ETSI TS 101 909-4 V1.5.2 (2006-08)

Technical Specification

Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 4: Network Call Signalling Protocol

[Partial Endorsement of ITU-T Recommendation J.162 (11/2005), modified]

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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 4 of a multi-part deliverable covering Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services. Full details of the entire series can be found in part 1.

Introduction

The cable industry in Europe and across other Global regions has already deployed broadband cable television Hybrid Fibre Coax (HFC) data networks running the Cable Modem Protocol. 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 with standards either already developed or under development in other regions. The ETSI Specifications are consistent 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 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 consumers' home cable telecom terminal. "IPCablecom" also refers to the ETSI working group program that shall define and develop these ETSI deliverables.

Many cable television operators are upgrading their facilities to provide two way capability and using this capability to provide high speed IP data services per ITU-T Recommendations J.83 and J.112 [1]. These operators now want to expand the capability of this delivery platform to include a variety of time critical services. The present document is one of a series of documents required to achieve this goal. It provides a network based call signalling protocol necessary to establish connections.

The present document is part 4 of the series of ETSI deliverables and 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 assumes a call control architecture where the call control "intelligence" is outside the media gateway and is handled by external call control elements. The profile, as described in the present document, will be referred to as the Network-based Call Signalling (NCS) Protocol. It is based on the Media Gateway Control Protocol (MGCP) 1.0 RFC 3435, which is the result of a merging of the Simple Gateway Control Protocol, and the IP Device Control (IPDC) family of protocols, as well as additional ideas incorporated during the protocol development process.

1   Scope

The present document is a multi-part deliverable belonging to IPCablecom. The present part (part 4) 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 the present document, is referred to as the Network Call Signalling (NCS) Protocol.

Annex B of the present document specifies an expansion of the NCS protocol to emulate an Access Node of an ETSI compliant local exchange. This annex specifies the mapping of expansion of the NCS protocol to V5.2.

Annex F of the present document specifies optional NCS components for the delivery of metering pulses.

This multi-part deliverable specifies IPCablecom, a set of protocols and associated element functional requirements. These have been developed to deliver high Quality of Service (QoS), enhanced secure IP multimedia time critical communication services to a consumer's home over a cable television Hybrid Fibre/Coaxial (HFC) data network.

NOTE 1:   IPCablecom defines a set of documents in the framework of a network superstructure that overlays the two-way data-ready cable television network, e.g. as specified within ES 201 488 [5] 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).

NOTE 3:   There may also be relevant equivalent studies on-going in IETF or ITU specific to the needs of European IPCablecom. Where possible ETSI TC AT-D working group for IPCablecom should align annex B package annex or similar packages addressing the specific needs of European IPCablecom with work on going in IETF, Cablelabs, or the ITU.

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 EN 300 324-1: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

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

[4]   ETSI ES 201 235 (series): "Access and Terminals (AT); Specification of Dual-Tone Multi-Frequency (DTMF) Transmitters and Receivers ".

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

[6]   ETSI TS 101 909-3: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 3: Audio Codec Requirements for the Provision of Bi-Directional Audio Service over Cable Television Networks using Cable Modems".

[7]   ETSI EN 300 659-1: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 1: On-hook data transmission".

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

[9]   ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[10]   ETSI ES 200 659-3: "Access and Terminals (AT); Analogue acces to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 3: Data link message and parameter codings".

[11]   ITU-T Recommendation V.25: "Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".

[12]   ETSI EN 300 347-1: "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification".

[13]   ETSI EN 300 166: "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s - based plesiochronous or synchronous digital hierarchies".

[14]   ETSI EN 300 167: "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces".

[15]   ETSI TS 101 909-11: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 11: Security".

[16]   IETF RFC 2833: "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals".

[17]   ETSI ES 201 970 (see note): "Access and Terminals (AT); Public Switched Telephone Network (PSTN); Harmonized specification of physical and electrical characteristics at a 2-wire analogue presented Network Termination Point (NTP)".

[18]   ETSI ES 202 971 (see note): "Access and Terminals (AT); Public Switched Telephone Network (PSTN); Harmonized specification of physical and electrical characteristics of a 2-wire analogue interface for short line interface".

NOTE: EN 300 001 (declared historical at present) and EG 201 188 (an initial study detailed and updated in other documents later) were taken as base for the present document but they were later updated in ES 201 970 for the majority of the situations and in ES 202 971 for very short line interfaces, which is the most common case in IPCablecom systems.

3   Definitions and abbreviations

3.1   Definitions

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

Access Node (AN): layer two termination device that terminates the network end of the ITU-T Recommendation J.112 [1] connection

   NOTE: It is technology specific. In ITU-T Recommendation J.112 [1], annex A, it is called the INA while in annex B it is the CMTS.

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

embedded multimedia terminal adapter: physical and logical interface but it is physically integrated with the HFC Cable Modem functionality

> NOTE: The difference in MTA and E-MTA defines product design architectures and is not relevant to this annex therefore these terms and their abbreviations are used synonymously and inter-changeably throughout the present document.

internet protocol access node: device in which the PacketCable Signalling Gateway (SG), Media Gateway (MG) and Media Gateway Controller (MGC) have been closely integrated

> NOTE: The MGC includes the subset of Call Management Server (CMS) (aka Call Agent) functionality required to support the inter-working between a PacketCable HFC access network and a SCN through a switched circuit, line-controlled interface such as V5.

IPCablecom: ETSI working group project that includes 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

line treatment: signals that can be applied to or sensed from the subscriber's loop, such as loop open, loop closed, ring, reverse battery, etc.

Multimedia Terminal Adapter (MTA): physical and logical interface between a line presence and the HFC Cable Modem (CM)

V5: general descriptor used to reference the V5.1/V5.2 Signalling protocols at the digital Local Exchange

3.2   Abbreviations

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

AN	Access Node
BR	BRief signal
CA	Call Agents
CM	Cable Modem
CMS	Call Management Server
CMTS	Cable Modem Termination System
CPE	Customer Premises Equipment
DNS	Domain Name System
D-QoS	Dynamic Quality of Service
DTMF	Dual Tone Multi Frequency
E-MTA	Embedded Multimedia Terminal Adapter
HFC	Hybrid Fibre Coax
INA	Interactive Network Adapter
IP	Internet Protocol
IPAT	Internet Protocol Access Terminal
IPDC	IP Device Control
LE	Local Exchange
MFPB	Multi Frequency Push Button
MGCI	Media Gateway Controller Interface
MGCP	Media Gateway Control Protocol
MIB	Management Information Base
MTA	Media Terminal Adaptor
NCS	Network Call Signalling
OO	On/Off
PBX	Private Branch eXchange
PICS	Protocol Implementation Compliance Statement
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RDT	Remote Digital Terminal
RQNT	NoTificationReQuest
RTCP	Real Time Control Protocol

RTP	Real-Time Protocol
RTSP	Real-Time Streaming Protocol
SCN	Switched Circuit Network
SDP	Session Description Protocol
SIP	Session Initiation Protocol
TDD	Telecomm Devices for the Deaf tones
TE	Terminal Equipment
TO	Time-Out
VoIP	Voice over IP

Endorsement notice

The elements of ITU-T Recommendation J.162 apply, with the following modifications:

All references to "European" are replaced with "ETSI". The use of European does not reflect any specific standards or requirements document while ETSI is recognized as a standards body on a world wide basis.

ITU-T Recommendation J.161 references replaced by TS 101 909-3 [19].

ITU-T Recommendation J.162 references replaced by TS 101 909-4.

ITU-T Recommendation J.163 references replaced by TS 101 909-5.

ITU-T Recommendation J.170 references replaced by TS 101 909-11 [15].

Global modifications to ITU-T Recommendation J.162

4   Void

5   Overview

The present document describes the NCS profile of an application programming interface (MGCI) and a corresponding protocol (MGCP) for controlling embedded clients from external call control elements. An embedded client is a network element that provides:

- two or more traditional analogue access lines to a Voice over IP (VoIP) network;

- one or more video lines to a VoIP network are for further study.

Embedded clients may not be confined to residential use only. For example, they may be used in a business as well. Embedded clients are used for line-side access and, as such, are expected to have line-side equipment, e.g. analogue access lines for conventional telephones associated with them, as opposed to trunk gateways.

The MGCP assumes a call control architecture where the call control "intelligence" is outside the gateways and handled by external call-control elements referred to as Call Agents. The MGCP assumes that these call-control elements, or Call Agents (CAs), will synchronize with each other to send coherent commands to the gateways under their control. The MGCP defined in the present document does not define a mechanism for synchronizing Call Agents, although future IPCablecom specifications may specify such mechanisms.

The MGCP assumes a connection model where the basic constructs are endpoints and connections. A gateway contains a collection of endpoints, which are sources, or sinks, of data and could be physical or virtual.

An example of a physical endpoint is an interface on a gateway that terminates an analogue POTS connection to a phone, key system, PBX, etc. A gateway that terminates residential POTS lines (to phones) is called a residential gateway, an embedded client or an MTA. Embedded clients may optionally support video as well.

An example of a virtual endpoint is an audio source in an audio-content server. Creation of physical endpoints requires hardware installation, while creation of virtual endpoints can be accomplished by software. However, the NCS profile of MGCP only addresses physical endpoints.

Connections are point-to-point. A point-to-point connection is an association between two endpoints with the purpose of transmitting data between these endpoints. Once this association is established for both endpoints, data transfer between these endpoints can take place. The association is established by creating the connection as two halves; one on the origination endpoint, and one on the terminating endpoint.

Call Agents instruct the gateways to create connections between endpoints and to detect certain events, e.g. off-hook, and generate certain signals, e.g. ringing. It is strictly up to the Call Agent to specify how and when connections are made, between which endpoints they are made, as well as what events and signals are to be detected and generated on the endpoints. The gateway, thereby, becomes a simple device, without any call state, that receives general instructions from the Call Agent without any need to know about or even understand the concept of calls, call states, features, or feature interactions. When new services are introduced, customer profiles changed, etc., the changes are transparent to the gateway. The Call Agents implement the changes and generate the appropriate new mix of instructions to the gateways for the changes made. Whenever the gateway reboots, it will come up in a clean state and simply carry out the Call Agent's instructions as they are received.

5.1   Relation with H.323 standards

The elements of ITU-T Recommendation J.162 section 5.1 apply with the following modification:

- the H.225.0 call signalling and H.245 media signalling is therefore routed to the Call Agent.

5.2   Relation with IETF standards

The elements of ITU-T Recommendation J.162 section 5.2 apply with the following modification:

- the Session Initiation Protocol (SIP), RFC 3261.

5.3   Relation to RFC 3435 and ABNF Grammar

The elements of ITU-T Recommendation J.162 section 5.3 apply.

6   Media Gateway Control Interface (MGCI)

The elements of ITU-T Recommendation J.162 section 6 through 6.1.3 apply.

6.1.4   Names of Call Agents and other entities

The elements of ITU-T Recommendation J.162 section 6.1.4 apply with the following note modification:

In addition to the indirection provided by the use of domain names and the DNS, the concept of "notified entity" is central to reliability and fail-over in MGCP. The "notified entity" for an endpoint is the Call Agent currently controlling that endpoint. At any point in time, an endpoint has one, and only one, "notified entity" associated with it, and when the endpoint needs to send a command to the Call Agent, it MUST send the command to the current "notified entity" for which endpoint(s) the command pertains. Upon startup, the "notified entity" MUST be set to a provisioned value. Most commands sent by the Call Agent include the ability to explicitly name the "notified entity" through the use of a "NotifiedEntity" parameter. The "notified entity" MUST stay the same until either a new "NotifiedEntity" parameter is received or the endpoint reboots. If the "notified entity" for an endpoint is empty or has not been set explicitly (see note), the "notified entity" will then default to the source address of the last connection handling command or notification request received for the endpoint. Auditing will thus not change the "notified entity".

NOTE: This could happen as a result of specifying an empty NotifiedEntity parameter.

Clause 6.4 contains a more detailed description of reliability and fail-over.

6.1.5   Digit maps

The elements of ITU-T Recommendation J.162 section 6.1.5 through 6.3 apply.

6.3.1 Notification Request

The elements of ITU-T Recommendation J.162 section 6.3.1 apply with the following modifications:

Signals are divided into different types depending upon their behaviour:

- `Time-Out (TO)`: Once applied, these signals last until they are either cancelled (by the occurrence of an event or by not being included in a subsequent [possibly empty] list of signals), or a signal-specific period of time has elapsed. A signal that times out will generate an "operation complete" event (please see annex A for further definition of this event). A TO signal could be "ringback" timing out after 180 s. If an event occurs prior to the 180 s, the signal will, by default, be stopped (see note 3). If the signal is not stopped, the signal will time out, stop and generate an "operation complete" event, about which the Call Agent may or may not have requested to be notified. If the Call Agent has asked for the "operation complete" event to be notified, the "operation complete" event sent to the Call Agent will include the name(s) of the signal(s) that timed out (see note 4). Signal(s) generated on a connection will include the name of that connection. Time-out signals have a default time-out value defined for them, which may be altered by the provisioning process. Also, the time-out period may be provided as a parameter to the signal. A value of zero indicates that the time-out period is infinite. A TO signal that fails after being started, but before having generated on "operation complete" event will generate an "operation failure" event, which will include the name(s) of the signal(s), that timed out (see note 5).

NOTE 1: The "Keep signal(s) active" action may override this behaviour.

NOTE 2: If parameters were passed to the signal, the parameters will not be reported.

NOTE 3: These are merely examples from the example line package in 0.

Persistent events are always detected on an endpoint. If a persistent event is not included in the list of RequestedEvents, and the event occurs, the event will be detected anyway, and processed like all other events, as if the persistent event had been requested with a Notify action (see note 7). Thus, informally, persistent events can be viewed as always being implicitly included in the list of RequestedEvents with an action to Notify, although no glare detection, etc., will be performed (see note 8). Persistent events are identified as such through their definition - see annex A.

NOTE 4: Per ITU-T Recommendation J.162 section 6.3.1

NOTE 5: Thus the RequestIdentifier will be the RequestIdentifier of the current NotificationRequest.

NOTE 6: Normally, if a request to look for, e.g. off-hook, is made, the request is only successful if the phone is not already off-hook.

The signals being applied by the SignalRequests are synchronized with the collection of events specified or implied in the RequestedEvents parameter, except if overridden by the "Keep signal(s) active" action. For example, if the NotificationRequest mandated a "ringing" signal and the event request asked to look for an "off-hook" event, the ringing should, by default, stop as soon as the gateway detected an off-hook event. If "off-hook" was defined as a persistent event and the event request did not ask to look for an "off-hook" event, the ringing would stop anyway since off-hook would then be implied in the RequestedEvents parameter. The formal definition is that the generation of all "Time Out" signals MUST stop as soon as one of the requested events is detected, unless the "Keep signal(s) active" action is associated to the specified event. In the case of the action "accumulate according to digit map", the default behaviour would be to stop all active time-out signals when the first digit (see note 9) is accumulated - it is irrelevant to this synchronization if the accumulated digit results in a match, mismatch, or partial matching to the digit map.

NOTE 7: Digit as defined in digit maps, i.e. including asterisk, timer, etc.

The embedded ModifyConnection action allows the Call Agent to instruct the endpoint to change the connection mode of one or more connections immediately following the detection of the associated event. Each of connection mode changes work similarly to a corresponding ModifyConnection command (see note 10). When a list of connection mode changes is supplied, the connection mode changes MUST be applied one at a time in left-to-right order. When all the connection mode changes have finished, an "operation complete" event parameterized with the name of the completed action will be generated (see annex A for details). Should any of the connection mode changes fail, an "operation failure" event parameterized with the name of the failed action and connection mode change will be generated (see annex A for details) - the rest of the connection mode changes MUST NOT be attempted, and the previous successful connection mode changes in the list MUST remain effective.

NOTE 8: Thus, if, e.g. D-QoS is used on the connection, the default D-QoS action will still be taken when the embedded ModifyConnection action is carried out.

6.3.2   Notifications

The elements of ITU-T Recommendation J.162 section 6.3.2 apply.

6.3.3   CreateConnection

The elements of ITU-T Recommendation J.162 section 6.3.3 apply with the following modifications:

- **Packetization Period:** The packetization period in milliseconds, as defined in the SDP standard (RFC 2327), MUST be specified and with exactly one value or a range of values. The value or range only pertains to media sent. A range is specified as two decimal numbers separated by a hyphen. Note that only valid packetization rates within a specified range may be used by the MTA. A list of permissible packetization periods is specified in TS 101 909-3 [6].

The elements of ITU-T Recommendation J.162 section 6.3.4 through 8 apply.

Appendix VII   Event Packages

The elements of ITU-T Recommendation J.162 Appendix VII apply with the following modifications:

Each package defines a package name for the package and event codes and definitions for each of the events in the package. In the tables of events/signals for each package, there are five columns:

Code: The package unique event code used for the event/signal.

Description: A short description of the event/signal.

Event: A check mark appears in this column if the event can be Requested by the Media Gateway Controller. Alternatively, one or more of the following symbols may appear:

"**P**":   indicating that the event is persistent;

"**S**":   indicating that the event is an event-state that may be audited;

"**C**":   indicating that the event/signal may be detected/applied on a connection.

Signal: If nothing appears in this column for an event, then the event cannot be signalled on command by the Media Gateway Controller. Otherwise, the following symbols identify the type of event:

"**OO**":   On/Off signal. The signal is turned on until commanded by the Media Gateway Controller to turn it off, and vice versa;

"**TO**":   Timeout signal. The signal lasts for a given duration unless it is superseded by a new signal. Default time-out values are supplied. A value of zero indicates that the time-out period is infinite. The provisioning process may alter these default values;

"**BR**":   Brief signal. The event has a short, known duration.

Additional info: Provides additional information about the event/signal, e.g. the default duration of TO signals.

Unless otherwise stated, all of the events/signals are detected/applied on endpoints and audio generated by them is not forwarded on any connection the endpoint may have. Audio generated by events/signals that are detected/applied on a connection will however be forwarded on the associated connection irrespective of the connection mode.

A.1   Analogue Access Lines

This clause defines an initial set of event packages for the various types of endpoints currently defined by IPCablecom for embedded clients. The following packages are defined for the embedded client endpoint-types listed:

Endpoint-type	Package	Package name	Default package
Analogue Access Line	Line	L	Yes
FAX	Fax Package	FXR	No
VoIP RTCP-XR Metrics Package	VoIP Metrics	XRM	No
Expanded Analogue Access Line	ETSI Expansion	E	No

The "E" line package is **NOT A REPLACEMENT** for the "L" package and in fact, one absolutely must support the "L" package to create a working service for the "E" package to operate. By declaring support for the "L" **with** "E" line package the CA, IPAT and CM/MTAs will clearly be identifying their ability to support the European Telephony Services and Features.

A.2   Analogue Access Lines

The following packages are currently defined for Analogue Access Line endpoints. These packages apply to all endpoints:

- Line Package name: L

The following codes are used to identify events and signals for the "line" package for "analogue access lines":

Code	Description	Event	Signal	Additional Info
0-9,*,#,A, B,C,D	MFPB (DTMF) tones	√	BR	
Bz	Busy tone	-	TO	Time-out = 30 s
Cf	Confirmation tone	-	BR	
ci(ti, nu, na)	Caller Id	-	BR	"ti" denotes time, "nu" denotes number, and "na" denotes name
Dl	Dial tone	-	TO	Time-out = 16 s
Ft	Fax tone	√	-	
Hd	Off-hook transition	P, S	-	
Hf	Flash hook	P	-	
Hu	On-hook transition	P, S	-	
L	MFPB (DTMF) long duration	√	-	
Ld	Long duration connection	C	-	
Ma	Media start	C	-	
Mt	Modem tones	√	-	
mwi	Message waiting indicator	-	TO	Time-out = 16 s
Oc	Operation complete	√	-	
Of	Operation failure	√	-	
Osi	Open interval	-	TO	Default = 900 ms
Ot	Off-hook warning tone	-	TO	Time-out = infinite
r0, r1, r2, r3, r4, r5, r6 or r7	Distinctive ringing (0..7)	-	TO	Time-out = 180 s
Rg	Ringing	-	TO	Time-out = 180 s
Ro	Reorder tone	-	TO	Time-out = 30 s
Rs	Ringsplash	-	BR	
rt	Ring back tone	-	C, TO	Time-out = 180 s
Sl	Stutter dial tone	-	TO	Time-out = 16 s
T	Timer	√	-	
TDD	Telecomm Devices for the Deaf (TDD) tones	√	-	
vmwi	Visual message waiting indicator	-	OO	
wt1, wt2, wt3, wt4	Call waiting tones	-	TO	Time-out = 12 s
X	MFPB (DTMF) tones wildcard	√	-	Matches any of the digits "0-9"

The definition of the individual events and signals are as follows:

MFPB (DTMF) tones (0-9, *, #, A, B, C, D): Detection and generation of MFPB (DTMF) signals is described in ES 201 235 [4] series. It is considered an error to try and play MFPB (DTMF) tones on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone on hook).

Busy tone (bz): Station Busy is defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play busy tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Confirmation tone (cf): Confirmation Tone is defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play confirmation tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Caller Id (ci(time, number, name)): See EN 300 659-1 [7] and ES 200 659-3 [10]. Each of the three fields is optional, however each of the commas will always be included:

- The **time** parameter is coded as "MM/DD/HH/MM", where MM is a two-digit value for Month between 01 and 12, DD is a two-digit value for Day between 1 and 31, and Hour and Minute are two-digit values coded according to military local time, e.g. 00 is midnight, 01 is 1 a.m., and 13 is 1 p.m.

- The **number** parameter is coded as an ASCII character string of decimal digits that identify the calling line number. White spaces are permitted if the string is quoted, however they will be ignored.

- The **name** parameter is coded as a string of ASCII characters that identify the calling line name. White spaces, commas, and parentheses are permitted if the string is quoted.

A "P" in the number or name field is used to indicate a private number or name, and an "O" is used to indicate an unavailable number or name. The following example illustrates the use of the caller-id signal:

```
S: ci(08/14/17/26, "33 4 92 94 42 00", ETSI)
```

Dial-tone (dl): Dial Tone is defined by the local administration, and MAY be re-defined via provisioning. See ETSI ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play dial-tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Fax tone (ft): The fax tone event is generated whenever a fax call is detected *by presence of V.21 fax preamble.* REQ2872 The fax tone event SHOULD also be generated when the T.30 CNG tone is detected. See ITU-T Recommendations T.30 and V.21 (see bibliography).

Off-hook transition (hd): See ES 201 970 [17] and ES 202 971 [18], Seize signal.

Flash hook (hf): See ES 201 970 [17] and ES 202 971 [18], Register recall.

On-hook transition (hu): See ES 201 970 [17] and ES 202 971 [18], Clear Signal. The timing for the on-hook signal is for flash response enabled.

MFPB (DTMF) Long duration (L): The "MFPB (DTMF) Long duration" is observed when a MFPB (DTMF) signal is produced for a duration longer than two seconds. In this case, the gateway will detect two successive events: first, when the signal has been recognized, the MFPB (DTMF) signal, and then, 2 s later, the long duration signal.

Long duration connection (ld): The "long duration connection" is detected when a connection has been established for more than a certain period of time. The default value is 1 hour, however this may be changed by the provisioning process.

The event may be detected on a connection. When no connection is specified, the event applies to all connections for the endpoint, regardless of when the connections are created.

Media start (ma): The media start event occurs on a connection when the first valid (see note 1) RTP media packet is received on the connection. This event can be used to synchronize a local signal, e.g. ringback, with the arrival of media from the other party.

NOTE 1: When authentication and integrity security services are used, an RTP packet is not considered valid until it has passed the security checks.

The event may be detected on a connection. When no connection is specified, the event applies to all connections for the endpoint, regardless of when the connections are created.

Modem tones (mt): Modem tone (mt): The modem tone event is generated whenever a data call is detected by presence of V.25 answer tone (ANS) with or without phase reversal or V.8 modified answer tone (ANSam) with or without phase reversal. See ITU-T Recommendation V.25 [11] and V.8 (see bibliography).

Message Waiting Indicator (mwi): Message Waiting indicator tone is defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play message waiting indicator on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Open Switch Interval (osi): See <voiceband data transmission interface - on-hook transmission without power ringing>: See also <call processing - abandoned call scenario> and also <K-Break (as specified in ES 201 970 [17]) - an end-of-call signal consisting of a reduction in the PSTN loop current to below 1 mA for a certain period is referred to as K-break. Two times are suggested for the break:

a)   a range of 90 ms to 130 ms;

b)   a range of 250 ms to 300 ms. This is preferred for new equipment to avoid overlapping with the register recall signal>.

Operation complete (oc): The operation complete event is generated when the gateway was asked to apply one or several signals of type TO on the endpoint, and one or more of those signals completed without being stopped by the detection of a requested event such as off-hook transition or dialled digit. The completion report may carry as a parameter the name of the signal that came to the end of its live time, as in:

```
O: L/oc(L/dl)
```

When the reported signal was applied on a connection, the parameter supplied will include the name of the connection as well, as in:

```
O: L/oc(L/rt@0A3F58)
```

When the operation complete event is requested, it cannot be parameterized with any event parameters. When the package name is omitted, the default package name is assumed.

The operation complete event may additionally be generated as defined in the base protocol, e.g. when an embedded ModifyConnection command completes successfully, as in note 2:

```
O: L/oc(B/C)
```

NOTE 2: Note the use of "B" here as the prefix for the parameter reported.

Operation failure (of): In general, the operation failure event may be generated when the endpoint was asked to apply one or several signals of type TO on the endpoint, and one or more of those signals failed prior to timing out. The completion report may carry as a parameter the name of the signal that failed, as in:

```
O: L/of(L/rg)
```

When the reported signal was applied on a connection, the parameter supplied will include the name of the connection as well, as in:

```
O: L/of(L/rt@0A3F58)
```

When the operation failure event is requested, event parameters can not be specified. When the package name is omitted, the default package name is assumed.

The operation failure event may additionally be generated as specified in the base protocol, e.g. when an embedded ModifyConnection command fails, as in note 2:

```
O: L/of(B/C(M(sendrecv(AB2354))))
```

Off-hook warning tone (ot): Receiver Off Hook Tone (ROH Tone) or "howler" tone is defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play off-hook warning tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Distinctive ringing (r0, r1, r2, r3, r4, r5, r6 or r7): These power ring cadences are defined by the local administration and MAY be re-defined via provisioning.

See ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and ring a phone that is on line (off hook) and an error should consequently be returned when such attempts are made (error code 401 - phone on line (off hook)).

Ringing (rg): This power ring signal is defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18]. The ringing signal may be parameterized with the signal parameter "rep" which specifies the maximum number of ringing cycles (repetitions) to apply. The following will apply the ringing signal for up to 6 ringing cycles:

```
S: rg(rep=6)
```
It is considered an error to try and ring a phone that is on line (off hook) and an error should consequently be returned when such attempts are made (error code 401 - phone on line (off hook)).

Reorder tone (ro): Re-order tone is defined by the local administration, and MAY be re-defined via provisioning. See ETSI ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and play reorder tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Ringsplash (rs): Ringsplash, also known as "Reminder ring" is a burst of power ringing that may be applied to the physical forwarding line (when idle) to indicate that a call has been forwarded and to remind the user that a Call Forwarding subfeature is active. This signal is defined by the local administration, and MAY be re-defined via provisioning. See ETSI ES 201 970 [17] and ES 202 971 [18]. It is considered an error to try and ring a phone that is on line (off hook) and an error should consequently be returned when such attempts are made (error code 401 - phone on line (off hook)).

Ring back tone (rt): Audible Ring Tone is defined by the local administration, and MAY be re-defined via provisioning. See ETSI ES 201 970 [17] and ES 202 971 [18]. The ringback signal can be applied to both an endpoint and a connection.

When the ringback signal is applied to an endpoint, it is considered an error to try and play ring back tones, if the endpoint is considered off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)). When the ringback signal is applied to a connection, no such check is to be made.

Stutter Dial tone (sl): Stutter Dial Tone (also called Recall Dial Tone) is defined by the local administration, and MAY be re-defined via provisioning. See ETSI ES 201 970 [17] and ES 202 971 [18]. The stutter dial tone signal may be parameterized with the signal parameter "del" which will specify a delay in ms to apply between the confirmation tone and the dial tone (see note 3). The following will apply stutter dial tone with a delay of 1,5 s between the confirmation tone and the dial tone:

```
S: sl(del=1500)
```

NOTE 3: This feature is needed for, e.g. Speed Dialling.

It is considered an error to try and play stutter dial tone on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

Timer (t): As described in clause 6.15, timer T is a provisionable timer that can only be cancelled by MFPB (DTMF) input. When timer T is used with the "accumulate according to digit map" action, the timer is not started until the first digit is entered, and the timer is restarted after each new digit is entered until either a digit map match or mismatch occurs. In this case, timer T functions as an inter-digit timer and takes on one of two values, T_{par} or T_{crit}. When at least one more digit is required for the digit string to match any of the patterns in the digit map, timer T takes on the value T_{par}, corresponding to partial dial timing. If a timer is all that is required to produce a match, timer T takes on the value T_{crit} corresponding to critical timing. An example use is:

```
S:  dl
R:  [0-9T](D)
```

When timer T is used without the "accumulate according to digit map" action, timer T takes on the value T_{crit}, and the timer is started immediately and simply cancelled (but not restarted) as soon as a digit is entered. In this case, timer T can be used as an inter-digit timer when overlap sending is used, e.g.:

```
R:  [0-9](N), T(N)
```

NOTE 4: That only one of the two forms can be used at a time, since a given event can only be specified once.

The default value for T_{par} is 16 s and the default value for T_{crit} is 4 s. The provisioning process may alter both of these.

Telecomm Devices for the Deaf tones (TDD): The TDD event is generated whenever a TDD call is detected - see e.g. ITU-T recommendation V.18 (see bibliography).

Visual Message Waiting Indicator (vmwi): The transmission of the VMWI messages will conform to the requirements in EN 300 659-1 [7], clause 6.2 Data transmission not associated with ringing and ES 200 659-3 [10], clause 5.2.2 Message Waiting Indicator message. VMWI messages will only be sent from the embedded client to the attached equipment when the line is idle. If new messages arrive while the line is busy, the VMWI indicator message will be delayed until the line goes back to the idle state. The Call Agent should periodically refresh the CPE's visual indicator.

Call Waiting tone1 (wt1, .., wt4): Call Waiting tones are defined by the local administration, and MAY be re-defined via provisioning. See ES 201 970 [17] and ES 202 971 [18], It is considered an error to try and apply call waiting tones on a phone that is off line (on hook) and an error should consequently be returned when such attempts are made (error code 402 - phone off line (on hook)).

```
MFPB (DTMF) tones wildcard (X):
```

The MFPB (DTMF) tones wildcard matches any MFPB (DTMF) digit between 0 and 9.

The elements of ITU-T Recommendation J.162 annex A.3 FAX Package apply.

The elements of ITU-T Recommendation J.162 annex A.4 VoIP Metrics Package apply.

Appendix VIII   Expansion of the NCS protocol "L" Line Package

VIII.1   Overview

The elements of ITU-T Recommendation J.162 Appendix VIII apply with the following modifications:

This appendix specifies an expansion of the NCS protocol, described in the body of the present document, to emulate an Access Network to an ETSI compliant Local Exchange (LE) that forms a part of a SCN. This annex specifies the mapping between the NCS protocol and a subset of the V5.2 protocol, see EN 300 324-1 [2] applicable for the support of SCN services to analogue telephones.

NOTE 1: This annex has been produced in response to requests of current European Cable Operators to provide telephony services over their HFC cable plants while using existing V5 Switch capacity for SCN access, as described by ECCA EuroPacketCable working group requirements document (EPC-RequDoc-V10-220501).

This appendix applies to a subset of the V5 signalling protocol that relates to services provided by a 2-wire (a-b terminals), loop start, analogue POTS line.

NOTE 2: Support for additional line types is for further study.

NOTE 3: It should be recognized that while the proposed protocol enables the support of the suite of V5 SCN POTS services that due to evolving market requirements some of these services may no longer be desired or may have been discontinued within some administration boundaries. Therefore it is recommended that product compliance with the protocol in support of these services be based on manufacturers' declaration, similar to practices followed with V5 PICS declarations and not on "mandated" Services compliance. In cases where a product may not support a specific service, protocol compliance should be interpreted as being able to accept the protocol interface and mitigate mismatches in service requests to product capabilities. In this way product complexity and cost can be optimized per market requirements and administration needs while maintaining protocol inter-operability.

NOTE 4: The description of the signals defined for automatic metering given by this annex and that described for a standalone metering package in annex F are the same intentionally, and should remain aligned. The equivalence of the meter pulse signals as described in this annex and that described in annex F is directly mapped; E/ps(lt=em) maps directly to am/em and E/ps(mpb) maps directly to am/mpb respectively. These signals accept the same parameter usage in both packages. Annex F provides information on the package for standalone automatic metering and if it is applied then the package shall be implemented.

NOTE 5: In the present document, ITU-T Recommendation G.711 [9] only is assumed. All other codecs must be considered as a future study.

NOTE 6: ISDN/BRI lines are for further study.

NOTE 7: It should be recognized by the alignment with the body of the present document that the definition in this annex provide expansions to the "L" package and can enable VoIP architecture external call control elements to control and manage call activity in a manner to emulate the V5 services and features in a VoIP architecture.

VIII.2 IPAT architecture

The elements of ITU-T Recommendation J.162 section VIII.2 IPAT architecture apply.

VIII.3 Electrical and physical interface requirements

This appendix references the EN 300 324-1 [2] defined system architecture consisting of a Local Exchange (LE) and an Access Network (AN) connected via a V5 interface. The use of this annex in a pure VoIP architecture will emulate the reference architecture performance and services.

The V5 interface may have between one and sixteen 2 048 kbit/s interface as defined in EN 300 347-1 [12], EN 300 166 [13] and EN 300 167 [14].

The electrical and physical characteristics of the interface shall conform to EN 300 166 [13], 2 048 kbit/s case.

Two interface presentation alternatives are defined in EN 300 166 [13], the balanced interface pair type and the coaxial type. According to the two alternatives of interface applications shown in f igure VIII.2/J.162, it is left to the network operator to request the interface presentation required.
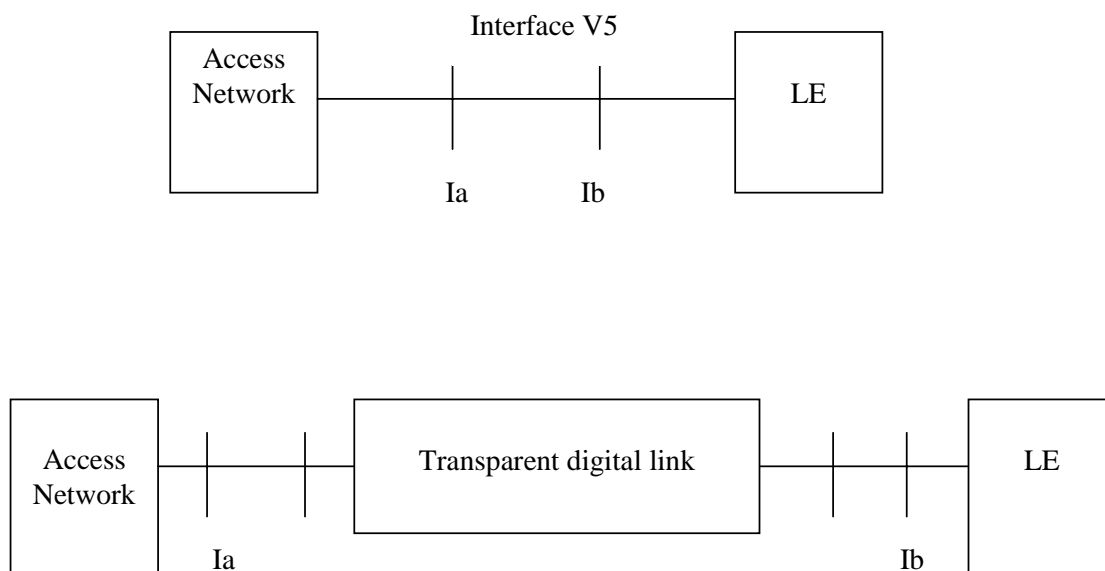
NOTE: Ia = interface point at the Access Network side.
Ib = interface point at the LE side.

Figure VIII.2/J.162 – V5 interface presentation alternatives

To expand the NCS signalling protocol definitions in this annex the AN is expanded to define a PacketCable network consisting of an Internet Protocol Access Terminal (IPAT), a Cable Modem Terminal System (CMTS), a Cable Modem (CM) and a Multimedia Terminal Adapter (MTA) or an Embedded Multimedia Terminal Adapter (E-MTA).
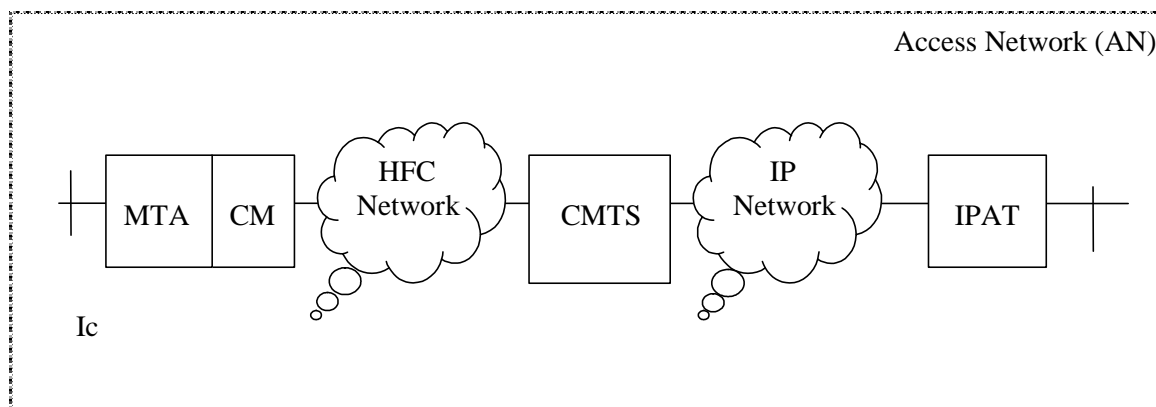
NOTE: Ic = interface point at the user premises side.

Figure VIII.3/J.162 – Access network

This Access Network is the synonymous to an access network utilizing a Remote Digital Terminal (RDT) in the traditional Circuit Switch architecture.

The electrical and logical definitions of the IP Network and the HFC Network are the subject of other standards activities.

This appendix assumes that these networks simply provide the transparent digital link as described in EN 300 324-1 [2]. This allows this annex to focus on the method of providing the signalling necessary between the V5 LE to the premises interface point as defined in EN 300 324-1 [2] in support of the desired services at the user premises termination point.

For cadence ringing requests, the annex defines an expanded range of ring cadences using a similar syntax as the NCS "L" line package in annex A ringing cadence signals.

For pulsed and steady state signals, the annex allows an external call element to emulate or a PacketCable IPAT to translate a V5 protocol message received from the V5 switch to a corresponding signal request from the IPAT or call element to the E-MTA specifying the desire signal to be applied to the premises termination point (line treatment; pulse duration, pulse period and number of repetitions, etc.). The annex also includes a means for the IPAT to support the V5 switch requests for acknowledgements.

VIII.4   NCS package for V5 SCN protocol messages

The elements of ITU-T Recommendation J.162 appendix VIII.4 apply with the following modifications:

This clause describes additional IPCablecom signal requests and an event request that creates the ETSI "E" Line Package which is an extension to the "L" line package described in annex A.

These signal requests and event requests map the corresponding information elements contained in a V5 SCN protocol Message Type, in a binary format, to the NCS format.

NOTE: Default values given in this annex are for the purpose of providing equipment vendors with values for initial product shipment.
          Provisions should be provided to allow these values to be overwritten as part of unit configuration or provisioning with alternate values per local administration requirements.

The following package Expansion is currently defined for Expanded Analogue Access Line endpoints. These packages apply to all endpoints:

- Line.Package name: E

The following codes are used to identify events and signals for the "E" package for "expanded analogue access lines".

Code	Description	Event	Signal	Additional Info
cr(x)	Ringing Cadence (x = 0 to 127)	-	TO	
Ta	Alerting Signal Tone	-	TO	
Td	Special Dial Tone	-	TO	
Ti	Special Info Tone	-	TO	
Tr	Release Tone	-	TO	
Tc	Congestion Tone	-	TO	
Ps1	Programmable Signal 1	-	TO	
Ps2	Programmable Signal 2	-	TO	
Ps3	Programmable Signal 3	-	TO	
Ps4	Programmable Signal 4	-	TO	

The definitions of the individual events and signals are as follows:

Ring Cadence (cr(0), cr(1) through cr(127): These power ring cadences are defined by the local administration and MAY be re-defined via provisioning.

See TR 101 183 for some national cadences. It is considered an error to try and ring a phone that is on line (off hook) and an error should consequently be returned when such attempts are made (error code 401 - phone on line (off hook)).

Alerting Signal Tone (ta): Alerting Signal tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

Special Dial Tone (td): Special Dial tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

Special Info Tone (ti): Special Info tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

Release Tone (tr): Release tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

Congestion Tone (tc): Congestion tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

Programmable Signal (ps1, ps2, ps3, ps4): Programmable Signal tones are defined by the local administration, and MAY be re-defined via provisioning. See ITU-T Supplement 2 for E.180, Tones Used in National Networks.

VIII.4.1 Cadence-ringing request

The elements of ITU-T Recommendation J.162 section VIII.4.1 apply.

VIII.4.1.1 Cadence ringing defaults and ranges

The elements of ITU-T Recommendation J.162 section VIII.4.1.1 apply.

VIII.4.2 Pulsed signal request

The elements of ITU-T Recommendation J.162 section VIII.4.2 apply.

VIII.4.2.1 Line treatment encoding

The elements of ITU-T Recommendation J.162 section VIII.4.2.1 apply.

VIII.4.2.2   Line treatment defaults and ranges

The elements of ITU-T Recommendation J.162 section VIII.4.2.2 apply with the following modification:

Table VIII.3/J.162 – Line treatment defaults and ranges

It Code	Description	Frequency (tolerance)	Amplitude (min-max, steps)	pd (min-max, steps)	pr (min-max, steps)	rep (min-max, steps)
Ir	Initial Ring	25 Hz (±1 Hz)	Full	200 (0 to 5 000, 50)	200 (0 to 5 000, 50)	1 (1 to 5, 1)
Lc	Pulsed loop closed	null	null	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
Lo	Pulsed loop open	null	null	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
Em	(Enable) metering pulse generation	16 KHz (±1%)	-13,5 dBm1 (-25 dB to +15,2 dB)	150 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	null
Mpb	Metering pulse burst generation	16 KHz (±1 %)	-13,5 dBm1 (-25 dB to +15,2 dB)	150 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 4095, 1)
Nb	Pulsed no battery	Null	0	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
Np	Pulsed normal polarity	Null	1	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
Rb	Pulsed reduced battery	Null	1	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
Rp	Pulsed reversed polarity	Null	0	200 (0 to 5 000, 10)	1 000 (0 to 5 000, 10)	1 (1 to 50, 1)
NOTE 1: Meter Pulse Amplitude is specified in dBm across a-b terminals terminated in the reference termination impedance per national norms. Refer to ES 201 970 [17].						
NOTE 2: Frequency may be provisioned for 12 KHz (±1 %).						

VIII.4.2.3   Requested events

The elements of ITU-T Recommendation J.162 section VIII.4.2.3 apply.

VIII.4.2.4   Pulse encoding

The elements of ITU-T Recommendation J.162 section VIII.4.2.4 apply.

VIII.4.2.4.1   Pulse duration encoding

The elements of ITU-T Recommendation J.162 section VIII.4.2.4.1 apply.

VIII.4.2.4.2   Pulse period encoding

The elements of ITU-T Recommendation J.162 section VIII.4.2.4.2 apply.

VIII.4.2.5   Pulse completion event coding

The elements of ITU-T Recommendation J.162 section VIII.4.2.4.3 apply.

VIII.4.2.6   Metering pulse report coding

The elements of ITU-T Recommendation J.162 section VIII.4.2.6 apply.

VIII.4.2.7   V5 suppression indicator

The elements of ITU-T Recommendation J.162 section VIII.4.2.7 apply.

VIII.4.2.7.1   No suppression

The elements of ITU-T Recommendation J.162 section VIII.4.2.7.1 apply.

VIII.4.2.7.2   Suppression by pre-defined V5 signal message

The elements of ITU-T Recommendation J.162 section VIII.4.2.7.2 apply.

VIII.4.2.7.3   Suppression by pre-defined line signal from TE

The elements of ITU-T Recommendation J.162 section VIII.4.2.7.3 apply.

VIII.4.2.7.4   Suppression by pre-defined V5 SIGNAL message from LE or pre-defined line signal from TE

The elements of ITU-T Recommendation J.162 section VIII.4.2.7.4 apply.

VIII.4.2.8   Repetition indicator

The elements of ITU-T Recommendation J.162 section VIII.4.2.8 apply.

VIII.4.3   Pulse repetition encoding

The elements of ITU-T Recommendation J.162 section VIII.4.3 apply.

VIII.4.4   Parameter usage

The elements of ITU-T Recommendation J.162 section VIII.4.4.4 apply.

VIII.4.5   Pulsed signal cancellation

The elements of ITU-T Recommendation J.162 section VIII.4.5 apply.

VIII.4.6   Pulsed completion event

The elements of ITU-T Recommendation J.162 section VIII.4.6 apply.

VIII.4.7   Pulsed signal failure event

The elements of ITU-T Recommendation J.162 section VIII.4.7 apply.

VIII.4.8   Steady-signal request

The elements of ITU-T Recommendation J.162 section VIII.4.8 apply.

VIII.4.8.1   Line treatment encoding

The elements of ITU-T Recommendation J.162 section VIII.4.8.1 apply.

VIII.4.8.2   Line treatment provisioning

The elements of ITU-T Recommendation J.162 section VIII.4.8.2 apply.

VIII.4.9   Metering pulse generation

The elements of ITU-T Recommendation J.162 section VIII.4.9 apply with the following modification:

On receiving an "enable metering pulse generation" **ps(lt=em(+))** signal request the MTA shall apply the first metering pulse to the termination immediately, and then apply subsequent metering pulses at intervals as specified by the value of the pulse repetition interval parameter **pr**, if supplied in the signal request, or the provisioned value.

The MTA shall continue to generate metering pulses until it receives a "disable metering pulse generation" **ps(lt=em(-))** signal request, or an empty signal request list.

A metering pulse burst signal **ps(lt=mpb)** request may be included in a signal request that also enables metering pulse generation, for example, to apply an initial charge to a call. When this occurs, the MTA shall apply the metering pulse burst to the endpoint completely, and then start generating normal metering pulses.

Because the metering pulse burst signal is a brief signal type, all pulses specified for the request (**rep=n**) are applied, even if the subscriber goes on-hook during the burst. This is to complete the billing reporting to the subscriber device. Should the subscriber shall go back off-hook prior to the metering completion, the original meter pulse request shall be completed and any new metering pulse sequence should then be applied.

A metering pulse burst signal request may occur during a call in progress, for example to take account of a chargeable subscriber action. When this occurs, the MTA shall suspend normal metering pulse generation, and apply the metering pulse burst signal request. The MTA then shall resume normal metering pulse generation without requiring a new "enable metering pulse generation" request from the IPAT. The IPAT or external call element must account for any normal metering pulses missed during the burst by including the missed pulses in the burst count.

The IPAT or external call element may optionally include a report pulse count (**rpc**) parameter with the enabling metering pulse generation (**em**) signal request. When this parameter is non-zero (rpc=n, where n=1 to x), the MTA generates meter pulse reports, in the form of notifications, each time its pulse count reaches the rpc value. Generation of the event notification resets an rpc counter so that a report will be generated each time the rpc "n" value is reached. This count does not include any metering pulses generated by metering pulse burst (**mpb**) signal requests.

VIII.5   Provisioning configurations

The elements of ITU-T Recommendation J.162 section VIII.5 apply.

VIII.6   ETSI Expansion line package support

The elements of ITU-T Recommendation J.162 section VIII.6 apply with the following modifications:

The important line for packages is the "v:L;E" which indicates support for the NCS Line Package (L) and for the Expansion line package (E).

VIII.7   Call flow examples

The elements of ITU-T Recommendation J.162 section VIII.7 apply with the following modifications:

The following call flow examples assume a V5-IPAT architecture. In a full VoIP architecture the V5-IPAT call flows may be provided by an external call element (Call Agent).

VIII.7.2.1   Pulse signal request for one loop open pulse

The elements of ITU-T Recommendation J.162 section VIII.7.2.2 apply with the following modifications:
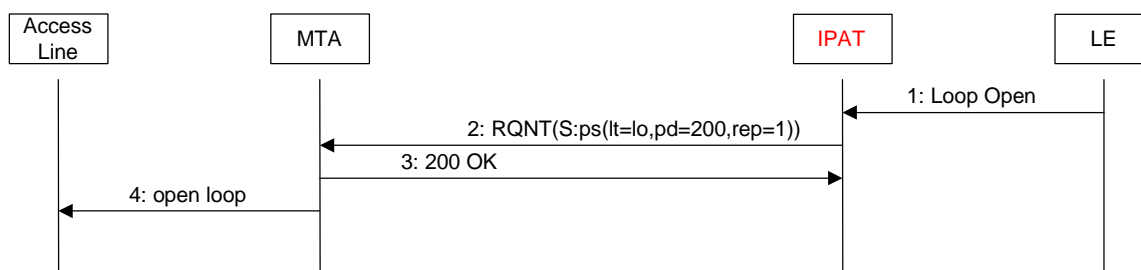

Figure VIII.4/J.162 – Pulsed signal request

VIII.7.2.5   Pulsed signal - Meter pulse with pulse acknowledgement

The elements of ITU-T Recommendation J.162 section VIII.7.2.5 apply with the following modifications:
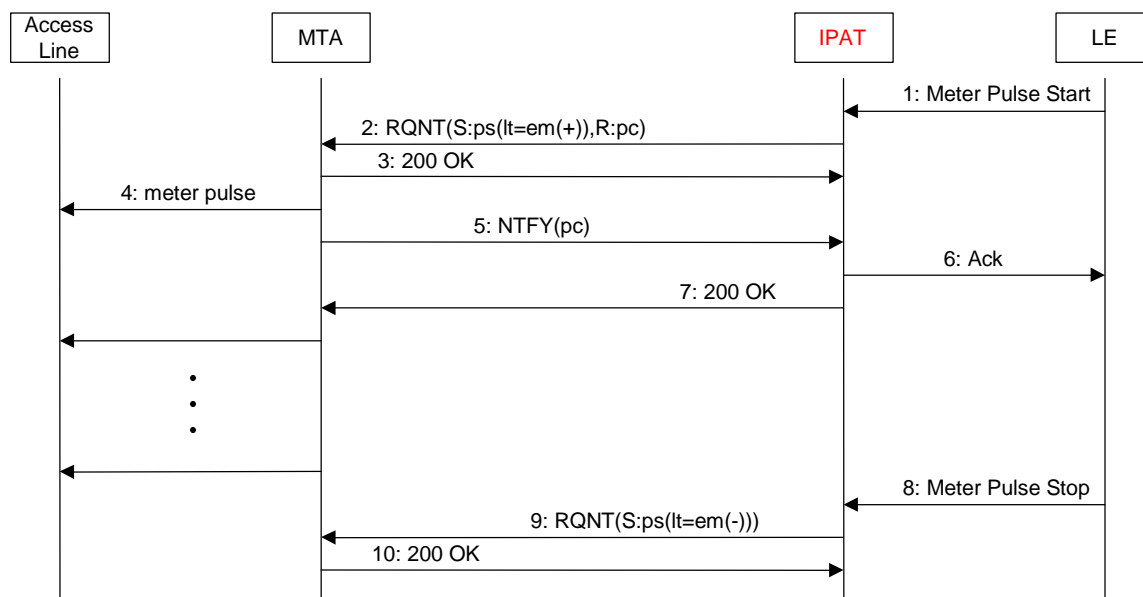

Figure VIII.4/J.162 – Pulsed signal request

VIII.7.3   Fixed meter pulse application, completed

The elements of ITU-T Recommendation J.162 section VIII.7.3 apply with the following modifications:
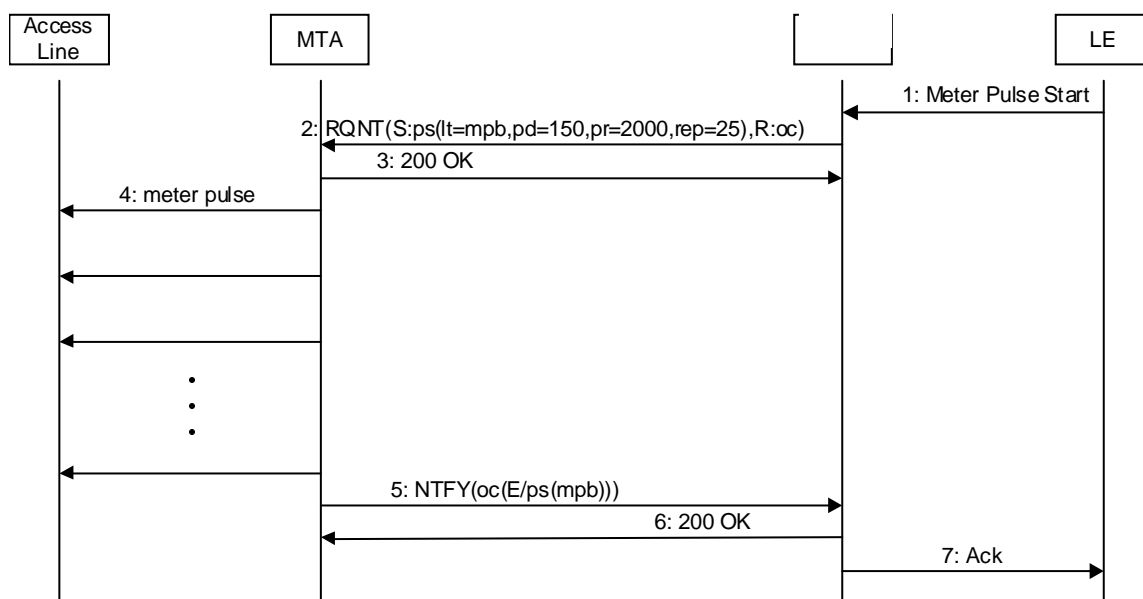

Figure VIII.9/J.162 – Fixed meter pulse application, completed

Annex B   Dynamic Quality of Service

The elements of ITU-T Recommendation J.162 Annex B Dynamic Quality of Service apply.

Appendix IV   Connection mode

The elements of ITU-T Recommendation J.162 Appendix IV Connection mode apply.

Appendix V   Compatibility information

The elements of ITU-T Recommendation J.162 Appendix V Compatibility information apply.

Appendix IX   Metering support for IPCablecom

The elements of ITU-T Recommendation J.162 appendix IX Metering support for IPCablecom apply.

Annex ZA (informative):
Bibliography

ETSI TS 101 909-1: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 1: General".

ETSI TS 101 909-2: "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".

ETSI TS 101 909-5: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 5: Dynamic Quality of Service for the Provision of Real Time Services over Cable Television Networks using Cable Modems".

ETSI EN 300 001: "Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

ETSI EG 201 188: "Public Switched Telephone Network (PSTN); Network Termination Point (NTP) analogue interface; Specification of physical and electrical characteristics at a 2-wire analogue presented NTP for short to medium length loop applications".

ITU-T Recommendation H.225: "Call signalling protocols and media stream packetization for packet-based multimedia communication systems".

ITU-T Recommendation H.245: "Control protocol for multimedia communication".

ITU-T Recommendation H.323: "Framework and wire-protocol for multiplexed call signalling transport".

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

ITU-T Recommendation T.30: "Procedures for document facsimile transmission in the general switched telephone network".

ITU-T Recommendation V.8: "Procedures for starting sessions of data transmission over the public switched telephone network".

ITU-T Recommendation V.21: "300 bits per second duplex modem standardized for use in the general switched telephone network".

ETSI TR 101 963: "Access and Terminals (AT); Report on the Requirements of European Cable Industry for Implementation of IPCablecom Technologies; Identification of high level requirements and establishment of priorities European IPCableCom requirements".

Arango, Dugan, Elliot, Huitema, Pickett, Foster, Andreasen, Basic MGCP Packages, Work in Progress, draft-foster-mgcp-basic-packages-00.txt, Internet Engineering Task Force, January 2001.

ETSI ES 201 296: "Integrated Services Digital Network (ISDN); Signalling System No.7 (SS7); ISDN User Part (ISUP); Signalling aspects of charging Charging SS7".

ETSI TS 101 868: "Services and Protocols for Advanced Networks (SPAN); Recommended V5 PSTN mapping".

ETSI TR 101 183: "Public Switched Telephone Network (PSTN); Analogue ringing signals".

ETSI EN 300 659-3: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 3: Data link message and parameter codings". – updated under ES 200 659-3

ITU-T Recommendation V.18: "Operational and interworking requirements for DCEs operating in the text telephone mode".

IETF RFC 821: "Simple Mail Transfer Protocol".

IETF RFC 1034: "Domain names - concepts and facilities".

IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control".

IETF RFC 2045: "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies".

IETF RFC 2234: "Augmented BNF for Syntax Specifications: ABNF".

IETF RFC 2326: "Real Time Streaming Protocol (RTSP)".

IETF RFC 2327: "SDP: Session Description Protocol".

IETF RFC 3261: "SIP: Session Initiation Protocol".

IETF RFC 3435: "Media Gateway Control Protocol (MGCP) Version 1.0".

IETF Internet Draft: "Network-Based Call Signalling (NCS) Signalling MIB for PacketCable and IPCablecom Multimedia Terminal Adapters (MTAs)".

NOTE: See TS 101 909-9.

List of ITU-T Recommendations referring to IP Cablecom:

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.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".

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)".

EPC-RequDoc-V10-220501 (2001): "European Requirements for the Delivery of Time-critical Services over Cable Television Networks using IPCablecom".

History

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