# ETSI TS 101 909-1 V1.4.1 (2006-04)

*Technical Specification*

## Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 1: General

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# Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access and Terminals (AT).

The present document is part 1 of a multi-part deliverable covering the Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services, as identified below:

**Part 1:** **"General";**

Part 2: "Architectural framework for the delivery of time critical services over cable Television networks using cable modems";

Part 3: "Audio Codec Requirements for the Provision of Bi-Directional Audio Service over Cable Television Networks using Cable Modems";

Part 4: "Network Call Signalling Protocol";

Part 5: "Dynamic Quality of Service for the Provision of Real Time Services over Cable Television Networks using Cable Modems";

Part 6: "Media Terminal Adapter (MTA) device provisioning";

Part 7: "Management Information Base (MIB) Framework";

Part 8: "Media Terminal Adapter (MTA) Management Information Base (MIB)";

Part 9: "Network Call Signalling (NCS) MIB Requirements";

Part 10: "Event Message Requirements for the Provision of Real Time Services over Cable Television Networks using Cable Modems";

Part 11: "Security";

Part 12: "Internet Signalling Transport Protocol (ISTP)";

Part 13: "Trunking Gateway Control Protocol";

Part 16: "Signalling for Call Management Server [ITU-T Recommendation J.178 (2003): Pre-Published Version, modified]";

Part 17: "Inter-domain Quality of Service";

Part 18: "Embedded Media Terminal Adapter (e-MTA) offering an interface to analogue terminals and Cable Modem";

Part 19: "IPCablecom Audio Server Protocol Specification";

Part 20: "Lawful Interception";

Part 22: "Management Event Messages";

Part 23:    "Internet Protocol Access Terminal - Line Control Signalling (IPAT - LCS)";

Part 24:    "MTA Basic Access ISDN Interface (MTA-ISDN)";

Part 26:    "Protocol Implementation Conformance Statement (PICS) proforma specification";

NOTE 1:    Additional parts may be proposed and will be added to the list in future versions.

NOTE 2:    The choice of a multi-part format for this deliverable is to facilitate maintenance and future enhancements.

# Introduction

The cable industry in Europe and across other regions have already deployed broadband cable television Hybrid Fibre Coax (HFC) data networks running Protocols like the ones specified in ES 201 488 [2] or ES 200 800 [3]. The Cable Industry is in the rapid stages of deploying IP Voice and other time critical multimedia services over these broadband cable television networks.

The cable industry has recognized the urgent need to develop ETSI Technical Specifications aimed at developing interoperable interface specifications and mechanisms for the delivery of end to end advanced real time IP multimedia time critical services over bi-directional broadband cable networks.

IPCablecom is a set of protocols and associated element functional requirements developed to deliver Quality of Service (QoS) enhanced secure IP multimedia time critical communications services using packetized data transmission technology to a consumer's home over the broadband cable television Hybrid Fibre/Coaxial (HFC) data network running the Cable Modem protocol. IPCablecom utilizes a network superstructure that overlays the two-way data-ready cable television network. While the initial service offerings in the IPCablecom product line are anticipated to be Packet Voice, the long-term project vision encompasses packet video and a large family of other packet-based services.

The cable industry is a global market and therefore the ETSI standards are developed to align to the extent possible with standards either already developed or under development in other regions. The ETSI Specifications are consistent to the extent possible with the CableLabs/PacketCable set of specifications as published by the SCTE. An agreement has been established between ETSI and SCTE in the US to ensure, where appropriate, that the release of PacketCable and IPCablecom set of specifications are aligned and to avoid unnecessary duplication. The set of IPCablecom ETSI specifications also refers to ITU-SG9 draft and published recommendations relating to IP Cable Communication.

The whole set of multi-part IPCablecom ETSI deliverables to which the present document belongs specify a Cable Communication Service for the delivery of IP Multimedia Time Critical Services over a HFC Broadband Cable Network to the consumer's home cable telecom terminal.

# 1        Scope

The present set of documents specifies IPCablecom, a set of protocols and associated element functional requirements. These have been developed to deliver Quality of Service (QoS), enhanced secure IP multimedia time critical communication services, using packetized data transmission technology to a consumer's home over a cable television Hybrid Fibre/Coaxial (HFC) data network.

> NOTE 1:   IPCablecom set of documents utilize a network superstructure that overlays the two-way data-ready cable television network, e.g. as specified within ES 201 488 [2] and ES 200 800 [3].

While the initial service offerings in the IPCablecom product line are anticipated to be Packet Voice and Packet Video, the long-term project vision encompasses a large family of packet-based services. This may require in the future, not only careful maintenance control, but also an extension of the present set of documents.

> NOTE 2:   The present set of documents aims for global acceptance and applicability. It is therefore developed in alignment with standards either already existing or under development in other regions and in International Telecommunications Union (ITU).

The present document is part 1 of the above mentioned series of ETSI deliverables and specifies general aspects of IPCablecom based on J.16x and J.17x ITU-T series of Recommendations.

# 2        References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1]            ITU-T Recommendation J.112: "Transmission systems for interactive cable television services".

[2]            ETSI ES 201 488 (all parts): "Access and Terminals (AT); Data Over Cable Systems".

[3]            ETSI ES 200 800: "Digital Video Broadcasting (DVB); DVB interaction channel for Cable TV distribution systems (CATV)".

# 3        Definitions and abbreviations

## 3.1     Definitions

For the purposes of the present document, the following terms and definitions apply:

**access node:** layer two termination device that terminates the network end of the ITU-T Recommendation J.112 connection

> NOTE:     The definition of "access node" is technology specific. In ES 201 488 [2] and in ITU-T Recommendation J.112, annex A [1], it is called the INA while in ES 200 800 [3] and in ITU-T Recommendation J.112, annex B [1] it is the CMTS.

**cable modem:** layer two termination device that terminates the customer end of the J.112 connection

**IPCablecom:** ETSI deliverables including an architecture and a series of Specifications that enable the delivery of real time services (such as telephony) over the cable television networks using cable modems

## 3.2    Abbreviations

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

| | |
|---|---|
| CMS | Call Management Server |
| CMTS | Cable Modem Termination System |
| DHCP | Dynamic Host Configuration Protocol |
| HFC | Hybrid Fibre Coax |
| IP | Internet Protocol |
| IPAT | IP Access Terminal |
| ISTP | Internet Signalling Transport Protocol |
| LCS | Large Capacity Storage |
| LCS | Line Control Signalling |
| LEA | Law Enforcement Agency |
| MGCP | Media Gateway Control Protocol |
| MIB | Management Information Base |
| MTA | Media Terminal Adapter |
| NCS | Network Call Signalling |
| PICS | Protocol Implementation Conformance Statement |
| PSTN | Public Switched Telephone Network |
| QoS | Quality of Service |
| TFTP | Trivial File Transfer Protocol |
| TGCP | Trunking Gateway Control Protocol |

# 4        Overview of the multi-part deliverable

The TS 101 909 series together present an IPCablecom network architecture for the provision of voice and multimedia IP services. The TS 101 909 series of standards represent a set of cohesive set of interwoven specifications that jointly evolved to present different phases of IPCablecom network developments. Changes made to one part of the series have to identify the consequence to other parts of the series to ensure the elements interface together properly.

## 4.1    Part 1: General

The present document.

## 4.2    Part 2: Architectural framework

Defines architecture framework for IPCablecom networks including all major system components and network interfaces necessary for delivery of IPCablecom services.

## 4.3    Part 3: Audio Codec Requirements

Defines the audio and video codecs necessary to provide the highest quality and the most resource-efficient service delivery to the customer. Also specifies the performance required in client devices to support future IPCablecom codecs and describes suggested methodology for optimal network support for codecs.

Offering a competitive and/or superior product requires support for more than high-quality delivery of audio. In addition to features and signalling capabilities, which are beyond the scope of this document, the audio codec application must provide transparent support for certain audio features. These include general detection mechanisms, DTMF, fax, analog modem, echo cancellation, and hearing-impaired support.

## 4.4        Part 4: Network Call Signalling Protocol

ETSI TS 101 909-4 adopts ITU-T Recommendation J.162 with some ETSI extensions defined within TS 101 909-4.

This part specifies a profile of an application programming interface, Media Gateway Controller Interface (MGCI), and a corresponding protocol, Media Gateway Control Protocol (MGCP), for controlling Voice over IP (VoIP) embedded clients from external call control elements. The MGCP is based on a call control architecture, where the call control "intelligence" resides outside the gateways and is handled by external call control elements. The profile, as described in TS 101 909-4, is referred to as the Network Call Signalling (NCS) Protocol.

## 4.5        Part 5: Dynamic Quality of Service

Defines the QoS Architecture for the "Access" portion of the IPCablecom network, provided to requesting applications on a per-flow basis. The access portion of the network is defined to be between the Multimedia Terminal Adapter (MTA) and the Cable Modem Termination System (CMTS). The method of QoS allocation over the backbone is unspecified in the present edition of TS 101 909-5.

The Dynamic QoS specification incorporates protocols to enable providers of packet-based voice communications using the IPCablecom framework to use different charging models, including both flat-rate charging as well as usage-based charging. It is the intent of TS 101 909-5 to ensure that enhanced QoS is provided only to authorized and authenticated users.

The Dynamic QoS specification recognizes the requirements of a commercially viable voice communications service analogous to that offered by means of the public switched telephone network. It is important to ensure that resources are available before the two parties involved in the session are invited to communicate. Thus, resources are reserved before the recipient of the communication is notified that someone is trying to initiate a communication. If there are insufficient resources for a session, then the session is blocked.

## 4.6        Part 6: Media Terminal Adapter (MTA) device provisioning

ETSI TS 101 909-6 adopts ITU-T Recommendation J.167 with some ETSI extensions defined within TS 101 909-6.

This part defines the protocol mechanisms for provisioning of an IPCablecom embedded-MTA device by a single provisioning and network management provider.

## 4.7        Part 7: Management Information Base (MIB) Framework

Describes the framework in which IPCablecom MIBs (Management Information Base) are defined. It provides information on the management requirements of IPCablecom specified devices and functions, and how these requirements are supported in the MIB. It is intended to support and complement the actual MIB documents, which are issued separately.

The original ETSI published version of TS 101 909-7 defined the MIB in full. However, in later versions of TS 101 909-7 reference to the latest IETF IPCDN published MIB was used.

## 4.8        Part 8: Media Terminal Adapter (MTA) Management Information Base (MIB)

Defines the MIB module which supplies the basic management objects for the MTA Device.

The original ETSI published version of TS 101 909-8 defined the MIB in full. However, in later versions of TS 101 909-8 reference to the latest IETF IPCDN published MIB was used.

## 4.9 Part 9: Network Call Signalling (NCS) MIB Requirements

Defines the MIB module which supplies the basic management object for the NCS protocol.

The original ETSI published version of TS 101 909-8 defined the MIB in full. However, in later versions of TS 101 909-8 reference to the latest IETF IPCDN published MIB was used.

## 4.10 Part 10: Event Message Requirements

Defines the concept of Event Messages used to collect usage for the purposes of billing within the IPCablecom architecture.

An Event Message is a data record containing information about network usage and activities. A single Event Message may contain a complete set of data regarding usage or it may only contain part of the total usage information. When correlated by the Record Keeping System (RKS), information contained in multiple Event Messages provides a complete record of the service. This complete record of the service is often referred to as a Call Detail Record (CDR). Event Messages or CDRs may be sent to one or more back office applications such as a billing system, fraud detection system, or pre-paid services processor.

The structure of the Event Message data record is designed to be flexible and extensible in order to carry information about network usage for a wide variety of services. Examples of these services include IPCablecom voice, video and other multimedia services, such as Video-On-Demand, Pay-Per-View and J.112 [1] high-speed data services.

The IPCablecom Event Messages Specification defines a transport protocol independent Event Message attribute TLV format, an Event Message file format, as well as the mandatory RADIUS protocol and the optional FTP transport protocol. Although the scope of this Event Message Specification is limited to defining Event Messages for simple voice communications activities, it is expected that the present document will be expanded to support additional IPCablecom services as well as high-speed data services.

## 4.11 Part 11: Security

This part defines the Security architecture, protocols, algorithms, associated functional requirements and the technological requirements that may provide for the security of the IPCablecom network.

## 4.12 Part 12: Internet Signalling Transport Protocol (ISTP)

This part addresses the protocol to implement ETSI SS7 used for signalling interconnection in a distributed IPCablecom architecture. Specifically, it defines the messages and procedures for transporting SS7 ISUP, and TCAP messages as defined by ETSI specifications between the IPCablecom control functions (Media Gateway Controller and Call Management Server) and the SS7 Signalling Gateway. The IPCablecom Networks are always connected to the PSTN/ISDN using standard ETSI SS7 interfaces Ref (ISUP, MTP and SCCP).

## 4.13 Part 13: Trunking Gateway Control Protocol

Defines a Trunking Gateway Control Protocol (TGCP) for use in a centralized call control architecture that assumes relatively simple endpoint devices. TGCP is designed to meet the protocol requirements for the Media Gateway Controller to Media Gateway interface defined in the IPCablecom architecture.

At present two alternative solutions may be found as given by sub-parts 1 and 2 that describe two competing alternative protocol options, H.248 and TGCP (NCS based) respectively.

### 4.13.1 Sub-part 1: H.248 option

Specifies H.248 option.

This sub-part specifies a profile of the ITU-T Recommendation H.248 protocol for controlling media gateways between cable networks and the PSTN.

### 4.13.2 Sub-part 2: MGCP option

Specifies MGCP (NCS based) option.

This sub-part specifies a profile of the MGCP protocol for controlling media gateways between cable networks and the PSTN.

## 4.14 Part 14: Reserved for future use

## 4.15 Part 15: Reserved for future use

## 4.16 Part 16: Signalling for Call Management Server

This part is a European delta to ITU-T Recommendation J.178 (Geneva May 2003), which defines a profile of the IETF SIP protocol for use within IPCablecom networks. This SIP profile (known as CMSS - "Call Management Server to Call Management Server Signalling Specification") contains extensions to the SIP protocol and usage rules to support IPCablecom services.

## 4.17 Part 17: Inter-domain Quality of Service

This part defines Inter-domain Quality of Service in the IPCablecom environment with the following objectives.

- Define signalling mechanisms for establishment of QoS resources between ANs that are separated by a managed IP backbone network.

- Define signalling mechanisms for establishment of QoS resources between ANs and other IPCableCom elements in the media path such as Edge Routers, Border Routers, Media Gateways, and Media Servers.

- Support end-to-end Dynamic QoS sessions across managed IP backbone networks.

- Define the interfaces for control and delivery of QoS between IPCableCom domains.

- Support Network-based Call Signalling (NCS) and Distributed Call Signalling (DCS) models.

- Support layer-2 QoS signalling (J.112) on the access network.

- Support multiple backbones with standard QoS implementations for managing scheduling and buffer allocation in switches and routers.

## 4.18 Part 18: Embedded Media Terminal Adapter (e-MTA) offering an interface to analogue terminals and Cable Modem

This part defines an analogue POTS presentation of an IPCablecom Termination Point (E-MTA) intended to deliver 3,1 kHz voiceband services equivalent to a Public Switched Telephone Network (PSTN) or equivalent network with short length 2-wire local loop.

The objective of this part is to specify the physical and electrical characteristics of the CM/MTA interfaces that are part of an analogue POTS presentation of an IPCablecom CM/MTA particularly suitable for use by new network operators. TS 101 909-18 specifies characteristics of the CM/MTA to enable it to operate with most existing national PSTN Terminal Equipment (TE), and especially with PSTN TE designed according to the European standards for analogue presented TEs.

## 4.19 Part 19: IPCablecom Audio Server Protocol Specification

This part describes the architecture and protocols that are required for playing announcements in Voice-over IP (VoIP) IPCablecom networks, including where an IVR (Interactive Voice Response) system is embedded in the IPCablecom network. Announcements are typically needed for calls that do not complete. Additionally, they may be used to provide enhanced information services to the caller. Different carrier service feature sets require different announcement sets and announcement formats.

Announcements can be as basic as fixed-content announcements (e.g. all circuits busy) or as complex as those provided by intelligent IVR (Interactive Voice Response) systems. The IPCablecom service model requires that all announcements be provisioned and signalled in a standard manner for all supported call features and use case scenarios.

Two alternative solutions may be found as given by sub-parts 1 and 2 that describe two alternative protocol options, H.248 and MGCP respectively.

### 4.19.1 Sub-part 1: H.248 option

This sub-part identifies a set of signalling interfaces that are used to provide announcement services within an IPCablecom network, and specifies one of these interfaces: the MP-MPC interface, based on the protocol defined in ITU-T Recommendation H.248.

### 4.19.2 Sub-part 2: MGCP option

This sub-part identifies a set of signalling protocols that are used to provide announcement services within an IPCablecom network. For one of these protocols, the IPCablecom Network Call Signalling (NCS) protocol, the present document defines two new event packages:

- A Base Audio Package.

- An Advanced Audio Package.

## 4.20 Part 20: Lawful Interception

Defines, within the IPCablecom environment, the Lawful Interception requirements.

Lawful Interception requirements described for the interception of voice services and streamed multimedia services may be found as given by sub-parts 1 and 2 respectively.

### 4.20.1 Sub-part 1: CMS based Voice Telephony Services

TS 101 909-20-1 defines the interception of voice communications within the IPCablecom "NCS" architecture, using a CMS for call control, as identified by a unique address (number) e.g. IUT-T Recommendation E.164. The present set of documents specifies IPCablecom, a set of protocols and associated element functional requirements. These have been developed to deliver Quality of Service (QoS), enhanced secure IP multimedia time critical communication services, using packetized data transmission technology to a consumer's home over a cable television Hybrid Fiber/Coaxial (HFC) data network.

### 4.20.2 Sub-part 2: Streamed Multimedia Services

TS 101 909-20-2 specifies the interception of those multi-media services carried over the network defined in the remainder of the IPCablecom series of deliverables that do not fall into the interception domain covered by TS 101 909-20-1.

The Lawful Interception requirements for streamed multimedia services is an area that has only recently been reviewed and the advances made in this sub part have been accepted as a valid approach within the European LEA environment.

## 4.21 Part 21: Reserved for future use

## 4.22 Part 22: Management Event Messages

Defines Management Event Messages in the IPCablecom environment.

## 4.23 Part 23: Internet Protocol Access Terminal - Line Control Signalling (IPAT - LCS)

Defines the LCS architecture for an IPAT in the IPCablecom environment.

This part provides a technical description of the Internet Protocol Access Terminal-Line Control Signalling (IPAT-LCS) architecture, and where appropriate, identifies the portions of the IPCablecom specifications that apply to this architecture and their use. It contains a description of modifications to the NCS architecture to support a V5.2 signalling interface to a local exchange, rather than the full NCS architecture. This is a "delta" document, describing areas where the LCS architecture differs from the NCS.

## 4.24 Part 24: MTA Basic Access ISDN Interface

This part provides a technical description of this architecture, and where appropriate, identifies the portions of the IPCablecom specifications that apply to this architecture and their use. The embedded, ISDN-enabled MTA (iMTA) and its interfaces are described in this part. The definition and interfaces of a standalone ISDN MTA (S-iMTA) are not described in this part and remain as an area for further study.

## 4.25 Part 25: Reserved for future use

## 4.26 Part 26: PICS Proforma for Conformance Test Suites

This part provides in its sub-parts the various PICS Proforma that may be used for conformance testing.

### 4.26.1 Sub-part 1: Embedded Multimedia Terminal Adapter

This sub-part provides the Protocol Implementation Conformance Statement (PICS) proforma for the Network-based Call Signalling, Dynamic Quality of Service, Provisioning and Security protocols for the IPCablecom (packet-based multimedia communication) system defined in TS 101 909-3, TS 101 909-4, TS 101 909-5, TS 101 909-6, TS 101 909-7, TS 101 909-8, TS 101 909-9, TS 101 909-11, in compliance with the relevant requirements of those specifications and in accordance with the relevant guidance given in ISO/IEC 9646-7.

### 4.26.2 Sub-part 2: Internet Protocol Access Terminal - Line Control Signalling

Although originally intended to be part of the TS 101 909 series this specification was published as TS 102 318 instead of the intended TS 101 909-26-2.

This document provides the Protocol Implementation Conformance Statement (PICS) proforma for the Network-based Call Signalling, Dynamic Quality of Service, Provisioning and Security protocols together with the ETSI V5 mapping for the IPCablecom (packet-based multimedia communication) system defined in TS 101 909-4, TS 101 909-5, TS 101 909-6, TS 101 909-7, TS 101 909-8, TS 101 909-9, TS 101 909-11, TS 101 909-23, in compliance with the relevant requirements of those specifications and in accordance with the relevant guidance given in ISO/IEC 9646-7.

## 4.27     Part 27: Reserved for future use

## 4.28     Part 28: Reserved for future use

# Annex A (informative):
# Bibliography

- IETF RFC 2132 (1997): "DHCP Options and BOOTP Vendor Extensions".

- IETF RFC 1700 (1994): "Assigned Numbers".

- IETF RFC 1350 (1992): "The TFTP Protocol (Revision 2)".

- ITU-T Recommendation J.83 (1997): "Digital multi-programme systems for television, sound and data services for cable distribution".

- ETSI TS 101 909-2: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 2: Architectural framework for the delivery of time critical services over cable Television networks using cable modems".

- IETF RFC 2131: "Dynamic Host Configuration Protocol".

- ITU-T Recommendation H.248: "Gateway control protocol".

- ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

- ETSI TS 102 318: "Access and Terminals (AT); Digital Broadband Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Protocol Implementation Conformance Statement (PICS); Internet Protocol Access Terminal - Line Control Signalling".

List of ITU-T Recommendations referring to IPCablecom:

- ITU-T Recommendation J.160: "Architectural framework for the delivery of time-critical services over cable television networks using cable modems".

- ITU-T Recommendation J.161: "Audio codec requirements for the provision of bidirectional audio service over cable television networks using cable modems".

- ITU-T Recommendation J.162: "Network call signalling protocol for the delivery of time critical services over cable television networks using cable modems".

- ITU-T Recommendation J.163: "Dynamic quality of service for the provision of real time services over cable television networks using cable modems".

- ITU-T Recommendation J.164: "Event message requirements for the support of real-time services over cable television networks using cable modems".

- ITU-T Recommendation J.165: "IPCablecom Internet Signalling Transport Protocol (ISTP)".

- ITU-T Recommendation J.166: "IPCablecom Management Information Base (MIB) framework".

- ITU-T Recommendation J.167: "Media Terminal Adapter (MTA) device provisioning requirements for the delivery of real time services over cable television networks using cable modems".

- ITU-T Recommendation J.168: "IPCablecom media terminal adapter (MTA) MIB requirements".

- ITU-T Recommendation J.169: "IPCablecom network call signalling (NCS) MIB requirements".

- ITU-T Recommendation J.170: "IPCablecom security specification".

- ITU-T Recommendation J.171: "IPcablecom trunking gateway control protocol (TGCP)".

- ITU-T Recommendation J.172: "IPCablecom management event mechanism".

- ITU-T Recommendation J.173: "IPCablecom embedded MTA primary line support".

- ITU-T Recommendation J.174: "IPCablecom interdomain quality of service".

- ITU-T Recommendation J.175: "Audio server protocol".

- ITU-T Recommendation J.176: "IPCablecom management event mechanism MIB".

- ITU-T Recommendation J.177: "IPCablecom CMS subscriber provisioning specification".

- ITU-T Recommendation J.178: "IPCablecom CMS to CMS signalling".

# History

| Document history | | | |
|---|---|---|---|
| V1.1.1 | June 2001 | Publication | |
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