# 8802-3/802.3 REVISION REQUEST 1080

DATE: 1st August 2001
NAME: Geoff Thompson
COMPANY/AFFILIATION: Nortel
E-MAIL: thompson@ieee.org

REQUESTED REVISION:
STANDARD: ISO/IEC 8802-3:2000
CLAUSE NUMBER: 1, 14, 15, 40, Annex A, D & 40A
CLAUSE TITLE: 1000BASE-T

PROPOSED REVISION TEXT:
Update references to cabling documents.
Remove Chromatic Dispersion specification from 10BASE-F Clause.
See attached draft.

RATIONALE FOR REVISION:
The referenced cabling documents were in draft stage when 1000BASE-T was approved. Both TIA and SC25/WG update their documents to reflect the needs of 1000BASE-T.
At this point we should not have to rely on the national reference and the references to TIA-568 should be able to be removed. In any case, 568-A is now obsolete and should be updated to the particular volume of 568-B that currently applies. Affected clauses: 14, 15, 25, 40, associated PICS, Annex A, D6, 40A.
In addition the specification for Chromatic Dispersion should be removed from the 10BASE-F Clause (Clause 15) as this is not a parameter normally specified for Multimode fibre.

IMPACT ON EXISTING NETWORKS:
None.

Please attach supporting material, if any
Submit to:- Geoffrey O. Thompson, Chair IEEE 802.3
E-Mail: gthompso@nortelnetworks.com

For official 802.3 use
REV REQ NUMBER: 1080
DATE RECEIVED: 1st August 2001
~~EDITORIAL~~/TECHNICAL
ACCEPTED/DENIED
BALLOT REQ'D YES/~~NO~~
COMMENTS: 10-Jan-03 Ver: D2.1 Status: B

For information about this Revision Request see -
http://www.ieee802.org/3/maint/requests/revision_history.html#REQ1080

# IEEE P802.3 Revision request ~~1080~~1080
# Changes to ANSI/IEEE Std 802.3-2002, Clauses 1, 14, 15, 25 and 40, Annexes D and 40A.

EDITORIAL NOTES - This revision request is based on the current edition of IEEE Std 802.3-2002. The editing instructions define how to merge the material contained here into this base document.

Editing instructions are shown in ***bold italic***. Three editing instructions are used: change, delete, and insert. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed either by using ~~strikethrough~~ (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. Editorial notes will not be carried over into future editions.

***Editors' Notes:*** *To be removed prior to final publication.*

***Revision History:***

| | |
|---|---|
| Draft 1.00, September 16, 2002 | Initial draft. |
| Draft 1.01, October 3, 2002 | Maintenance meeting review updates. Updated to reflect the recently approved ISO/IEC 11801:2002. Add the deletion of 10BASE-F Chromatic Dispersion specification. Remove 10BASE-FP updated as clause is now deprecated. |
| Draft 2.00, November 14, 2002 | Working Group Ballot draft.<br>Correct metres to m. |

***Editors' Notes:*** *To be removed prior to final publication.*

***Revision History:***

| | |
|---|---|
| Draft 1.0, September 16, 2002 | Initial draft. |
| Draft 1.1, October 3, 2002 | Maintenance meeting review updates. Updated to reflect the recently approved ISO/IEC 11801:2002. Add the deletion of 10BASE-F Chromatic Dispersion specification. Remove 10BASE-FP updated as clause is now deprecated. |
| Draft 2.0, November 14, 2002 | Working Group Ballot draft.<br>Correct metres to m. |
| Draft 2.1, January 11, 2003 | Working Group Recirculation Ballot draft.<br>Clarify references to 11801 and 568. |

***Change subclause 1.3 as follows to add new reference:***

ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard.

ANSI/TIA/EIA-568-B:2001, Commercial Building Telecommunications Cabling Standard.

CISPR 22:1993, Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.[1]

ISO/IEC 11801:1995, Information technology —Generic cabling for customer premises [2]

[1]CISPR documents are a available from the International Electrotechnical Commission, 3 rue de Varembé, Case Postale 131, CH 1211, Genève 20, Switzerland/Suisse (www.iec.ch/). CISPR documents are also available in the United States from the American National Standards Institute.

[2]Previous editions of ISO/IEC standards are available from Deutsches Institut für Normung, Burggrafenstrasse 6, 10787 Berlin, Germany (www.din.de).

ISO/IEC 11801:2002, Information technology —Generic cabling for customer premises.

***Change subclause 14.4.1 as follows:***

### 14.4.1 Overview

The medium for 10BASE-T is twisted-pair wiring. Since a significant number of 10BASE-T networks are expected to be installed utilizing in-place unshielded telephone wiring and typical telephony installation practices, the end-to-end path including different types of wiring, cable connectors, and cross connects must be considered. Typically, a DTE connects to a wall outlet using a twisted-pair patch cord. Wall outlets connect through building wiring and a cross connect to the repeater MAU in a wiring closet.

NOTE—~~ANSI/TIA/EIA-568-A-1995 ISO/IEC11801:1995 [B16] provides specifications for media and installation practices suitable for use with this standard.~~ ISO/IEC11801:2002 provides a specification for media that exceeds the minimum requirements of this standard.

***Change subclauses 15.3.1.1 and 15.3.1.2 as follows:***

### 15.3.1.1 Attenuation

This standard was developed on the basis of an attenuation value of less than or equal t o 3.75dB/km, when measured at a wavelength of 850 nm. Higher loss fiber may be used for shorter fiber pair lengths as long as the requirements in 15.3.3 are met.

NOTE—This value of attenuation is a relaxation of the standard ~~(~~IEC 60793-2: 1992, type A1b, category ≤3.5 dB/km~~)~~, and ISO/IEC11801:1995~~is the same as ANSI/TIA/EIA-568-A-1995~~[B16].

### 15.3.1.2 Modal bandwidth

Each optical fiber shall have a modal bandwidth-length product of not less than 160 MHz-km at a wavelength of 850nm.

NOTE—This value of modal bandwidth is a relaxation of the standard IEC 60793-2: 1992, type A1b, category >200 MHz-km~~)~~ and ISO/IEC11801:1995~~is the same as ANSI/TIA/EIA-568-A-1995~~ [B16].

***Delete subclause 15.3.1.2 and associated un-numbered table. Renumber following subclauses as required.***

~~**15.3.1.3 Chromatic dispersion**~~

~~Each optical fiber shall have a dispersion characteristic in the range shown below:~~

| ~~**Zero-dispersion wavelength $\lambda_0$ (0); nm**~~ | ~~**Maximum dispersion slope $S_0$; ps/nm$^2$ · km**~~ |
|---|---|
| ~~1320–1348~~ | ~~0.11~~ |
| ~~1348–1365~~ | ~~[1458 – $\lambda$(0)]/1000~~ |
| ~~NOTE—This characteristic is an addition to the values specified by IEC 60793-2: 1992, Type A1b, and is the same as ANSI/TIA/EIA-568-A-1995 [B16].~~ | |

***Change the first paragraph of subclause 25.4.6.1 as follows:***

### 25.4.6.1 Cabling system characteristics

The cabling system used to support a 100BASE-TX duplex channel requires two pairs of Category 5 balanced cabling with a nominal impedance of 100 ohms. The cabling system components (cables, cords, and connectors) used to provide the link segment shall consist of Category 5 components as specified in ANSI/TIA/EIA-568-A:1995 and ISO/IEC 11801:1995 (Class D).

NOTE—ISO/IEC11801:2002 provides a specification (Class D) for media that exceeds the minimum requirements of this standard.

***Change the first paragraph of subclause 40.1 as follows:***

## 40.1 Overview

The 1000BASE-T PHY is one of the Gigabit Ethernet family of high-speed CSMA/CD network specifications. The 1000BASE-T Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) and baseband medium specifications are intended for users who want 1000 Mb/s performance over Category 5 balanced twisted-pair cabling systems. 1000BASE-T signaling requires four pairs of ~~Category 5/ Class D~~ 5 balanced cabling, as specified in ISO/IEC 11801:1995 (Class D) and ANSI/EIA/TIA-568-~~B:2001A~~ A ~~(~~1995~~)~~ (Category 5), and tested for the additional performance parameters specified in ANSI/EIA/TIA-568-B1 Annex D~~40.7 using testing procedures defined in proposed ANSI/TIA/EIA-TSB95. These requirements are met by a Class D channel as specified in ISO/IEC 11801:2002.~~

NOTE—ISO/IEC11801:2002 provides a specification (Class D) for media that exceeds the minimum requirements of this standard.

***Change the first paragraph of subclause 40.6.1.1.1 as follows:***

### 40.6.1.1.1 Test channel

To perform the transmitter MASTER-SLAVE timing jitter tests described in this clause, a test channel is required to ensure that jitter is measured under conditions of poor signal to echo ratio. This test channel shall be constructed by combining 100 and 120 Ω cable segments that both meet or exceed ISO/IEC 11801 Cate-

gory 5 specifications for each pair, as shown in ~~Figure 40–18~~Figure 40–18, with the lengths and additional restrictions on parameters described in Table 40–6. The ends of the test channel shall be terminated with connectors meeting or exceeding ~~ANSI/TIA/EIA-568-A:1995 or~~ ISO/IEC 11801:1995 Category 5 specifications. The return loss of the resulting test channel shall meet the return loss requirements of 40.7.2.3 and the crosstalk requirements of 40.7.3.

***Change subclauses 40.7 through 40.7.2.1 as follows:***

## 40.7 Link segment characteristics

1000BASE-T is designed to operate over a 4-pair Category 5/Class D balanced cabling system. Each of the four pairs supports an effective data rate of 250 Mbps in each direction simultaneously. The term "link segment" used in this clause refers to four duplex channels. The term "duplex channel" will be used to refer to a single channel with full duplex capability. Specifications for a link segment apply equally to each of the four duplex channels. All implementations of the balanced cabling link shall be compatible at the MDI.

### 40.7.1 Cabling system characteristics

1000BASE-T requires 4-pair Class D cabling with a nominal impedance of ~~100~~100 Ω, as specified in ISO/IEC 11801~~:~~:1995~~The cabling system used to support 1000BASE-T requires 4 pairs of Category 5 balanced cabling with a nominal impedance of 100 Ω~~. The cabling system components (cables, cords, and connectors) used to provide the link segment shall consist of Category 5 components as specified in ANSI/TIA/EIA-568-A:1995 and ISO/IEC 11801:1995. Additionally:

~~a) 1000BASE-T uses a star topology with Category 5 balanced cabling used to connect PHY entities.~~
a) 1000BASE-T is an ISO/IEC 11801 Class D application, with additional installation requirements and transmission parameters specified in Annex 40A.
b) The width of the PMD transmit signal spectrum is approximately 80 MHz.
c) The use of shielding is outside the scope of this standard.

### 40.7.2 Link transmission parameters

The transmission parameters contained in this subclause are specified to ensure that a Class D~~Category 5~~ link segment of up to at least 100 m will provide a reliable medium. The transmission parameters of the link segment include insertion loss, delay parameters, characteristic impedance, NEXT loss, ELFEXT loss, and return loss.

Link segment testing shall be conducted using source and load impedances of 1 0 0 Ω. The tolerance on the poles of the test filter used in this subclause shall be no worse than 1%.

#### 40.7.2.1 Insertion loss

The insertion loss of each duplex channel shall be less than

$$\text{Insertion\_Loss}(f) < 2.1\ f^{0.529} + 0.4/f \quad \text{(dB)}$$

at all frequencies from 1 MHz to 100 MHz. This includes the attenuation of the balanced cabling pairs, including work area and equipment cables plus connector losses within each duplex channel. The insertion loss specification shall be met when the duplex channel is terminated in 100 Ω.

NOTE—The above equation approximates the insertion loss specification at discrete frequencies for Class D 100 m channels specified by ISO/IEC 11801:1995~~Category 5 100-meter links specified in ANSI/TIA/EIA-568-A Annex E and in TIA/EIA-TSB-67~~.

***Change subclause 40.7.3.1.1 as follows:***

### 40.7.3.1.1 Differential Near-End Crosstalk

In order to limit the crosstalk at the near end of a link segment, the differential pair-to-pair Near-End Crosstalk (NEXT) loss between a duplex channel and the other three duplex channels is specified to meet the symbol error rate objective specified in 40.1. The NEXT loss between any two duplex channels of a link segment shall be at least

$$27.1 - 16.8\log_{10}(f/100)$$

where f is the frequency over the range of 1 MHz to 100 MHz.

NOTE—The above equation approximates the NEXT loss specification at discrete frequencies for Class D 100 ~~metre~~ m channels specified by ISO/IEC 11801:1995 ~~Category 5 100-meter links specified in ANSI/TIA/EIA-568-A Annex E and in TSB-67~~.

***Change the first paragraph of subclause 40.8.3 as follows:***

### 40.8.3 MDI electrical specifications

The MDI connector (jack) when mated with a specified balanced cabling connector (plug) shall meet the electrical requirements for Category 5 connecting hardware for use with 100-ohm Category 5 cable as specified in ~~ANSI/TIA/EIA-568-A:1995 and~~ ISO/IEC 11801:1995.

***Change subclause 40.12.7, item PME20 as follows:***

| | | | | | |
|---|---|---|---|---|---|
| PME1 | The ends of the MASTER-SLAVE timing jitter test channel shall | 40.6.1.1.1 | M | Yes [ ] | Be connectorized with connectors meeting or exceeding ~~ANSI/TIA/EIA-568-A:1995 or~~ ISO/IEC 11801:1995 Category 5 specifications. |

***Change subclause 40.12.7, item LKS2 as follows:***

| | | | | | |
|---|---|---|---|---|---|
| LKS2 | 1000BASE-T links shall | 40.7.1 | M | Yes [ ] | Be compliant with Class D performance requirements, ~~Consist of Category 5 components~~ as specified ~~in ANSI/TIA/EIA-568-A:1995 and~~ by ISO/IEC 11801:1995. |

***Change subclause 40.12.7, item MDI5 as follows:***

| | | | | | |
|---|---|---|---|---|---|
| MDI5 | The MDI connector (jack) when mated with a balanced cabling connector (plug) shall | 40.8.3 | M | Yes [ ] | Meet the electrical requirements for Category 5 connecting hardware for use with 100 Ω Category 5 cable as specified in ~~ANSI/TIA/EIA-568-A:1995 and~~ ISO/IEC 11801:1995. |

***Change Annex A as follows:***

[B15] ANSI/TIA/EIA 526-7-1998, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.

[B16] ANSI/TIA/EIA-568-A-1995, Commercial Building Telecommunications Cabling Standard.

[B17] ANSI/TIA/EIA-568-B: 2001, Commercial Building Telecommunications Cabling Standard.

~~[B17] ANSI/TIA/EIA-TSB95 (Proposed), Additional Transmission Performance Guidelines for 100 Ohm 4-Pair Category 5.~~

[B18] ANSI/UL 94-1990, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

***Change first and second paragraph of Annex D.6 as follows:***

## D.6 10BASE-T use of cabling systems with a nominal differential characteristic impedance of 150 Ω

This subclause outlines the philosophy and methodology for allowing 10BASE-T stations to support transmission on 150 Ω balanced STP cabling, ~~installed in accordance with ANSI/TIA/EIA-568-A-1995 [B16], Clause 4, and~~ as specified by ISO/IEC 11801: 1995, Clause 8, with the use of impedance matching transformers.

The 10BASE-T specification was designed to support Manchester signaling over a link segment consisting of 100 Ω cabling system. The MAU link interface specifications were designed to ensure that jitter due to impedance discontinuities were minimized as specified in 14.4.2.3. In theory and in practice, a 150 Ω cabling system may be used to provide the link segment function provided the proper impedance match (100 Ω) with the MAU over the frequency range of interest as specified in 14.4, and the resultant transmission characteristics of the cabling system used to provide the link segment function meet or exceed those specified in 14.4. Therefore, to ensure the jitter specification of 14.4.2.3 and the jitter budget of B.4.1 are met, the following approach is recommended when using 1 50 Ω balanced STP cabling (as specified in ISO/IEC 11801: 1995):

a) The 150 Ω section included in the link segment shown in Figure D–1 meets the specifications of ISO/IEC 11801: 1995, 7.2~~, and ANSI/TIA/EIA-568-A-1995 [B16]~~.

***Change first paragraph of Annex 40A as follows:***

# Additional cabling design guidelines

This annex provides additional cabling guidelines when installing a new Category 5/Class D balanced cabling system or using an existing Category 5/Class D balanced cabling system. These guidelines are intended to supplement those in Clause 40. 1000BASE-T is designed to operate over 4-pair unshielded twisted-pair cabling systems that meet ~~both~~ the ~~Category 5/Class D~~ 5 requirements described in ANSI/TIA/EIA-~~568A~~ 568-A ~~(~~1995~~)~~ (Category 5) and ISO/IEC 11801:~~1995~~1995 (Class D), and the additional transmission parameters of return loss, ELFEXT loss, and MDELFEXT loss specified in 40.7. There are additional steps that may be taken by network designers that provide additional operating margins and ensure the objective BER of $10^{-10}$ is achieved. Cabling systems that meet or exceed the specifications in 40.7 for a worst case 4-connector topology are recommended for new installations. Whether installing a new Category 5/Class D balanced cabling system or reusing one that is already installed, it is *highly*

*recommended* that the cabling system be measured/certified before connecting 1000BASE-T equipment following the guidelines in ANSI/EIA/TIA 568-B1 Annex D ~~(proposed) ANSI/TIA/EIA TSB95~~.

***Change first paragraph of Annex 40A.2 as follows:***

## 40A.2 Cabling configurations

The primary application for the Clause 40 specification is expected to be between a workstation and the local telecommunications closet. In commercial buildings this application is generally referred to as the horizontal cabling subsystem. As specified in ~~ANSI/TIA/EIA-568-A and~~ ISO/IEC 11801: 1995 the maximum length of a horizontal subsystem building wiring channel is 100 m. The channel consists of cords, cables, and connecting hardware. The maximum configuration for this channel is shown in ~~Figure 40A–1~~Figure 40A–1.