



**Digital Video Broadcasting (DVB);
Home Access Network (HAN)
with an Active Telco Network Termination**

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1 Scope

The DVB In-home Digital Network (IHDN) can be subdivided into a Home Access Network (HAN) for the connection to external networks and a Home Local Network (HLN) for interconnections of user equipment to clusters and between rooms [1] [2].

In addition to the DVB access technologies DVB-S, DVB-C, DVB-T, DVB-SMATV, DVB-MC and DVB-MS with the interaction channels for interactive broadcast services, the IHDN-HAN specification will focus on the definition of new interfaces and network terminations (NT), such as an xDSL modem or an external cable modem. The existing DVB transmission systems form part of the HAN architecture, but access the IRD without any influence from other sections of the HAN.

Different versions of HAN are possible. The HAN for use with an active Telco NT is based on an ATM interface operating at 25 or 51 Mbps. The IEEE 1394 interface with the long reach extension has been selected for the HLN.

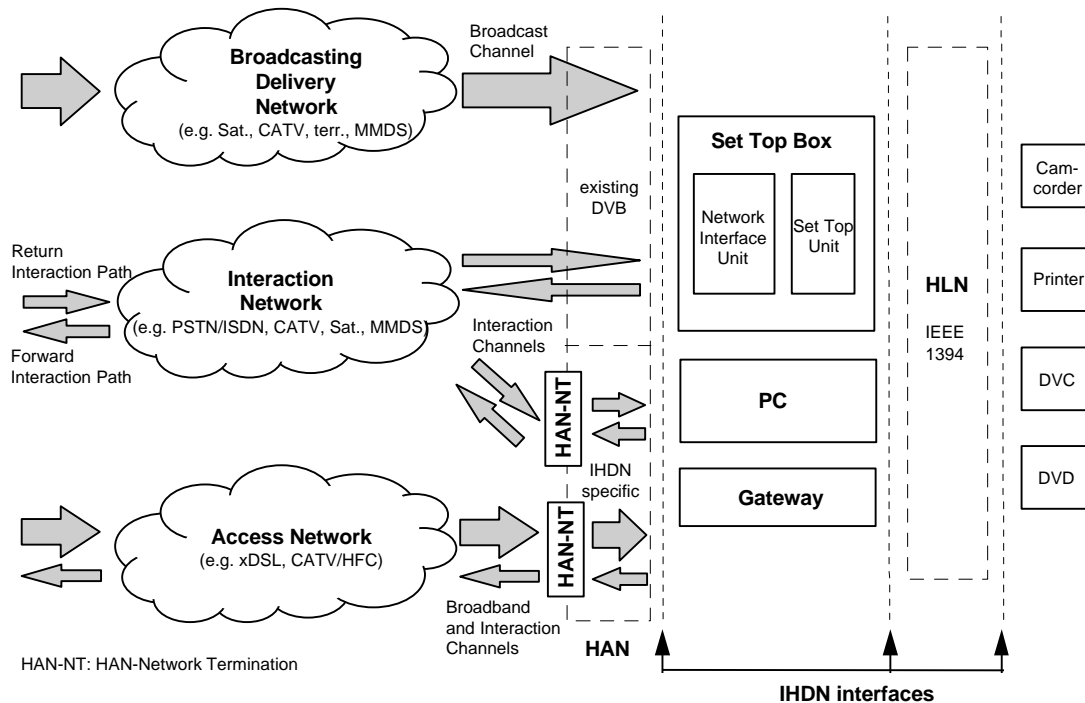


Figure 1 Elements of the IHDN.

Figure 1 shows the extension of the DVB interactive systems reference model with the IHDN. The network clouds on the left hand side show logically the association to corresponding services (broadcast, interactive broadcast, interactive multimedia services). Physically they may overlap and not all of them may be used in parallel. The Telco broadband access network is new; which enables broadband multimedia services, such as video on demand and switched digital broadcast, over twisted pair lines with an xDSL modem. It may also be used for interaction purposes in combination with any broadcast delivery network.

2 Normative references

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] DVB Interactive Services Commercial Module User and Market Requirements for In-Home Digital Networks - DVB-ISCM-004 (Rev 7 - 9/7/96)
- [2] DVB IHDN Guidelines - in preparation - to be based on DVB-TM 2003 DVB- IHDN - 012
- [3] DVB IHDN HLN Specification - in preparation
- [4] ATM Forum "Residential Broadband Physical Interfaces Specification."
- [5] ATM Forum "Physical Interface Specification for 25.6 Mb/s over Twisted Pair Cable,"af-phy-0040.000.
- [6] ITU-T I.610 "B-ISDN Operations & Maintenance Principles & Functions"
- [7] IEC 603-7, "Connectors for frequencies below 3 MHz for use with printed boards, Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features" 1990-04.
- [8] DAVIC 1.3 Specification Part 7, High and Mid Layer Protocols (Rev 6.3 - 29/10/97)
- [9] EN 301 192 Digital Video Broadcasting (DVB); DVB specification for data broadcasting
- [10] ISO/IEC 13818-1: "Information Technology - Generic Coding of Moving Pictures and Associated Audio Recommendation H.222.0 (systems)".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADSL	Asynchronous Digital Subscriber Loop
ATM	Asynchronous Transfer Mode
CPE	Customer Premises Equipment
DVB	Digital Video Broadcasting
DVB-C	DVB cable transmission standard (ETS 300 429)
DVB-MC	DVB Microwave Multipoint Distribution Systems (MMDS) below 10 GHz
DVB-MS	DVB Microwave Multipoint Distribution Systems (MMDS) below 10 GHz
DVB-S	DVB satellite transmission standard (ETS 300 421)
DVB-SMATV	DVB satellite master antenna television delivery standard (ETS 300 473)
DVB-T	DVB terrestrial transmission standard (ETS 300 744)
DVCR	Digital Video Cassette Recorder
DVD	Digital Versatile Disk
EBU	European Broadcasting Union
EMC	Electromagnetic Compatibility
HAN	Home Access Network
HLN	Home Local Network
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IHDN	In-Home Digital Network

IRD	Integrated Receiver Decoder
LLC	Logical Link Control
MMDS	Microwave Multipoint Distribution Systems
MPEG	Moving Pictures Experts Group
NT	Network Termination
OAM	Operations And Maintenance
PID	Packet IDentifier
PHY	Physical layer
PC	Personal Computer
POF	Plastic Optical Fibre
POTS	Plain Old Telephone System
PPP	Point of Presence Protocol
RBB	Residential Broadband
RF	Radio Frequency
RFI	Radio Frequency Interference
RS	Reed-Solomon
SI	Service Information
SDH	Synchronous Digital Hierarchy
SMATV	Satellite Master Antenna Television
SNAP	SubNetwork Attachment Point
SONET	Synchronous Optical Network
TS	Transport Stream
TV	TeleVision
UTP	Unscreened twisted pair
VC	Virtual Container
xDSL	Generic Digital Subscriber Loop technology, e.g. ADSL

4 Introduction

The In-Home Digital Network (IHDN), which is being implemented to meet a set of commercial requirements listed in [1] is described in reference [2]. It consists of two distinct sections, the Home Access Network (HAN) and the Home Local Network (HLN). The main purpose of the HAN is the connection of Access Network delivered services from a Network Termination (NT) to various items of CPE. The Home Local Network (HLN) [3], based on IEEE 1394, provides interconnection among local clusters of equipment where most of the traffic will not traverse the Access Network. An example of such a configuration is shown in Figure 2. This TS describes and defines the elements of an ATM HAN for use with an active Telco NT.

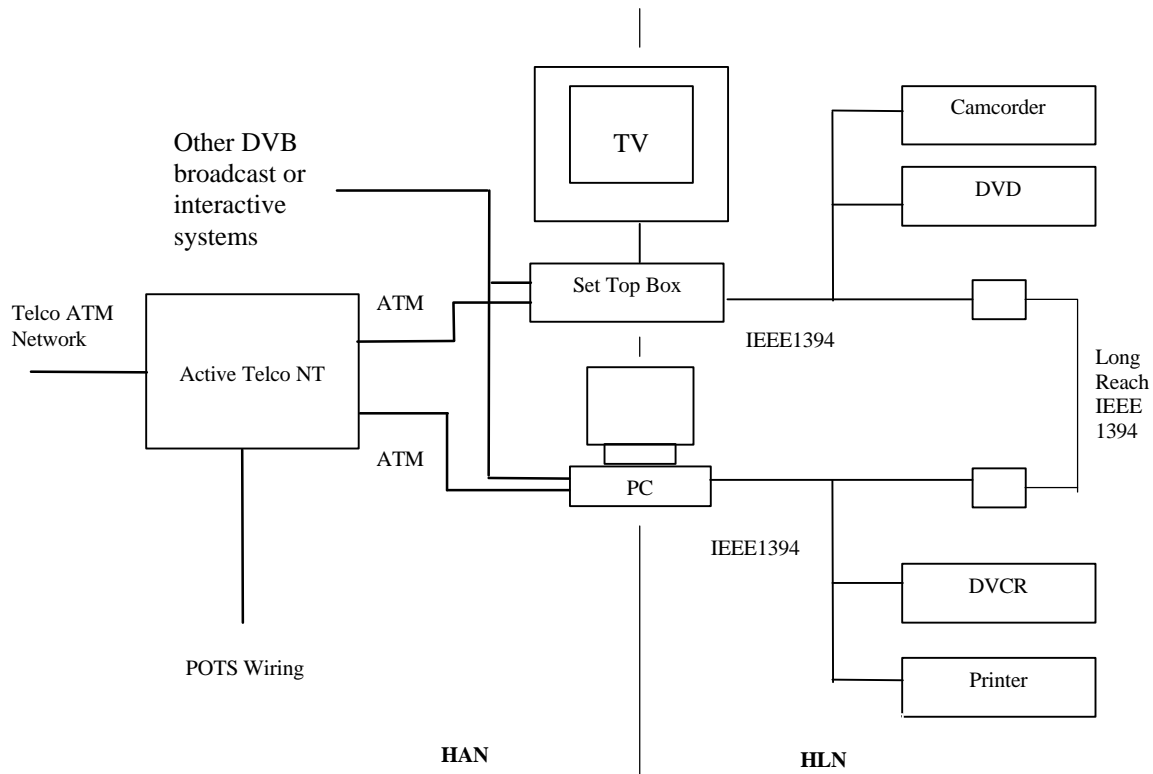


Figure 2 Elements of the IHDN.

As the purpose of this ATM HAN is primarily to distribute ATM Access Network delivered services to various locations within the home, it must provide a means of connecting multiple in-home devices to the Access Network as shown above. However, the limiting case would be a single connected device.

Depending on the implementation, it may also support intra-home communications i.e. device to device communication within the home without going via the Access Network, but local regulatory restrictions might prevent such functionality being incorporated into the NT itself.

5 Topology

The classical ATM point to point, star topology shall be supported.

6 Physical Layer

The Physical Layer (PHY) specified for the DVB HAN is a subset of the Residential Broadband (RBB) PHY defined by the ATM Forum in [4].

The ATM Forum specification defines a system that will operate at either 25,6 Mbps or 51,2 Mbps; it was derived from the existing ATM 25 specification [5], but was modified so as to provide:

- improved RFI egress properties, particularly in the spectral region below 30 MHz which is not covered by existing radiated emissions regulations, but is subject to the legally enforceable requirement not to interfere with existing services
- an optional, higher speed (51,2 Mbps) mode
- physical layer OAM functionality

- mandatory support for 8 kHz timing
- Category 5 TP and POF are the only supported media types.

This ATM Forum ATM 25/51 specification is backward compatible with, and will interoperate with ATM 25 as defined in [5]. When the 51,2 Mbps mode is implemented it must be able to autosense the operating speed of the other end of the link and drop back to a lower rate of 25,6 Mbps if necessary for interoperability. A common transmit level is used at both speeds which supports operation over 50 m of Category 5 UTP cable and remains compatible with the current 25,6 Mb/s UTP PHY over such cables.

The following options in [4] are mandatory for the DVB HAN:

- The 51,2 Mbps mode shall be supported;
- 100 Ohm, Category 5 Unscreened Twisted Pair (UTP) copper cable shall be supported.

Formal EMC requirements are country specific and so do not form part of the DVB HAN specification. However there is a widely applicable general requirement not to interfere with any existing licensed service. The most difficult services with which to co-exist are amateur and shortwave radio. The ATM Forum PHY specification [4] has been developed so that co-existence with such services can be achieved.

7 Timing References

Certain applications, in particular those which involve interworking with narrowband services at some point in the (external) network, may require the delivery of a network referenced (e.g. 8 kHz) clock.

The ATM HAN shall provide an 8 kHz clock reference derived from a timing reference on the Access network connection. This clock reference shall be distributed by means of the timing character markers defined in [4].

Note that as the HAN is not SONET/SDH framed, there is no requirement for the PHY to support loop timing at the terminal equipment.

Timing characters will not be looped back at terminal equipment.

8 Operations and Maintenance flows

The ATM HAN shall support F4 and F5 OAM flows, as defined in [6].

Physical layer OAM functions shall be supported, as specified in [4].

9 Infrastructure

The existing published wiring standard did not cover the home environment, and so the following subset of the infrastructure reference model developed by the RBB Working Group of the ATM Forum and used in [4] has been adopted.

9.1 Cables

100 Ohm Category 5 UTP copper cable shall be used.

The nominal maximum reach between the NT and an item of CPE is 50 m. This includes the length of any patch cords.

9.2 Connectors

The supported connector type is specified in IEC 603-7 [7] (commonly referred to as RJ45).

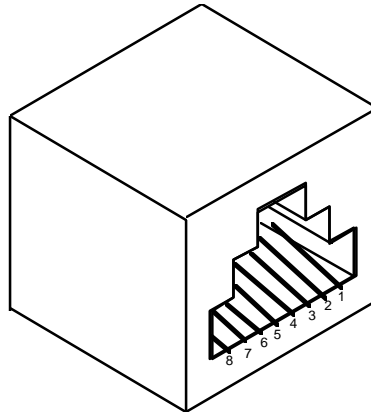


Figure 3 Example of UTP-RJ45 Jack

The contact assignments for the UTP-RJ45 receptacle (jack) shown in Figure 3 shall be as listed in Table 1.

Table 1 Contact Assignments for UTP-RJ45 Jack

Contact	Signal at the ATM User Device	Signal at the ATM Network Termination
1	Transmit +	Receive +
2	Transmit -	Receive -
3	Unused	Unused
4	Unused	Unused
5	Unused	Unused
6	Unused	Unused
7	Receive +	Transmit +
8	Receive -	Transmit -

A maximum of 3 mated connector pairs shall be supported in any point to point link.

10. Higher Layer Support

10.1 MPEG

MPEG transport streams, as described in [10], shall be carried using AAL5, as defined in section 6.3.12.1 of [8].

10.2 IP

IP will be carried over ATM using the LLC/SNAP format with AAL5 and VC based multiplexing, as defined in section 11.3.1 of [8].

10.3 IP through MPEG

IP can also be tunnelled via MPEG-2 transport stream as described in [9].

Annex A (informative): Bibliography

For the purposes of the present document, the following informative references apply:

- ITU-T J.110 “Basic principles for a worldwide common family of systems for the provision of interactive television services”

History

Document history		
Draft	27 th March 1998	Draft from Project Office to IHDN based on TM 1960 Rev. 2
Draft	28 th April 1998	Draft from Project Office to IHDN and TM based on 27/3/98 draft and comments from Will Dobbie, Dave Thorne and Bert Stienstra
Draft	25 th June 1998	Draft to IHDN group with CM comments from Will Dobbie
Draft	7 th July 1998	Draft from Bert Stienstra on comments from Will Dobbie