

INTERNATIONAL STANDARD

IEC
60728-7-2

First edition
2003-10

Cable networks for television signals, sound signals and interactive services –

Part 7-2: Hybrid Fibre Coax Outside Plant Status Monitoring – Media access Control (MAC) Layer Specification

© IEC 2003 — Copyright - all rights reserved

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.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

X

For price, see current catalogue

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references.....	7
3 Terms, definitions and abbreviations.....	8
4 Reference architecture forward and return channel specifications.....	10
5 Media access control layer specification	10
5.1 Overview	10
5.2 MAC packet transport	11
5.3 MAC packet structure	13
5.4 MAC packet delimiters.....	18
5.5 MAC protocol data units (PDUs)	18
6 MAC protocol operation	29
6.1 Non-volatile parameters.....	29
6.2 Duplex capabilities.....	29
6.3 Packet priorities.....	29
6.4 Packet reception.....	29
6.5 NE responses	30
6.6 Message sequence numbers and transaction synchronization	30
6.7 Solicited messages.....	31
6.8 Autonomous (unsolicited) messages.....	31
6.9 Return channel transmissions.....	35
6.10 MAC state machines.....	35
Annex A (informative) Operational elements	38
A.1 Introduction.....	38
A.2 Time of day.....	38
A.3 Firmware download.....	38
A.4 NE addressing	38
A.5 Alarm processing EMS MAC protocol	39
A.6 Automatic channel discovery.....	43
A.7 Auto-registration	44
A.8 Configuration changes and SNMP trap generation	45
Figure 1 – Reference architecture diagram.....	10
Figure 2 – Bit transmission order.....	12
Figure 3 – MAC packet structure	13
Figure 4 – MAC header control byte – Bit definition.....	13
Figure 5 – MAC header sequence byte – Bit definition	16
Figure 6 – MAC PDU structure	18
Figure 7 – STATRESP STATUS byte – Bit definition	20
Figure 8 – Return channel transmission permitted.....	35

Figure 9 – Contention state diagram	36
Figure 10 – Backoff state diagram	37
Figure A.1 – Property MIB usage	39
Table 1 – Transponder type classifications	7
Table 2 – Generic MAC packet structure	13
Table 3 – Protocol field values	14
Table 4 – MAC PDUs	19
Table 5 – Possible MAC protocol transactions	19
Table 6 – NAK PDU format	20
Table 7 – ACK PDU format	20
Table 8 – STATRQST PDU format	20
Table 9 – STATRESP PDU format	20
Table 10 – CHNLRQST bit settings	21
Table 11 – CNTNRM bit settings	21
Table 12 – CNTCUR bit settings	21
Table 13 – MAJOR bit settings	21
Table 14 – MINOR bit settings	22
Table 15 – TALKRQST PDU format	22
Table 16 – TALK PDU format	23
Table 17 – CONTMODE PDU format	23
Table 18 – CONTMODE: MODE settings	23
Table 19 – NE message retrieval example	24
Table 20 – REG_REQ PDU format	25
Table 21 – SET_ADDR PDU format	25
Table 22 – REG_END PDU format	26
Table 23 – REG_END: STATUS settings	26
Table 24 – CHNLDESC PDU format	27
Table 25 – INVCMD PDU format	28
Table 26 – INVCMD: REASON codes	28
Table 27 – TIME PDU format	29
Table 28 – Non-volatile parameters	29
Table 29 – MAC sequence field example (non-contention mode)	31
Table 30 – Contention state settings versus forward channel packets	32
Table 31 – Backoff state machine parameters	34
Table A.1 – Properties	40
Table A.2 – Alarm notification and retrieval – Polled mode	42
Table A.3 – Alarm notification and retrieval – Contention mode	43
Table A.4 – Auto-registration implementation example	45

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE NETWORKS FOR TELEVISION SIGNALS,
SOUND SIGNALS AND INTERACTIVE SERVICES –**

**Part 7-2: Hybrid Fibre Coax Outside Plant status monitoring –
Media Access Control (MAC) layer specification**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees 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, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) 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.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60728-7-2 has been prepared by technical area 5: Cable networks for television signals, sound signals and interactive services, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This standard was submitted to the national committees for voting under the IEC Fast Track Procedure as the following documents:

CDV	Report on voting
100/577/CDV	100/684/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The following differences exist in some countries:

The Japanese *de facto* standard (NCTEA S-006) concerning requirements for the HFC outside plant management, which was published in 1995, has already been available in Japan. The purpose of this standard is to support the design and implementation of interoperable management systems for HFC cable networks used in Japan.

INTRODUCTION

Standards of the IEC 60728 series deal with cable networks for television signals, sound signals and interactive services including equipment, systems and installations for

- head-end reception, processing and distribution of television and sound signals and their associated data signals, and
- processing, interfacing and transmitting all kinds of signals for interactive services

using all applicable transmission media.

All kinds of networks like

- CATV-networks,
- MATV-networks and SMATV-networks,
- individual receiving networks,

and all kinds of equipment, systems and installations installed in such networks, are within this scope.

The extent of this standardization work is from the antennas, special signal source inputs to the head-end or other interface points to the network up to the system outlet or the terminal input, where no system outlet exists.

The standardization of any user terminals (i.e. tuners, receivers, decoders, multimedia terminals, etc.) as well as any coaxial and optical cables and accessories therefore is excluded.

CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 7-2: Hybrid Fibre Coax Outside Plant status monitoring – Media Access Control (MAC) layer specification

1 Scope

This part of IEC 60728 specifies requirements for The Hybrid Fibre Coax (HFC) Outside Plant (OSP) Media Access Control (MAC) Layer. This standard is part of the series developed to support the design and implementation of interoperable management systems for existing HFC cable networks. The HMS Media Access Control (MAC) layer specification describes the messaging and protocols implemented at the Data Link Layer (DLL), layer 2 in the 7-layer ISO-OSI reference model, that support reliable and efficient communications between HMS compliant transponders interfacing to managed OSP network elements (NEs) and a centralized head-end element (HE).

This standard describes the MAC layer protocols that must be implemented between all *Type 2* and *Type 3* compliant OSP transponders on the HFC plant and the controlling equipment in the head-end to support bandwidth management and reliable communications. Any exceptions to compliance with this standard will be specifically noted herein as necessary. Refer to Table 1 for a full definition of the type classifications.

Transponder type classifications referenced within the HMS series of standards are defined in Table 1.

Table 1 – Transponder type classifications

Type	Description	Application
Type 0	Refers to legacy transponder equipment, which is incapable of supporting the specifications.	This transponder interfaces with legacy network equipment through proprietary means. This transponder could be managed through the same management applications as the other types through proxies or other means at the head-end.
Type 1	Refers to stand-alone transponder equipment (legacy or new), which can be upgraded to support the specifications.	This transponder interfaces with legacy network equipment through proprietary means. Type 1 is a standards-compliant transponder (either manufactured to the standard or upgraded) that connects to legacy network equipment via a proprietary interface.
Type 2	Refers to a stand-alone, compliant transponder.	This transponder interfaces with network equipment designed to support the electrical and physical specifications defined in the standards. It can be factory or field-installed. Its RF connection is independent of the monitored NE.
Type 3	Refers to a stand-alone or embedded, compliant transponder.	This transponder interfaces with network equipment designed to support the electrical specifications defined in the standards. It may or may not support the physical specifications defined in the standards. It can be factory-installed. It may or may not be field-installed. Its RF connection is through the monitored NE.

2 Normative references

None.