

APPLICATION NOTE

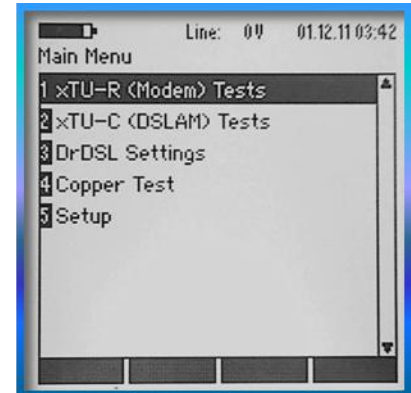


INTRODUCTION TO THE *KECT1* COPPER TEST FEATURE IN THE KE3400B

BEYOND THE BASIC DSL SERVICE TEST

The KE3400B DSL Inspector is a performance tester for broadband digital subscriber lines (DSL). The powerful DSLmodem engine and expert system in the DSL Inspector can be supplemented by a “Copper Test” option that greatly extends the user’s cable troubleshooting ability.

When a KE3400B is equipped with the KECT1 factory option the Main Menu shows Copper Test as a menu item as seen at right. A special receptacle is added on the right-hand side of the test set for the high performance test leads needed for these measurements.



The Copper Test features are divided into three parts: 1) a 3-lead digital multi-meter (DMM) that does the fundamental voltage-resistance-capacitance-current measurements that are most commonly needed, 2) an extensive set of 30 MHz DSL-oriented line qualification tests, and 3) a time domain reflectometer (TDR).

DIGITAL MULTIMETER (DMM) TESTS

Voltmeter

Three-Lead Input: T-R, T-G, R-G.

Range: ± 360 V-DC, and about 250 V AC (sine wave)

Max. Voltage: ± 500 V-DC

Input impedance: 240 k Ω

Frequency band: 0 - 2700 Hz (3dB)

✓ You shouldn't have more than 3 volts of either DC or AC on a dry DSL line.

Insulation

Three-Lead Input: T-R, R-G, T-G.

Range: 1M Ω to 2G Ω , max. shown 20G Ω

Test Voltage (ITU): 100V

✓ You should have several G Ω of insulation resistance and R-G/T-G should be no more than 150 k Ω different.

Resistance

Three-Lead Input: T-R, T-G, R-G.

Range: 0 Ω to 20 M Ω , max. shown 20G Ω

Test Voltage: 5 and 30V

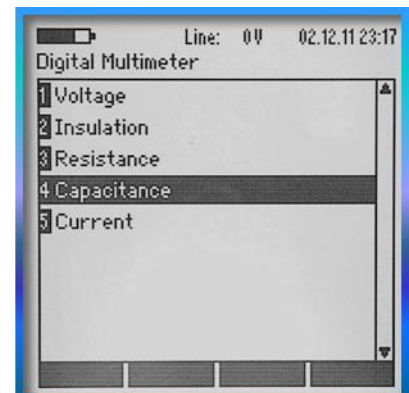
✓ T-G/R-G resistances should be within about 5 ohms, and the total T-R resistance should not exceed about 50 ohms per 1,000 feet of loop.

Capacitance

Three-Lead Input: T-R, T-G, R-G.

Range: 0 to 2 μ F

✓ T-G/R-G capacitance shouldn't be more than a few percent different from each other for balance.



Current

Three-Lead Input: T-R, T-G, R-G.

Range: ± 500 mA DC, about 350 mA AC (Sine wave)

Max Current: ± 520 mA DC

Input Impedance: 5.8Ω

xDSL LINE QUALIFICATION TESTS

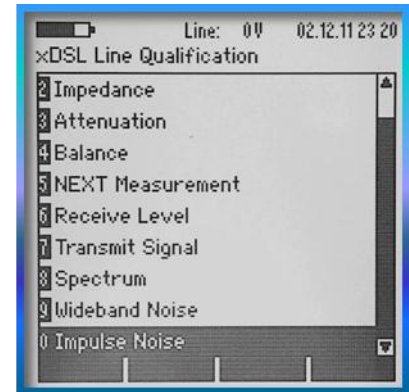
Return Loss

Input: T-R.

Range: 0 to 30MHz

Receive Impedance: $100\Omega, 120\Omega, 135\Omega$ or 150Ω

✓ Should be 25 dB or better.



Impedance

Input: T-R.

Range: 0 to 30MHz

Receive Impedance: $100\Omega, 120\Omega, 135\Omega$ or 150Ω

Longitudinal Balance

Input: T-R.

Range: 0 to 30MHz

Receive Impedance: $100\Omega, 120\Omega, 135\Omega$ or 150Ω

✓ Should be 50-60 dB for good noise immunity.

NEXT

Input: T-R.

Range: 0 to 30MHz

Receive Impedance: $100\Omega, 120\Omega, 135\Omega$ or 150Ω

Transmit Signal

Output: T-R.

Level: -10dBm to +10dBm

Frequency: 0 to 30MHz

Output impedance: $100\Omega, 120\Omega, 135\Omega, 150\Omega$

✓ Use two test sets to measure end-to-end loss at any frequency up to 30 MHz with the Transmit and Receive functions.

Receive Signal

Input: T-R.

Range: 0 to 30MHz

Receive Impedance: $100\Omega, 120\Omega, 135\Omega$ or 150Ω

Spectrum Analyzer

Input: T-R.

Amplitude: $< 10\text{dBm}$ at $Z \leq 150$

Range: 0 to 30MHz

Filter bandwidth: > 1.078 Hz

Frequency points: 1 to 400

Input Impedance : $100\Omega, 120\Omega, 135\Omega, 150\Omega$ and $30\text{k}\Omega$

Output: dBm or $\text{dBm}/\sqrt{\text{Hz}}$

✓ The spectrum analyzer can help you track down RF interference that is costing data throughput.

Resolution Output: 1/100 dBm 1/100dBm/Hz
Analog amplification: -6dB to 44dB in 10dB steps and 55dB
Modes: Normal, peak, average
Auto Zoom, Min or Max

Wideband Noise

Input: T-R.

Filter widths:

ADSL	1.1 MHz
ADSL+	2.2 MHz
VDSL 1	12 MHz
VDSL2-8	8.5 MHz
VDSL2-12	12 MHz
VDSL2-17	17 MHz
VDSL2-30	30 MHz

Impedance: 100Ω,120Ω,135Ω,150Ω

Impulse Noise

Input: T-R.

Impulse time: > 500μs

Impedance: 100Ω,120Ω,135Ω,150Ω

Threshold 1 mV to 999 mV

Measuring Time up to 9 hours

min shown 1/10 sec

Result : Number of Impulses / Time

TDR TEST

Input: T1-R1 (for crosstalk test).

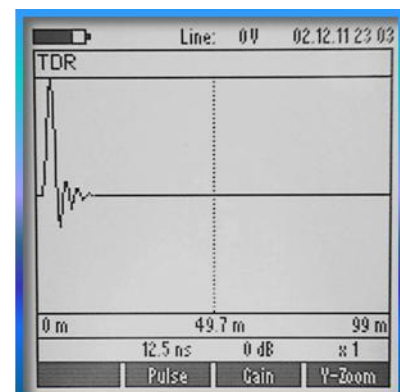
Output: T-R

Variable pulse length for varying loop length. 12.5 μs - 2500 ns

Zoom x1 - x10

Max cable length depending on wire diameter 36,000 ft

Analog amplification: -6dB to 44dB in 10dB Steps and 55dB



✓ The TDR can help you confirm and locate the problems. It can serve to determine physical loop length.