c** points) are shown the worse values, as highlighted on the image at left for the low insulation value between **a - b** points.

All the transmissive measurements are only between **a - b** points.

Under the "Subscriber" column, the estimated values are shown (i.e. Far-end Noise* and ADSL down stream estimation).

Once the automatic test is finished, push the ***F1*** "**Save**" key to save the summarizing table and all the hidden details (spectral / graphics responses included) on the internal memory.

By pushing the ⊠ "Clear" key, it is possible to export the screen-shot to the USB Pendrive or PC in .BMP format.

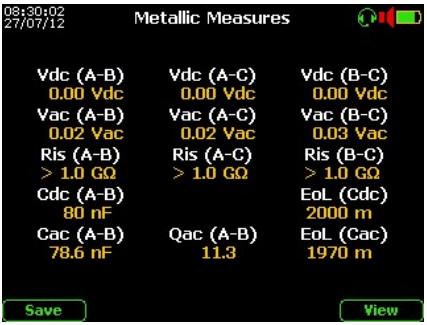
** if found an extraneous voltage over 2.0 Volt, some measurements will be blocked !*

***Noise note**: The results of the Noise RMS (local and remote estimation for the ADSL, ADSL2+ and VDSL) are weighted with the right filters depending to the selected line service and masks (e.g. "G3" for the ADSL2+).*

Note: Pass/Fail indications

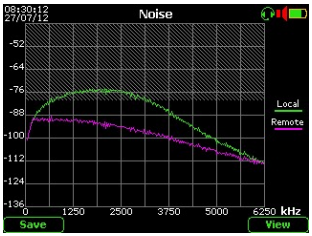
*If some measured value is out of the preconfigured threshold limits the value will be shown in **red**. - When the **DC Capacitance** value is abnormal (e.g. ≥ 700 nF) and highlighted, it is probable that the line is terminated with one or more telephones or similar POTS devices (due the ring capacitor) - When the **line length** estimated by TDR is incongruent with the typical AC or DC line capacitance or however it is out of the TDR range, the **Line End**, **Ins. Loss** and **Bit-Rate** results can be wrong and will be highlighted in **red**.*

Details visualization

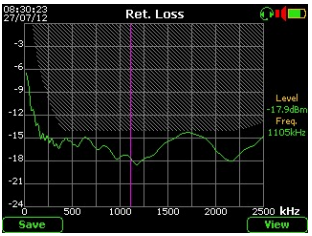


If Metallic Measure is selected on the previous menu, pushing the ***F5*** "**View**" key will open a page where the detailed measured electric values as at left shown:
- AC (as AC line power influence);
- DC Voltage, Resistive Insulation; - DC and AC line Capacitance, both with the estimated Line Length "EoL" related to the previous setup on the "Config. & Utility" menu.

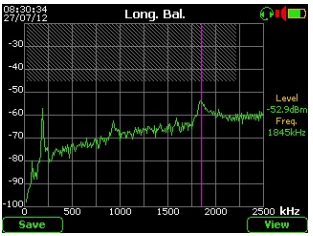
By pushing ▶ arrow it is possible to view the graphs of other transmissive measurements, as follows:



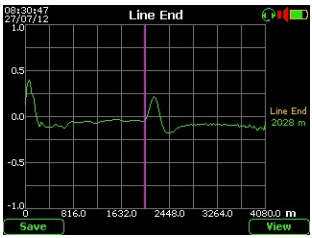
Local Noise and its remote transferred to the related frequency reference (1.1 MHz) *



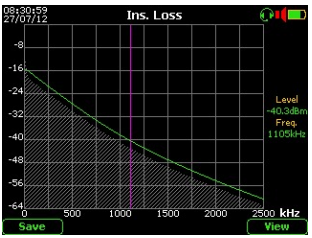
Return-Loss with marker on the related frequency with marker on the worse value of the band.



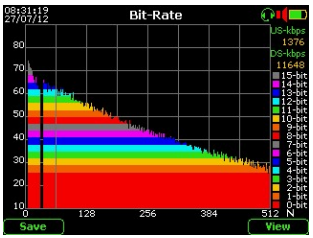
Longitudinal Balance Loss estimation, the presumed noise floor.



TDR echogram with marker on estimated Line End (open) at 2028 m.



Insertion Loss with marker on the related frequency reference (1.1 MHz) **.



Signal-to-Noise Ratio (bit rate) where are highlighted any DMT channel amplitude.

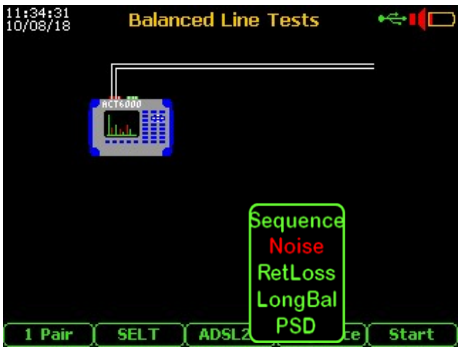
Notes:
** **Return-Loss**: Due to the impossibility to terminate the line-end for this Automatic Sequence, in some cases the bad result of the R.L. can be false, above all when the line under test is short (under 500 - 700 meters) or when selected a Base Band mask (Voice or MODEM 56k).*
In this case it is suggested to apply the termination at the line-end (i.e. 600 Ohm for Base Band masks) and perform the R.L. measurement as single test …see 7.1

*** Insertion Loss**: The threshold limit (decreased of 2 dB) is referred to the typical good line with same length, capacitance and gauge wires.*

7.1. LINE TESTS Pre-configured Single Transmissive Measurements

By the adoption of the "Advanced Software 1/II", and with one ACT6000 c/o Central MDF, Street Cabinet or User side, it is possible perform a single pre-configured transmissive: **Noise**, **Return-Loss**, **Longitudinal Balance-Loss** and **NEXT** measurement for these services: **VOICE, MODEM 56k, ISDN**, **HDSL 1/2 P**, **SHDSL**, **E1/T1**, **ADSL**, **ADSL2+**, **VDSL2-12 -17 -30** and **VDSL Plus** (35 MHz).
Connecting the instrument parallel to the active line, it is possible to perform the PSD (Power Spectral Density) in high impedance (sniffer mode).

Procedure



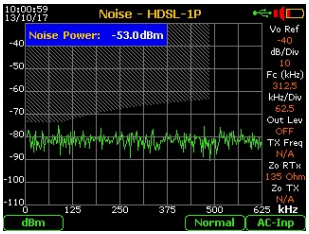
From the **Main Menu**, select and enter on "**1. Balanced Line Tests**" menu.
- By the ***F3*** key select the service type; - by the ***F4*** key select the measurements type (excluding the "Sequence").
To perform any test (excluding the PSD) connect the line to the **a** - **b** point of the **RTX** connector and the "earth" (Gnd) to the point "**c**".

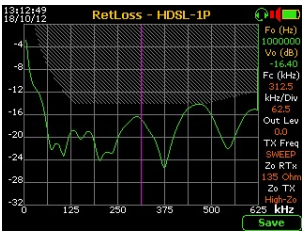
By ***F1*** key select the **1 Pair** or **2 Pairs**.
The "**1 Pair**" is the normal mode operation with a single line.

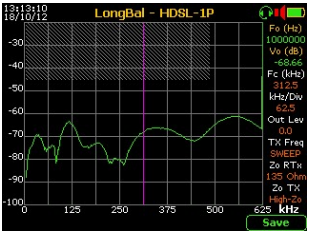
The "**2 Pairs**" allows to perform the NEXT (Near Cross-Talk) measurement, in

this case it is necessary to connect the second (disturbance) line to the **a** - **b** point of the **TX** connector.

Pushing the ***F5*** "**Start**" the measurement is activated and updated every second.
This test mode is very useful when a quick test is necessary to verify the quality and cleaning of the line under test, also to select the best lines.







For the Noise test it is shown the Noise Power Value on BW.

By pushing the  "Photo" key, the measurement can be temporary frozen and a special function-key will be enabled to save the measurement on the internal memory.

By pushing the  key the measurement will be reactivated.

Pushing the  (Cancel) key it is allows the immediate export of the screen shot to the Pen-Drive or PC (image in BMP format).

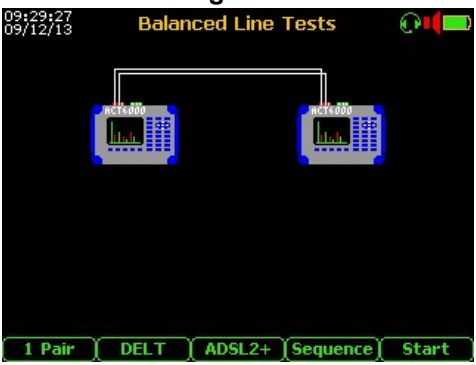
7.2. LINE TESTS Pre-configured DELT (End-to-End) Sequence

Adopting the ASW-1/II it is possible to perform an automatic and accurate transmissive line qualification using a couple of ACT6000s (in **Master/Slave** configuration) connected to the opposite side of the line: **Master** on Central Office (MDF) or street cabinet and **SLAVE** on the user side or on intermediary point (as remote street cabinet).

MASTER setup

Disconnect the line under test from the "central side" and connect its "user side" to the **a** - **b** points of the **RTX** connector; connect also the **c** point to the "ground" reference.
If the Cross-Talk test is also needed to be performed, connect the free "disturbance line" to the **a** - **b** points of the **TX** connector.

Instrument configuration



From the **Main Menu** select and enter on the "**1. BALANCED LINE TESTS**" menu.
By the ***F1*** key select the modality **1** or **2 Pairs**, this last if needed to perform also the Cross-Talk (NEXT - local / FEXT - remote) between two lines.

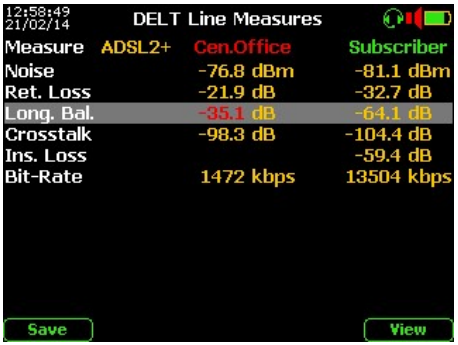
By the ***F2*** key select the "**DELT**" modality.

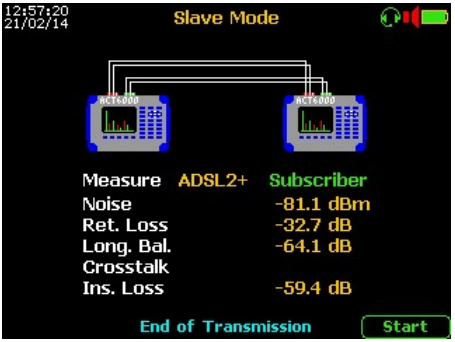
By the ***F3*** key select the service type: **VOICE, MODEM 56K, ISDN, HDSL (1-2 P), SHDSL, E1, ADSL, ADSL2+, VDSL2.. / P.**

Push the ***F5*** key "**Start**" to enable the Master/Slave connection and start the automatic test sequence. From this moment the Master sends a beep to facilitate the line interception (pair tracer function) by the Slave.

Slave setup

From the Main Menu select and enter on the "**8. "Slave Mode**".
Push the "**Enter**" key to validate the "**1. BALANCEDLINE TEST"** selection.
Disconnect the internal plant (user side) of the line to be test and connect it to the **a** – **b** point of the **RTX** connector, connect also the **c** point to the "ground" reference.
If needed to perform also the Cross-Talk test, connect the above "disturbance line" to the **a** - **b** points of **TX** connector.
From this moment, if the line is good (without interruptions or short circuit) the beep sent from the Master will be heard on the loudspeaker of the Slave.
Push the ***F5*** "**Start**" key to enable the Master/Slave connection and automatic test sequence.
After the acknowledgement by the Salve, Master sends a data request and, according to the setup of the Config. & Utility, it start the measurements sequence.
Master and Slave shows the progress of the sequence and the data transfer on the related display. The test is finished, the instrument is ready for another test.





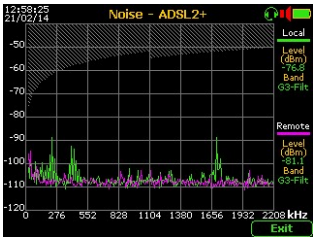
As for the SELT test, Master shows the test summary on the display (Central side and Subscriber side) of the line under test.

*If some measured value is out of the preconfigured threshold limits the value will be shown in **red**.*

Pushing the ***F1*** "**Save**" key it is possible to save the tests sequence on the internal memory.

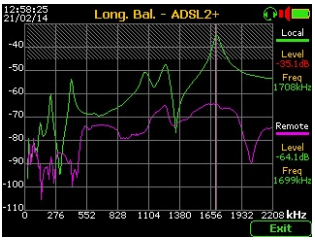
By pushing the  "Clear" key, it is possible to export the screen-shot on USB Pen-drive in .BMP format.

By pushing ***F5*** "**View**" key and then the ▶ arrow it is possible to view the graphs of other transmissive measurements, as follows:

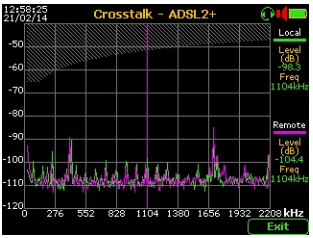


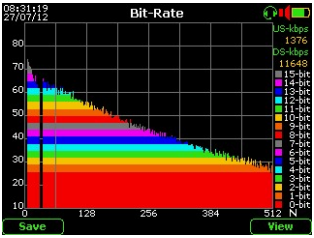
Noise ("local" and "remote") weighed with G3 filter

Return-Loss ("local and "remote") - Marker on 1.1MHz freq. reference



Long. Balance-Loss ("local" and "remote") - Marker on worse point.

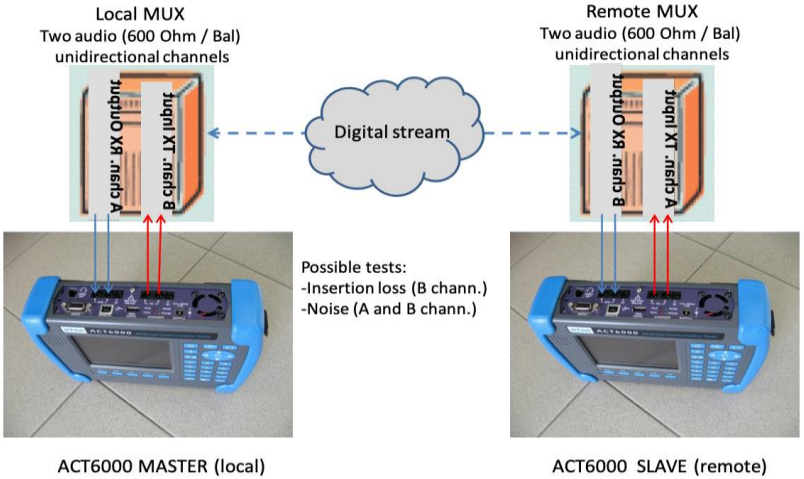




Insertion-Loss - Marker on 1.1 NETX / FEXT - Marker on 1.1 Signal-to-Noise Ratio (bit rate), MHz **ACT6000** freq. reference. – **New DELT** MHz freq. reference **mode operation** where **for** are **Base** highlighted **Band** any –

DMT channel amplitude.

Automatic DELT operation on two unidirectional cannels – EIA-464 4W E&M



MASTER unit configuration and channels connection

- From the Main Menu select and enter on "**1 Line Tests**" menu;

- Enter on "**1. BALANCED LINE TESTS**" menu, select "**DELT**" by ***F2*** key and push **Enter**; - Select and enter "**Modem56k**" by ***F3*** key and push */. of key-pad.
- Verify the right configuration on the display as the **Image 1** below.
- Connect the receiving cannel (600 Ohm) to the **a** - **b** points of the **RTX** connector.
- Connect the transmission cannel (600 Ohm) to the **a** - **b** points of the **TX** connector.

SLAVE unit configuration and channels connection

- From the Main Menu select and enter on "**8 Slave Mode**" menu (...see at page 22);
- Select and enter on "**2. EIA-464 4W E&M TESTS**" menu;
- Verify the right configuration on the display as the **Image 2** below.
- Connect the receiving cannel (600 Ohm) to the **a** - **b** points of the **RTX** connector. - Connect the transmission cannel (600 Ohm) to the **a** - **b** points of the **TX** connector;

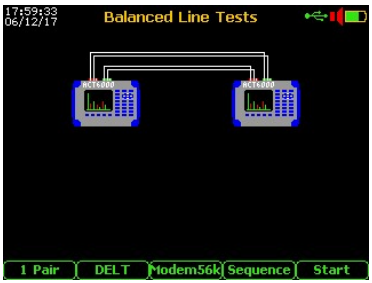


Image 1 (Local / Master side)

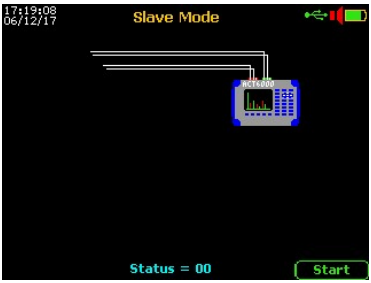
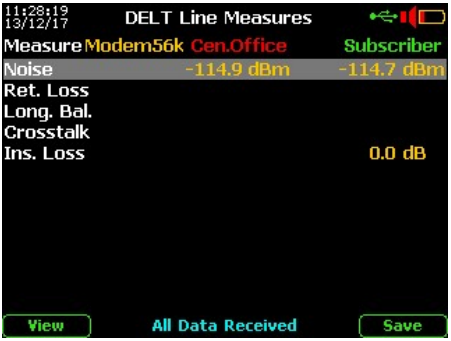


Image 2 (remote / subscriber side)

MASTER: Push the ***F5*** key to start the call vs. SLAVE;

SLAVE: an audible beep confirms the right channel connection, now push the ***F5*** key to enable the reception of the commands data from the Master.

Wait the end of the automatic test sequence and the complete measurements transfer from SLAVE to the MASTER unit.

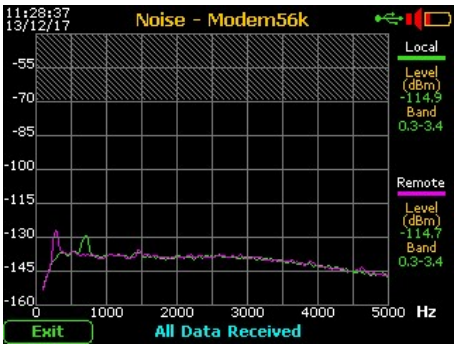


Once the measurements transfer is finished, the MASTER display will show the following results:

If desired, push the ***F5*** "**Save**" two times on the internal memory. The display will show:

- the RMS Noise value of both Receiving channels
- the Insertion-loss @ 1 kHz related to the transmission cannel connected to the MASTER unit.

then push the ***F1*** "**View**" key for spectral readout:



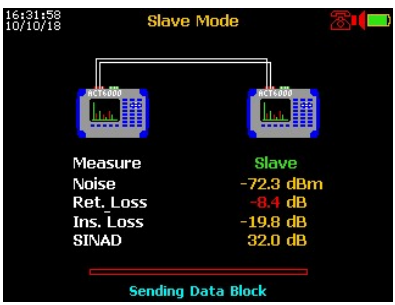
Spectral Noise (with typical threshold limit -70dBm)

Insertion-loss (without threshold limits) @

7.3.LINE TESTS Pre-configured Telephone DELT (End-to-End) Sequence

By using the "Advanced Software 1/II", ACT-11 options and two ACT6000s configured as POTS telephone devices connected to CO Exchanges, it is possible to perform a complete POTS link qualification by Signaling and Transmissive tests (according to M.1040 mask).

Slave setup



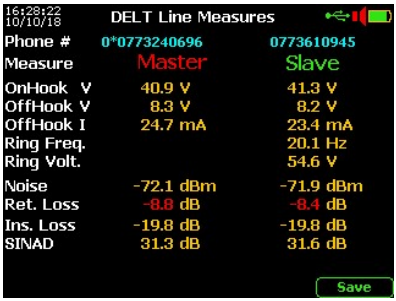
From the Main Menu select and enter "**8. SlaveMode**" then select and enter "**2. TELEPHONE TESTS**".

Connect the powered line (Tip & Ring) to the **a** - **b** points of the **RTX** connector.

Verify the "**On-Hook**" voltage from the CO Exchange (normally 40 - 50 Vdc, however it can be between 20 to 72 Vdc). Where line voltage is not present, or it is not correct, verify the connection to the line under test or check the line for another potential problem. The Slave is now ready to receive data requests from

the Master unit. When the measurement sequence is completed, the Slave automatically sends all its results to the Master unit. Once the data transfer is completed, the Slave automatically returns to stand-by mode ready for other tests.

MASTER setup



From the Main Menu select and enter "**1. LINE TESTS**" then select and enter "**2. TELEPHONE TESTS**".
Using the Keypad enter the telephone number of the caller (Master) then press "Enter". Press "Enter" again, then using the ▼ key select "Slave #", press "Enter" again.
Enter the telephone number① of the Slave unit and then press "Enter".
Connect the powered line (Tip & Ring) to the **a** - **b** points of the **RTX** connector.

Start the test by using the ***F5*** key "**Start**".
Once the test has completed the data will be transferred from the Slave unit to the Master, all test results are then displayed on the Master.

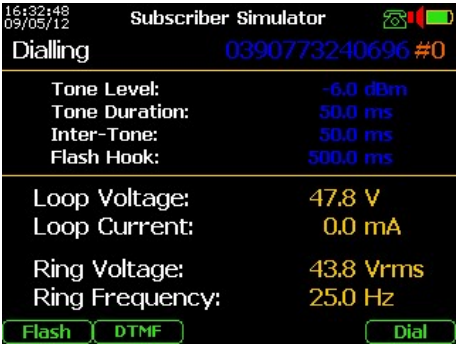
To save the test results press ***F5*** "**Save**" and by using the keypad enter the file name. Press "Enter" and then press ***F5*** "**Save**" again.
Failed tests are shown in red, according to the appropriate POTS standard.

If it is necessary to repeat the test, press "**Escape**" to go back to the Master Setup menu and then press ***F5*** "**Start**" to restart the test.

Note①: if necessary typing [*/.] *it is possible to insert a short pause for prefix number.*

8. Subscriber Simulator

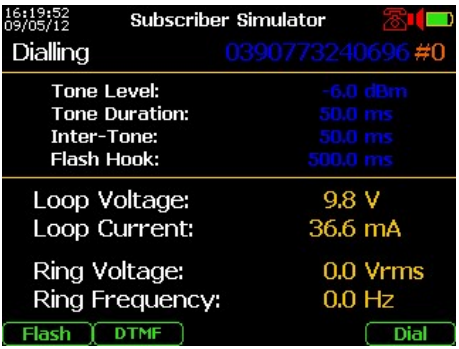
By the adoption of the POTS-SUB optional module ACT-11 (installed on the DMM module) it is possible to perform a simple test to verify the CO signaling parameters using the ACT6000 as POTS telephone device.
From the **Main Menu** select and enter on the "**1. Line Tests**" menu, then select and enter on the "**3. SUBSCRIBER SIMULATOR**".



Connecting the telephone line from the CO to the **a** – **b** points of the **RTX** connector, it is possible to verify immediately the Loop Voltage (CO line feed) in Hook-On condition.
On this condition it is possible to measure the possible Ring Voltage and Frequency.

For answer:

Next the Ring tone detection engage the line pushing the key.
On this condition it is possible the conversation with the caller using the headset connected to the instrument. When the test is finished disengagement the line pushing the key.



For call-up:

- Select the "**Dialling**" line pushing the key and press "Enter".
- Type the Line Service telephone number and then press "Enter".
- Push the key to engage (Hook Off) the telephone line.

On this condition is shown the Loop Voltage and Current.

- Start the call-up pushing the ***F4*** "**DIAL**" function key.

During the line engagement it is allows the conversation with the responder using the Headset connected to the instrument.

When the test is finished, disengagement the line pushing the key.

Other settings:

By pushing the ***F2*** function key it is possible to select the DIAL mode: standard **DTMF** tones or standard **Pulse**.

Selecting the Tone parameters by and the ▲▼ arrows it is possible to change the Tone Level, Duration, Inter-Tone, but also the Flash Hook duration.

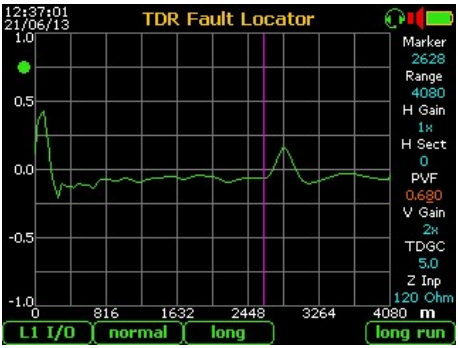
Pushing the "**Flash**" ***F1*** function key it is possible to temporary disengagement and reengagement the line.

9. TDR Fault Locator

This item allows the selection of a useful function to locate a fault along the line or to estimate its total length. Any impedance mismatches on the line under test are shown as upward pulses when the impedance increases (up to the “open circuit”), and downward pulses when the impedance decreases (up to the “short circuit”).

Measurement setup

From the **Main Menu** select and enter on the **TDR Fault locator** function.



- Connect the line under test to the **a** – **b** point of the **RTX** connector and observe the graph.
- If in the selected range a positive trace is displayed (as shown on the image at left) or negative (if the line was in short circuit), select the “Marker” window by key and ▲▼ arrows, then using the ◄► arrows move the marker bar on “knee” of last upward pulse; the distance is shown in the marker window.

If necessary, optimize by using the ”**Range**” / “**H Gain**” / “**H Sect**” commands the horizontal display of the trace in the center / right of the grid.
If necessary modify the “**V Gain**” parameter to optimize vertical display of the envelope, and/or the “**TDGC**” parameter to increase or decrease the gain of the receiver.

The selection of the parameter related to the Pulse Velocity Factor (**PVF**, **Ft/µs**, **V1/2** etc.) and to the Distance Measure Unit (**Meters** or **Feet**) it must be performed into the “**7. Config. & Utility**” menu.
To the automatic set of the **PVF** it is suggested to select the preponderant cable type from the “**8. Cable Setup**” menu of the **Config. & Utility**” group (see at page 48).

long run To clean the trace related to a long and (over 3km) and very noisy line, it is suggested to press the ***F5*** “**long run**” key. A repetition of 64 tests (in about 20 seconds) will be able to clean the trace of the possible “end-of-line” echo.

Other setting:

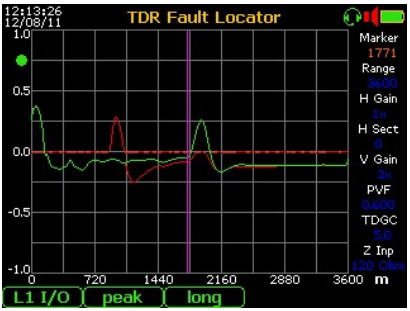
L1 I/O
L1 I/L2 O

By repeated pushing of the ***F1*** key and “Enter” the IN/OUT of the TDR front-end can be changed; the “**L1 I/O**” is the usual mode operation to localize faults or anomalies on the line under test connected to RTX connector.

The “**L1 I/L2 O**” is an useful operation mode to find and localize the possible cross-talk point (e.g.
due to split-pairs) between two lines connected to TX and RTX connector.

normal
relative
peak

By repeated pushing of the ***F2*** key and “Enter” the TDR operating mode can be changed from “**Normal**” to “**Relative**” (to zero the echogram and highlight only the new mismatching) or “**Peak**” to sample and hold intermittent discontinuities during long term measurements.
The “**Relative**” mode is useful to detect mismatching among two lines on the same cable. On this image is shown an echo-graph at the end of the monitoring time on “**peak**” mode.



The TDR has captured a short positive trace from a line interrupted for a short time.
This function is very useful to find and localize any intermittent events on the line (short circuit, false contacts or open circuit).
If necessary to measure the **differential distance** between two envelopes, pushing the ▲ or ▼ arrows into the Marker window, it is possible to enable a second Marker and move it by the ◀ ▶ arrows on the needed point.
To clear the second Marker it is sufficient push the ▲ or ▼ arrows into the Marker window.

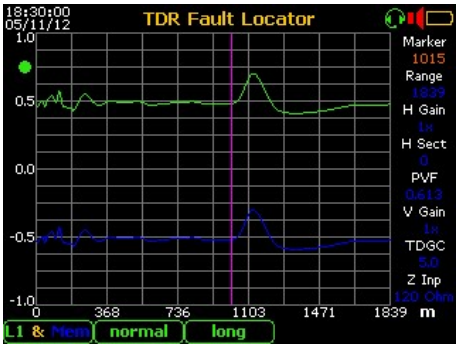
long
short
boost

By repeated pushing of the ***F3*** key and “Enter” the “**long**” pulse generally used for medium/long ranges (over 500 meters) can be selected.
Selection of the “**short**” pulse is suggested for short ranges (under 500 meters).
In the cases of noisy or very long lines (over 4 km) it is possible to set the “Boost” pulse. It is always recommended to limit the time this mode with a strong pulse is used to avoid possible interference with adjacent lines.

By pushing the “Photo” key, the measurement can be temporarily frozen and the ***F5*** key will be enabled to save the measurement in the internal memory. By pushing the F1 key the measurement will be reactivated.

By pushing the key the image on the display will export in BMP format on the USB Pen-Drive or PC.

COMPARATIVE TEST
If desired to compare the real-time echogram with another one previously performed and memorized, follow these instructions:



- From **Main Menu** enter with "**8. File Manager**" menu and select the test to be compare, then push ***F5*** key.

- Return on the **Main Menu** and enter with "**2 TDR Fault Locator**" menu, by the ***F1*** key select the L1 & Mem mode.

As on the image at the left, will be shown the real-time graph (top side and green) and the old graph (bottom side and blue).

L1 - Mem

Selecting by the ***F1*** key the modality, will be shown the differential graph between the two echograms.

10. Events Tests

This item allows the selection of some test functions oriented to line troubleshooting such as MICROINTERRUPTIONS and IMPULSIVE NOISE .

10.1. Micro-interruptions Test

This test can be performed in three ways: **End-to-End**, **Single-End** and **Tracking**. For the **End-to-End** mode it is necessary to use two instruments (one as Generator and one ACT6000 as Meter, connected at opposite ends of the line under test.
For the **Single-End** mode a single ACT6000 is used, but it is necessary to have available a good reference line to transport the reference signal up to the end of the line under test by a simple loop.
For the **Tracking** mode a single ACT6000 is used together with the constant presence on line of a good reference signal between 1 kHz and 6 MHz, with suitable stability (under ±10 ppm) and suitable level (> -20 dBm and < +10 dBm).

Single-End mode
After the creation of the loop between the lines, connect the reference line (good) to the TX connector of the ACT6000 setting the Test Frequency to 2 kHz.

End-to-End mode
Set the Remote Generator (*it can be another ACT6000*) to **2 kHz** / **600 Ohm** / **0 dBm** (*for the ACT6000 see the Generator & Meter instructions on this guide*) and connect the line under test to the output of this generator.

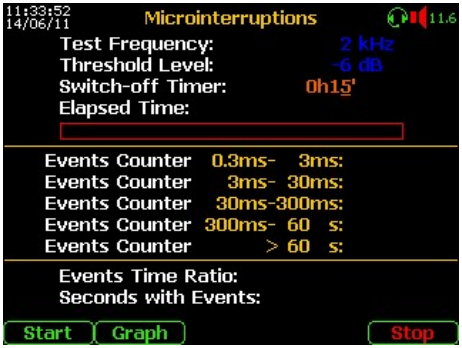
Tracking mode

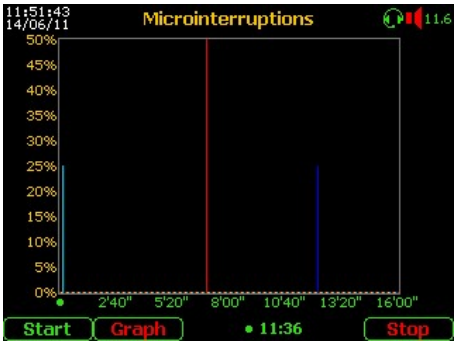
Set on the ACT6000 the same Test Frequency of the reference signal already present on the line.

Measurement setup

From the **Main Menu** select and enter on the **1 Event Tests,** then select the "**2. Microinterruptions**" function; the display will show the following menu.

- Connect the line under test to **a** – **b** points of the **RTX** connector, if the Test Signal is in the voice band a tone will be heard on the internal loudspeaker (if needed it is possible to reduce the volume by pressing the command and the ▼ arrow); By pushing the key set the Threshold Level, below which is defined the signal interruption;
- By , "**Enter**" and ▲▼ arrows set the Switch-off Timer (≥ 15 min. is suggested); - Push the "**Start**" (**F1**) key.





At the end of the test, all the results will be shown on the display.

During the test, or at the end, pushing the ***F2*** "**Graph**" key will show the graphic representation in the time domain on the horizontal axis.
The percentage of seconds with events will be represented on the vertical axis.
Re-pushing the ***F2*** key goes back to the tabular representation.

By pushing the "Photo" key, the measurement can be frozen and the ***F5*** key will allow to save the measurement to be saved in the internal memory.

10.2. Impulsive Noise Test

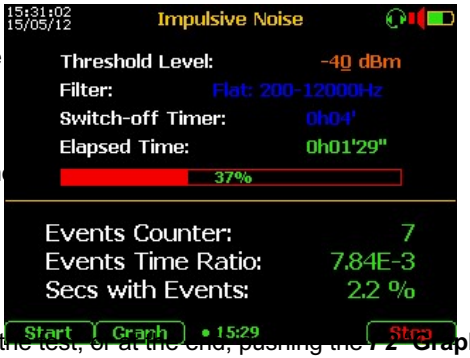
Measurement setup

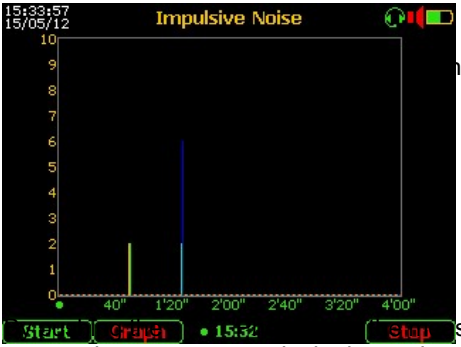
From the **Main Menu** select and enter on **3 Event Tests,** then select the

"**1. IMPULSIVE NOISE**" function; the display will show the following menu.

- Connect the line under test to the **a** – **b** points of the **RTX** connector;
- By pushing the key set the Threshold Level to noise detection;
- By , "**Enter**" and ▲▼ arrows set the Band Filter and the Switch-off Timer (≥15 minutes is suggested); -

Push the "**Start**" (**F1**) key.
At the end of the test, all the results will be sh
on the display.





ng the test, or at the end, pushing the ***F2*** "**Graph**" key will show the histogram representation in the time domain on the horizontal axis.
The number events will be represented on the vertical axis.
Re-pushing the ***F2*** key goes back to the tabular representation.

surement can be frozen and the ***F5*** key will allow to save the measurement in the internal memory.

11. Digital Multimeter

(by DMM optional module ACT-12 adoption)

This item allows the selection of some metallic measurements:

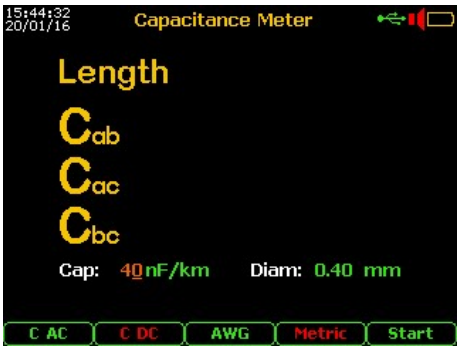
AC/DC Voltage, to measure extraneous voltage on the line, **AC/DC Capacitance** to measure the **AC** capacitance and **Q** of the line or **DC** (by capacitor discharge method) the capacitance value of the line plus the possible capacitance loads (i.e. telephones), **Resistance** to measure the loop resistance, **R-Bal** to measure the wires balancement, **Insulation** to measure the insulation resistance between the conductors and GND, the **RFL** to localize the possible low insulation points of the line and **Line / Load Impedance**. The occasional calibration of the DMM is allowed by pushing the ***F1*** "**DMM Cal**" key.

11.1. DC/AC Voltage Measurement

From the **Main Menu** select and enter the **Digital Multimeter** function, then select item **1. Line Voltage**; on the display will appear the menu shown to left.

- Push "**Set Zero**" before connecting the test cables .
- Push the ***F2*** key to select the measurement mode **V DC** or **V AC**. - Connect the line to **a** – **b** points and GND reference to the **c** point of the **RTX** conn. - Push the ***F5*** "**Start**" key and wait for the sequence of results to be displayed. ◘ **Vab** value still in real-time

11.2. DC/AC Capacitance Measurement



From the **Main Menu** select and enter the **Digital Multimeter** function, select item **2. Capacitance Meter**; then select by ***F2*** or ***F3*** key the test modality AC or DC.

- Connect the line to **a** – **b** points and GND reference to the **c** point of the **RTX** conn.
- Disconnect the AC/DC battery charger. - Push the ***F5*** "**Start**" key to show the results progressively.

When the DC* capacitance value between **a**-**b** is congruent with the typical capacitance of copper lines, an estimation of the length related to the capacitance value per meter is automatically shown (see the **Cable Setup** menu at page 48).

To modify the Cap value nF/km and/or wires diameter use the commands group 

By pushing the  "Photo" key, the measurement can be temporarily frozen and the ***F5*** key will allow to save the measurement in the internal memory.

** if found an extraneous voltage over 2.0 Volt, the test will be blocked !*

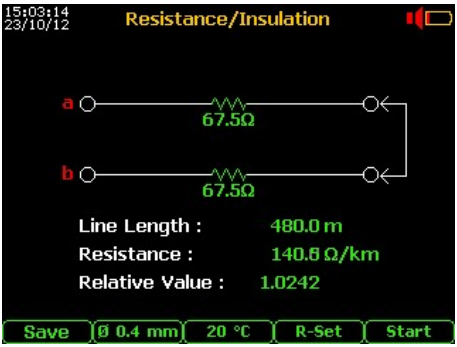
11.3. Resistance Measurement (Loop and/or Insulation)

Setup of the true copper resistivity

Knowing the exact length or exact resistive value of a line, by a special procedure it is possible adjust the copper resistance to increase the lines length accuracy.

From the **Main Menu** select and enter the **Digital Multimeter** function, then select item **3.**

Resistance/Insulation, then press "**Enter**".
By the test-cable connect the line to **a** – **b** point of the RTX connector.

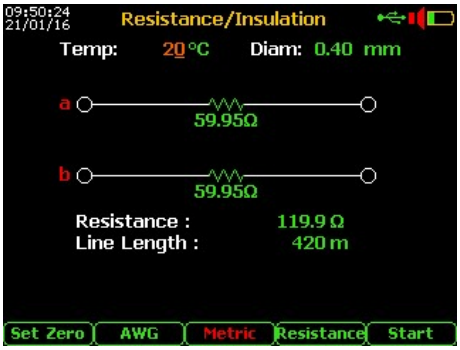


Select by ***F4*** key "**R-Set**" then press ***F5*** "**Start**";
By ◄ ►▲▼ set the right **Line Length** or the right "**Resistance**"by ↻command and ◄ ► ▲ ▼, then push ***F5*** "**Start**".
As suggested on the display, short the end of this line then press ***F5*** "**Start**".
Finished the measurement, remove the short circuit at the line end and push ***F5***.
With the certainty of the right "Relative Value", press again ***F5*** "**Start**" and then ***F1*** "**Save**".
From this moment all the tests related to the resistance measurement will be always calibrated with this resistivity value.

To restore the default (factory) standard copper resistance from the **Main Menu** select "**7. Config & Utility**" and push ***F1*** "Default".

Loop Resistance with line length calculation

From the **Main Menu** select and enter the **Digital Multimeter** function, select item **3. Resistance/Insulation**, then press "**Enter**".
*To improve the Resistance test accuracy, short the end of the test-cable (**a** – **b** points) and press **F1** "**Set Zero**".*



By the **Cable Setup** menu (see page 48) select the presumed cable under test. Short the line (**a** – **b**) at the opposite side.
By the test cable connect the line to **a** – **b** points of the RTX.
If necessary correct the presumed cable gauges by ***F2*** key.
By ***F3*** set the presumed temperature of the cable then press ***F5*** "**Start**" *
When the loop resistance between **a**-**b** is congruent with typical resistance value of copper line (under 5 kOhm), an estimation of the length related to the loop resistance value per meter is automatically shown.

** if found an extraneous voltage over 2.0 Volt, the test will be blocked !*

Real time Loop Resistance Measurement (it requires the ACT-18 optional module)

If installed the "Real time Resistance Meter" **ACT-18** optional module, from the **Main Menu** select and enter the **Digital Multimeter** function, then select **6. OHM METER** then press "**Enter**".

*To improve the Resistance test accuracy, short the end of the test-cable (**a** – **b** points) and press **F1** "**Set Zero**".*

By the test-cable connect the line to **a** – **b** point of the RTX connector.

Push the ***F4*** "Start" key.

Rab value still in real-time *

Finished the test push ***F5*** "Stop"

By pushing the "Photo" key, the measurement can be temporarily frozen and the ***F5*** key will allow to save the measurement in the internal memory.

** if found an extraneous voltage over 2.0 Volt, the test will be blocked !*

Insulation Test **ATTENTION! Also for this test disconnect the external power supply!**

From the **Main Menu** select and enter the **Digital Multimeter** function, select item **3. Resistance/Insulation**. By ***F4*** select the "**Insulation**" test and push "Enter".

Warning! During the test cycles don't manage the line (a-b) or "ground" (c) connections.

*Note: to the correct length estimation it is necessary to select the cable type from the **Cable Setup** menu (see page 48) and, if possible, setting the right conductor resistivity (see 11.3).*

- Connect the line to **a** – **b** points of the RTX connector and the Gnd ref. to **c** point.

- By ***F3*** set the presumed temperature of the cable then press ***F5*** "**Start**" *
  If the result of insulation value between **a**, **b** or **c** wires is under 20 MOhm, it is possible to estimate the distance to the fault by the RFL function.

* *if found an extraneous voltage over 2.0 Volt, the test will be blocked !*

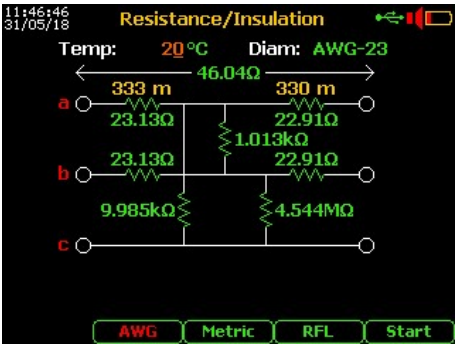
11.4. Low Insulation Localization (RFL) without extraneous voltage

*First of all it is necessary to find the **a** or **b** conductor at the end of the line.*
A possible method is to perform a short circuit between one conductor of the line and the reference conductor (of other line or "earth" / "Gnd" reference point of the street cabinet, box or the shielding of the cable).
*Performing again the resistance measurement by pushing the **F5** "**Start**" it is possible to find what conductor (**a** or **b**) has been used for this test.*

Remove the short-circuits and repeat the Insulation Test above described.

After the new **Insulation Test**, push more time ***F4*** to select "**RFL**" mode, then push "**Enter**".
Pushing ***F5*** "Start" on the display will appear the advises that invites the remote technician to short some conductors.

Performed the first action it is necessary to push again the ***F5*** key and wait the possible next steps following the instructions shown on the display for the final calculation.

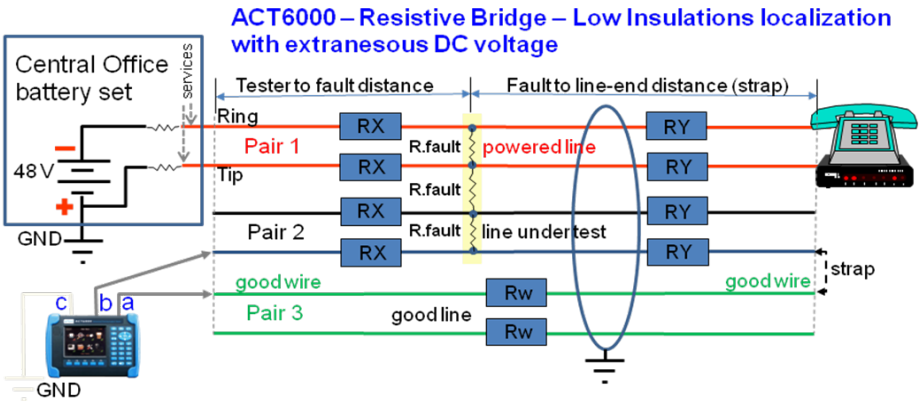


11.5. Fault Localization (RFL) with extraneous DC voltage

If during the **Insulation test** is detected an extraneous DC voltage among the wires connected to **a** – **b** points and /or to **c** (**GND** reference), this advise will appears.

In this case is not possible any Insulation test !

To localize the possible fault it is possible to select a special test among the functions of the "**Resistance/Insulation**" menu. The typical situation is a low insulation for water/oxide presence between the line under test (e.g. Pair 2) and one powered lines (e.g. Pair 1) as represented on the scheme below.

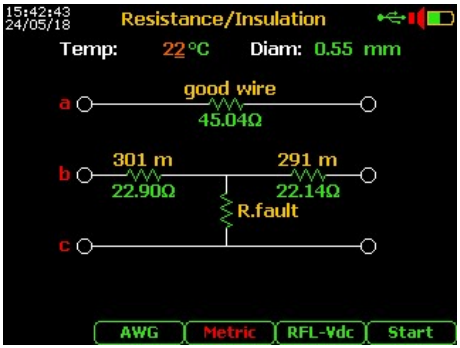


First of all, it is necessary to find on the cable a "**good wire**" among the pairs (with same length). The method is to measure the **DC Voltage** (see 11.1) connecting one of the free lines to **a** – **b** points and **c** point to the GND reference of the RTX connector. Found the "good wire" (i.e. of the Pair 3) it is possible to proceed as following.

By the **Cable Setup** menu (see page 48) select the presumed cable under test.
Select and enter the "**RFL-Vdc**" test among the functions of the "**Resistance/Insulation**" menu.

Connect one wire of the line under test "faulted pair" to the **b** point, connect the "good wire" of the free good line to the **a** point, connect the GND reference to the **c** point. Press the ***F5*** "Start", short the "good wire" connected to **a** point to the "faulted pair" connected to **b** point, press again ***F5*** "Start". Finished the test it is possible to read the distance from the test point to fault and from fault to line-end.

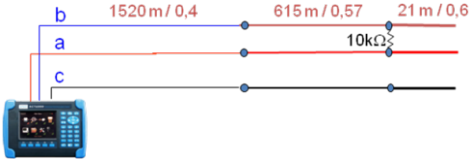
By this test is not possible to measure the value of the fault resistance.



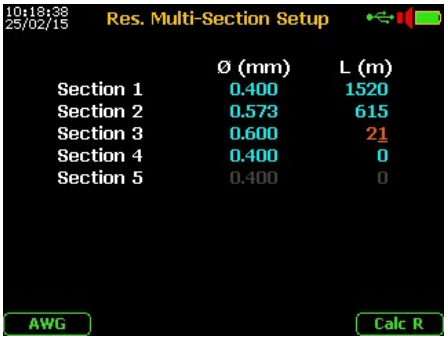
Multi-section Setup

If the line is realized by different cables type, (as the following example) using the detailed plant map, it is suggested to perform this test following these instructions:

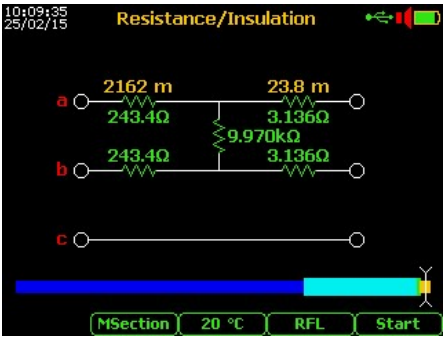
From the **Multimeter** menu select and enter on the "**4. RES. MULTI-SECTION SETUP**". Type the right diameter (Ø mm) (or AWG type) and set the right length (L m) of each section.



Then, exit from this menu and select the **Insulation test** as describer on previous page. Finished the **Insulation test**, select and perform the **RFL test** as already described. Finished the fault localization, under the diagram will be shown a color bar that highlights the different cable sections.



>>>

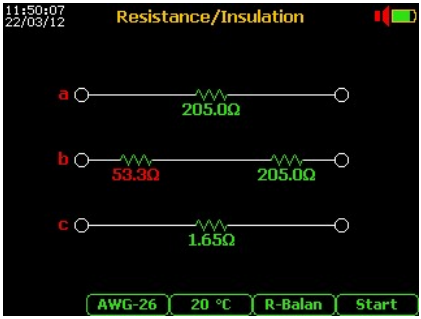


Attention!

This multi-section setup will stay even after the switch-off of the instrument !

To avoid errors on other possible fault localizations, restore the default condition pushing the ***F1*** key "**Default**" from the **Config & Utility** menu.

11.6. Resistive Balancement "R-bal" measurement



From the **Main Menu** select and enter the **Digital Multimeter** function, select item "**3. Res. / Insulation**"

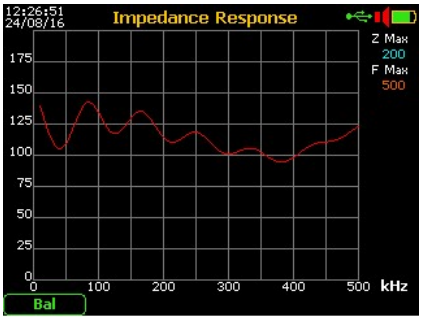
By the ***F4*** select the **R Balan**" function, then press **"Enter"**. Connect the wires of the line under test and the reference wire (or "Gnd" reference) to the **a** - **b** and **c** points respectively of the **RTX** connector.

Pushing the ***F5*** "**Start**" * will appear the advise that invites the remote technician to short the three conductors at the other side of the line.

Push again the ***F5*** "**Start**" key and wait the end of the test. If the resistance value of the **a** it is different over **5 Ohm** respect to the **b** wire, will be shown on graph the additional (differential) resistor and its resistance value (in red) as the figure above.

** if found an extraneous voltage over 2.0 Volt, the test will be blocked !*

11.7. Line / Load Impedance Response

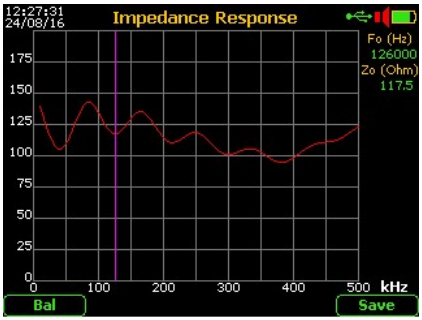


From the **Main Menu** select and enter the **Digital Multimeter** function, then select the item "**5. Impedance Response**".

Connect the wires of the balanced line (or load under test) to the **a** - **b** of the **RTX** connector, or unbalanced line (or load) using the Banana to BNC Adapter (option ALT-16) *.

Pushing the ↩ key and ▲▼ arrows select the "**Z Max**" (maximum impedance range) and "**F Max**" (maximum frequency range).

*To perform the measurement on unbalanced line/load press ***F1*** key to select "**Unb**" mode. The display will shows the impedance response up to the maximum frequency set.



Pushing the “Photo” key, the measurement can be frozen and will be enabled the marker.

Moving the marker using the ◀ ▶ arrows will be possible to read the exact impedance value for any specific frequency.

Besides pushing the ***F5*** key is allowed the saving on the measurement in the internal memory.

12. Signal Analyzer & Generator

This item allows the selection of some measurement functions to test the transmission performance of lines, apparatus and communication systems.

GENERATOR & METER:
Sinusoidal Signal Generator, wide or weighed band and Selective Level Meter up to 20 kHz, Selective Level Meter for medium/high band up to 6 MHz (or 35 MHz by internal optional module), selective or wide band Frequency-Meter.
It allows these measurements to be performed:

- **Insertion Loss** (at a single frequency with two instruments);
- **Noise** (wide and weighed on base band);
- **Crosstalk** (NEXT with single instrument / FEXT with two instruments); - **S/N** and **Distortion** (in the base band); - **Signal Frequency**.

By the key is allowed the export on the USB Pen-Drive or PC the image on the display (in BMP format).

SPECTURM & NETWORK ANALYZER:
This is a powerful analyzer to measure **signals** and/or **noise** levels with various input configurations such as: low and high impedances or DC decoupling to perform special “sniffer” measurements on powered lines.

In 4 Wire mode, using the tracking generator output (TX) separate from the receiver input (RTX) it is possible to perform these spectral measurements:

- **Insertion Loss** of loop lines or channels or various quad-pole devices; - **Crosstalk** (NEXT) between two lines or channels.

In 2 Wire mode, using the active bridge and the tracking generator (RTX connector), it allows:

- **Return Loss** measurement;
- **Longitudinal Balance Loss** measurement (limited to Base and Medium Band).

By pushing the  key it is possible to freeze the measurement.
Moving the marker by the ◀▶ arrows, it is possible to read the amplitude and frequency of any point of the trace on the first two windows at the top right of the display.

In **Medium Band** by pushing the ***F1*** "**F_Max**" key it is possible to display the frequency value of the maximum signal level shown on the display (set by **Fc** and **kHz/Div**). The frequency resolution is 1/100 of the kHz/Div setting (i.e. 10 Hz for 1 kHz/Div.)

Pushing the  key it is possible to mark up to four different frequency points associated to different colors.
By the "**Save**" key function it is allowed the saving of the measurement on internal memory, included the four possible markers points.

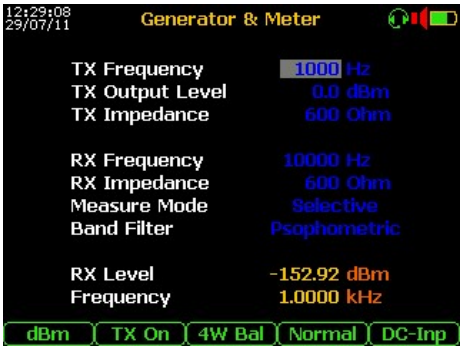
By the  key is allowed the export on the USB Pen-Drive the image on the display (in BMP format).

&

From **Main** and

12.1. Generator Meter

the **Menu** select enter the **Signal Analysis** item, then select and enter one of these bands: **1. BASE BAND TESTS** or **2. MEDIUM BAND TESTS**.
Select the item **1 GENERATOR & METER**, on the display will appear this menu:



By pushing key and ▲▼ arrows select the required TX and / or RX parameter. confirming the selection by the key, th modify the parameter by ▲▼ arrows.
For the RX section (only for base band), it is possible to select the **Measurement Mode**: wide band, selective, notch and S/(N+D) for distortion measurements and narrow bands: 120, 240, 360, 400 and 480 Hz BW.
By using the **Band Filter** it is possible to select various weighting bands.
In **Medium / High Band** the RX works only in selective mode.
There are the selectable filters: 25, 100, 200, 400, 1740, 3100, 4000, 8000 and 16 kHz.

When selected the High Z Impedance the RX Level in dBm it is related to the reference impedance selected on the TX section.

Other settings:

By repeated pushing of the ***F1*** key and then "Enter" key, the following level reading mode **dBm**, **dBr**, **dBV**, **dBu** and **Volt** can be selected

By repeated pushing of the ***F2*** key and then "Enter" key, it is possible to set the generator: **TX On** (on any programmable frequency), **TX->RX** (RX and TX on same frequency), **TX Off** (to switch-off the generator, a very useful thing to measure very low level signals.

By repeated pushing of the ***F3*** key and then "Enter", it is possible to set the front-end of the instrument to: **4 W**ires (separated TX and RX) on **Balanced**
mode for copper pairs tests or **4 W**ires (separated TX and RX) on **Unbalanced** mode for coaxial cables tests.

&

From **Main** and

Normal
MaxVal
MeanVal
MinVal

By repeated pushing of the ***F4*** key and then "Enter", it is possible to select the measurement mode: **Normal** or highlighting in red text the **Maximum** or **Mean** or **Minimum** input level.

DC-Inp
AC-Inp
Probe
-50dB

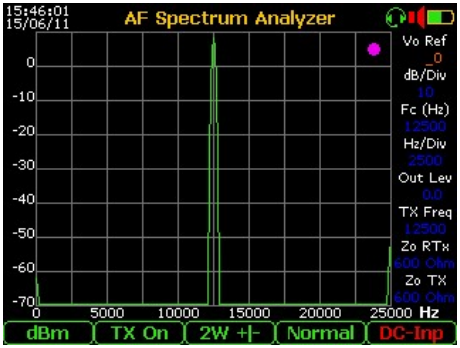
By repeated pushing of the ***F5*** key and then "Enter", it is possible to configure the front-end of the instrument to perform the measurements by **AC** or **DC** coupling useful to increase the level accuracy of very low frequency.

Only for **Medium Band** is added **-50 dB** modality to compensate the high levels readout if inserted the specific 50 dB Attenuator "ACT-17/B" o "ACT-17/U".

To measure the **frequency** of the input signal it is necessary to push the */. Key.
The sensitivity threshold of the frequency-meter is about -30 dBm.

12.2. Spectrum Network Analyzer (for Base and Medium Band)

the **Menu** select enter the **Signal Analysis** item, then select and enter one of these bands: **1. BASE BAND TESTS** or **2. MEDIUM BAND TESTS** and select the item **2. SPECTRUM ANALYZER**, will shown this menu:



By pushing the key and ▲▼ arrows select the RX and / or the TX parameters: **Vo Ref** (to set the grid range), **dB/Div** (to set the vertical resolution), **Fc (Hz)** (to set the central frequency on the grid), **Hz/Div** (to set the horizontal resolution), **Out Lev** (to set the output level of the generator), **TX Freq** (to set in Hz the fixed frequency of the generator), **Zo RTx** (to set the Input or In/Out impedance), **Zo TX** (to set the Output impedance)*. After the selection, pushing the it is possible to modify the parameter by using the ▲▼ arrows.

Other setting:

dBm
dBm/Hz
dBr
dBV
dBu

Repeated pushing of the ***F1*** key and "Enter" the following level reading mode: **dBm**, **dBm/Hz**, **dBr**, **dBV** and **dBu** can be selected.

TX On
Noise
TX SW
TX Off

By repeated pushing of the ***F2*** key and "Enter" it is possible to set the generator: **TX On** (at a fixed programmable frequency), **Noise** (wide band white noise), **TX SW** (sweep signal tracking with RX, **TX Off** to switch off the generator, an useful thing to measure very low signals (e.g. noise level).

2W Ret-L
2W L-Bal
2W Unb
4W Bal
4W Unb

&

From **Main** and

By repeated pushing of the ***F2*** key and "Enter" it is possible to set the measurement mode: **2W Ret-L** (2 wires Balanced) - mix TX/RX to measure the **Return Loss**, or **2W L-Bal** (2 wires Balanced) - mix TX/RX to measure the **Longitudinal Balance Loss**, or **4W Bal** (4 wires Balanced), or **4W Unb** (4 wires Unbalanced) to measure the Cross-Talk "Next" or the Insertion Loss of a loop line).

Normal
MaxVal
MeanVal
MinVal

By repeated pushing of the ***F4*** key and "Enter" it is possible select the measurement mode: **Normal** or (highlighting in red text) the **Maximum** or **Mean** or **Minimum** input level.

DC-Inp
AC-Inp
Probe
-50dB

By repeated pushing of the ***F5*** key and "Enter" it is possible to configure the front-end of the instrument to perform the measurements by **DC** or **AC** coupling or, by external **Probe** "ACT-15" to perform the PSD on powered lines enabled only if selected the "Zo RTx" in "**Z-high**", or **-50 dB** to compensate the high levels
readout if inserted the 50 dB Attenuator ""ACT-17/B" o "ACT-17/U".

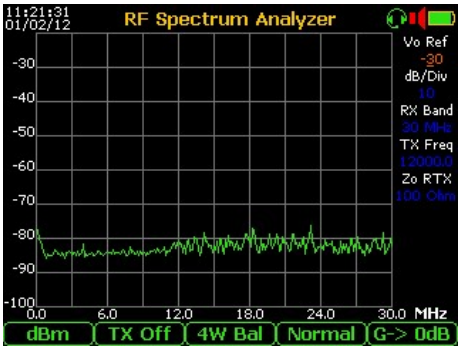
To improve the maximum resolution in **Base Band** (**625 Hz/Div**), push the */. key. In this case the horizontal resolution will change from **625 Hz/Div** to **312.5 Hz/Div**. With **Fc (Hz)** on **1862 Hz**, the frequency range will be **300 ÷ 3425 Hz**.

In **Medium Band** push the #/± key to show the applied "**Resolution Bandwidth**".

** In **2 Wire** mode the TX impedance is the same of the RX, the High Z isn't allowed.*

12.3. Spectrum Network Analyzer (for High Band)

the **Menu** select enter the **Signal Analysis** item, then select and enter on **3. HIGH BAND TESTS** and select **2. SPECTRUM ANALYZER**, will appear this menu: By pushing



the key and ▼ arrows select the RX and / or the TX parameters: **Vo Ref** (to set the grid range), **dB/Div** (to set the vertical resolution), **RX Band** (to select **0 to 12** or **0 to 18** or **0 to 35** MHz band, **TX Freq** to set in kHz the fixed frequency of the generator, **Zo RTx** (to set the Input (RX) impedance (100 Ohm or 50 Ohm or HighZ impedance) if selected **4W Bal** or **4W Umb** mode.

After the selection, pushing the it is possible to modify the parameters by using the ▲▼ arrows.

Other setting:

&

From **Main** and

Repeated pushing of the ***F1*** key and "Enter" the following level reading mode: **dBm**, **dBm/Hz**, **dBr** and **dBV** can be selected.

By repeated pushing of the ***F2*** key and "Enter" it is possible to set the generator: **TX On** (at a fixed programmable frequency), **TX SW** (sweep signal tracking with RX, **TX Off** to switch off the generator, an useful thing to measure low signals (e.g. noise level).

By repeated pushing of the ***F2*** key and "Enter" it is possible to set the measurement mode: **2 W Bal** (2 wires Balanced - mix TX/RX to measure the **Return Loss**) or **2W Unb** (2 wires Unbalanced) when **TX ON** or **TX SW** is selected, or **4W Bal** (4 wires Balanced) or **4W Unb** (4 wires Unbalanced) to to measure the Near Cross-Talk "Next", or Insertion Loss of a loop line.

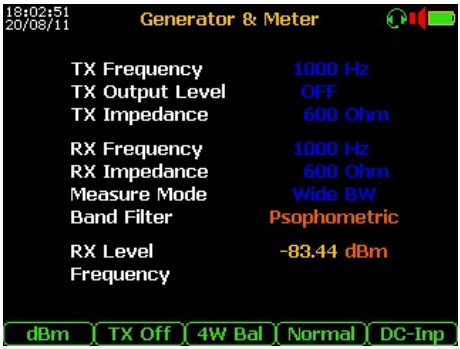
By repeated pushing of the ***F4*** key and "Enter" it is possible select the measurement mode: **Normal** or highlighting in red text the **Maximum** or **Mean** or **Minimum** input level.

By repeated pushing of the ***F5*** key and "Enter" it is possible to set the gain of the receiver (0 or 20 dB) to perform the measurements on High level or Low level (e.g. noise) signals, or by external HighZ **Probe** to perform the PSD on powered lines.

12.4. Guide for generic manual transmissive measurements

- **RMS Noise in Base Band with Generator & Meter**

The RMS Noise measurement in **Base Band** can be performed in wide band, or in limited band or in weighted band (with Psophometric or C-Message filter).
For this measurement it is possible to use the "**RX**" section of the **Generator & Meter**.



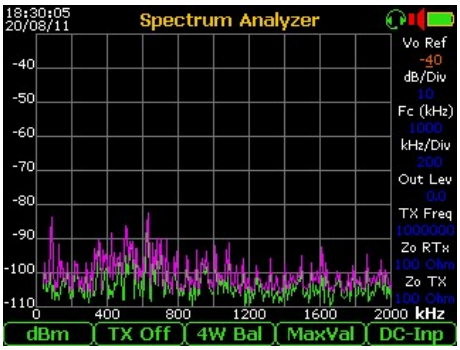
Set the instrument as follows:

- **dBm** by ***F1***
- **TX Off** by ***F2***
- **4W Bal** by ***F3***
- **Normal** by ***F4*** - **DC-Inp** * by ***F5*** and then:
- **RX Impedance:** (eg. **600 Ohm**)
- **Measurement Mode:** (eg. **Wide BW**)
- **Band Filter:** (eg. **Psophometric**) -

Connect the line to **a-b** of the **RTX** Read in **RX Level** the Noise level.

- **Spectral Noise / Level with Spectrum Analyzer**

The spectral measurement of the Noise / level, in **Base** or **Medium Band**, can be performed in limited band by the **Spectrum Analyzer**. Set the Instrument as follows:



- **dBm** by ***F1***
- **TX Off** by ***F2***
- **4W Bal** by ***F3***
- **MaxVal** by ***F4***
- **DC-Inp** by ***F5*** *(for maximum level accuracy in very low frequencies)*
- **Vo Rif** for the best trace display
- **dB/Div** for the best vertical resolution
- **Fc (kHz)** for the Base or Medium Band centre or **RX Band** (for one of the High Bands).
- **kHz/Div** for the Medium Band limit
- **Zo RTX:** (eg. **100 Ohm**)

Connect the line to **a - b** points of the **RTX** connector.
The setting on the example shown it is used to measure the noise on the typical copper pairs for the transport of ADSL2+ stream, where the bandwidth is few kHz to 2 MHz.

Long Time Noise / Level Monitoring
After the measuring parameters setting on **Medium Band**, connect the USB Pen-Drive

-

The
(empty) and press "**0**" and "**Enter**" of the keypad. The spectral signal will be saved on the Pen-Drive every two seconds (about) until the "**0**" key is pressed again. The analysis of the storage data (related to the time) will be possible by the new PC Utility named "**Spectrum.exe**" downloadable from this web page https://www.tempocom.com/products/act6000/

*Note *) this is the condition for maximum level accuracy, however if a DC Voltage (eg. line feed) is found, the front-end will be decoupled automatically by two capacitors.*

Power Spectral Density (with Spectrum Analyzer in High Impedance)

PSD measurement, in **Medium** or **High Band**, can be performed in limited band by the **Spectrum Analyzer** (not intrusive).

Set the instrument as follows:

- **dBm** or **dBm/Hz** by ***F1***
- **TX Off** by ***F2***
- **4W Bal** by ***F3***
- **Normal** or **MaxVal** by ***F4***
- **AC-Inp** by ***F5*** and then:
- **Vo Rif** for the best trace display
- **dB/Div** for the best vertical resolution
- **Fc (kHz)** for the Medium Band center or **RX Band** (for one of the High Bands)
- **kHz/Div** for the Medium Band limit
- **Zo RTX: Z-High**
- Connect (in parallel) the line to **a** - **b** points of the **RTX** connector directly for unfed lines;
- Connect (in parallel) the line to **a** - **b** points of the **RTX** connector inserting the right Probe, "**ACT-15/6**" (for medium Band) or "**ACT-15/30**" (for High Band), for fed lines and select "**Probe**" by **F5**.

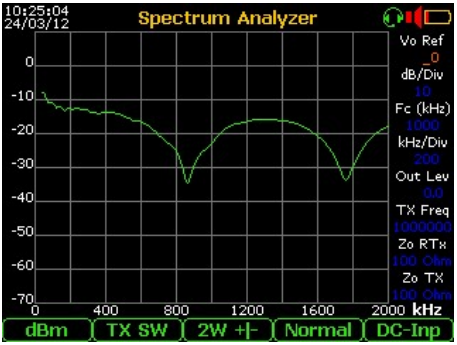
In the figure is shown the PSD measurement (subscriber side) of the typical ADSL stream (over POTS), in fact the line feed is shown by the little "**Vdc**" window.

- **Return Loss with Network Analyzer**

The spectral measurement of the Return Loss in any band, can be performed in limited band by the **Network Analyzer**. Set the Spectrum Analyzer as follows:

-

The



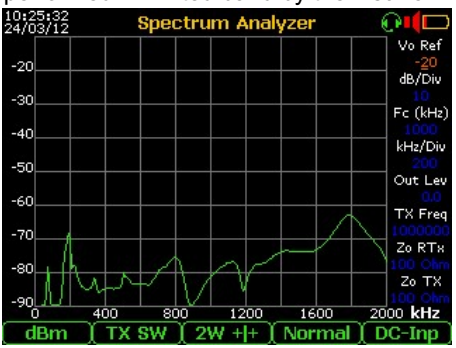
- **dBm** by ***F1***
- **TX SW** by ***F2***
- **2W +/-** (or **2W Bal** for High Band) by ***F3***
- **Normal** by ***F4*** **- DC-Inp** * by ***F5*** and then: **- Vo Ref** to **0**
- **dB/Div** for the best vertical resolution **- Fc (kHz)** for the Base / Medium Band centre or **RX Band** (for one of the High Bands)
- **kHz/Div** for the Medium Band limit **- Out Lev: 0.0** and **Zo RTX:** (eg. **100 Ohm**)

Connect the line to **a** - **b** points of the **RTX** connector.

The setting made as in the example shown is used to measure the Return Loss of typical copper pairs for the transport of ADSL2+ stream, where the bandwidth is from few kHz up to 2 MHz (approx).

The typical value of the Return Loss of a good copper line (>1 km long ..at least) is normally over 15 dB *(see the table at the end of this paragraph).*

Longitudinal Balance Attenuation with Network Analyzer spectral measurement of the Longitudinal Balance Attenuation in **Base** and **Medium Band** can be performed in limited band by the **Network Analyzer**.



Set the Spectrum Analyzer as follows:

- **dBm** by ***F1***
- **TX SW** by ***F2***
- **2W +/+** by ***F3***
- **Normal** by ***F4*** **- DC-Inp** * by ***F5*** and then:
- **Vo Ref** for the best trace display
- **dB/Div** to **10**
- **Fc (kHz)** for the band centre
- **kHz/Div** for the band limit
- **Out Lev: 0.0** and **Zo RTX:** (eg. **100 Ohm**)

- Connect the line to **a** - **b** points of the **RTX** connector;
- Connect **c** point of the **RTX** connector to GND ref. (cable shield, cabinet shield etc..)

-

The

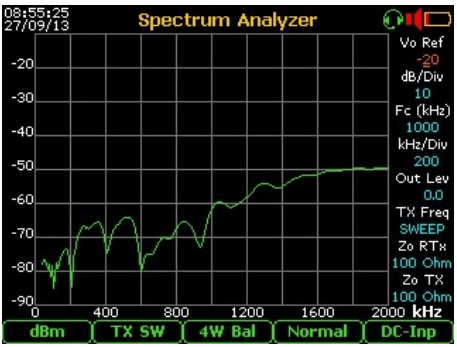
The setting made as in the example shown is used to measure the Longitudinal Balance Loss of typical copper pairs for the transport of ADSL2+ stream, where the bandwidth is from few kHz up to 2 MHz (approx).

*Note *) this is the condition for maximum level accuracy, however if a DC Voltage (eg. line feed) is found, the front-end will be decoupled automatically by two capacitors.*

- **Near End Crosstalk "NEXT" with Spectrum Analyzer**

The spectral measurement of the NEXT in any band, can be performed in limited band by the **Spectrum Analyzer**.

This measurement must be performed between two lines of the same cable to verify the transmissive insulation. Set the instrument as follows:



- **dBm** by ***F1***
- **TX SW** by ***F2***
- **4F Bil** by ***F3***
- **Normal** by ***F4*** **- DC-Inp** by ***F5*** and then:
- **Vo Ref** for the best trace display
- **dB/Div** to **10**
- **Fc (kHz)** for the Base / Medium Band centre or **RX Band** (for one of the High Bands)
- **kHz/Div** for the Base or Medium band
- **Out Lev: 0.0** and **Zo RTX:** (eg. **100 Ohm**)
- Connect one line to **a - b** points of the **RTX** connector;
- Connect the other (disturbing) line to **a** - **b** points of the **TX** connector.

The setting made as in the example shown is used to measure the NEXT on typical copper pairs for the transport of ADSL2+ stream, where the bandwidth is from few kHz up to 2 MHz (approx).

Insertion Loss meas. End-to-End manual or semi-automatic mode.

Insertion Loss measurement (or line attenuation vs. frequency) can be performed with a couple of instruments connected at the opposite ends of the line under test.

With the **Generator & Meter** function of two ACT6000 it is possible to perform this measurement at a single frequency, by suitable setting of all the parameters (see the Generator & Meter description and instructions).

Usually the **Generator** Output (**a** - **b** of the **TX** connector) must be connected to the remote side of the line, and the **Meter** Input (**a** - **b** of the **RTX** connector) must be connected to the local side of the line.

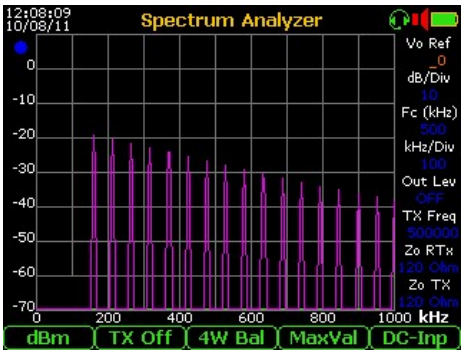
For the wide band spectral mode measurement (i.e. for PLCC line systems) it is necessary to use the **Spectrum Analyzer** function as meter and the **Step Generator** as reference signals.

Below the operation mode is described.

-

The

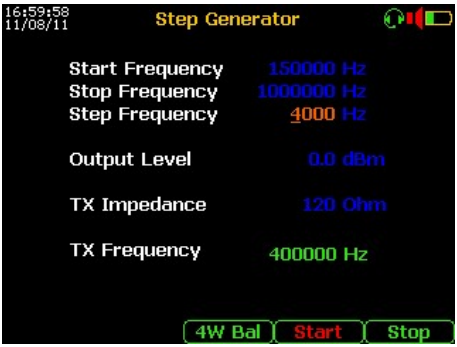
Meter setup



First of all it is necessary to define the operating band by setting the **Fc** (Central Frequency) and span by the **kHz/Div**.
To hold the peak levels on the display it is necessary to set the "**Max Val**" by the ***F4***. To do a quick test, useful to estimate the attenuation vs. frequency (see the image at the left), it is suggested to set the Step Generator with "wide" steps (e.g. 4 kHz), in this case the test time will take a few seconds.
To get a continuous trace it is necessary to set the **Step Generator** with very small steps (e.g.

200 Hz) but the time test for the same band will increased to over 15 minutes.

Step Generator setup

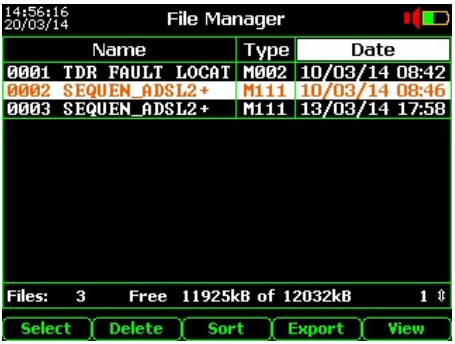


To perform the spectral Insertion Loss measurement using the Spectrum Analyzer at the opposite end of the line under test, set the "**Start Frequency**" and "**Stop Frequency**" and then set the "**Step Frequency**" (from 10 to 1000 Hz for Base Band and from 10 to 8000 Hz for the Medium Band).
Set the right "**TX Impedance**" (from 200 to 600 Ohm for Base Band and from 100 to 150 Ohm for Medium Band) and if needed the **Output Level**.

Press ***F4*** "**Start**" to start the sweep, the frequency progress of the output signal is shown (in green) in the "**TX Frequency**" field.
After the complete sequence (from Frequency Start to Frequency Stop), press ***F5*** "**Stop**" to finish the test.

13. File Manager

From the Main menu select the "**6. File Manager**".



All the measurements saved in the memory, they can be seen and/or exported to the USB Pen-drive or PC.
To view a measurement, select the file by the ▲▼ arrows, then push ***F5*** "**View**". To cancel or to export one or more files select the file by ▲▼ and push the ***F1*** "**Select**" key, repeat this procedure to select others possible files.
Push the ***F4*** "**Export**" key to export the selected file on the USB Pen-drive or PC (in .CSV* format) or to cancel the file.

Pushing and selecting "All files" by ***F2*** "**Delete**" key it is possible to erase the memory. By the ***F3*** "**Sort**" key it is possible to arrange the data file for "**Date**" or "**Name**".

Note Opening an exported CSV file by a PC with Windows Excel, it is possible to view the test parameters and all the row data results.*
Selecting the columns related to the transmissive row data it is possible to convert these in graphics useful to edit some possible Test Reports.

ACT6000 CSV-PDF Converter
By this PC Utility, free downloadable from https://www.tempocom.com/products/act6000 it is possible to convert automatically the in PDF the CSV files related to the automatic **SELT** and **DELT Sequences** performed thanks to the **ASW-1/II** (Advanced Software), to produce the useful **Test Report**.
*Note: Some transmissive threshold limits of the above PC Utility are similar to the limits set on the instrument (standard version), vice-versa in some cases the limits for **DELT** and **SELT Sequences** are different to satisfy the pass/fail indications according to the indication displayed by the instrument.*
The limits setup is listed on the **act6000.ini** present into the "**Tempo_CSV_PDF_Converter**" PC folder.

SELT Electric Tests
Vac A-B, Vac A-C, Vac B-C = <2.0 (Vac), Vdc A-B, Vdc A-C, Vdc B-C = <2.0 (Vdc) Insulation (isol) A-B, A-C, B-C = >20 (MOhm)

SELT / DELT Transmissive tests

Noise (rumore)_Voice	<-47.0 (dBm)	SELT Ret-loss (local)	<-14 (dB) same for any mask
Noise (rumore)_Modem 56k	<-47.0 (dBm)	DELT Ret-loss local	<-14 (dB) same for any mask
Noise (rumore)_ISDN	<-45.0 (dBm)	DELT Ret-Loss remote	<-14 (dB) same for any mask
Noise (rumore)_HDSL1p	<-45.0 (dBm)	Bilan_long (local)	<-45 (dB) same for any mask

Noise (rumore)_HDSL2p	<-45.0 (dBm)	DELT Bilan-long (local)	<-45 (dB) same for any mask
Noise (rumore)_SHDSL	<-45.0 (dBm)	DELT Bilan-long (remote)	<-45 (dB) same for any mask
Noise (rumore)_E1 / T1	<-45.0 (dBm)	Ins-Loss (att) Voice/Modem	DELT >-11 (dB), SELT >-12 (dB)
Noise (rumore)_ADSL	<-45.0 (dBm)	Ins-Loss (att) ISDN	DELT >-37 (dB), SELT >-38 (dB)
Noise (rumore)_ADSL2+	<-45.0 (dBm)	Ins-Loss (att) HDSL1p	DELT >-24 (dB), SELT >-25 (dB)
Noise (rumore)_VDSL2-12	<-45.0 (dBm)	Ins-Loss (att) HDSL2p	DELT >-28 (dB), SELT >-29 (dB)
Noise (rumore)_VDSL2-17	<-45.0 (dBm)	Ins-Loss (att) SHDSL	DELT >-23 (dB), SELT >-24 (dB)
Noise (rumore)_VDSL2-30	<-45.0 (dBm)	Ins-Loss (att) E1/T1	DELT >-15 (dB), SELT >-16 (dB)

If necessary, it is possible to modify any limit opening the file with note-pad, changing and saving it.

14. Configurations and Utilities

This item allows the selection of sub-menus to configure the instrument.
From the **Main Menu** select **7.Config & Utility**

the Par. 15 – **Appendix 1**, to configure the parameters for the automatic line tests (by Advanced Software 1/II).

setup (or verifications) of all typical DSLAM parameters used on FTTCab plant (see the **Appendix 2**)

to set the screen Brightness and Contrast inside this menu, pushing the **F1** key it is possible to invert the screen background (from black to white) useful to very floodlit environment.

4. DIAGNOSTIC (reserved to Tempo's Authorized Service Laboratories)

5. LANGUAGE

6. DATE & TIME

Function keys

F1 **"Default"** to restore some test parameters to the original factory setup.

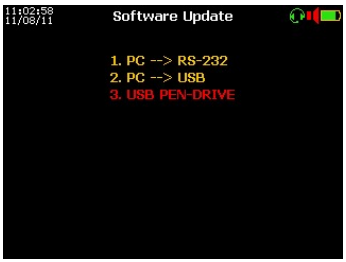
F2 "**PVF**" to personalize propagation velocity factor unit for the TDR: **PVF** or **V** or **V ½.**

F3 "**meters**" to personalize units of the lengths.

F5 (not highlighted) to erase the possible incongruent "CABLE TABLE" …that some times block the functionality of the instrument!

7. SOFTWARE UPDATE

Below is the information to perform the **Software Update**



- Insert to the USB port the Pen-Drive loaded with the new software named **FLASH_EN.BIN**".
- Switch-On the instrument and from the **Main Menu** select and enter on the "**7. Config & Utility**" menu, then select the item "**3. USB PEN-DRIVE**" and push "**Enter**".

The new software will be automatically captured from the Pen-Drive. Push "**Enter**" to confirm the load and the progress of the upload will be shown.

At the complete loading, when appeared "**You Can Now Restart**", it is necessary to restart the instrument by Power-Off and Power-On.

In any case, it is suggested to follow all the instructions enclosed on the .zip updating packet downloadable from *https://www.tempocom.com/products/act6000/*

ATTENTION ! After every software update it is suggested to set the instrument to the original (default) configuration: from the **Main Menu** select and enter into "**7 - Config & Utility**" menu, then select push ***F1*** "**Default**" and "**Enter".**

The instrument is ready to work!

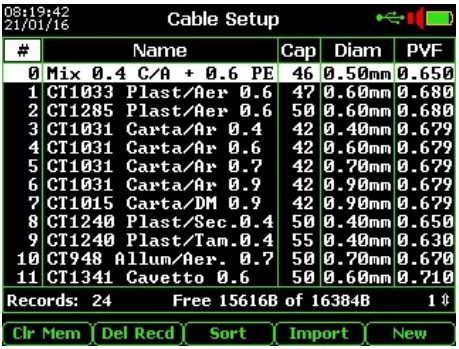
Pressing [?] from the Main Menu it is possible to verify the installed software release.

8. CABLE SETUP

By this menu it is possible to select from the wide **Cables data-base** the cable type to be test:

usual Name (dielectric type), typical Capacitance/km, Wires Diameter (with typical resistance/km), and typical PVF.

Selecting the preponderant cable by ▲▼ arrows and pushing "**Enter**" the reference cable will be automatically pre-configured for various measurements or functions as TDR, Capacitance length, Resistance, Fault location etc.



To create a new cable type, use the ***F5*** "**New**" key typing and saving the related parameters into the proper fields of the new record named "**Custom Cable Type**".

If necessary to update the “Cable data-base” with the new externally re-edited, i.e. by the specific **ACT6000 PC Utility** (compatible only with Windows XP and downloadable from https://www.tempocom.com/products/act6000), it is before necessary to erase the actual data-base pushing ***F1*** “**Clr Mem**”, then pushing the ***F4*** “**Import**” key selecting **1** from PC or **2** from Pen-drive.

If desired to export the currently **cabledat.csv** file it is enough to push the */. key and select **1** from PC or **2** from Pen-drive.

If desire to verify the typical Insertion-Loss (frequency response) of a line of 1 km with specific dielectric, specific wires diameter and specific capacitance/km, proceed as follows:
- Highlight the cable type by the ▲▼arrows:
- push **1** for the response up to 0.9 MHz;
- push **2** for the response up to 2.4 MHz;
- push **3** for the response up to 6 MHz;
- push **4** for the response up to 12 MHz;
- push **5** for the response up to 18 MHz; - push **6** for the response up to 30 MHz.

9. **Advanced Software Activation** to install the optional software module.
Loaded on the Pen-Drive the software key (i.e. for **ASW-1/II**), connecting the Pen-Drive to the related USB ports, selecting this menu the software will be automatically activated.

0. THRESHOLD LIMITS SETUP
This menu allows to verify or configure the transmissive threshold limits for the SELT or DELT measurements.
Any limit can be modified according to (when necessary) the ranges of the of the specific test functions declared on the technical specifications.
Pushing the ***F5*** “**Edit**” key a window appears, then by the ↻ key and the ▲▼◄ ► arrows it is possible to modify every parameter value.

17:19:58 09/01/19 — Limits Setup

Line	XT	Noise	RLoss	LBalc	Fext	ILoss
Voice	-52	-45.00	-9.0	-45.0	-65.0	-10.24
Modem56k	-52	-45.00	-9.0	-45.0	-65.0	-10.24
ISDN	-52	-63.60	-12.0	-45.0	-65.0	-37.00
HDSL-1P	-52	-73.50	-14.0	-45.0	-65.0	-24.00
HDSL-2P	-52	-71.30	-14.0	-45.0	-65.0	-28.00
SHDSL	-52	-71.30	-14.0	-45.0	-65.0	-23.00
E1	-52	-79.70	-14.0	-45.0	-65.0	-15.00
ADSL	-52	-77.00	-14.0	-45.0	-65.0	0.00
ADSL2+	-52	-80.00	-14.0	-45.0	-65.0	0.00
VDSL2-12	-52	-87.40	-14.0	-45.0	-65.0	0.00
VDSL2-17	-52	-89.10	-14.0	-45.0	-65.0	0.00
VDSL2-30	-52	-91.40	-14.0	-45.0	-65.0	0.00
VDSL2-35	-52	-92.10	-14.0	-45.0	-65.0	0.00

Import | Edit

If necessary to update the “Limits data-base” with the new one externally re-edited, i.e. by the specific **ACT6000 PC Utility** (compatible with Windows XP and downloadable from https://www.tempocom.com/products/act6000), push the ***F4*** “**Import**” key selecting **1** from PC or **2** from USB Pen-drive.

If desired to export the present **limitdat.csv** file it is enough to push the */- key and select **1** from PC or **2** from USB Pen-drive.

Trasmission Tests Limits (DELT and SELT mode)
XT: -52 (cross-talk value @ 1 MHz of typical telephone cables), useful for the RMS Noise automatic calculation.
Noise VOICE / MODEM 56 K = <-45.00 dBm (integral RMS value weighed 300 – 3400 Hz)
Noise ISDN = <-63.60 dBm Total Power (integral RMS value weighed 1 – 80 kHz)
Noise HDSL1P = <-73.50 dBm Total Power (integral RMS value weighed 1 – 485 kHz)
Noise HDSL2P = <-71.30 dBm Total Power (integral RMS value weighed 1 – 296 kHz)
Noise SHSDL = <-71.30 dBm Total Power (integral RMS value weighed 1 – 300 kHz)
Noise T1/E1 = <-79.70 dBm Total Power (integral RMS value weighed 1 – 2050 kHz)
Noise ADSL = <-77.00 dBm Total Power (integral RMS value weighed 20 – 1200 kHz)
Noise ADSL2+ = <-80.00 dBm Total Power (RMS value weighed 20 – 2200 kHz)
Noise VDSL2-12 = <-87.40 dBm Total Power (RMS value weighed 20 – 12000 kHz)
Noise VDSL2-17 = <-89.10 dBm Total Power (RMS value weighed 20 – 17800 kHz)
Noise VDSL2-30 = <-91.40 dBm Total Power (RMS value weighed 20 – 30000 kHz)
Noise VDSL 35 (Plus) = <-92.10 dBm Total Power (RMS value weighed 20 – 35000 kHz)

RLoss (Return-Loss) Voice / Modem 56k = <-9.0 dB (valid for any frequency within 200 to 5000 Hz)
RLoss (Return-Loss) ISDN = <-12.0 dB (valid for any frequency within 1 to 80 kHz)
RLoss (Return-Loss) from HDS1p to VDSL-35 = <-14.0 dB (valid for any frequency within the specific selected mask/BW)

LBalc (Longitudinal Balance-Loss)= <-45 dB (valid for any frequency within the specific selected mask/BW)

Fext (Near-End and Far-end cross-talk loss) = <-65 dB (valid for any frequency within the specific selected mask/BW)

ILoss (Insertion-Loss) Voice / Modem= >-10.24 dB referred @ 1 kHz
ILoss (Insertion-Loss) Isdn = >-37.00 dB referred @ 40 kHz
ILoss (Insertion-Loss) Hdsl1p = >-24.00 dB referred @ 150 kHz
ILoss (Insertion-Loss) Hdsl2p = >-28.00 dB referred @ 150 kHz
ILoss (Insertion-Loss) Shdsl = >-23.00 dB referred @ 150 kHz
ILoss (Insertion-Loss) E1-T1 = >-15.00 dB referred @ 1024 kHz

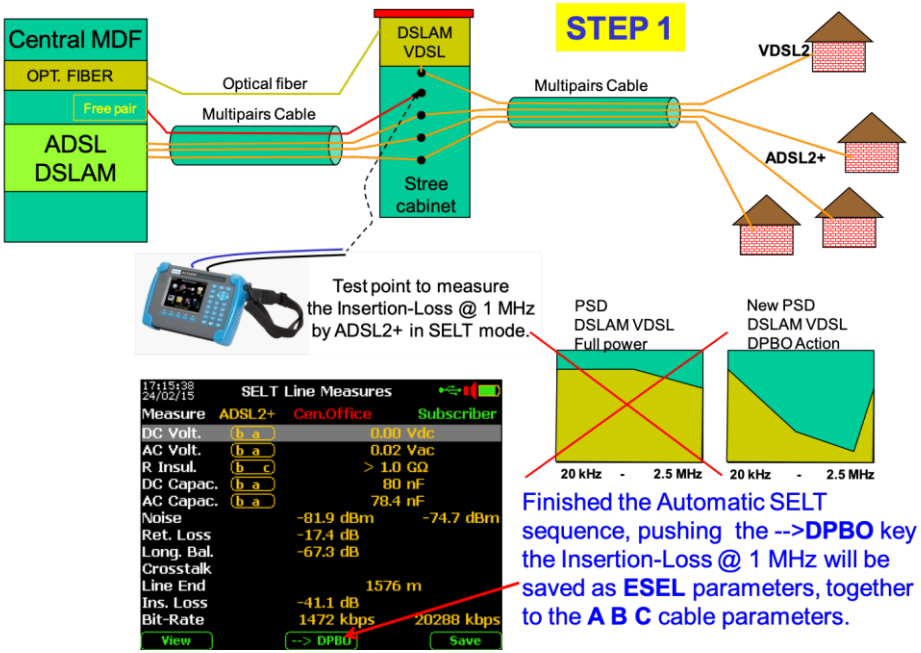
Transmissive Telephone Test - DELT
- RMS Psophometric Noise: <-45 dBm
- Return-Loss: <-6 dB @ 1020 Hz
- Insertion-Loss: >-20 dB @ 1020 Hz
- SINAD: >30 dB @ 1020 Hz

SELT Automatic Sequence - Electric Tests Limits (not modifiable)
Vac A-B, Vac A-C, Vac B-C = <2.0 (Vac), Vdc A-B, Vdc A-C, Vdc B-C = <2.0 (Vdc)
Insulation A-B, A-C, B-C = >20 (MOhm)

15. Appendix 2 - DPBO verification

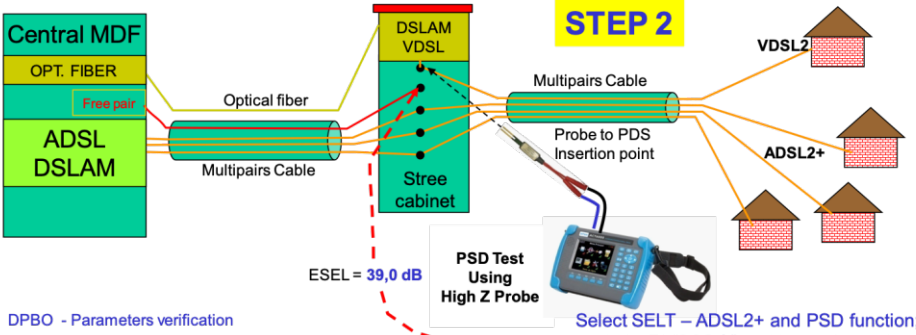
STEP 1

The first step is to extrapolate and save on the internal memory the “ESEL” and “A-B-C” parameters (useful for the second step) from the results of the **SELT Sequence** performed on the primary sector of the line (Central to Cabinet), using the **ADSL2+** mask, as the following scheme.

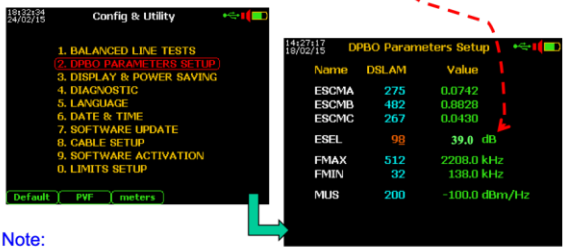


STEP 2

By the availability of the “ESEL” and “A – B – C” parameters it is now possible to operate the **PSD** (sniffer mode by specific probe) on the ADSL2+ band, as the following scheme.



DPBO - Parameters verification



Note:
by the automatic SELT Sequence performed in ADSL2+ band all the parameters: ESCMA, ESCMB, ESCMC and ESEL will be set

Select SELT – ADSL2+ and PSD function; push the***F2*** "DPBO" and insert the probe to the VDSL line