INTERNATIONAL STANDARD

ISO/IEC 14165-114

First edition
2005-04

Information technology –
Fibre Channel –

Part 114:
100 MB/s balanced copper physical interface (FC-100-DF-EL-S)

© ISO/IEC 2005

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

ISO/IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland

PRICE CODE H

For price, see current catalogue

CONTENTS

FOREWORD....5
INTRODUCTION....6
1 Scope....7
2 Normative references....7
3 Definitions, symbols and abbreviations....8
3.1 Definitions....8
3.2 Symbols....9
3.3 Abbreviations....9
4 MAC interface....9
4.1 General....9
4.2 Overview....9
4.3 Detailed specification....10
4.3.1 RD<7:0> received data....10
4.3.2 RV receive valid....10
4.3.3 RE receive error....10
4.3.4 RCLK receive clock....10
4.3.5 TD<7:0> transmit data....10
4.3.6 TV transmit valid....11
4.3.7 TE transmit error....11
4.3.8 TCLK transmit clock....11
4.3.9 DC characteristics....11
4.3.10 MAC characteristics....11
4.3.11 MAC, GMII and MII interfaces....11
4.4 Testing....12
4.5 Data stream....12
4.6 Service control functions....12
4.7 Timers....13
4.8 Delay requirements....13
4.9 Reset....13
5 Operation....13
5.1 Detail of the physical interfaces....13
5.2 Signalling....14
5.3 Frame format....14
5.4 Functions at the MAC interface....15
6 Coding....15
6.1 Timers....15
6.2 Receive status OK....15
6.3 Errors....15
6.4 PHY control....15
6.5 Bit error rate....15
7 Test....15
7.1 General....15
7.2 Tests....16
7.3 Fixtures....16
7.4 Interoperability compliance points....16
8 Transmitter signal....16

8.1 General 16
8.2 Differential output voltage and accuracy 16
8.3 Scrambling 16
8.4 Transmit eye diagram 17
8.5 Jitter 17
9 Receiver signal 18
9.1 General 18
9.2 Differential input voltage and accuracy 18
9.3 Descrambling 18
9.4 Receive eye diagram 18
10 Electrical and mechanical requirements 19
10.1 Isolation 19
10.2 Clock frequency 19
10.3 Receiver common mode rejection 19
10.4 Transmitter common mode output voltage 19
10.5 Input tolerance 19
10.6 Return loss 20
10.7 Connector 20
10.8 Connector configuration 20
11 Cabling channel 20
11.1 General conditions 20
11.2 External noise 20
12 Environmental 20
12.1 Safety 20
12.2 Grounding 20
12.3 Telephone voltages 21
12.4 Susceptibility 21
12.5 Temperature and humidity 21
12.6 Labelling 21
BIBLIOGRAPHY 22

Figure 1 – Model 6
Figure 2 – MAC interface 9
Figure 3 – Interface overview via 100 Ω Class F cabling 10
Figure 4 – MAC interface data stream 12
Figure 5 - State diagram of MLT-3 13
Figure 6 – Coding scheme of MLT-3 13
Figure 7 – Transmission with MLT-3 14
Figure 8 – Frame format 14
Figure 9 – Scrambler polynomial and correspondent circuit diagram 16
Figure 10 – Transmission eye diagram 17
Figure 11 – Transmission eye diagram detail 17
Figure 12 – Receiver eye diagram 18
Figure 13 – Receiver common mode rejection test 19
Figure 14 – Common mode voltage test 19

Table 1 – DC characteristics 11
Table 2 – AC characteristics 11
Table 3 – Signal mapping.....12
Table 4 – Delay requirements 13
Table 5 – Control functions 15
Table 6 – Eye diagram mask at points R1 and R2.....18
Table 7 – Return loss.....20
Table 8 – Connector configuration.....20

INFORMATION TECHNOLOGY – FIBRE CHANNEL – Part 114: 100 MB/s balanced copper physical interface (FC-100-DF-EL-S)

FOREWORD

1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

3) All users should ensure that they have the latest edition of this publication.

4) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.

5) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 14165-114 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

ISO/IEC 14165-114 has to be read in conjunction with the forthcoming International Standard ISO/IEC 14165-115.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

INTRODUCTION

This standard builds on ISO/IEC 14165-115 and ISO/IEC 14165-251 (see bibliography). It specifies a Media Dependent Interface for duplex Ethernet transmission of 100 MB/s: a physical layer interface for a signalling rate of 1 062,5 Mbit/s over two pairs. It is specified for operation over Class F balanced cabling channels, for up to 100 m of Category 7 balanced (twisted pair) cabling. The interface is referred to as 100-DF-EL-S based on the nomenclature defined in 5.9 of ISO/IEC 14165-115.

This standard eliminates the need for implementation of the complex functions specified in ISO/IEC 8802-3 that cancel the effects of crosstalk and return loss. This provides a solution that can operate at a much lower power level, and that can be implemented at a lower cost than products that use Clause 40 of ISO/IEC 8802-3. Therefore, it also has the potential for multiple ports per chip.

Model

A 1000BASE-TX2/4 PHY model is shown in Figure 1. Although sublayers within the 1000BASE-TX2/4 PHY may be present, e.g. for management, reconciliation or auto-negotiation as defined in ISO/IEC 8802-3, they are not presented in Figure 1.

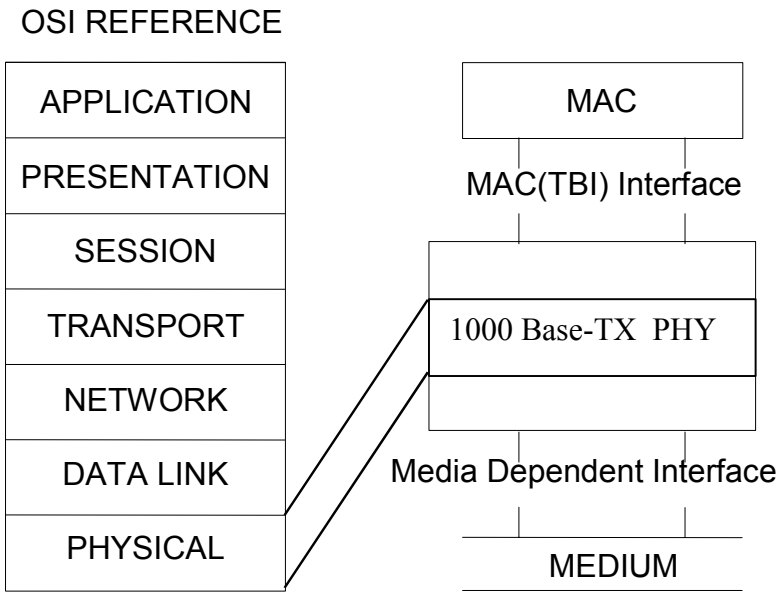

Figure 1 – Model

Relation to other standards

This standard specifies a dedicated full-duplex Ethernet PHY layer, as defined in ISO/IEC 7498-1: Open Systems Interconnection (OSI) reference model, but does not support Carrier Sense or Collision Detect. The MAC interface specified in this standard inter-operates with the GMII interface specified in ISO/IEC 8802-3 at full duplex. Implementers may choose to be compliant with this international standard along with clauses in other standards.

INFORMATION TECHNOLOGY – FIBRE CHANNEL – Part 114: 100 MB/s Balanced copper physical interface (FC-100-DF-EL-S)

1 Scope

This International Standard describes a physical interface for Fibre Channel that is based on and adds to ISO/IEC 14165-115. It specifies a Medium Dependent Interface for 1000BASE-TX2/4 PHY layers as defined in ISO/IEC 7498-1 together with the consequences for the physical layer and the MAC (TBI) Interface. Scrambling, coding and modulation necessary to provide a bit error rate of 10^{-12} or less are specified. This standard also specifies the requirements for the medium (transmission channel). These requirements are within the minimum performance of a dedicated balanced Class F channel (in general made of up to 100 m Class F balanced (twisted pair) cabling, as specified in ISO/IEC 11801:2002). This International Standard supports full duplex transmission with a signalling rate of 1 062,5 Mbit/s.

This International Standard provides a low-complexity Media Independent Interface and the functional description of an Ethernet physical layer for 100 MB/s transmission that can easily be implemented by many vendors. This standard takes advantage of the improved transmission characteristics provided by balanced cabling channels of Class F, as specified in ISO/IEC 11801:2002.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060 (all parts), *High-voltage test techniques*

IEC 60950 (all parts), *Information technology equipment - Safety*

IEC 61076-3-104, *Connectors for electronic equipment - Part 3-104: Rectangular connectors - Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 600 MHz minimum*

IEC 62151, *Safety of equipment electrically connected to a telecommunication network*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection - Basic Reference Model: The Basic Model*

ISO/IEC 8802-3:2000, *Information technology – Local and metropolitan area networks – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*