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Supplement 2
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**SERIES J: TRANSMISSION OF TELEVISION, SOUND
PROGRAMME AND OTHER MULTIMEDIA SIGNALS**

**Guidelines for the implementation of Annex A of
Recommendation J.112, "Transmission systems
for interactive cable television services"**

**Example of Digital Video Broadcasting (DVB)
interaction channel for cable television
distribution**

ITU-T J-series Recommendations – Supplement 2

(Previously CCITT Recommendations)

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SUPPLEMENT 2 TO ITU-T J-SERIES RECOMMENDATIONS

GUIDELINES FOR THE IMPLEMENTATION OF ANNEX A OF RECOMMENDATION J.112, "TRANSMISSION SYSTEMS FOR INTERACTIVE CABLE TELEVISION SERVICES"

EXAMPLE OF DIGITAL VIDEO BROADCASTING (DVB) INTERACTION CHANNEL FOR CABLE TELEVISION DISTRIBUTION

Source

Supplement 2 to ITU-T J-series Recommendations was prepared by ITU-T Study Group 9 (1997-2000) and was approved under the WTSC Resolution No. 5 procedure on the 19th of November 1998.

FOREWORD

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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Supplement 2 to J-series Recommendations

GUIDELINES FOR THE IMPLEMENTATION OF ANNEX A OF RECOMMENDATION J.112, "TRANSMISSION SYSTEMS FOR INTERACTIVE CABLE TELEVISION SERVICES"

EXAMPLE OF DIGITAL VIDEO BROADCASTING (DVB) INTERACTION CHANNEL FOR CABLE TELEVISION DISTRIBUTION

(Geneva, 1998)

1 Scope

This Supplement gives guidelines for use of the DVB interaction channel for Cable TV distribution systems (CATV) specification of Annex A/J.112 [2].

Hybrid Fibre Coax (HFC) networks are a sub-class of CATV networks in which the subscribers are divided into groups by using optical transmission technology in the trunk network.

The CATV infrastructures can support the implementation of the RC for interactive services suitable for DVB systems. CATV can be used to implement interactive services in the DVB environment, providing a bidirectional communication path between the user terminal and the service provider.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- [1] ITU-T Recommendation J.110 (1997), *Basic principles for a worldwide common family of systems for the provision of interactive television services.*
- [2] ITU-T Recommendation J.112 (1998), *Transmission systems for interactive cable television services.*
- [3] ITU-T Recommendation J.83 (1997), *Digital multi-programme systems for television, sound and data services for cable distribution.*
- [4] ITU-T Recommendations I.363 series, *B-ISDN ATM Adaptation Layer specification.*

3 Abbreviations

For the purposes of this Supplement, the following abbreviations apply:

AAL 5	ATM Adaptation Layer 5
ATM	Asynchronous Transfer Mode
BC	Broadcast Channel
BIM	Broadcast Interface Module
BRA	Basic Rate Access
CATV	Cable TV



Documents

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CB radio	Citizens' Band radio
DAVIC	Digital Audio Visual Council
DVB	Digital Video Broadcasting Project ¹
EMC	ElectroMagnetic Compatibility
FIP	Forward Interaction Path
HFC	Hybrid Fibre Coax
IB	In-Band
IC	Interaction Channel
ID	IDentifier
IEEE	Institute of Electrical and Electronics Engineers
IIM	Interactive Interface Module
INA	Interactive Network Adapter
IP	Internet Protocol
IRD	Integrated Receiver Decoder
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LLC	Link Layer Control
MAC	Media Access Control
MPEG	Moving Picture Expert Group
NIU	Network Interface Unit
ONU	Optical Node Unit
OOB	Out-of-Band
OSI	Open Systems Interconnection
PSTN	Public Switched Telephone Network
RC	Return Channel
RCC	Return Channel – Cable
RIP	Return Interaction Path
RMS	Root Mean Square
SDH	Synchronous Digital Hierarchy
SMATV	Satellite Master Antenna Television
SNR	Signal-to-Noise power Ratio
STB	Set Top Box
STU	Set Top Unit
TCP	Transmission Control Protocol
TDMA	Time Division Multiple Access
TS	Transport Stream

¹ The Digital Video Broadcasting Project (DVB) is a consortium of broadcasters, manufacturers, network operators and regulatory bodies created for designing standards for the delivery of digital television.

UC Upstream Channel
VCI Virtual Channel Identifier
VPI Virtual Path Identifier

4 System model

Figure 1 shows the system model which is to be used within DVB for interactive services [1].

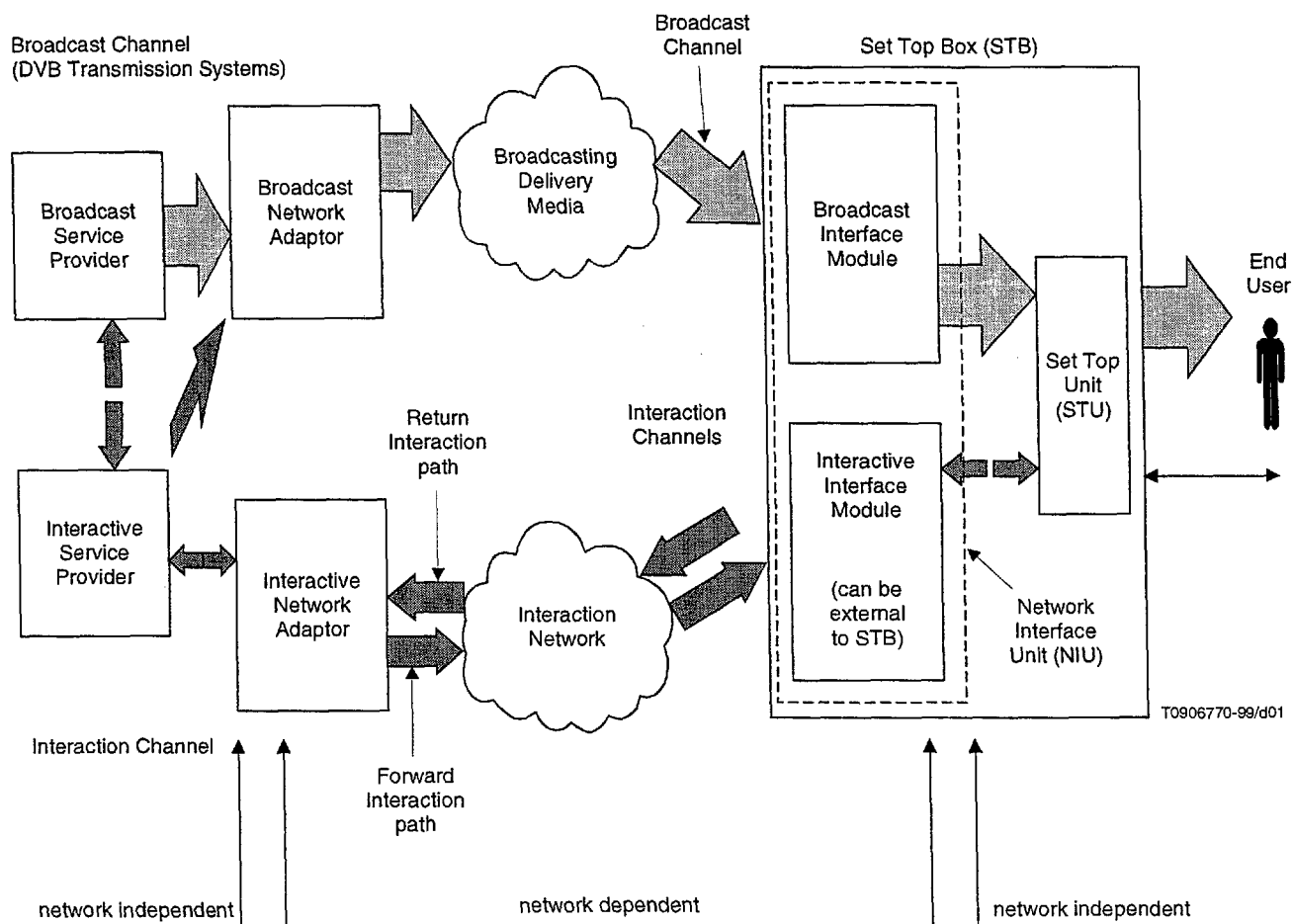


Figure 1 – Generic system reference model for interactive systems

In the system model, two channels are established between the service provider and the user:

- **Broadcast Channel (BC):** A unidirectional broadband BC including video, audio and data. BC is established from the service provider to the users. It may include the Forward Interaction Path (FIP).
- **Interaction Channel (IC):** A bidirectional interaction channel is established between the service provider and the user for interaction purposes. It is formed by:
 - **Return Interaction Path (RIP):** From the user to the service provider. It is used to make requests to the service provider or to answer questions. Also commonly known as Return Channel (RC) or Upstream Channel (UC).
 - **Forward Interaction Path (FIP):** From the service provider to the user. It is used to provide some sort of information by the service provider to the user and any other required communication for the interactive service provision. It may be embedded into the BC. It is possible that this channel is not required in some simple implementations which make use of the BC for the carriage of data to the user.

In this Supplement the word "channel" denotes logical link and "path" corresponds to a physical link.

The user terminal is formed by the Network Interface Unit (NIU) [consisting of the Broadcast Interface Module (BIM) and the Interactive Interface Module (IIM)] and the Set Top Unit (STU). The user terminal provides interface for both broadcast and interaction channels. The interface between the user terminal and the interaction network is via the IIM.

The interactive system is composed of FIP (downstream) and RIP (upstream). The general concept is to use FIP to act as a transmission medium for MAC control channel and to carry a part of the downstream data. This allows the NIUs to adapt to the network and send synchronized information upstream.

RIP is divided into time slots which can be used by different users, using the technique of Time Division Multiple Access (TDMA). One MAC control channel is used to control up to 8 UCs, which are all divided into time slots. A time marker and an upstream counter at the INA is sent periodically to the NIUs, so that all NIUs work with synchronized clock and same upstream counter value. This gives the opportunity to the INA to assign time slots to different users.

Three major access modes are provided with this system. The first one is based on contention access, which lets users send information at any time with the risk of having a collision with other user's transmissions. The second and third modes are contention-less-based, where the INA either provides a finite amount of slots to a specific NIU, or a given bit rate requested by a NIU until the INA stops the connection on NIU's demand. These access modes are dynamically shared among time slots, which allows NIUs to know when contention-based transmission is or is not allowed. This is to avoid a collision for the two contention-less-based access modes.

Periodically, the INA will indicate to new users that they have the possibility to go through sign-on procedure, in order to give them the opportunity to synchronize their clock to the network clock, without risking collisions with already active users. This is done by leaving a larger time interval for new users to send their information, taking into account the propagation time required from the INA to the NIUs and back.

5 Protocol stack model

For asymmetric interactive services supporting broadcast to the home with narrowband RC, a simple communication model consists of the following layers:

- **Network-dependent physical layer:** where all the physical (electrical) transmission parameters are defined;
- **Network-dependent access mechanism layer:** defines all the relevant data structures and communication protocols like data containers, etc.;
- **Network-independent application layer:** the interactive application software and runtime environments (e.g. home shopping application, script interpreter, etc.).

DVB-RCC (Annex A/J.112 [2]) addresses the lower two layers (the physical and transport), leaving the application layer open to competitive market forces.

A simplified model of the OSI layers was adopted to facilitate the production of specifications for these nodes. Figure 2 points out the lower layers of the simplified model and identifies some of the key parameters for the lower two layers. Following the user requirements for interactive services, no attempt will be made in this Supplement to consider higher medium layers.

This Supplement addresses the HFC/CATV network specific aspects only. The network-independent protocols will be specified separately.