

Entertainment Services and Technology Association

DMX512 Over Category 5 Cable

Task Group Report

Summary

Prepared by Dave Higgins and Michael A.(Sandy) Twose
Edited by Mitch Heffer

CP/2000-1024

October 2000

ESTA Technical Standards Program
(ANSI ASC E1)
Control Protocols Working Group

© 2000 Entertainment Services and Technology Association

The **Entertainment Services and Technology Association (ESTA)** is a non-profit trade association representing the North American entertainment technology industry. Its members include dealers, manufacturers, manufacturer representatives, service and production companies, scenic houses, designers and consultants. The Association addresses areas of common concern such as technical standards, customer service, equipment quality, business practices, insurance, and credit reporting, and provides a wide variety of services to Members.

ESTA's Technical Standards Program is accredited by the American National Standards Institute (ANSI) as Accredited Standards Committee *E1, Safety and Compatibility of Entertainment Technical Equipment and Practices* with ESTA as its Secretariat. This accreditation means that the ESTA Technical Standards Program for standards-making has passed a detailed scrutiny by ANSI to insure that it meets the most stringent requirements for fairness and proper public review of proposed ESTA standards. The accreditation allows ESTA to submit standards for the ANSI public review and comment process, and then publish them as ANSI standards. The ESTA Technical Standards Program is now the only ANSI-accredited standards-making program dedicated to the needs of entertainment technology.

ESTA
875 6th Ave - Suite 2302
New York, NY 10001

(212) 244-1505 (212) 244-1502 FAX

<http://www.esta.org>

ESTA Technical Standards Manager
Karl G. Ruling

ESTA Control Protocols Working Group - Co-Chairs
Steve Carlson, High Speed Design
Steve Terry, Fourth Phase - PRG

ESTA E1.11 (DMX512) Task Groups Chair
Mitch Hefter, Rosco / ET; USITT

ESTA DMX-Over-Cat 5 Task Group
Dave Higgins, Pathway Connectivity
Michael A.(Sandy) Twose, Pathway Connectivity
Tim Bachman, Leviton/NSI/Colortran
Milton Davis, Doug Fleenor Design
Doug Fleenor, Doug Fleenor Design
Steve Terry, Fourth Phase - PRG
Peter Willis, Howard Eaton Lighting, Ltd.

NOTICE and DISCLAIMER

ESTA and ANSI Accredited Standards Committee E1 (for which ESTA serves as the secretariat) do not approve, inspect, or certify any installations, procedures, equipment or materials for compliance with codes, recommended practices or standards. Compliance with an ESTA standard or recommended practice, or an American National Standard developed under Accredited Standards Committee E1 is the sole and exclusive responsibility of the manufacturer or provider and is entirely within their control and discretion. Any markings, identification or other claims of compliance do not constitute certification or approval of any type or nature whatsoever by ESTA or Accredited Standards Committee E1.

ESTA and ANSI Accredited Standards Committee E1 (ASC E1) neither guaranty nor warrant the accuracy or completeness of any information published herein and disclaim liability for any personal injury, property or other damage or injury of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

In issuing and distributing this document, ESTA and ASC E1 do not either (a) undertake to render professional or other services for or on behalf of any person or entity, or (b) undertake any duty to any person or entity with respect to this document or its contents. Anyone using this document should rely on his or her own independent judgement or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance.

Introduction

In response to a perceived industry requirement for lower cost DMX512 cable installations, the DMX-over-Category 5 Cable Task Group was formed by ESTA's Control Protocols Working Group (CPWG) at the January 1998 TSP meetings in Dallas. The Task Group's mission was to employ an independent laboratory to carry out a series of comparison tests between a typical cable presently used for hardwired DMX512 installations, and conventional Category 5 data cable. The goal of this testing was to establish whether Category 5 cable, or "generic premises cable" as it has become known, could be used as a low cost substitute in permanently wired DMX512 installations.

Two series of lab tests were conducted in July and November of 1998 at MPB Technologies in Airdrie, Alberta. Additional tests were conducted in December of 1999

Part 1 of this report (CP/2000-1024.1) describes the first series of tests which compared the DMX512 handling characteristics of a typical EIA-422 rated data cable with those of a standard Category 5 unshielded twisted pair (UTP) cable. Radiated emissions tests were also done. Results of these tests indicated that Category 5 UTP cable performed as well as conventional DMX512 cable.

Part 2 of this report (CP/2000-1024.2) describes the second series of tests which were carried out with Category 5 shielded twisted pair (STP) cable, and also included radiated and induced signal immunity tests to current IEC standards on all cable types.

Part 3 of this report (CP/2000-1024.3) describes the third series of tests which were conducted to determine the effect of combining different types of cable (i.e., Category 5 and EIA-485) on the same wire run. At this time, tests were also done with Rosco/ET IPS equipment to determine whether the use of Category 5 cable caused any timing problems with their talkback data.

Test Conditions & Equipment

MPB Technologies supplied a HP54510A 250MHz Digital Storage Oscilloscope and HP7475 pen plotter to generate oscillograph plots. Radiated emissions and immunity tests were carried out in one of the largest of their five anechoic chambers, and data was acquired by a HP8566B Spectrum Analyzer with HP85685A pre-selector. To generate the required sweep frequencies, a HP8340A Synthesized Sweep Generator was used; this was driven by a HP43314A Function Generator. MPB used a custom software interface to format the output of the Spectrum Analyzer for laser printing. For induced immunity testing, a Velonex V-3300 fast transient burst generator, in conjunction with an MPB-constructed induction clamp conforming to IEC1000-4-4, was employed.

Gray Interfaces supplied the following equipment to facilitate the various tests:

- Goddard Design Li'l DMX'ter (used for DMX512 source and error checking)
- Gray DMX Repeater (isolated 1-in, 6-out buffer unit)
- Tektronix TDS 220 Oscilloscope
- Fluke DSP-100 LANMeter c/w smart remote
- Custom-wired transceiver unit with various EIA-485 transceiver types and switchable termination values
- Custom pulse generator

300 meters (1000 feet) of each of the following cable types was purchased for testing:

- EIA-422 (100 ohm) cable (2-pair with overall shield): Belden 9829
- EIA-485 (120 ohm) cable (2-pair with overall shield): Belden 9842
- Category 5 unshielded twisted pair (UTP) cable: Prestolite D0424 COU BL R-2
- Category 5 unshielded twisted pair (UTP) cable: Alpha 9504C
- Category 5 foil shielded twisted pair (STP) cable: Commscope 5NS4LAN568

Conclusion

Data obtained from all three of these test sessions confirms that, in most respects, UTP and STP Category 5 cable can be expected to perform at least as well as EIA-485 rated data cable for DMX512 applications. Detailed supporting test documentation is provided in the subsequent parts of this report.

A separate ESTA standard (BSR E1.11, Entertainment Technology – USITT DMX512-A Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories) is in development which addresses implementation of DMX512 over Category 5 cable.

– End Summary –