



**Patch Cord
Component Level
vs
Channel Level**

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INTRODUCTION

Patch cords, by virtue of their construction and placement near the ends of a typical LAN cabling channel, can have a huge impact on a LAN performance, error rates and channel throughput, especially at higher speed network protocols. Consisting of a short length of cable with a modular plug (connection) at each end, non-compliant cords create relatively large near end crosstalk (NEXT) and return loss (RL) noise levels. To make matters worse, since patch cords are usually located near the active network gear, these noise levels are not subject to much attenuation.

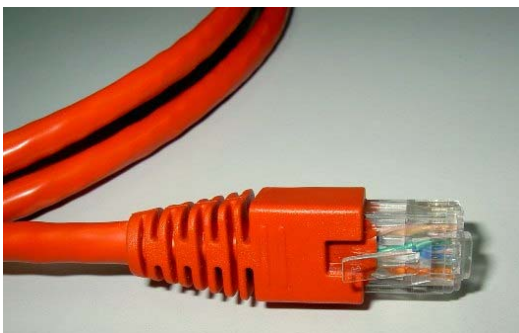
In mid-2002, the Telecommunications Industry Association (TIA) issued the first true component level patch cord test procedure and requirement, TIA/EIA-568B. 2-1 Annex J. Component level patch cord is of a higher quality standard as compared to Channel level. The differentiation in performance and quality is due to the difference in the nature of the testing procedure.

A Component level patch cord must meet the following requirements:

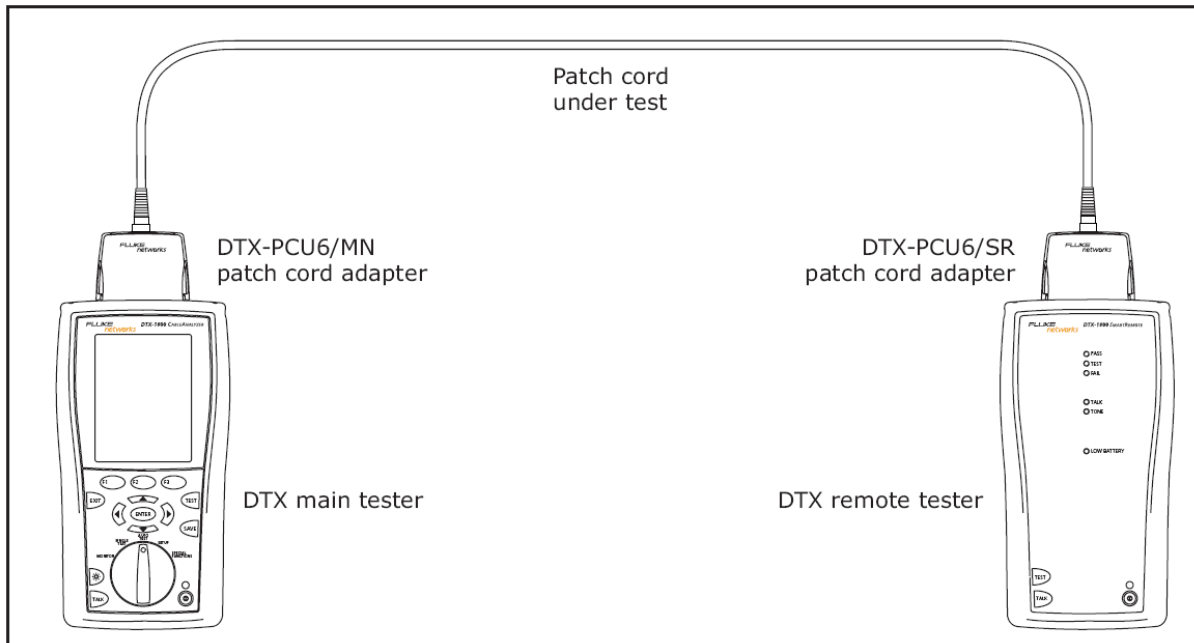
- It is tested individually and independently.
- The performance reach the designated 100% transmission tested international standards (TIA/EIA 568-B).

A Channel level patch cord, on the other hand, is tested in conjunction with other products of the same progression (e.g. patch panel, keystone jack, horizontal cabling, wiring sockets, etc), and the designated 100% transmission tested standards must be achieved. The performance and quality level of a Channel level patch cord can be raised or lowered by the quality of the fittings or products connected.

Patch cords manufactured by Picotech are tested by highly trained personnel using Fluke Networks' latest DTX CableAnalyzer. This test tool permits patch cord testing at Component Level or Channel Level to the full requirements of TIA/EIA-568B, including measurement of propagation delay, length, delay skew, NEXT, wire map, and return loss.



COMPONENT LEVEL PATCH CORD TEST



Patch Cord Test Connections

Patch Cord Test Results

Patch cord tests evaluate the following:

- Wire map
- Return loss
- NEXT

The patch cord test specifications assume that dc resistance, length, propagation delay, and delay skew requirements are met by the patch cord's design; therefore, test limits for these measurements are not required.

Note

NEXT loss and return loss are measured in one direction only, as required by the patch cord test standard. For standard patch cords up to 5 m this method is adequate and can detect performance problems at the remote connection. For longer patch cords, Fluke Networks recommends repeating the test with the patch cord reversed.

Why Patch Cords Fail

Patch cords may fail because of faulty wiring, poor workmanship, poor quality materials, or damage to the cable or plug.

The following sections give typical causes for wire map, return loss, and NEXT failures.

Wire Map Failures

Wire map failures are typically caused by the following:

- Wires connected to wrong pins at plug
- Faulty connections
- Damaged plug
- Damaged cable
- Wrong **Outlet Configuration** selected in setup
- Mix of 568A and 568B wiring standards (12 and 36 crossed)
- Conductive material stuck between pins at plug

Return Loss Failures

Return loss failures are typically caused by the following:

- Cable impedance not 100 Ω
- Patch cord handling causing changes in impedance
- Excessive untwisting of pairs at plug
- Poor quality plug
- Cable impedance not uniform (poor quality cable)
- Cable compression (pinches, kinks, etc.)
- Poorly matched plug and jack (most often affects Cat 6/Class E applications)
- Wrong test limit selected

The return loss plot can often tell you if a patch cord failed because of bad cable or a bad plug:

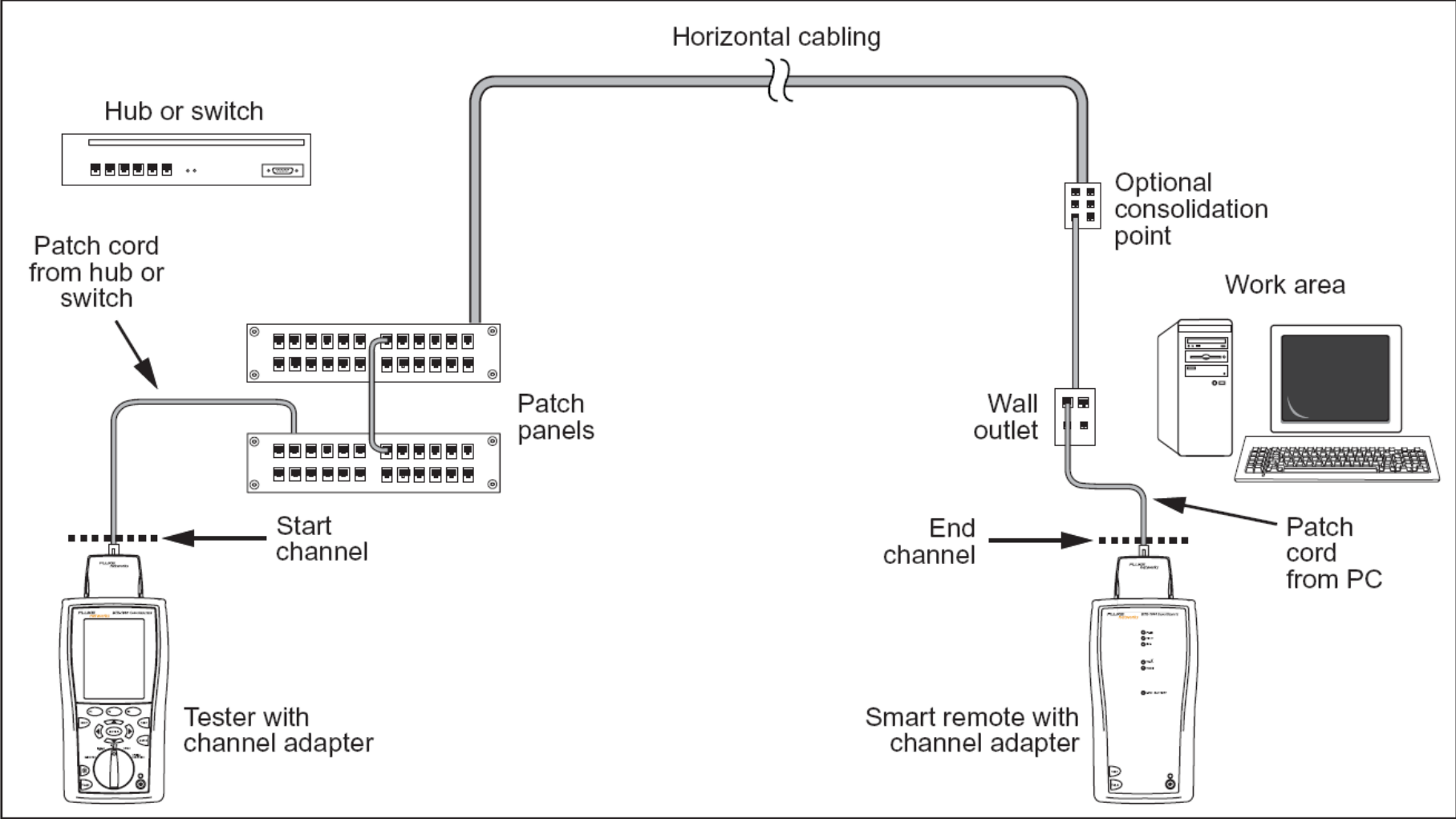
- Return loss failures at low frequencies (below 50 MHz) tend to be caused by the cable.
- Return loss failures at high frequencies tend to be caused by plugs.

NEXT Failures

NEXT failures are typically caused by the following:

- Excessive untwisting of pairs at plug. Most NEXT failures occur at plugs, where the twist in the wire pairs is interrupted.
- Poor quality plug
- Poor quality cable
- Poorly matched plug and jack (Cat 6/Class E applications)
- Cable compression (pinches, kinks, etc.)
- Excessive noise source near cabling under test. Use the impulse noise test to check for noise.
- Wrong test limit selected

CHANNEL LEVEL PATCH CORD TEST



Channel Test Connections

ANNEX: PATCH CORD TECHNICAL INFORMATION

Patch Cable

- **CABLE CLASSIFIED:** CAT5e and CAT6
- **CABLE TYPE:** UTP, FTP and S-FTP
- **JACKET GRADE:** CM, CMR and CMX
- **Temperature Rating:** 60°C or 75°C

Cat 5e Patch Cable (100MHz)

- **CONDUCTOR:** 4P*24AWG and Bare Copper
- **CONDUCTOR SIZE:** Strand Core – 7/0.27mm
- **INSULATION MATERIAL:** HD-PE (High Density Polyethylene)
- **JACKET MATERIAL:** LIGHT PVC (TUBE)
- **JACKET O.D.:** 5.50±0.1mm or 6.0±0.1mm

Cat 6 Patch Cable (250MHz)

- **CONDUCTOR:** 4P*24AWG and Bare Copper
- **CONDUCTOR SIZE:** Strand Core – 7/0.27mm
- **INSULATION MATERIAL:** HD-PE (High Density Polyethylene)
- **JACKET MATERIAL:** LIGHT PVC (TUBE)
- **JACKET O.D.:** 7.10±0.15mm (with Shape Filler)

Modular Plug

- **SPECS:** 8P8C ,10P10C
- **OPTIONS:** Shielded, Short body, Long body, Insert
- **GOLD PLATING:** 3U", 6U", 15U", 30U", 50U"
- **PLUGS:** CAT5e and CAT6

International Standard

- ISO/IEC 11801
- EN 50173
- ANSI TIA/EIA 568-A
- CENELEC EN 50288-3

Jacket Grade Identified

Communications cable is identified by marking on the surface of the jacket or on a marker tape under the jacket. This marking includes one of the following Type designations:

- **CM** - Indicates cable intended for general use within buildings in accordance with Section 800.53(E)(1) of the NEC. This cable does not spread flame to the top of the tray in the Vertical-Tray Flame Test in UL 1685, "Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables."
- **CMR** - Indicates cable intended for use within buildings in vertical shafts in accordance with Section 800.53(B) of the NEC. The flame propagation height of this cable is less than 12 ft when tested per UL 1666, "Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts."

- **CMX** - Indicates cable intended for use within buildings (1) where the wire or cable is enclosed in raceway or noncombustible tubing, or (2) in non-concealed spaces where the exposed length of wire or cable does not exceed 10 ft, or (3) in one- or two-family or multifamily dwellings when the cable diameter is less than 0.25 in., in accordance with Section 800.53(E) of the NEC. Type CMX cable may be marked "Outdoor" to indicate its suitability for installation outdoors on dwellings. This cable complies with the VW-1 Flame Test requirements in UL 1581. JACKET MATERIAL: LIGHT PVC (TUBE)

The general difference between category 5e and category 6

The general difference between category 5e and category 6 is in the transmission performance, and extension of the available bandwidth from 100 MHz for category 5e to 250 MHz for category 6. This includes better insertion loss, near end crosstalk (NEXT), return loss, and equal level far end crosstalk (ELFEXT). These improvements provide a higher signal-to-noise ratio, allowing higher reliability for current applications and higher data rates for future applications.

Performance Parameters Definition

- **Insertion Loss (Attenuation):**
 - A measure of signal loss from the resistance in the cable and connectors.
- **NEXT: (Pair-to-Pair) Near End Cross-Talk**
 - The noise coupled from one pair onto another pair at the near end (transmitter).
- **PSNEXT: (Pair-to-Pair) Power Sum NEXT**
 - The noise coupled from three energized pairs onto the 4th pair at the Near End.
 - Used for multi-disturber environments.
 - Applications that use more than two pairs, such as 1000BaseT (GbE).
- **FEXT: (Pair-to-Pair) Far End Cross-Talk**
 - The noise coupled from three energized pairs onto the 4th pair at the Near End.
 - Used for multi-disturber environments.
 - Applications that use more than two pairs, such as 1000BaseT (GbE).
- **ELFEXT (Pair-to-Pair): Equal Level FEXT**
 - FEXT compensated for attenuation.
 - By compensating for length ELFEXT can be compared to NEXT.
- **PSELFEXT: (Pair-to-Pair) Power Sum ELFEXT**
 - FEXT coupling from three energized pairs onto the 4th pair, each compensated for attenuation to factor out length. Used for multi-disturber environments. Applications that use more than two pairs, such as 1000Base-T (GbE).
- **Return Loss (RL):**
 - A measurement of reflected signal caused by imperfections and mismatches in impedance.
 - Imperfections in cables = Structural Return Loss
 - Mismatched cable/connectors = Return Loss (generally)
 - More connectors = more Return Loss
 - Poor terminations/untwisting = more Return Loss