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SERIES Q: SWITCHING AND SIGNALLING

Testing specifications – Testing specifications for next generation networks

IMS/NGN performance benchmark – Part 4: Testing of the performance design objectives

Recommendation ITU-T Q.3932.4

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Recommendation ITU-T Q.3932.4

IMS/NGN performance benchmark – Part 4: Testing of the performance design objectives

Summary

Recommendation ITU-T Q.3932.4 contains the benchmark testing of signalling parameters against the performance design objectives specified in Recommendation ITU-T Q.543 and ETSI TS 101 563, which are applicable to IMS/PES/NGN and VoLTE implementations.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Q.3932.4	2016-05-14	11	11.1002/1000/12863

Keywords

Benchmark, IP multimedia subsystem, IMS, new generation network, NGN, performance, PSTN/ISDN emulation subsystem, PES, signalling, testing, VoLTE.

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1 Scope

This Recommendation contains the benchmark testing of signalling parameters against the performance design objectives specified in ITU-T Q.543 and ETSI TS 101 563, which are applicable to IMS/PES/NGN and VoLTE implementations. The values of the performance design objectives (reference load A and reference load B), which are contained in this Recommendation and found in Table 1 to Table 9, are taken from ETSI TS 101 563. These values are "best practice" performance values measured on IMS/PES/NGN and VoLTE implementations.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.812] Recommendation ITU-T G.812 (2004), *Timing requirements of slave clocks suitable for use as node clocks in synchronization networks*.

[ITU-T G.823] Recommendation ITU-T G.823 (2000), *The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy*.

[ITU-T Q.541] Recommendation ITU-T Q.541 (1993), *Digital exchange design objectives – General*.

[ITU-T Q.543] Recommendation ITU-T Q.543 (1993), *Digital exchange performance design objectives*.

[ITU-T Q.3403 v.1] Recommendation ITU-T Q.3403 v.1 (2016), *IP multimedia call control protocol based on the session initiation protocol and the session description protocol – Basic call: Requirements for the user side and the network side*.

[ETSI TS 101 563] ETSI TS 101 563 V1.4.1 (2015), *Speech and multimedia Transmission Quality (STQ); IMS/PES/VoLTE exchange performance requirements*.

[ETSI TS 102 250-2] ETSI TS 102 250-2 V2.4.1 (2015), *Speech and multimedia Transmission Quality (STQ); QoS aspects for popular services in mobile networks; Part 2: Definition of Quality of Service parameters and their computation*.

[ETSI TS 102 928] ETSI TS 102 928 V1.1.3 (2014), *Speech and multimedia Transmission Quality (STQ); End-to-End Transmission Planning Requirements for Real Time Services in an NGN context*.

[ETSI TS 183 036] ETSI TS 183 036 V3.5.1 (2012), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); ISDN/SIP interworking; Protocol specification*.

[ETSI TS 183 043] ETSI TS 183 043 V3.4.1 (2011), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based PSTN/ISDN Emulation; Stage 3 specification*.

3 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AGCF Access Gateway Control Function

CSCF Call Session Control Function

ECM EPS Connection Management

GW Gateway

IAD Integrated Access Device

IMS IP Multimedia Subsystem

ISDN Integrated Service Digital Network

ITU-T ITU Telecommunication Standardization Sector

MGW Media Gateway

MME Mobility Management Entity

MSAN Multi Service Access Node

NGN New Generation Network

P-CSCF Proxy Call Server Control Function

PES PSTN/ISDN Emulation Subsystem

QCI QoS Class Identifier

RTP Real Time Protocol

SBC Session Border Control

SC Sending Complete

SDP Session Description Protocol

S-GW Signalling Gateway

SIP Session Initiation Protocol

TIE Time Interval Error

UE User Equipment

VGW Voice Gateway

VoLTE Voice over LTE

4 Metrics and design objectives

4.1 Delay probability

This clause defines delay parameters related to ISDN/PSTN, IMS and VoLTE. The values are based on the values in [ITU-T Q.543] and [ETSI TS 101 563].

4.2 Loads definitions

The ISDN/PSTN, IMS and VoLTE reference loads definitions and values described in Table 1 to Table 9 are the reference loads definitions described in [ITU-T Q.543] and [ETSI TS 101 563]. The derived ISDN procedures are based on the ISDN/SIP interworking [ETSI TS 183 036] procedures, the derived PES procedures are based on the IMS/PES Emulation specification [ETSI TS 183 043]

and the derived SIP procedures are based on session initiation protocol (SIP) and session description protocol (SDP) [ITU-T Q.3403 v.1].

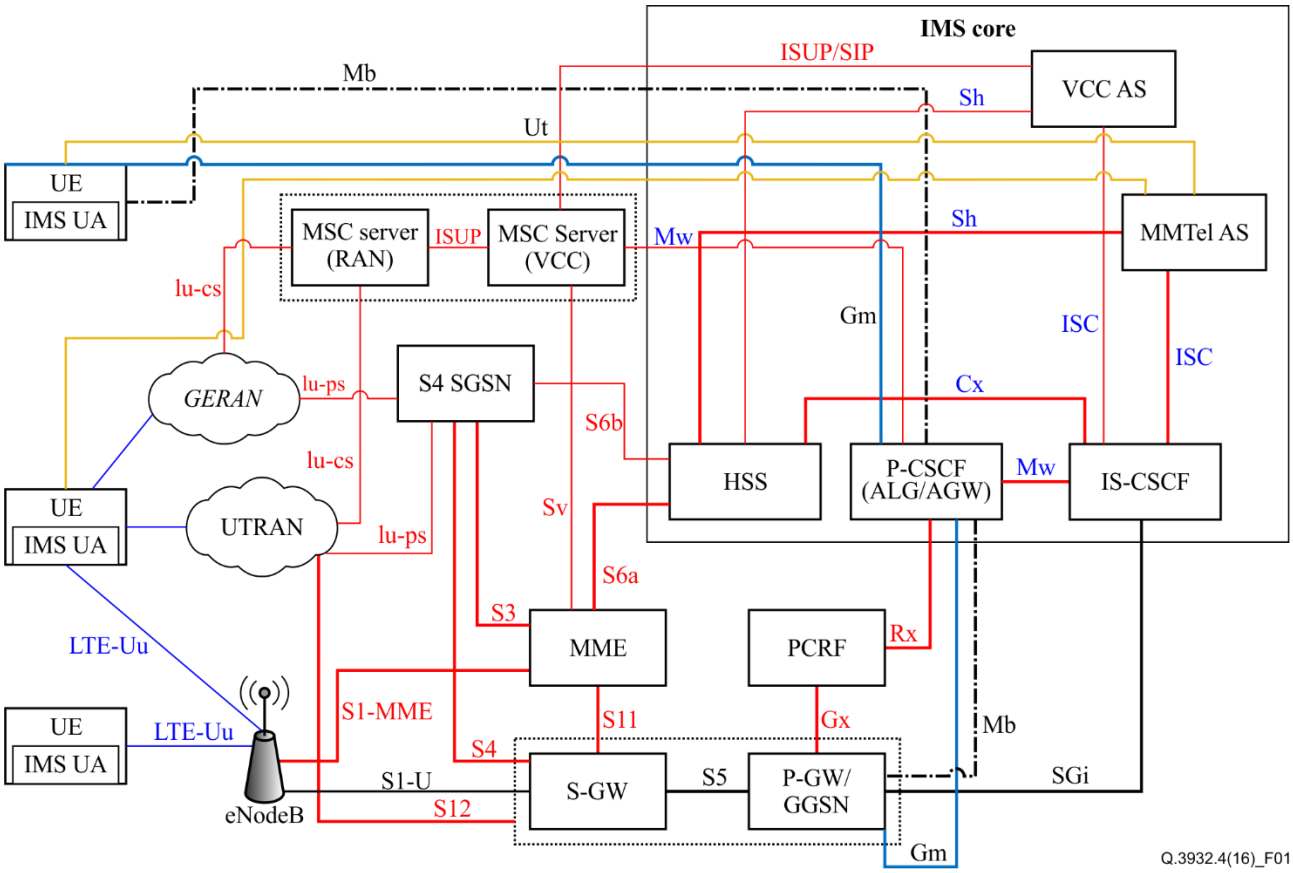

Figure 1 – IMS/LTE basic configuration

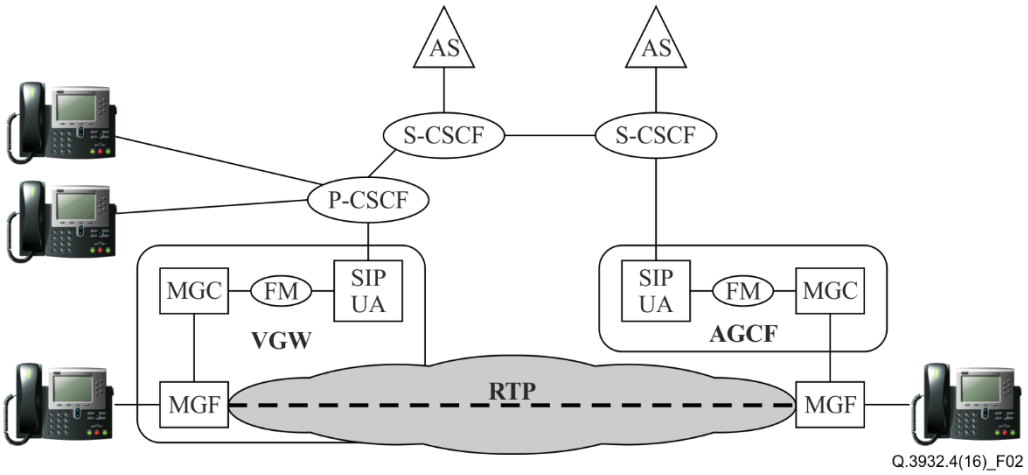

Figure 2 – AGCF/VGW session processing models

Figure 2 illustrates the session processing model used by the AGCF and VGW functional entities.

An AGCF is modelled as comprising ITU-T H.248 Media Gateway Controller (MGC), Feature Manager (FM), and SIP UA functionality. An AGCF interfaces to a Media Gateway (MG) and also to the S-CSCF (via P1 and Mw reference points respectively).

A functional modelling of the VGW contains an entity similar to ITU-T H.248 Media Gateway Controller, a Feature Manager, a SIP UA, and MGW functionality. The VGW interfaces to the P-CSCF using the Gm reference point.

The SIP UA functionality provides the interface to the other components of the IMS-based architecture. It is involved in registration and session processing as well as in event subscription/notification procedures with application servers.

The MGC functionality enable the session processing functionality to interface with existing line signalling such as analogue signalling or DSS1.

Session and registration processing in the AGCF or VGW involves two halves: ITU-T H.248 based MGC processing and SIP user agent (UA) processing (see Figure 2). MGC processing focuses on the interactions with the media gateway functions, while SIP UA processing focuses on the interactions with the IMS components. The feature manager (FM) coordinates the two processing activities.

4.3 Parameter requirements (performance design objectives)

IMS/PES/VoLTE exchange implementations shall comply with the requirements given in Table 1 to Table 9.

NOTE – The values of the performance design objectives (reference load A and reference load B), which are contained in this Recommendation and found in Table 1to Table 9, are taken from [ETSI TS 101 563].

Table 1

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Local exchange call request delay – originating outgoing and internal traffic connections						
ANALOGUE SUBSCRIBER LINES Local exchange call request delay – originating outgoing and internal traffic connections.	Clause 2.3.2.1of [ITU-T Q.543] For ANALOGUE SUBSCRIBER LINES, call request delay is defined as the interval from the instant when the off-hook condition is recognizable at the subscriber line interface of the exchange until the exchange begins to apply dial tone to the line. The call request delay interval is assumed to correspond to the period at the beginning of a call attempt during which the exchange is unable to receive any call address information from the subscriber.	PES [ETSI TS 183 043] For ANALOGUE SUBSCRIBER LINES connected to the AGCF/MSAN. Call request delay is defined as the interval from the instant when the off-hook condition is recognizable at the subscriber line interface of the AGCF/MSAN until the AGCF/MSAN begins to apply dial tone to the line.	≤ 400 ms	≤ 600 ms	≤ 800 ms	≤ 1 000 ms
ANALOGUE SUBSCRIBER with IAD (VGW) Local exchange call request delay – originating outgoing and internal traffic connections.		PES [ETSI TS 183 043] For ANALOGUE SUBSCRIBER LINES connected to the VGW. Call request delay is defined as the interval from the instant when the off-hook condition is recognizable at the subscriber line interface of the VGW until the VGW begins to apply dial tone to the line.	≤ 400 ms	≤ 600 ms	≤ 800 ms	≤ 1 000 ms

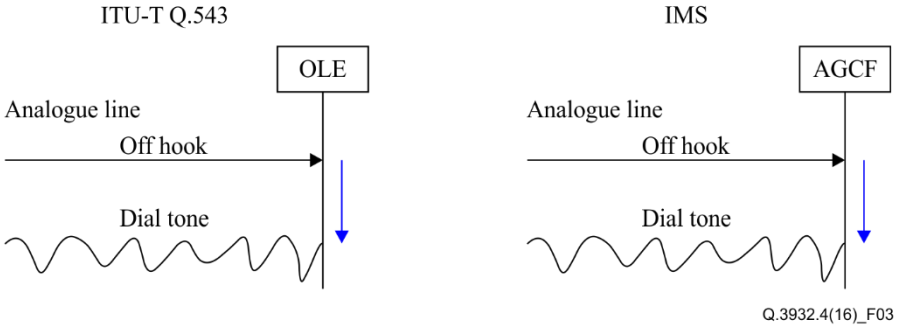

Figure 3 – Local exchange analogue subscriber call request delay: overlap sending

Table 2

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Local exchange ISDN subscriber call request delay: overlap sending						
ISDN SUBSCRIBER LINES Local exchange call request delay – Overlap sending.	Clause 2.3.2.2 of [ITU-T Q.543] Local exchange call request delay. Call request delay is defined as the interval from the instant at which the SET-UP message has been received from the subscriber signalling system until the SET-UP ACKNOWLEDGE message is passed back to the subscriber signalling system.	ISDN [ETSI TS 183 036] Call request delay is defined as the interval from the instant at which the SET-UP message has been received from the subscriber signalling system until the SET-UP ACKNOWLEDGE message is passed back to the subscriber signalling system.	≤ 200 ms	≤ 250 ms	≤ 300 ms	≤ 400 ms
IMS SUBSCRIBER Local exchange call request delay.		IMS [ITU-T Q.3403 v.1] Call request delay is defined as the interval from the instant at which the INVITE message has been received from the SIP subscriber until the 100 Trying from the SBC/P-CSCF is passed back to the subscriber.	≤ 15 ms	≤ 20 ms	≤ 30 ms	≤ 40 ms

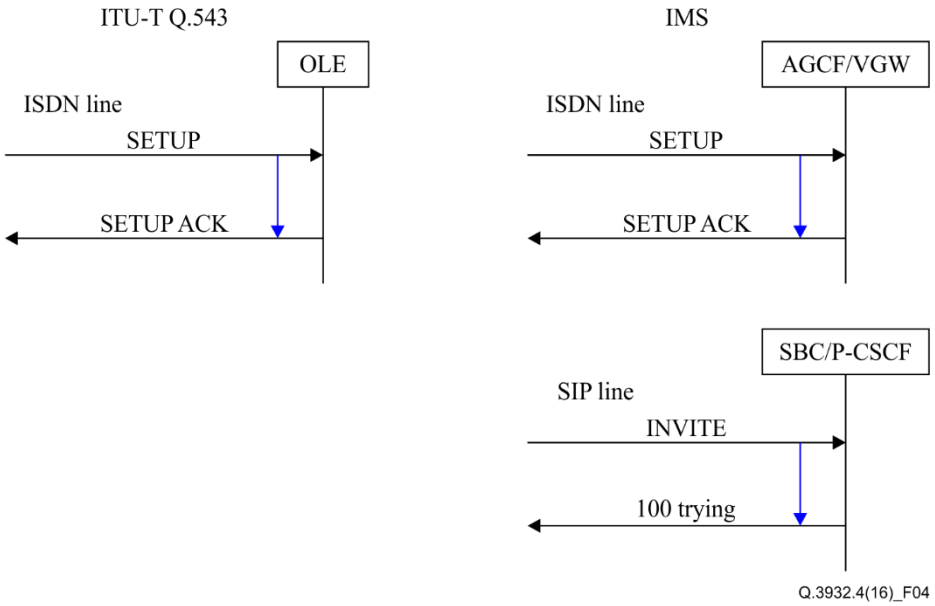

Figure 4 – Local exchange ISDN subscriber call request delay: overlap sending

Table 3

Meaning of timers	**Parameter ITU-T Q.543**	**IMS, PES equivalent**	**Reference load A**		**Reference load B**	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Local exchange ISDN subscriber call request delay: en-block sending						
ISDN SUBSCRIBER LINES Local exchange call request delay en- block sending.	Clause 2.3.2.3 of [ITU-T Q.543] For DIGITAL SUBSCRIBER LINES using en-bloc sending, call request delay is defined as the interval from the instant at which the SET-UP message is received	ISDN [ETSI TS 183 036] For ISDN using en-bloc sending, call request delay is defined as the interval from the instant at which the SET-UP message is received from the subscriber signalling system until	≤ 300 ms	≤ 400 ms	≤ 500 ms	≤ 600 ms

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Local exchange ISDN subscriber call request delay: en-block sending						
	from the subscriber signalling system until the call proceeding message is passed back to the subscriber signalling system.	the CALL PROCCEDING message is passed back to the subscriber signalling system.				

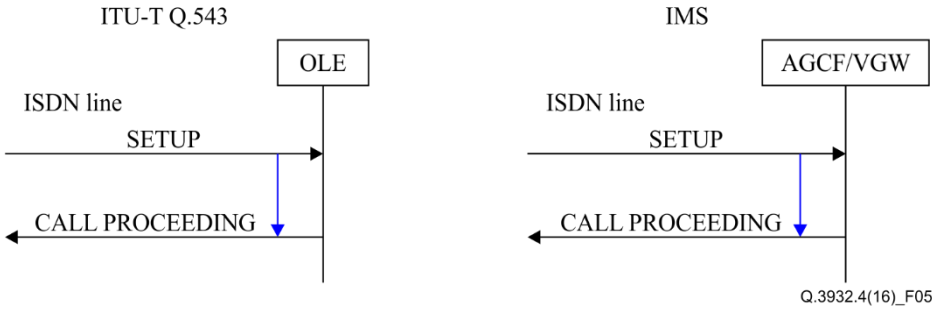

Figure 5 – Local exchange ISDN subscriber call request delay: en-block sending

Table 4

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Alerting sending delay for terminating traffic (the users are in different locations, controlled by different S-CSCF/P-CSCF)						
ANALOGUE SUBSCRIBER LINES Alerting sending Delay for terminating traffic.	Clause 2.3.6.1.1 of [ITU-T Q.543] For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant when the last digit is available for processing in the exchange until the ringing tone is sent backwards toward the calling user.	PES [ETSI TS 183 043] For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant when the last digit is available for processing in the AGCF/MSAN until the ringing tone is sent toward the calling user.	≤ 300 ms	≤ 450 ms	≤ 600 ms	≤ 750 ms
ISDN SUBSCRIBER LINES Alerting sending Delay for terminating traffic.	Clause 2.3.6.1.2 of [ITU-T Q.543] For calls terminating on DIGITAL SUBSCRIBER LINES, the alerting sending delay is defined as the interval from the instant that an ALERTING message is received from the digital subscriber line signalling system to the instant at which an ADDRESS COMPLETE message is passed to the interexchange signalling system or ringing tone is sent backward toward the calling user.	ISDN [ETSI TS 183 036] For calls terminating on ISDN, the alerting sending delay is defined as the interval from the instant that an ALERTING message is received from the digital subscriber line signalling to the instant at which an AGCF/MSAN sends the 180 Ringing backward toward the calling user.	≤ 250 ms	≤ 300 ms	≤ 350 ms	≤ 400 ms

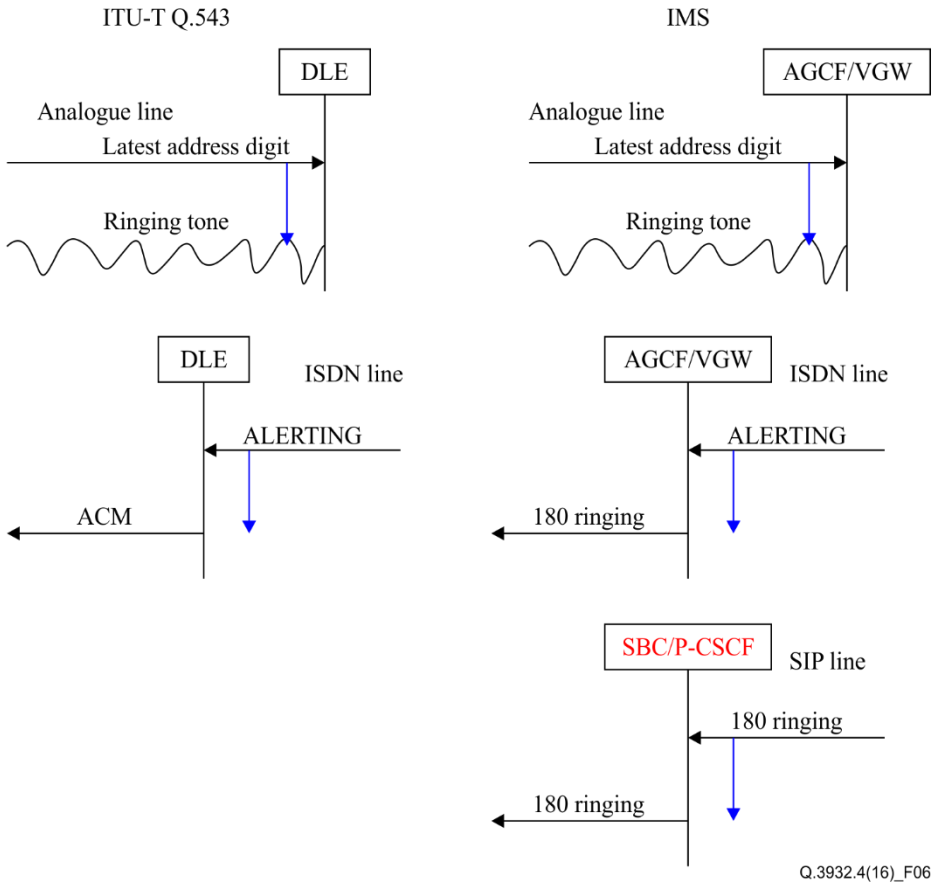

Figure 6 – Local exchange alerting sending delay for terminating traffic (in different locations)

Table 5

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		Mean value	95% probability of not exceeding	Mean value	95% probability of not exceeding
Alerting sending delay for internal traffic (the user are in same locations, controlled by same AGCF/VGW or P-CSCF)						
ANALOGUE SUBSCRIBER LINES Alerting sending Delay for internal traffic.	Clause 2.3.6.2.1 of [ITU-T Q.543] For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant that the signalling information is available for processing in the exchange until ringing tone is applied to an ANALOGUE calling subscriber.	PES [ETSI TS 183 043] For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant that the signalling information is available for processing in the AGCF/MSAN until Ringing tone is sent towards the calling subscriber.	≤ 300 ms	≤ 450 ms	≤ 600 ms	≤ 750 ms
ANALOGUE SUBSCRIBER LINES Alerting sending Delay for internal traffic.		PES [ETSI TS 183 043] For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant that the signalling information is available for processing in the MGW/VGW until Ringing tone is sent towards the calling subscriber.	≤ 550 ms	≤ 800 ms	≤ 1 000 ms	≤ 1 100 ms

Table 5

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
ISDN SUBSCRIBER LINES Alerting sending Delay for Internal traffic.	Clause 2.3.6.2.2 of [ITU-T Q.543] For internal calls terminating on DIGITAL SUBSCRIBER LINES originating from DIGITAL SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant that an ALERTING message is received from the signalling system of the called subscriber's line until the ALERTING message is applied to the calling subscriber line.	ISDN [ETSI TS 183 036] For calls terminating on ISDN, alerting sending delay is defined as the interval from the instant that an ALERTING message is received and ALERTING is sent towards the calling subscriber.	≤ 300 ms	≤ 350 ms	≤ 400 ms	≤ 450 ms
IMS SUBSCRIBER LINES 180 sending Delay for Internal traffic.		IMS For calls terminating sending delay is defined as the interval from the instant that a 180 message at the Gm interface has received and 180 is sent on the Gm towards the calling subscriber.	≤ 100 ms	≤ 150 ms	≤ 200 ms	≤ 250 ms
VoLTE SUBSCRIBER LINES 180 sending Delay for Internal traffic.		VoLTE For calls terminating sending delay is defined as the interval from the instant that a 180 message at the VoLTE – UE interface has received and 180 is sent on the VoLTE – UE towards the calling subscriber.	≤ 150 ms	≤ 200 ms	≤ 250 ms	≤ 300 ms

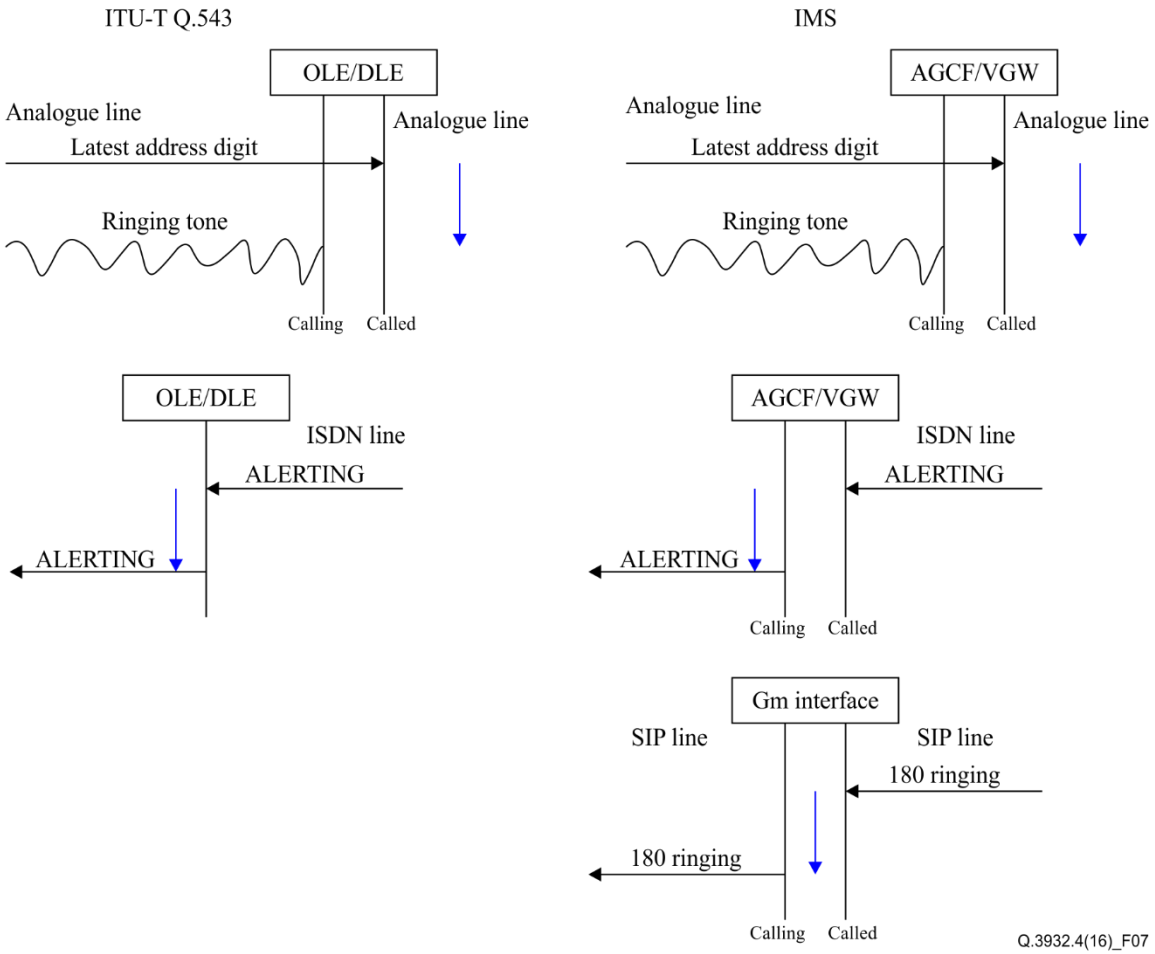

Figure 7 – Alerting sending delay for internal traffic
(the user are in same locations, controlled by same AGCF/VGW or P-CSCF)

Table 6

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Call set-up delay						
ISDN SUBSCRIBER LINES Call set-up delay using overlap signalling.	Clause 2.4.3.1 of [ITU-T Q.543] Call set-up delay is defined as the interval from the instant when the signalling information required for routing is received from the incoming signalling system until the instant when the corresponding signalling information is passed to the outgoing signalling system. Exchange call set-up delay for originating outgoing traffic connections, digital subscriber lines. The time interval starts when the INFORMATION message received contains a "sending complete indication" or when the address information necessary for call set-up is complete and ends when the corresponding signalling information is passed to the outgoing signalling system.	ISDN [ETSI TS 183 036] Sending, the time interval starts when the INFORMATION message received contains a "sending complete indication" and ends when the INVITE message on the Ic interface has been sent.	≤ 400 ms	≤ 500 ms	≤ 550 ms	≤ 650 ms
		ISDN [ETSI TS 183 036] Sending, the time interval starts when the INFORMATION message received contains a "sending complete indication" and ends when the INVITE message on terminating Gm interface has been sent.	≤ 450 ms	≤ 450 ms	≤ 550 ms	≤ 650 ms

Table 6

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
		IMS [ITU-T Q.3403 v.1] Session initiation call set-up delay is defined as the interval from the instant when the INVITE signalling information is received from the calling user on the originating Gm interface until the instant when the corresponding INVITE signalling information is passed on the terminating Ic interface to the called user	≤ 250 ms	≤ 350 ms	≤ 450 ms	≤ 550 ms

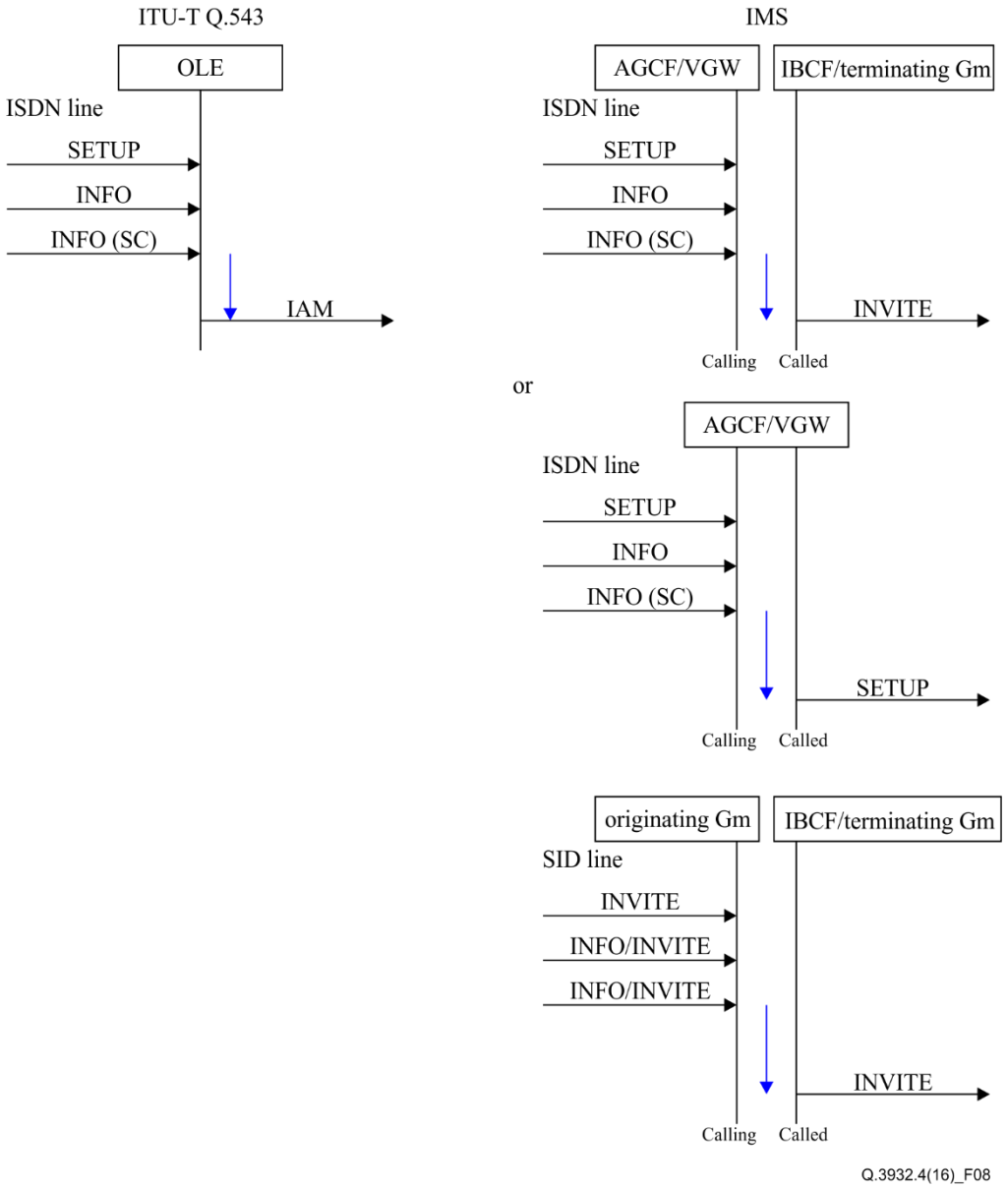

Figure 8 – Call set-up delay: Overlap sending is used

Table 7

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Call set-up delay: en-block sending is used						
ISDN SUBSCRIBER LINES Call set-up delay using en-block signalling.	Clause 2.4.3.1 of [ITU-T Q.543] Exchange call set-up delay for originating outgoing traffic connections. For call attempts using en-bloc sending Call set-up delay is defined as the interval from the instant when the signalling information required for routing is received from the incoming signalling system until the instant when the corresponding signalling information is passed to the outgoing signalling system. The time interval starts when the SET-UP message received contains a "sending complete indication" or when the address information necessary for call set-up is complete and ends when the call set-up is sent on the outgoing signalling system.	ISDN [ETSI TS 183 036] Call set-up delay is defined as the interval from the instant when the signalling information including Sending Complete (#) is received from the incoming signalling system until the instant when the corresponding INVITE signalling information is passed to the Ic interface.	≤ 350 ms	≤ 450 ms	≤ 550 ms	≤ 650 ms
		ISDN [ETSI TS 183 036] Call set-up delay is defined as the interval from the instant when the signalling information including Sending Complete (#) is received from the incoming signalling system until the instant when the corresponding INVITE signalling information is passed to the terminating Gm interface.	≤ 350 ms	≤ 450 ms	≤ 550 ms	≤ 650 ms
		ISDN [ETSI TS 183 036] Call set-up delay for Internal traffic is defined as the interval from the instant when the SET-UP including Sending Complete (#) is received from the incoming signalling system until the	≤ 450 ms	≤ 550 ms	≤ 650 ms	≤ 750 ms

Table 7

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Call set-up delay: en-block sending is used						
		instant when the corresponding SET-UP signalling information is passed to the called line signalling system (see Note 1).				
IMS SUBSCRIBER Call set-up delay using for Internal traffic.		IMS [ITU-T Q.3403 v.1] Session initiation call set-up delay is defined as the interval from the instant when the INVITE signalling information is received from the calling user on the originating Gm interface until the instant when the corresponding INVITE signalling information is passed on the terminating Gm interface to the called user.	≤ 250 ms	≤ 350 ms	≤ 450 ms	≤ 550 ms
		VoLTE Session initiation delay is defined as the interval from the instant when the INVITE signalling information is received from the calling user on the originating VoLTE – UE (ECM idle) interface until the instant when the corresponding INVITE signalling information is passed on the terminating VoLTE – UE (ECM Idle)	≤ 1 800 ms	≤ 1900 ms	≤ 2 000 ms	≤ 2 100 ms

Table 7

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95% probability of not exceeding**	**Mean value**	**95% probability of not exceeding**
Call set-up delay: en-block sending is used						
		interface to the called user with QCI 1 (see Note 2).				
		VoLTE Session initiation delay is defined as the interval from the instant when the INVITE signalling information is received from the calling user on the originating VoLTE – UE (ECM Connected) interface until the instant when the corresponding INVITE signalling information is passed on the terminating VoLTE – UE (ECM Connected) interface to the called user (see Note 3).	≤ 280 ms	≤ 380 ms	≤ 500 ms	≤ 600 ms
Call set-up time:						
		VoLTE The definition of Call set-up time is defined in [ETSI TS 102 250-2].	≤ 1 950 ms	≤ 2 100 ms	≤ 2 250 ms	≤ 2 400 ms (Note 4)

NOTE 1 – If SC (#) is not included the set-up delay may increase up to the digit collection timer (15 s).
NOTE 2 – Paging Cycle 1.28 s.
NOTE 3 – S1-Control plane delay: 2 ms – 15 ms (S1 is the interface between eNode Bs and MME and S-GW).
NOTE 4 – The maximum value should not exceed 5.9 seconds.

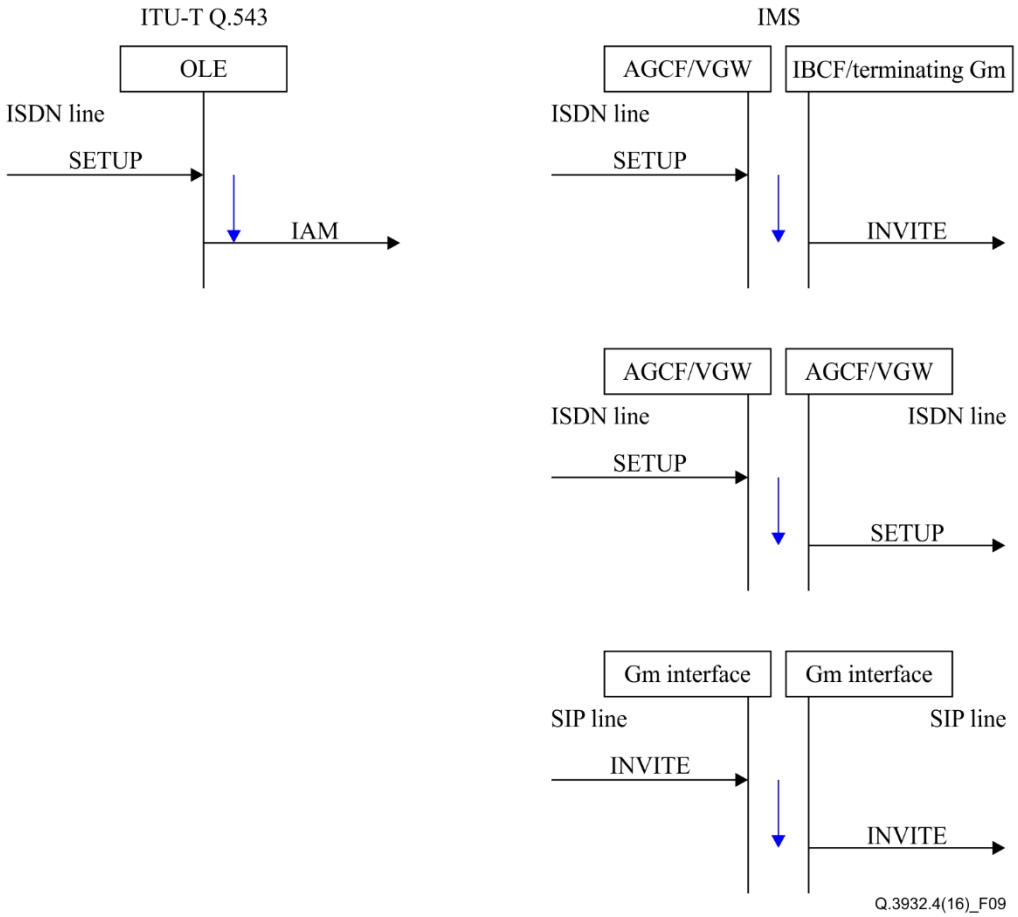

Figure 9 – Call set-up delay: en-block sending is used

Table 8

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95 % probability of not exceeding**	**Mean value**	**95 % probability of not exceeding**
Through-connection delay						
ISDN SUBSCRIBER LINES Through-connection delay.	Clause 2.4.4.2 of ITU-T Q.543 Through-connection delay. The through connection delay is defined as the interval from the instant that the CONNECT message is received from the called line signalling system until the through connection is established and available for carrying traffic and the ANSWER and CONNECT ACKNOWLEDGEMENT messages have been passed to the appropriate signalling systems.	ISDN [ETSI TS 183 036] The through connection delay is defined as the interval from the instant that the CONNECT message is received from the called line signalling system until the through connection is established and available for carrying traffic and the CONNECT message has been sent to the calling user signalling system (see Note).	≤ 300 ms	≤ 350 ms	≤ 400 ms	≤ 450 ms
IMS Through-connection delay Delay for Internal traffic.		IMS [ITU-T Q.3403 v.1] The through connection delay is defined as the interval from the instant that the 200 OK message is received from the called user at the terminating Gm interface until the through connection is established and available for carrying traffic and the 200 OK message has been sent to the calling user on the originating Gm interface.	≤ 100 ms	≤ 150 ms	≤ 200 ms	≤ 250 ms

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		Mean value	95 % probability of not exceeding	Mean value	95 % probability of not exceeding
VoLTE		VoLTE The through connection delay is defined as the interval from the instant that the 200 OK message is received from the called user at the terminating VoLTE – UE interface until the through connection is established and available for carrying traffic and the 200 OK message has been sent to the calling user on the originating VoLTE – UE interface.	≤ 150 ms	≤ 200 ms	≤ 250 ms	≤ 300 ms
NOTE – The through connection of RTP is not considered.						

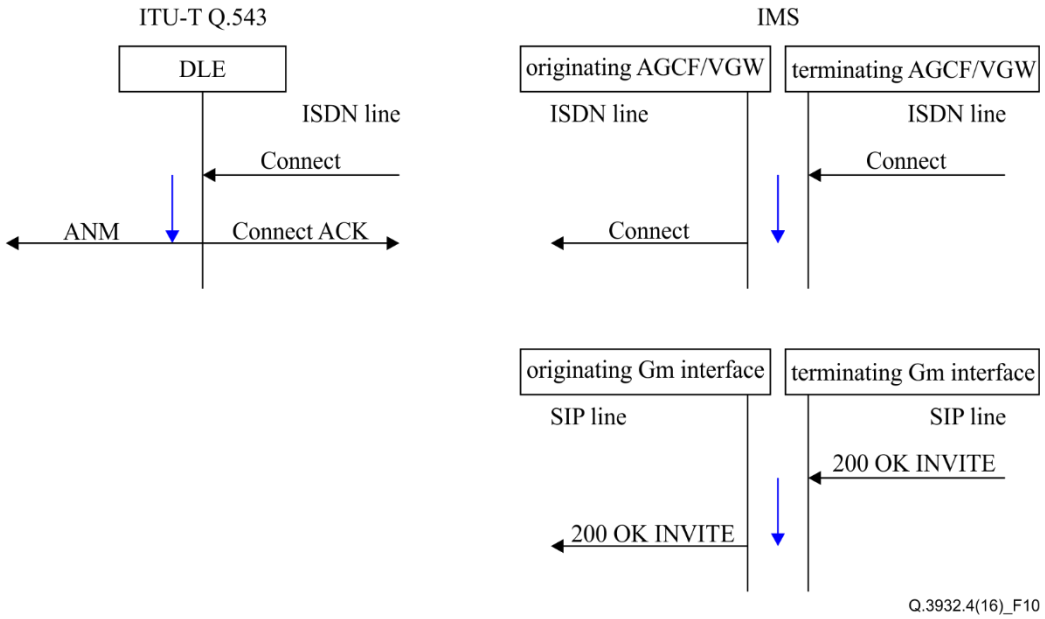

Figure 10 – Through-connection delay

Table 9

Meaning of timers	**Parameter ITU-T Q.543**	**IMS, PES equivalent**	**Reference load A**		**Reference load B**	
	Detailed description		**Mean value**	**95 % probability of not exceeding**	**Mean value**	**95 % probability of not exceeding**
Connection release delay:						
ISDN SUBSCRIBER LINES Connection call release delay.	Clause 2.4.6 of ITU-T Q.543 Connection release delay is defined as the interval from the instant when DISCONNECT or RELEASE message is received from a signalling system until the instant	ISDN [ETSI TS 183 036] Connection release delay is defined as the interval from the instant when DISCONNECT or RELEASE message is received from a signalling system until the instant when	≤ 300 ms	≤ 350 ms	≤ 400 ms	≤ 450 ms

Meaning of timers	Parameter ITU-T Q.543	IMS, PES equivalent	Reference load A		Reference load B	
	Detailed description		**Mean value**	**95 % probability of not exceeding**	**Mean value**	**95 % probability of not exceeding**
	when the connection is no longer available for use on the call (and is available for use on another call) and a corresponding RELEASE or DISCONNECT message is passed to the other signalling system involved in the connection.	RELEASE COMPLETE is sent and a corresponding RELEASE or DISCONNECT message is sent, or vice versa.				
IMS SUBSCRIBER Connection call release delay Delay for Internal traffic.		IMS [ITU-T Q.3403 v.1] Connection release delay is defined as the interval from the instant when a BYE message is received at the originating or terminating Gm interface until the instant when 200OK is sent and a corresponding BYE message is sent at the terminating or originating Gm interface respectively.	≤ 100 ms	≤ 150 ms	≤ 200 ms	≤ 250 ms
VoLTE – IMS SUBSCRIBER Connection call release delay Delay for Internal traffic.		VoLTE Connection release delay is defined as the interval from the instant when a BYE message is received at the originating or terminating VoLTE – UE interface until the instant when 200OK is sent and a corresponding BYE message is sent at the terminating or originating VoLTE – UE interface respectively.	≤ 150 ms	≤ 200 ms	≤ 250 ms	≤ 300 ms

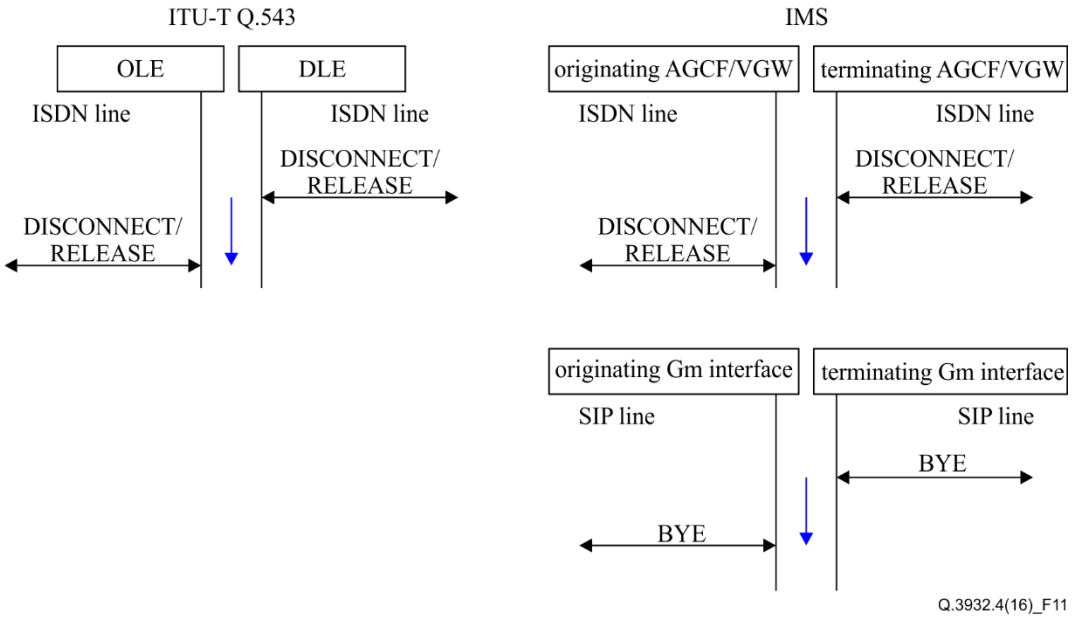

Figure 11 – Connection call release delay

4.4 Call processing performance objectives

4.4.1 Premature release

The probability that an exchange malfunction will result in the premature release of an established connection in any one minute interval shall be:

$$P \leq 2 \times 10^{-5}$$

4.4.2 Release failure

The probability that an exchange malfunction will prevent the required release of a connection shall be:

$$P \leq 2 \times 10^{-5}$$

4.4.3 Incorrect charging or accounting

The probability of a call attempt receiving incorrect charging or accounting treatment due to an exchange malfunction shall be:

$$P \leq 10^{-4}$$

4.4.4 Misrouting

The probability of a call attempt misrouted following receipt by the exchange of a valid address shall be:

$$P \leq 10^{-4}$$

4.4.5 No tone

The probability of a call attempt encountering no tone following receipt of a valid address by the exchange shall be:

$$P \leq 10^{-4}$$

4.4.6 Other failures

The probability of the exchange causing a call failure for any other reason not identified specifically above shall be:

$$P \leq 10^{-4}$$

4.5 Transmission performance

4.5.1 64 kbit/s switched connections

The probability of a connection being established with an unacceptable transmission quality across the exchange shall be:

$$P \leq 10^{-5}$$

The transmission quality across the exchange is said to be unacceptable when the bit error ratio is above the alarm condition.

NOTE – According to [b-ITU-T G.826] and [b-ITU-T G.828], budgets of 18.5% of 1.5×10^{-6} were allocated to each national network, so the packet loss for a national connection should be no more than 2.75×10^{-7} [ETSI TS 102 928].

4.6 Slip rate

4.6.1 Normal conditions

The slip rate under normal conditions is covered in [ITU-T Q.541].

4.6.2 Temporary loss of timing control

The case of temporary loss of timing control corresponds to the "holdover operation" defined and recommended in [ITU-T G.812]. The allowable slip rate will correspond to the maximum relative TIE also recommended in [ITU-T G.812].

4.6.3 Abnormal conditions at the exchange input

The slip rate in case of abnormal conditions (wide phase deviations, etc.) at the exchange input is the subject of further study taking into account the requirements of [ITU-T G.823].

Bibliography

[b-ITU-T G.826] *Recommendation ITU-T G.826 (1993), End-to-end performance parameters and objectives for international, constant bit-rate digital paths and connections*.

[b- ITU-T G.828] Recommendation ITU-T G.828 (2000), *Error performance parameters and objectives for international, constant bit-rate synchronous digital paths*.

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