



The ATM Forum
Technical Committee

UNI Signalling Performance
Test Suite

Version 1.1

af-test-0158.001

July 2002

© 2002 by The ATM Forum. This specification/document may be reproduced and distributed in whole, but (except as provided in the next sentence) not in part, for internal and informational use only and not for commercial distribution. Notwithstanding the foregoing sentence, any protocol implementation conformance statements (PICS) or implementation conformance statements (ICS) contained in this specification/document may be separately reproduced and distributed provided that it is reproduced and distributed in whole, but not in part, for uses other than commercial distribution. All other rights reserved. Except as expressly stated in this notice, no part of this specification/document may be reproduced or transmitted in any form or by any means, or stored in any information storage and retrieval system, without the prior written permission of The ATM Forum.

The information in this publication is believed to be accurate as of its publication date. Such information is subject to change without notice and The ATM Forum is not responsible for any errors. The ATM Forum does not assume any responsibility to update or correct any information in this publication. Notwithstanding anything to the contrary, neither The ATM Forum nor the publisher make any representation or warranty, expressed or implied, concerning the completeness, accuracy, or applicability of any information contained in this publication. No liability of any kind shall be assumed by The ATM Forum or the publisher as a result of reliance upon any information contained in this publication. The receipt or any use of this document or its contents does not in any way create by implication or otherwise:

- Any express or implied license or right to or under any ATM Forum member company's patent, copyright, trademark or trade secret rights which are or may be associated with the ideas, techniques, concepts or expressions contained herein; nor
- Any warranty or representation that any ATM Forum member companies will announce any product(s) and/or service(s) related thereto, or if such announcements are made, that such announced product(s) and/or service(s) embody any or all of the ideas, technologies, or concepts contained herein; nor
- Any form of relationship between any ATM Forum member companies and the recipient or user of this document.

Implementation or use of specific ATM standards or recommendations and ATM Forum specifications will be voluntary, and no company shall agree or be obliged to implement them by virtue of participation in The ATM Forum.

The ATM Forum is a non-profit international organization accelerating industry cooperation on ATM technology. The ATM Forum does not, expressly or otherwise, endorse or promote any specific products or services.

NOTE: The user's attention is called to the possibility that implementation of the ATM interoperability specification contained herein may require use of an invention covered by patent rights held by ATM Forum Member companies or others. By publication of this ATM interoperability specification, no position is taken by The ATM Forum with respect to validity of any patent claims or of any patent rights related thereto or the ability to obtain the license to use such rights. ATM Forum Member companies agree to grant licenses under the relevant patents they own on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. For additional information contact:

The ATM Forum
Email: info@atmforum.com

www.atmforum.com

Preface

The editors would like to thank the following people for their help with this document as well as the regular attendees of the TEST and CS Working Groups for their input.

Rick Raskin
Fred Kaudel
Ostap Monkewich
Kelvin Steeden
Piergiorgio Vittori
Gregan Crawford
Leslie Collica

Joel Orvis and Alvin Francis, Editors.

Table Of Contents

1	INTRODUCTION	5
1.1	SCOPE.....	5
1.2	REFERENCES	5
1.3	METHODOLOGIES	5
1.4	UNI SIGNALLING PERFORMANCE TEST SUITE	5
2	TERMINOLOGY	6
3	PERFORMANCE METRICS	8
3.1	SIGNALLING MESSAGE LATENCY	8
3.2	CALL ESTABLISHMENT TIME.....	9
3.3	CALL RELEASE TIME.....	10
3.4	PARTY ESTABLISHMENT TIME.....	11
3.5	PARTY RELEASE TIME.....	12
3.6	CALL ESTABLISHMENT LATENCY.....	12
3.7	CALL ESTABLISHMENT BURST TIME	14
3.8	CALL RELEASE BURST TIME	14
3.9	PARTY ESTABLISHMENT BURST TIME	16
3.10	PARTY RELEASE BURST TIME	16
3.11	CALL CYCLE TIME	17
3.12	CALL CYCLE BURST TIME.....	18
3.13	PARTY CYCLE TIME	20
3.14	PARTY CYCLE BURST TIME.....	21
3.15	PARTY ESTABLISHMENT LATENCY.....	22
3.16	AVERAGE SIGNALLING MESSAGE RATE.....	23
4	TEST ARCHITECTURE	25
4.1	APPLICABLE SYSTEMS UNDER TEST	25
5	GLOBAL PARAMETERS	26
5.1	IDENTIFICATION SUMMARY.....	26
5.2	ABSTRACT TEST SUITE SUMMARY	26
5.3	TEST LABORATORY	26
5.4	CLIENT.....	26
5.5	SUT	27
5.6	ANCILLARY PROTOCOLS.....	27
5.7	PROTOCOL INFORMATION (FOR <i>ATM UNI SIGNALLING</i>).....	27
6	TEST SUITE GROUPS	34
6.1	SUSTAINED THROUGHPUT TEST GROUP	34
6.2	SIMULTANEOUS ACTIVE CALL CAPACITY TEST GROUP	40
6.3	LATENCY TEST GROUP.....	46
6.4	BURST THROUGHPUT GROUP	59
7	REPORTING RESULTS.....	69
7.1	GENERAL INSTRUCTIONS.....	69
7.2	GLOBAL PARAMETERS REPORTING	69
7.3	TEST CASE SPECIFIC PARAMETER REPORTING	69
7.4	TEST CASE SPECIFIC RESULT TABLES	69
APPENDIX A	FACTORS AFFECTING SUT PERFORMANCE MEASUREMENTS.....	89
APPENDIX B	FACTORS AFFECTING SUT PERFORMANCE.....	95

1 Introduction

One of the advantages of ATM is the ability to set up and tear down virtual connections dynamically between source and destination. There are many factors that may influence the number of switched connections that a network can accept, and the rate at which they can be accepted. Both of these performance criteria are influenced by the signalling performance of the SUT.

The objective of this test suite is to provide test cases and metrics that will be useful in gauging the signalling performance of the SUT under various call loading conditions between ATM network endpoints. Although all test cases are performed on UNI interfaces, the performance metrics obtained can provide information on the signalling performance of the signalling path between the endpoints.

1.1 Scope

This document describes a UNI signalling performance test suite. This test suite will address the following aspects of UNI signalling layer:

- Sustained Throughput
- Simultaneous Active Call Capacity
- Latency
- Burst Throughput

1.2 References

- | | |
|-----------------------------------|---|
| [1] af-test-0137.000 (2000-02) | “ICS Proforma Style Guide” |
| [2] ITU-T Q.2931 (1995-02) | “B-ISDN APPLICATION PROTOCOLS FOR ACCESS SIGNALLING” |
| [3] af-uni-0010.001 (1993-09) | “ATM User-Network Interface Specification Version 3.0” |
| [4] af-uni-0010.002 (1994-09) | “ATM User-Network Interface Specification Version 3.1” |
| [5] af-sig-0061.000 (1996-07) | “ATM User-Network Interface (UNI) Signalling Specification Version 3.1” |
| [6] af-sig-0076.000 (1997-01) | “Addendum to UNI Signalling 4.0 for ABR Parameter Negotiation” |
| [7] af-test-0022.000 (1994-12) | “Introduction to ATM Forum Test Specifications” |
| [8] af-test-tm-0131.000 (1999-10) | “ATM Forum Performance Testing Specification” |

1.3 Methodologies

This test suite provides a methodology for testing the signalling performance of a System Under Test (SUT), and as stated above, will provide measurements. An SUT may comprise a single ATM switch, part of an ATM switch, or a network of switches.

Input parameters to the test cases described in this document consist of variables that can affect the performance of the SUT. The test suite is not intended to be a signalling performance benchmark, nor does it define any “default” or “recommended” parameter values. The input parameters must be chosen by the executor of the test. Since the results of any test may be significantly affected by the values chosen, all input parameter values for a test case must be stated along with the test results. This requirement ensures that the test results are reproducible.

1.4 UNI Signalling Performance Test Suite

This test suite will test performance aspects of UNI signalling (UNI 3.0, UNI 3.1, Q.2931, and UNI 4.0). Section 6 describes in details the test cases provided within the UNI signalling performance test suite. The description of each test case contains the following information:

- Test case Identification.
- Test case Purpose.
- Test case Procedure.
- Test case Specific Parameters.
- Test case Results.

Some test cases also have a section defining prerequisites.

The performance metrics used to obtain results are defined in section 3. Section 4 introduces the test architectures that can be used during the execution of the test suite, section 5 describes the Global parameters that will be applied to all test cases, and section 6 describes the test suite structure as well as individual test cases. Appendix A describes how a tester could inadvertently influence the SUT's actual performance during a test. Appendix B describes factors that can affect SUT performance.

2 Terminology

The specific parameters are the inputs to the test cases. For each test case, the related specific parameters must be configured prior to execution. The values of these parameters will determine the behavior of the test case.

Offered Call Establishment Rate: The user specified rate at which the tester initiates call connection requests.

Maximum Test Case Duration: Maximum length of time that the specified test case will be run. The execution of the specified test case may be completed before the expiration of this time.

Minimum Test Case Duration: Minimum length of time that the specified test case will be run. The execution of the specified test case should not be completed before the expiration of this time.

Message Rate: The rate at which messages are generated or observed, calculated over a reported period of time, expressed in messages/second. On any given interface, message rates are measured one direction at a time.

Message Distribution: The variation of the message initiation rate over time.

Two modes are available:

- Constant Rate – The time between Setup messages is fixed for the Setup Rate Duration.
- Burst – The time between Setup messages varies during the Setup Rate Duration.

Setup Rate: The message rate for the setup message.

Call Duration: The length of time that the call remains in the active state at the originating side.

Initial Setup Rate: The Setup Rate at the beginning of the test case (*e.g.*, 5 Setups/sec).

Setup Rate Duration: The length of time that the current Setup Rate will be applied (*e.g.*, 2 sec).

Setup Rate Step: The value used to change the current Setup Rate upon the expiry of the Setup Rate Duration (*e.g.*, 5 Setups/sec).

Final Setup Rate: The Setup Rate at the end of the test case (*e.g.*, 20 Setups/sec).

Specific Cause: The user specified cause value that is monitored as a possible halting condition.

Number of Rejects: The number of calls rejected by the SUT that will cause the test case to terminate.

Add Party Rate: The message rate for the add party message (*e.g.*, 5 Add Party /sec).

Add Party per Call: The number of Add Party messages generated by the tester for a specific point-to-multipoint call.

Number of Calls to be Generated: The total number of the calls to be generated by the tester.

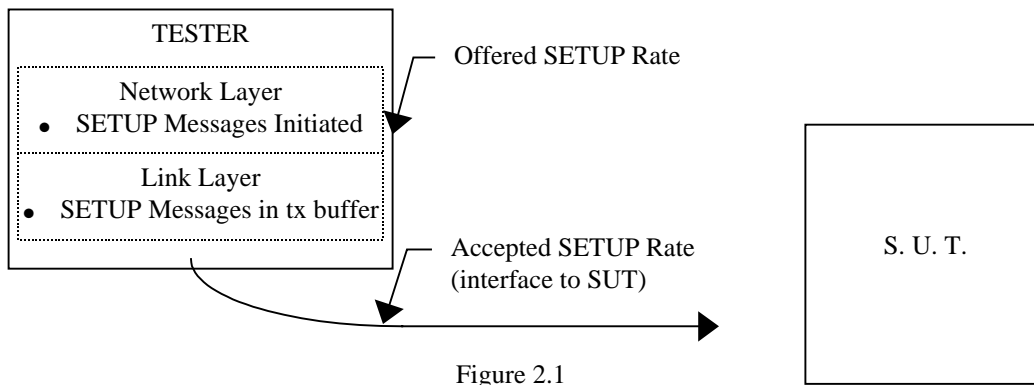
PTP: Abbreviation of point-to-point.

PMP: Abbreviation of point-to-multipoint.

Ratio of PMP to PTP calls: The ratio of Point-to-multipoint calls to Point-to-point calls (*e.g.*, for 50 point-to-multipoint calls and 100 point-to-point calls, the ratio is 0.5).

Offered SETUP Rate: The number of SETUP messages defined by the user (SETUPS/sec) and initiated by the Tester. For example, this rate may differ from the accepted setup rate due the link layer flow control mechanism. (Figure 1 shows a graphical representation of the Offered SETUP rate measurement)

Accepted SETUP Rate: The average SETUP message rate as observed on the interface. This rate may differ from the offered call establishment rate due to the link layer flow control mechanism. (**Figure 2.1 shows a graphical representation of the accepted SETUP rate measurement**) The SUT may cause the Tester to stop transmitting temporarily during the POLL-STAT procedures defined in the SAAL layer. This blocking can influence the rate at which messages are observed on the physical interface.



Note: the rate at which SETUP messages are seen on the interface is based on the link layer (flow control) protocol between the Tester and the SUT

Offered ADD PARTY Rate: The user specified rate at which the tester initiates ADD PARTY requests.

Accepted ADD PARTY Rate: The average ADD PARTY message rate as observed on the interface. This rate may differ from the offered ADD PARTY rate due to the link layer flow control mechanism, just as with an accepted versus offered average SETUP rate.

Test Case Duration: The elapsed time until complete execution of the test case.

3 Performance Metrics

3.1 Signalling Message Latency

The time that it takes for a network to propagate signalling messages will impact the signalling performance of the network. The message latencies introduced by nodes in an ATM network are additive. This property of the measurement implies that as more nodes are traversed on a signalling message path, the signalling message latency increases. The latency measured across a small number of nodes could be used to predict the performance of a larger network of similar nodes.

3.1.1 Definition

The delay in the propagation of each signalling message through one or more nodes is defined as the message latency.

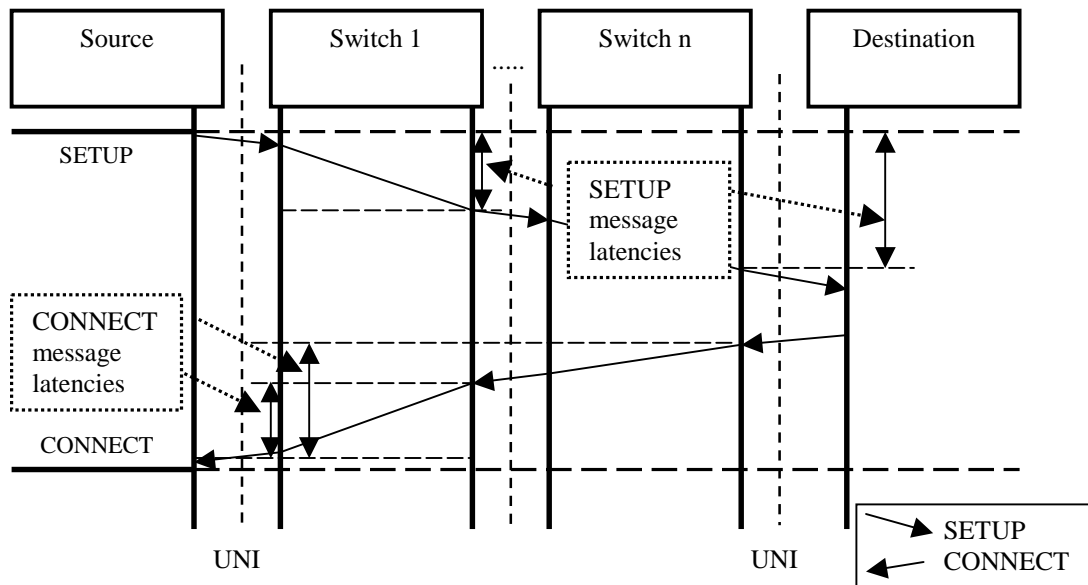


Figure 3.1 Signalling Message Latency

Figure 3.1 shows SETUP and CONNECT message latencies. Latencies for a single switch, as well as a collection of switches are shown for each message.

3.1.2 Units

Signalling message latency measurements are reported in units of time.

3.1.3 Measurement Procedure

Measuring signalling message latencies essentially follows the MIMO latency measurement procedures defined in af-test-tm-0131.000 [8], with one major deviation; the message being propagated is not necessarily identical on both sides of the SUT. In fact, the message contents and types can change as the message propagates through the network. Information elements can change, since the call reference value in the signalling message is more than likely different on either side of any node in the network. Also, as an example, as the message traverses the SUT, extended QOS parameters (UNI 4.0) will change. Message types can change as well. Considering the case of ADD PARTY message latencies, the ADD PARTY message may be changed to a SETUP message. Message latencies can still be measured in these cases, even though the measurement procedure does not follow the traditional MIMO latency measurements exactly.

There is sometimes no way to correlate signalling messages on either side of an SUT. The CRV changes, and the message contents may look the same as other signalling messages on the link. Correlating corresponding messages to one another is a problem that requires further study.

3.2 Call Establishment Time

The amount of time that it takes for an ATM system to establish a switched virtual connection between network components is a fundamental signalling performance metric. The larger the call establishment time, the fewer calls can be established during any fixed period.

3.2.1 Definition

The time elapsed between the observation of a SETUP message and the observation of a corresponding CONNECT message on the same interface is defined to be the Call Establishment Time for that interface. This metric yields the time taken to establish a connection from the perspective of the signalling entity that is initiating the connection. It applies on user-network interfaces, as well as network-network interfaces. The initiator in the context of this definition does not necessarily imply the originating user, since the SETUP message could be coming from an intermediate node.

Figure 3.2 shows a call being initiated by “Source” towards “Destination”, with call establishment times being measured along the path which the call takes through the network.

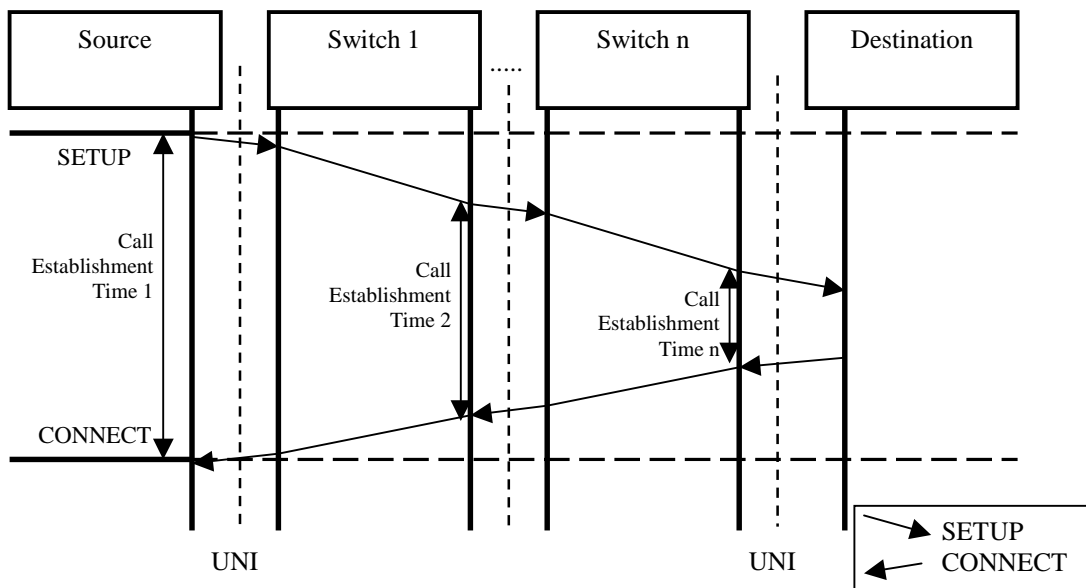


Figure 3.2 Call Establishment Time

3.2.2 Units

Call establishment time is reported in units of time.

3.3 Call Release Time

The amount of time that it takes for an ATM system to release all resources allocated to an active call on a signalling interface is the call release time. The larger the call release time, the longer it takes for a network to reclaim resources on an interface. In a situation where the network is under extreme load, this could result in delays or failures in establishing new connections. This may result in ambiguous results being reported to the user.

3.3.1 Definition

The time elapsed between the observation of a RELEASE message and the observation of a corresponding RELEASE COMPLETE message on the same interface is defined to be the Call Release Time for that interface. The call reference used in both of these messages must correspond to an active connection on the interface. This metric yields the time taken to terminate an active connection. It applies on user-network interfaces, as well as network-network interfaces. The initiator in the context of this definition does not necessarily refer to the network component that initiated the connection. The call release time could be measured at the call source entity, the call destination entity, and any intermediate node in between on the call path.

Figure 3.3 shows a call being terminated by the destination towards the source, with call release times being measured along the path which the call initiation took through the network. Since RELEASE COMPLETE messages do not imply that the connection has been terminated end to end, the call release time applies to each signalling interface independently. The call release time *does not* provide a measurement of the time taken to tear down a connection over a call path from end to end.

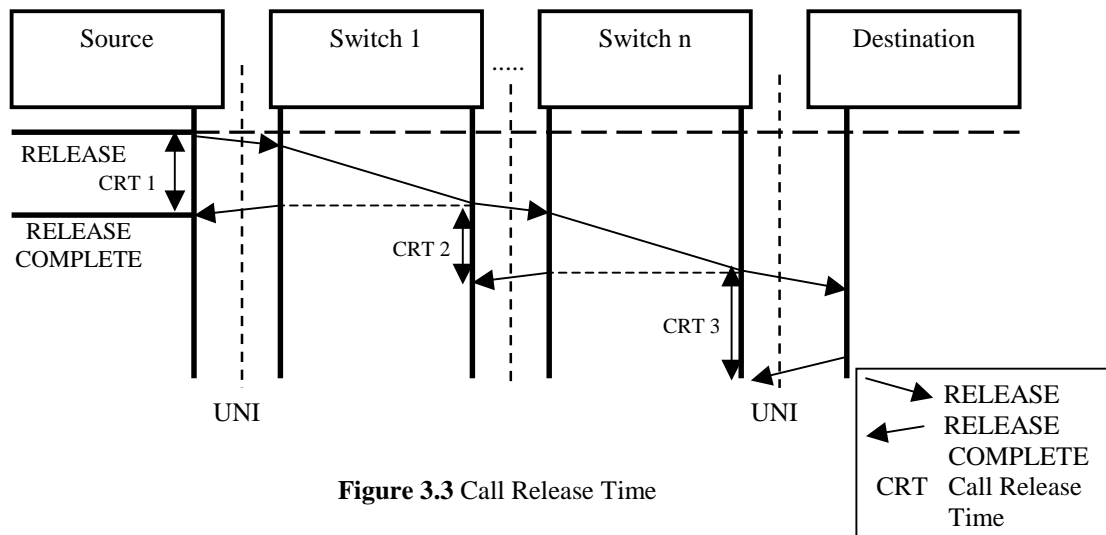


Figure 3.3 Call Release Time

3.3.2 Units

Call release time is reported in units of time.

3.4 Party Establishment Time

The amount of time that it takes for an ATM system to establish a party to a point to multipoint switched virtual connection between network components is analogous to the Call Establishment Time. The larger the party establishment time, the fewer parties can be established during any fixed period.

3.4.1 Definition

The time elapsed between the observation of an ADD PARTY message and the observation of a corresponding ADD PARTY ACK message on the same interface is defined to be the Party Establishment Time for that interface. This metric yields the time taken to establish a party to a connection from the perspective of a signalling entity initiating the party. It applies on user-network interfaces, as well as network-network interfaces. The initiator in the context of this definition does not necessarily imply the originating user, since the ADD PARTY could be coming from an intermediate node.

Figure 3.4 shows an add party being initiated by "Source" towards "Destination", with party establishment times being measured along the path which the call takes through the network. In this example, there is already an active connection to another destination. As the last switch in the connection path tries to establish a party to the destination in this example, a SETUP message is sent instead of an ADD PARTY, as is required by the ATM Forum UNI specifications. This is because there was no existing party to the root connection established to the destination previously. The party establishment time for this last interface is therefore more correctly labeled a call establishment time.

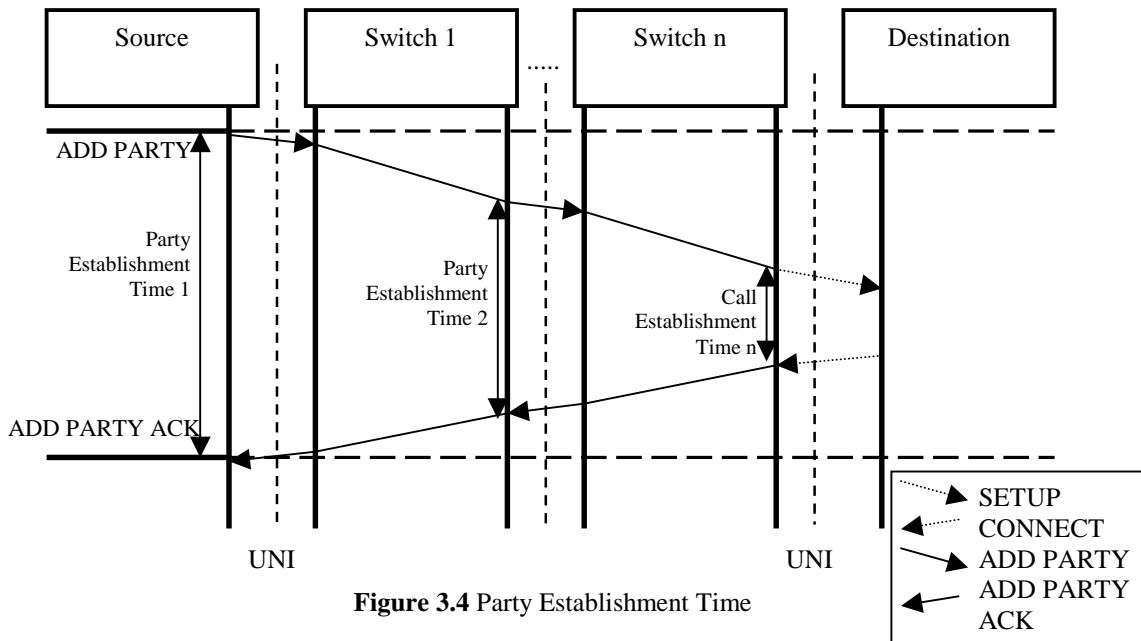


Figure 3.4 Party Establishment Time

3.4.2 Units

Party establishment time is reported in units of time.

3.4.3 Measurement Procedure

Before taking this measurement, the tester must first SETUP a root connection. Additional connections established in this test case are via ADD PARTY messages on the source interface.

3.5 Party Release Time

The amount of time that it takes for an ATM system to terminate an active party to a switched virtual connection on a signalling interface is the party release time. The larger the party release time, the longer it takes for a network to reclaim resources on an interface. In a situation where the network is under extreme load, this could result in delays or failures in establishing new connections. This may result in ambiguous results being reported to the user.

3.5.1 Definition

The time elapsed between the observation of a DROP PARTY message and the observation of a corresponding DROP PARTY ACK message on the same interface is defined to be the Party Release Time for that interface. The party referred to in both of these messages must correspond to an active party on the interface. This metric yields the time taken to terminate an active party. It applies on user-network interfaces, as well as network-network interfaces. The initiator in the context of this definition does not necessarily refer to the network component that initiated the party. The party release time could be measured at the call source entity, the call destination entity, and any intermediate node in between.

Figure 3.5 shows a party being terminated by destination towards the source, with party release times being measured along the path which the call initiation took through the network. Since DROP PARTY ACK messages do not imply that the party has been terminated end to end, the party release time applies to each signalling interface independently. The party release time *does not* provide a measurement of the time taken to tear down a party to a connection over the connection path from end to end.

3.5.2 Units

Party release time is reported in units of time.

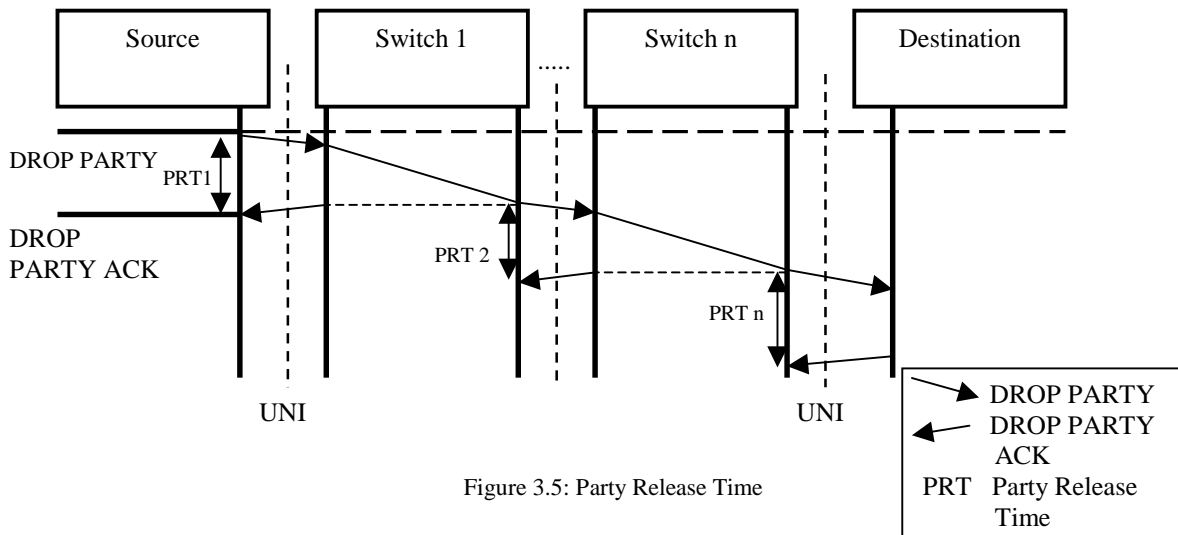


Figure 3.5: Party Release Time

3.6 Call Establishment Latency

The total time taken *by the network* to establish a connection from source to destination is the call establishment latency. For short duration VCs, call establishment latency is an important part of the user perceived performance.

3.6.1 Definition

The sum of the SETUP message latency and the CONNECT message latency is defined as the call establishment latency. This is the time that it takes for the call to be established from the initiator's perspective, with the end destination's call establishment time removed. The time lost at the destination

while the destination was deciding whether to accept the call is not under network control and is, therefore, not included in call establishment latency (see Figure 3.6).

Thus, the sum of the latency experienced by the setup message and the resulting connect message is the call setup latency.

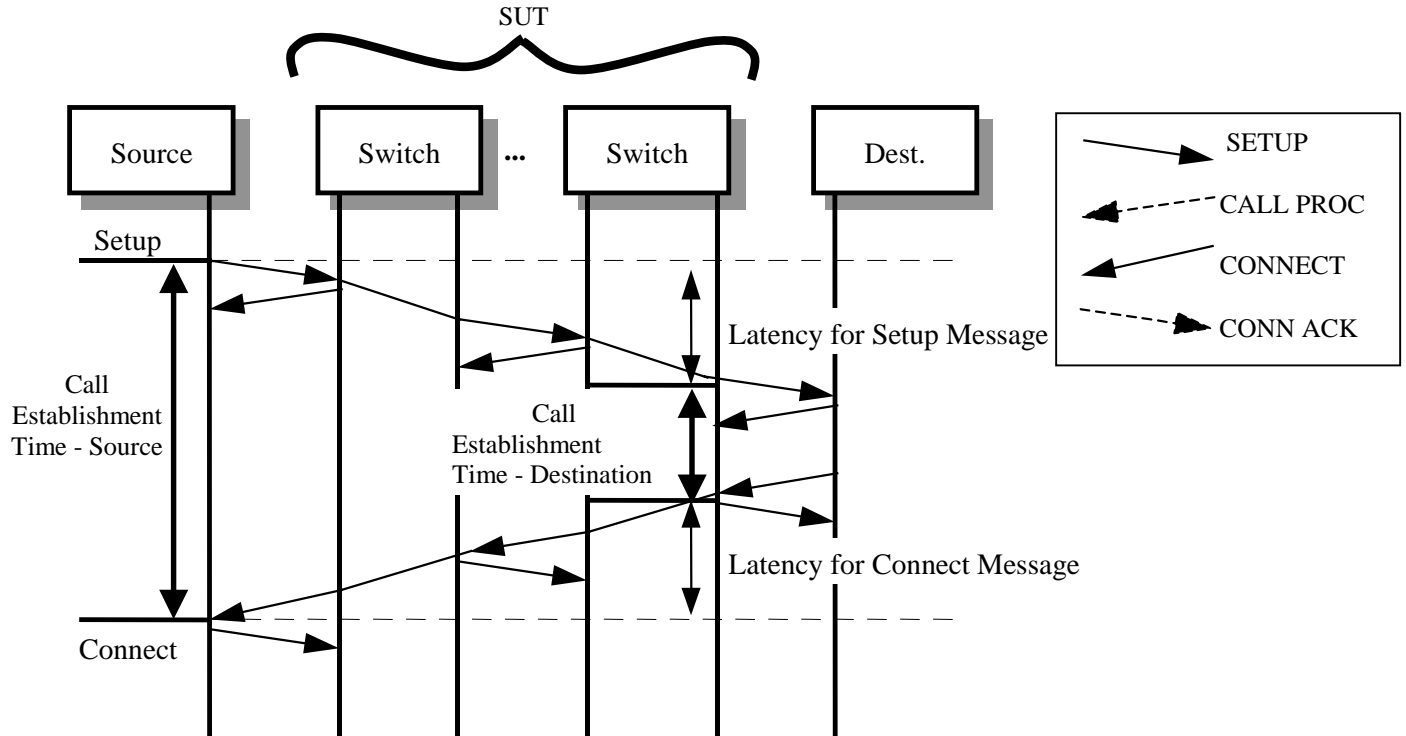


Figure 3.6: Call Establishment Latency

Call Establishment Latency = SETUP message latency
+ CONNECT message latency for the corresponding CONNECT

Note: The Call Establishment Latency does not include the time taken by the destination entity to respond to the SETUP message with a CONNECT message, which is where it differs from the Call Establishment Time.

3.6.2 Units

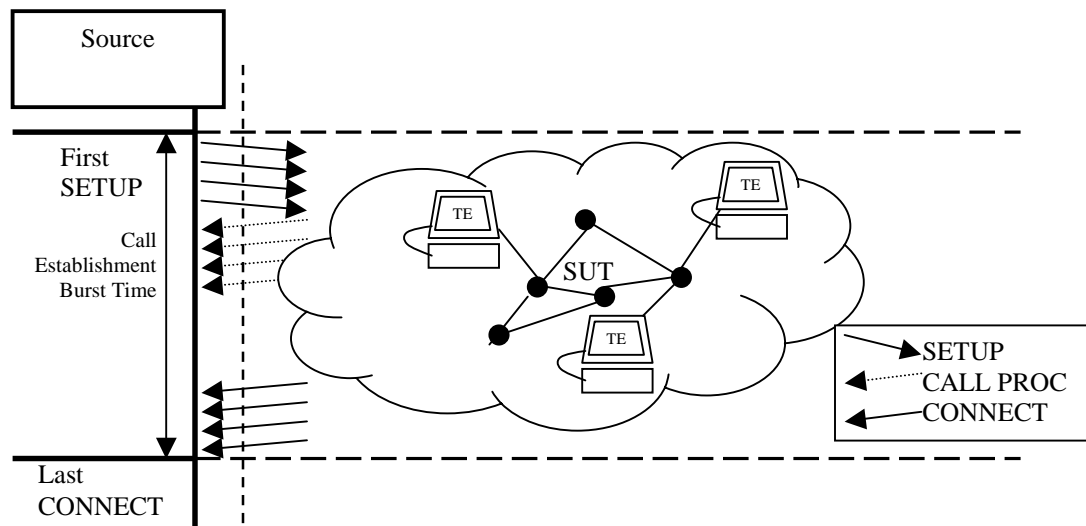
Call establishment latency is measured in units of time.

3.7 Call Establishment Burst Time

Call establishment times are used to measure how long that it takes to establish individual switched virtual connections. The call establishment burst time measurement yields the time that it takes to establish a burst of connections on an ATM interface. A tester cannot simply take the call establishment time for a single connection, and conclude that it would take twice as long for two connections with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.7.1 Definition

The time between the first SETUP message of a burst, and the last CONNECT message of a burst defines the call establishment burst time. From the perspective of the source, the metric yields the time taken to bring all calls for the burst from the initiated to the active state.



UNI **Figure 3.7** Call Establishment Burst Time

Figure 3.7 shows a burst of four calls being established. The call establishment burst time in this four call example is the time between the transmission of the first of the four SETUP messages and the last of the four CONNECT messages on the Source UNI interface shown above.

3.7.2 Units

Call establishment burst time is measured in units of time.

3.7.3 Measurement

The measurement of call establishment burst time is possible only if all of the calls being initiated in the burst proceed to the active state. If the tester (see Section 7.2) or the SUT retransmits any of the signalling messages involved in the establishment of these connections, but all of the calls do go active, the measurement is still valid.

3.8 Call Release Burst Time

Call release burst times yield the amount of time taken to release a set of calls in a burst on a user-network interface. A tester cannot simply take the call release time for a single connection, and conclude that it would take twice as long for two calls with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.8.1 Definition

The time between the first RELEASE message of a burst, and the last RELEASE COMPLETE message of a burst defines the call release burst time. From the perspective of the source, the metric yields the time taken to bring all calls in the burst from the active to the null state.

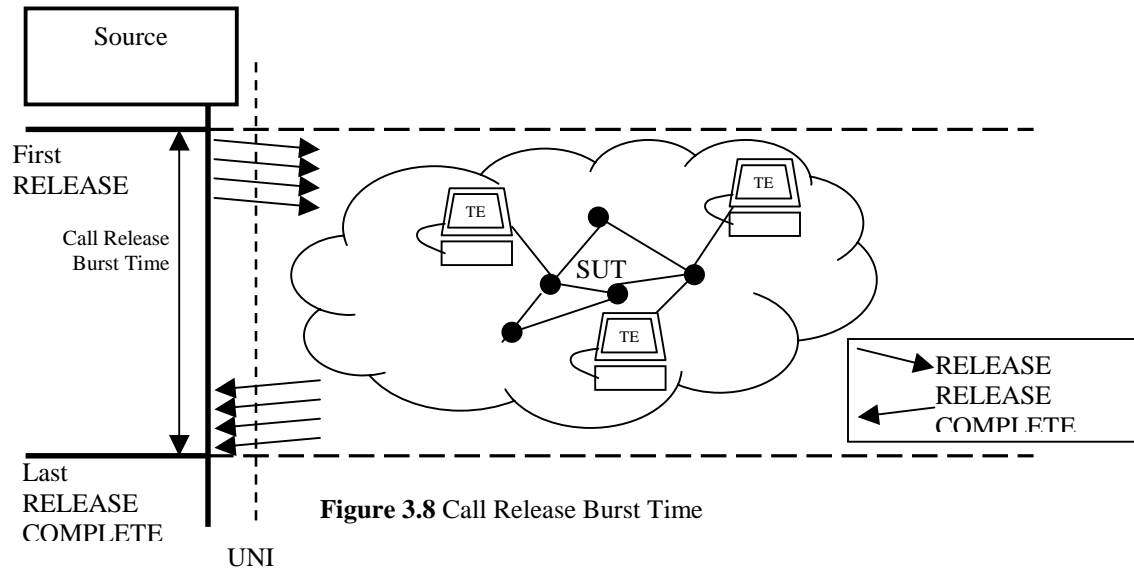


Figure 3.8 shows a four calls being terminated by a burst of RELEASE messages. The call release burst time is the time between the transmission of the first of the four RELEASE messages and the last of the four RELEASE COMPLETE messages on the UNI interface shown above

3.8.2 Units

Call release burst time is measured in units of time.

3.9 Party Establishment Burst Time

Party establishment times are used to measure how long that it takes to establish a single party to an existing switched virtual connection. The party establishment burst time measurement yields the time that it takes to establish a burst of parties to a connection on an ATM interface. A tester cannot simply take the party establishment time for a single connection, and conclude that it would take twice as long for two connections with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.9.1 Definition

The time between the first ADD PARTY message of a burst, and the last ADD PARTY ACK message of a burst defines the party establishment burst time. From the perspective of the source, the metric yields the time taken to bring all parties for the burst from the initiated to the active state. The party establishment burst time does not include the time taken to establish the root connection on any of the initiator interfaces.

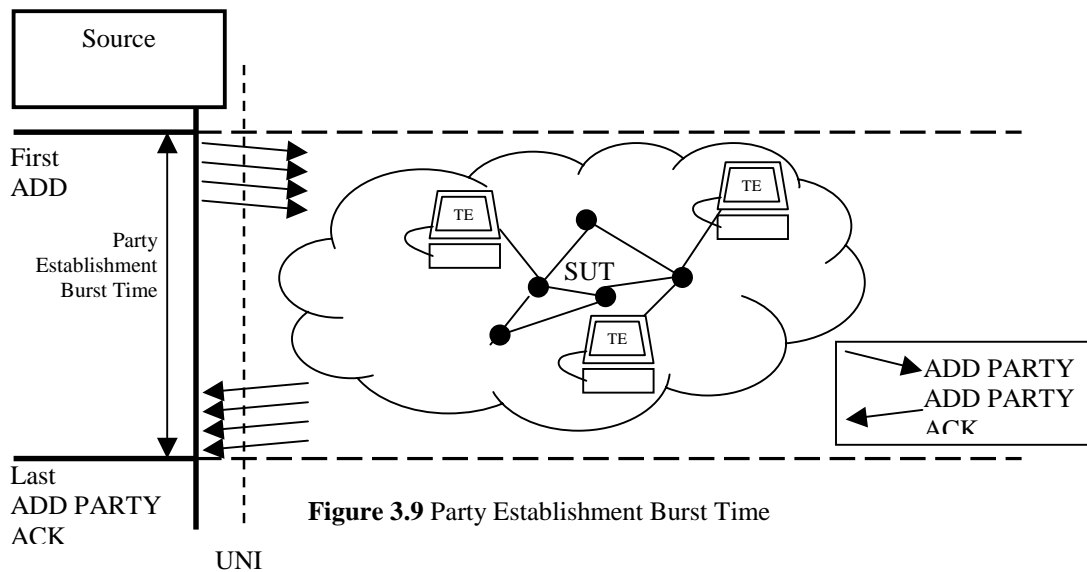


Figure 3.9 Party Establishment Burst Time

Figure 3.9 shows a burst of four parties being added to an existing connection. The call establishment burst time is the time between the transmission of the first of the four ADD PARTY messages and the last of the four ADD PARTY ACK messages on the source UNI shown above

3.9.2 Units

Call establishment burst time is measured in units of time.

3.9.3 Measurement

The measurement of party establishment burst time is possible only if all of the parties being established in the burst proceed to the active state. If the tester (see Section 7.2) or the SUT retransmits any of the signalling messages involved in the establishment of these connections, but all of the calls do go active, the measurement is still valid.

3.10 Party Release Burst Time

Party release burst times yield the amount of time taken to release a set of parties in a burst to a connection on a UNI interface. A tester cannot simply take the party release time for a single connection, and conclude that it would take twice as long for two parties with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.10.1 Definition

The time between the first DROP PARTY message of a burst, and the last DROP PARTY ACK message defines the party release burst time. The metric yields the time taken to bring each party from the active state to the null state. The party release burst time does not apply to cases where the parties are released by terminating the root connection directly.

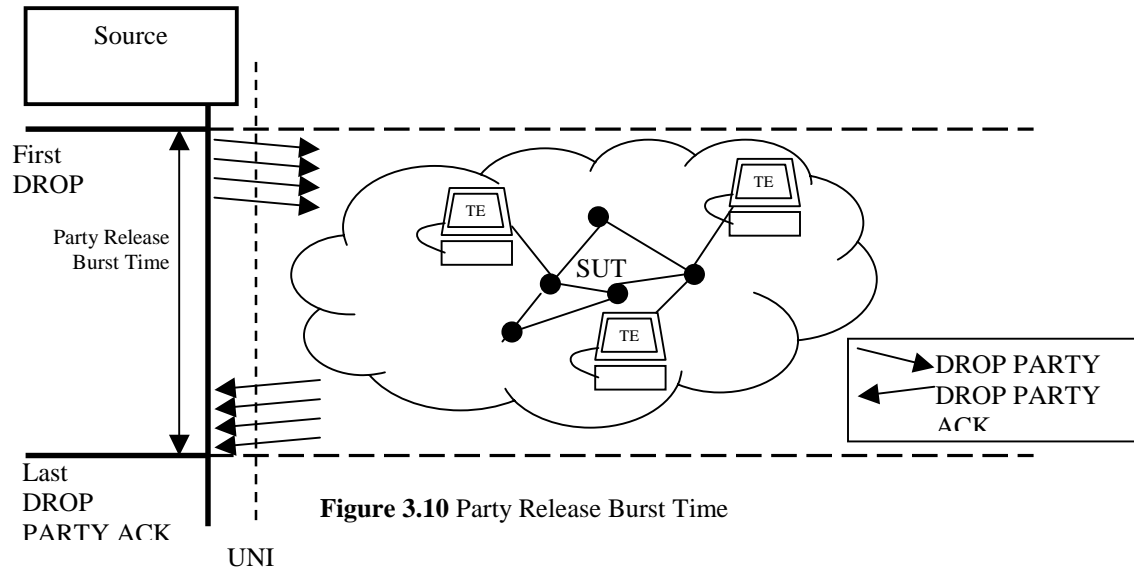


Figure 3.10 Party Release Burst Time

Figure 3.10 shows a burst of four parties being terminated. The party release burst time is the time between the transmission of the first of the four DROP PARTY messages and the last of the four DROP PARTY ACK messages on the source UNI shown above.

3.10.2 Units

Party release burst time is measured in units of time.

3.11 Call Cycle Time

The amount of time that it takes for an ATM system to establish a call and then immediately release all resources allocated to the call on a signalling interface is the call cycle time.

3.11.1 Definition

When a connection is established, and then released with a RELEASE message as soon as the CONNECT message is received, the time elapsed between the observation of the SETUP message and the observation of the corresponding RELEASE COMPLETE message on the same interface is defined to be the Call Cycle Time for that interface.

The call must go active in order to take this measurement. This metric yields the time taken to bring a call from the null state to the active state, and back to the null state. It applies on user-network interfaces, as well as network-network interfaces. The call cycle time could be measured at the call source entity, the call destination entity, and any intermediate node in between on the call path, providing that the RELEASE message is initiated on the interface that the measurement takes place. Ideally, the call duration on the source interface should be zero.

Figure 3.11 shows a call being cycled by the “Source” towards “Destination”, with the call cycle time being measured on the UNI that the call initiation took place.

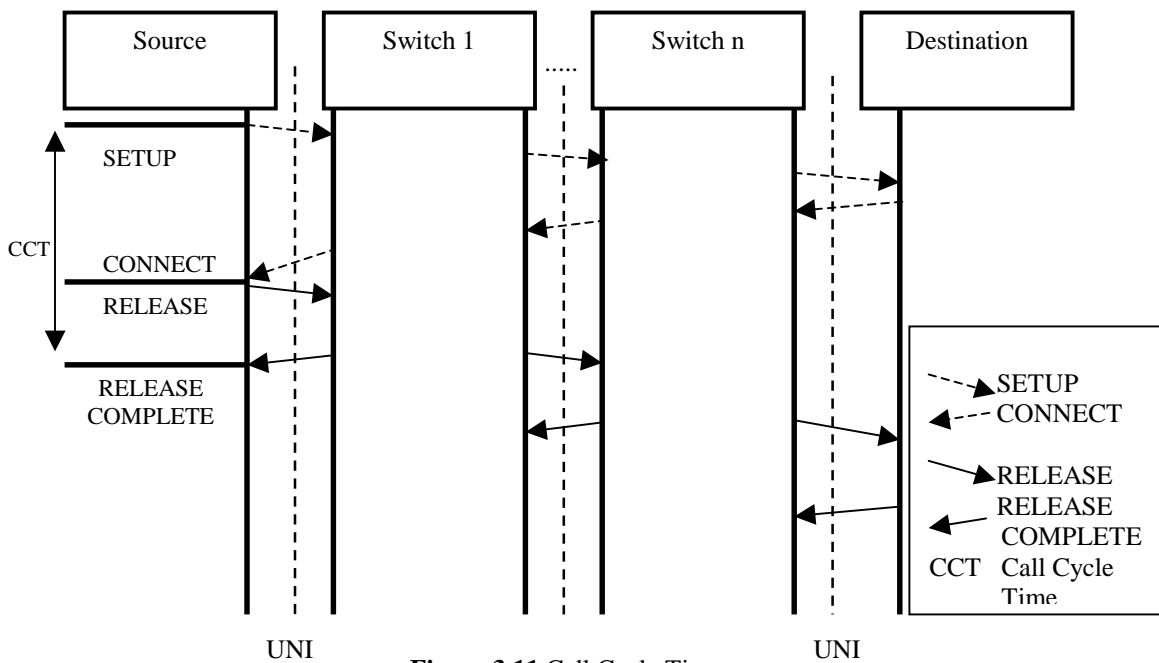


Figure 3.11 Call Cycle Time

3.11.2 Units

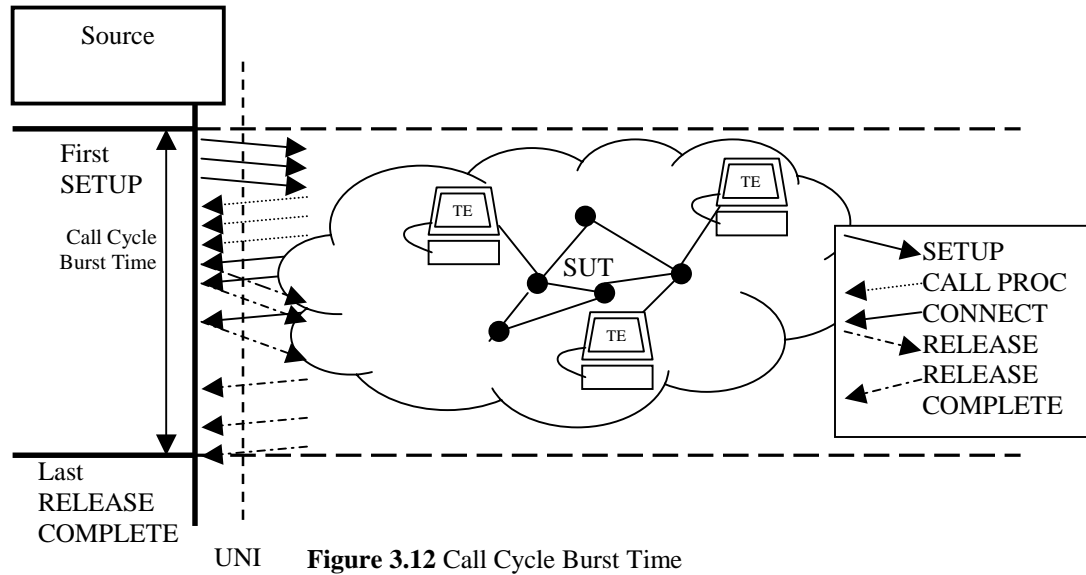
Call cycle time is reported in units of time.

3.12 Call Cycle Burst Time

Call cycle times are used to measure how long it takes to establish individual switched virtual connections and tear each one down as soon as it is established. The call cycle burst time measurement yields the time that it takes to cycle a burst of connections on an ATM interface. A tester cannot simply take the call cycle time for a single connection, and conclude that it would take twice as long for two connections with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.12.1 Definition

The time between the first SETUP message of a call cycle burst, and the last RELEASE COMPLETE message of the call cycle burst defines the call cycle burst time. From the perspective of the source, the metric yields the time taken to bring all calls for the burst from the null state to the active state, and back to the null state.



UNI **Figure 3.12** Call Cycle Burst Time

Figure 3.12 shows a burst of three calls being cycled. The call cycle burst time in this three call example is the time between the transmission of the first of the three SETUP messages and the last of the three RELEASE COMPLETE messages on the Source UNI interface shown above. Note how a RELEASE message is sent for the call immediately after receiving the CONNECT message.

3.12.2 Units

Call cycle burst time is measured in units of time.

3.12.3 Measurement

The measurement of call cycle burst time is possible only if all of the calls being initiated in the burst proceed to the active state before they are terminated. Each call must be terminated with a RELEASE message as soon as the CONNECT message arrives at the interface. If any of the signalling messages involved in the establishment of these connections are retransmitted, but all of the calls are cycled, the measurement is still valid. Ideally, the call duration on the source interface for each call should be zero.

3.13 Party Cycle Time

The amount of time that it takes for an ATM system to establish a party and then immediately release all resources allocated to the party on a signalling interface is the party cycle time.

3.13.1 Definition

When a party is established, and then released with a DROP PARTY message as soon as the ADD PARTY ACK message is received, the time elapsed between the observation of the ADD PARTY message and the observation of the corresponding DROP PARTY ACK message on the same interface is defined to be the Party Cycle Time for that interface.

The party must go active in order to take this measurement. This metric yields the time taken to bring a party from the null state to the active state, and back to the null state. It applies on user-network interfaces, as well as network-network interfaces. The party cycle time could be measured at the add party source entity, the destination entity, and any intermediate node in between on the call path, providing that the DROP PARTY message is initiated on the interface that the measurement takes place. Ideally, the party duration on the source interface should be zero. Interfaces between the destination up to, but not including the interface where the measurement is being done may see the party initiated with SETUP instead of an ADD PARTY, and released with a RELEASE instead of a DROP PARTY. This does not prevent us from measuring the party cycle time.

Figure 3.13 shows a party being cycled by the “Source” towards “Destination”, with the party cycle time being measured on the UNI that the call initiation took place.

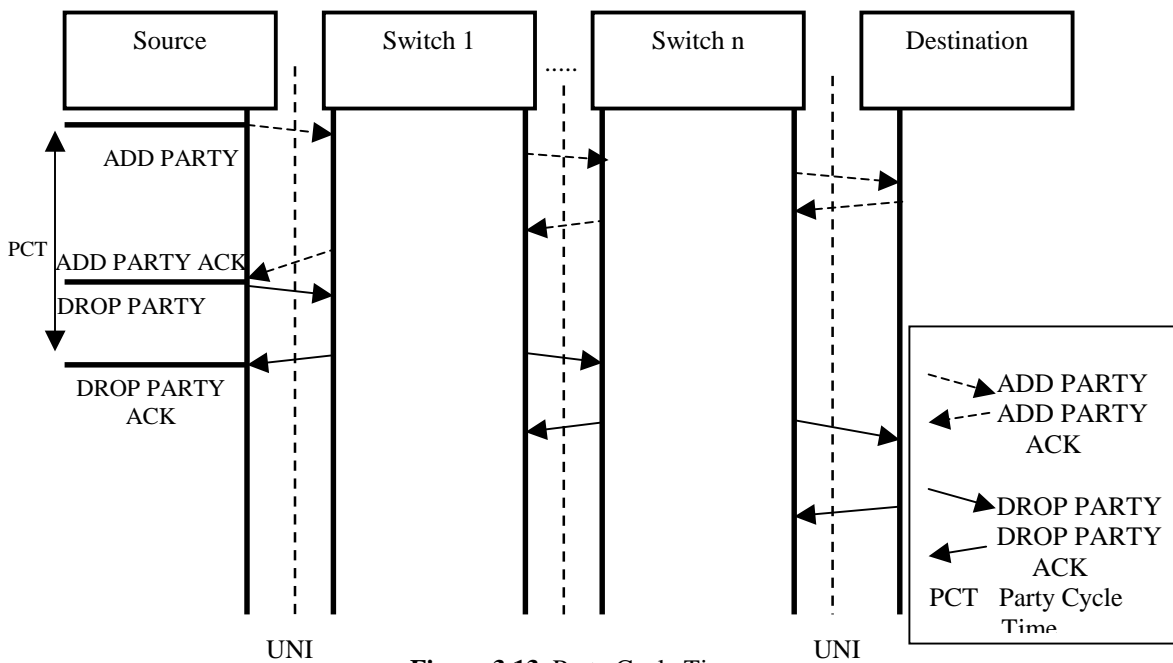


Figure 3.13 Party Cycle Time

3.13.2 Units

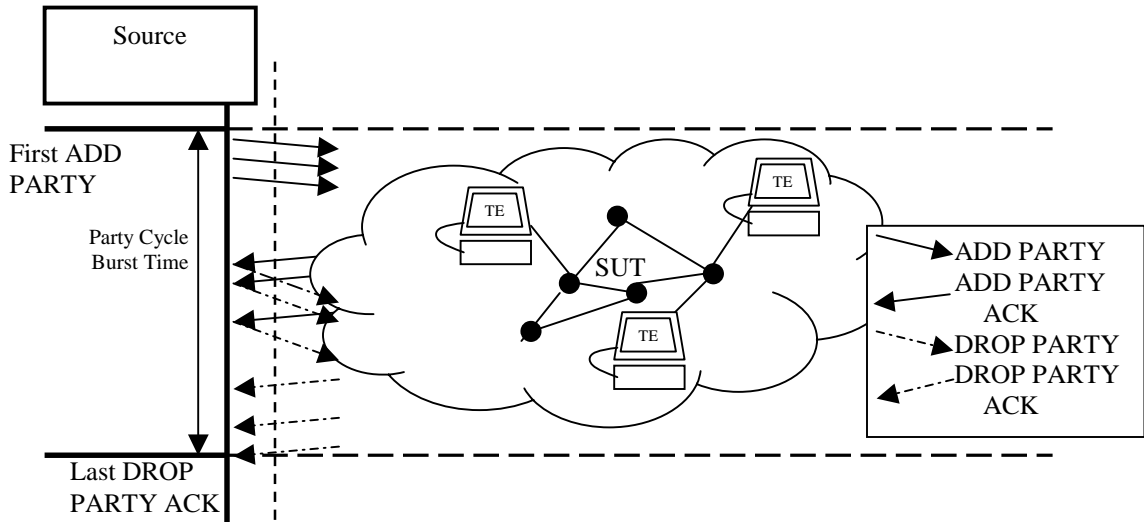
Party cycle time is reported in units of time.

3.14 Party Cycle Burst Time

Party cycle times are used to measure how long it takes to establish individual parties to switched virtual connections and tear each them down as soon as they are established. The party cycle burst time measurement yields the time that it takes to cycle a burst of parties on an ATM interface. A tester cannot simply take the party cycle time for a single party, and conclude that it would take twice as long for two parties with the same parameters. This extrapolation does not take into account the overlapping of signalling messages.

3.14.1 Definition

The time between the first ADD PARTY message of a party cycle burst, and the last DROP PARTY ACK message of the party cycle burst defines the party cycle burst time. From the perspective of the source, the metric yields the time taken to bring all parties for the burst from the null state to the active state, and back to the null state.



UNI **Figure 3.14** Party Cycle Burst Time

Figure 3.14 shows a burst of three parties being cycled. The party cycle burst time in this three party example is the time between the transmission of the first of the three ADD PARTY messages and the last of the three DROP PARTY ACK messages on the Source UNI interface shown above. Note how a DROP PARTY message is sent for the call immediately after receiving the ADD PARTY ACK message.

3.14.2 Units

Party cycle burst time is measured in units of time.

3.14.3 Measurement

The measurement of party cycle burst time is possible only if all of the parties being initiated in the burst proceed to the active state before they are terminated. Each party must be terminated with a DROP PARTY message as soon as the ADD PARTY ACK message arrives at the interface. If any of the signalling messages involved in the establishment of these parties are retransmitted, but all of the parties are cycled, the measurement is still valid. Ideally, the party duration on the source interface for each call should be zero.

3.15 Party Establishment Latency

The total time taken *by the network* to establish a party from source to destination is the party establishment latency. For short duration parties, party establishment latency is an important part of the user perceived performance.

3.15.1 Definition

The sum of the ADD PARTY message latency and the ADD PARTY ACK message latency is defined as the party establishment latency. This is the time that it takes for the party to be established from the initiator's perspective, with the end destination's party establishment time removed. The time lost at the

destination while the destination was deciding whether to accept the party or call is not under network (SUT) control and is, therefore, not included in party establishment latency (see Figure 3.15).

Thus, the sum of the latency experienced by the ADD PARTY message and the resulting ADD PARTY ACK message is the Party Establishment latency.

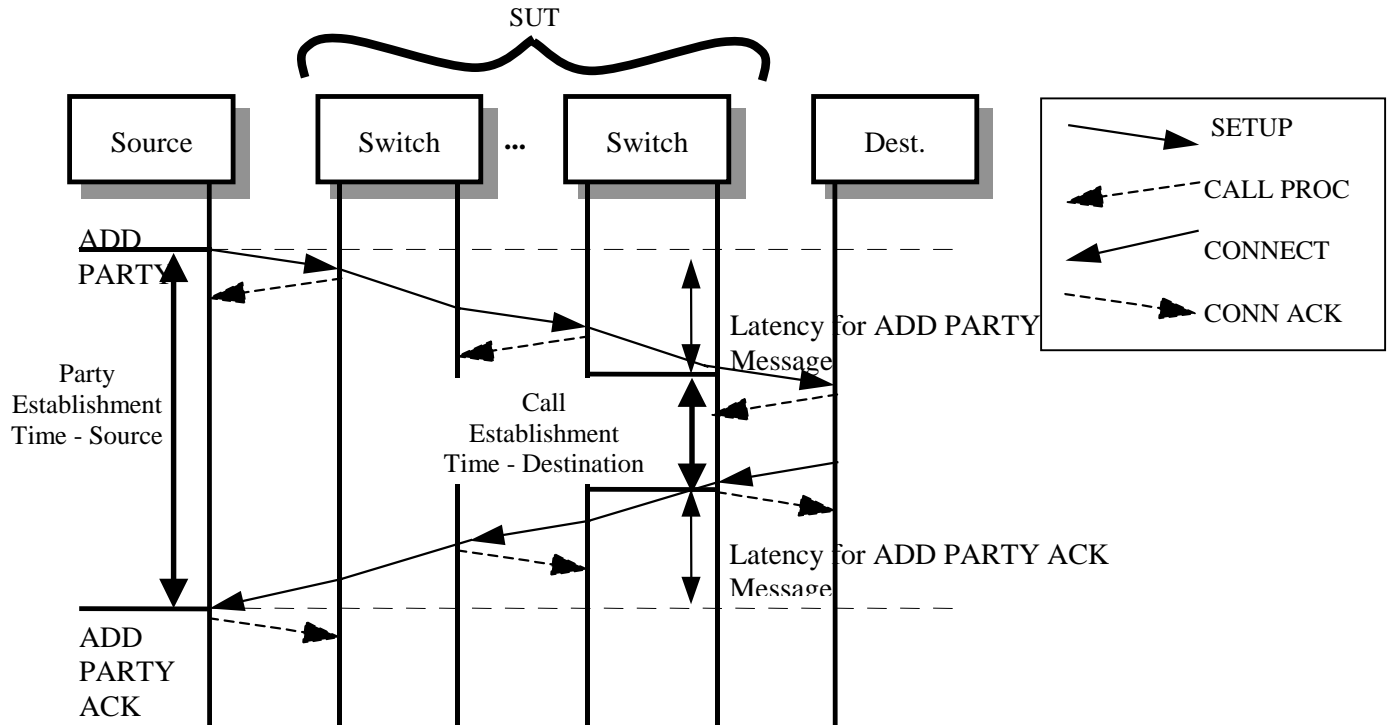


Figure 3.15: Party Establishment Latency

Party Establishment Latency =

ADD PARTY message latency + ADD PARTY ACK message latency for the corresponding
ADD PARTY ACK

Note: The Party Establishment Latency does not include the time taken by the destination entity to respond to the ADD PARTY message with a ADD PARTY ACK message, which is where it differs from the Party Establishment Time.

3.15.2 Units

Party establishment latency is measured in units of time.

3.16 Average Signalling Message Rate

The rate at which signalling messages are transmitted or observed on an interface is of great importance to the measurement of a system's performance. The signalling message rate is observed in one direction on a particular signalling interface for a single signalling message type, and it is based on the average time between individual message frames. Message rates can be reported for any signalling message type, such as SETUP and CONNECT messages. It is important to note the difference between the offered and accepted rates for SETUP messages, described in section 2.

3.16.1 Definition

The average signalling message rate over n messages is calculated with the following equation.

Average Signalling Message Rate = $(n - 1) / ((\text{Time of Message } n-1) - (\text{Time of Message } 0))$

3.16.2 Units

The signalling message rate measurement is reported in messages per second.

4 Test Architecture

4.1 Applicable Systems Under Test

Although there are many different ways in which ATM signalling entities can be interconnected, they can generally be categorized into three architectures listed below. Although other test configurations may be valid, they are not used in this test suite. Each of these test architectures applies to each signalling performance test case unless otherwise specified.

4.1.1 Network Nodes

If the SUT consists purely of network switching elements, the tester must emulate one or more terminal entities that will be the end points of the switched virtual connections.

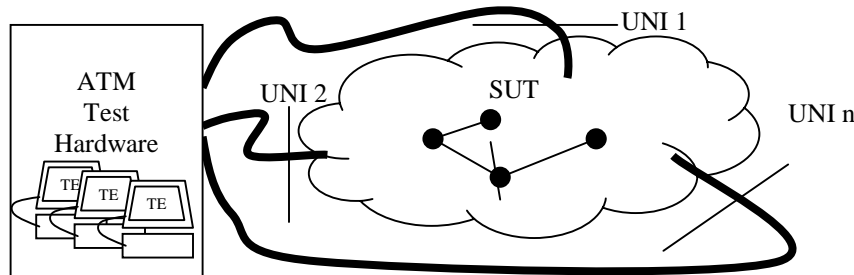


Figure 4.1

4.1.2 Network Nodes and Terminal Mix

If the SUT consists of network nodes and terminal equipment, the tester will emulate one or more terminal entities that will make calls to the SUT's terminal entities. The tester may also make calls to itself through the network. This configuration will measure the combined performance of both the network nodes and terminal equipment.

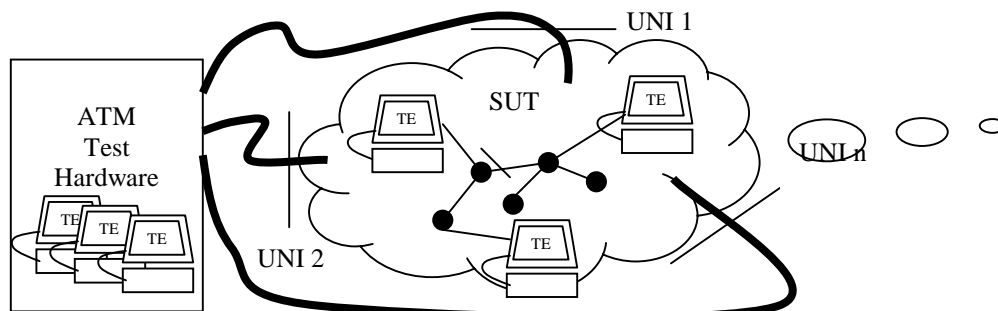


Figure 4.2

4.1.3 Terminal Signalling Performance Testing

The SUT can consist of one piece of terminal equipment, with no network nodes. This forces the tester to emulate the behavior of the network side of the interface. Since network nodes cannot serve as originate calls to terminal equipment, connections must be initiated by a simulated user on the ATM test equipment.

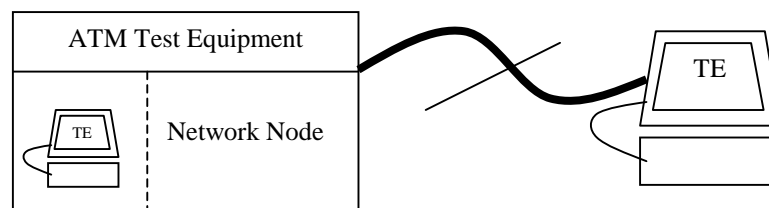


Figure 4.3

5 Global Parameters

This section defines the parameters that apply to all test cases within this test suite. The Global parameters also define the parameters needed by the tester for the configuration of the signalling emulation. Before the start of a test case, a RESTART will be sent to ensure that the SUT is in an initialized condition.

IXIT Proforma

5.1 IDENTIFICATION SUMMARY

This section is completed by the test laboratory.

IXIT Number: Reference number

Test Laboratory Name: Name

Date of Issue: Date

Issued to: Name of client

The test laboratory may include client or contract references in the identification summary.

5.2 ABSTRACT TEST SUITE SUMMARY

This section is completed by the Test Laboratory.

Protocol specification: One of Q.2931, UNI3.0, UNI3.1

Information object specification(s): Information object(s) to be tested, if any

ATS specification: ATS reference

Abstract Test Method(s): Abstract Test Method(s) used in the ATS

5.3 TEST LABORATORY

This section is completed by the Test Laboratory.

Test Laboratory Identification: Name and addressing details

Accreditation status of the test service: Accreditation status

Accreditation reference: Accreditation reference

Test Laboratory Manager: Name

Test Laboratory contact: Name

Means of Testing: Identification of MOT, including version number

Instructions for Completion:

The test laboratory should include any special instructions necessary for the completion and return of the proforma by the client.

5.4 CLIENT

This section is completed by the client and contains information to the identify the client. Typically, this should include:

Client Identification: Name and addressing details

Client Test Manager: Name

Client contact: Name

Test Facilities Required:

The client should record the particular facilities required for testing, if a range of facilities is provided by the test laboratory.

5.5 SUT

This section is completed by the client.

Name: *System name*
 Version: *System version*
 SCS Reference: *Reference*
 Machine Configuration: *Machine on which the SUT is mounted*
 Operating System Identification: *Operating system on which IUT is mounted*
 Upper Tester Identification: *Identification, if any*
 Upper Tester Validation Date: *Date, if appropriate*
 IUT Identification: *Implementation name*
 ICS(s) *Reference(s) to ICS(s) for the IUT*

Limitations of the SUT:

The client may provide information explaining if any of the abstract test cases cannot be executed, e.g., non-realization of ASPs if the Remote test method is used.

Environmental Conditions:

The test laboratory may specify the normal environmental conditions applying to the laboratory to be used for testing (e.g., temperature, humidity). The client should specify any tighter environmental conditions that may be necessary for the correct operation of the SUT.

5.6 ANCILLARY PROTOCOLS

This section is completed by the client in conjunction with the test laboratory.

In the following table, the client identifies relevant information concerning each ancillary protocol of the SUT:

Protocol Name	Version No.	PICS Ref. (opt.)	PIXIT Ref. (opt.)	PCTR Ref. (opt.)

*One clause is required for each ancillary protocol included in the SUT other than the IUT itself. The information required is dependent on the MOT and the SUT, and covers all the addressing, parameter values, timer values and facilities (relevant to ITU-T Recommendations) as defined by the PICS for each protocol. **Examples include ILMI, LANE, and PNNI.***

5.7 PROTOCOL INFORMATION (for ATM UNI Signalling)

This section is completed by the test laboratory and client in consultation. This section applies only to Protocol IXIT proformas.

5.7.1 PROTOCOL IDENTIFICATION

Specification reference: *Reference including edition*
 Protocol version: *Protocol version number*
 PICS reference: *Reference*

5.7.2 IUT INFORMATION

This subsection should include such items as addresses, parameter values and timer values required to test the IUT. It should be a refinement of the information provided in the PICS for the relevant protocol, but not conflict with it. Furthermore, it should include test suite parameters where they are identified in the test specification.

5.7.3 Addresses

This section allows the user to define a list of source and destination address pairs. The order in which addresses appear in this table is important.

5.7.4 Parameter Values**Source and Destination Addresses**

Address Pair number	Source ATM Endsystem Address	Type of Source Address	Destination ATM Endsystem Address	Type of Destination Address

The client provides the address pairs to be used in the tests.

Setup Message Contents

The client provides a description of the contents of the SETUP messages that are to be sent.

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Setup Message Contents			
AAL Type IE			
AAL Parameters Present	Boolean	Yes or No	
AAL Type	Enumeration	AAL 1, AAL ³ / ₄ , AAL 5, User Defined	
Subtype Present	Boolean	Yes or No	
Subtype Value	Integer	0-255	
CBR Rate Present	Boolean	Yes or No	
CBR Rate Value	Integer	0-255	
Multiplier Present	Boolean	Yes or No	
Multiplier Value	Integer	2 to 2 ¹⁶ -1	
Source Clock Frequency Recovery Method Present	Boolean	Yes or No	

Source Clock Frequency Recovery Method Value	Integer	0-255	
Error Correction Method Present	Boolean	Yes or No	
Error Correction Method Value	Integer	0-255	
Structured Data Transfer Blocksize Present	Boolean	Yes or No	
Structured Data Transfer Blocksize Value	Integer	1 to $2^{16}-1$	
Partially Filled Cells Present	Boolean	Yes or No	
Partially Filled Cells Method Value	Integer	1-47	
Forward Maximum CPCS-SDU Size Present	Boolean	Yes or No	
Forward Maximum CPCS-SDU Size Value	Integer	0 to $2^{16}-1$	
Backward Maximum CPCS-SDU Size Present	Boolean	Yes or No	
Backward Maximum CPCS-SDU Size Value	Integer	0 to $2^{16}-1$	
MID Range Present	Boolean	Yes or No	
Lowest MID Range Value	Integer	0 to 1023	
Highest MID Range Value	Integer	0 to 1023	
SSCS Type Present	Boolean	Yes or No	
SSCS Type Value	Integer	0 to 255	
User Defined AAL Information	Integer	0 to $2^{32}-1$	
ATM Traffic Descriptor IE (ATM User Cell Rate for UNI 3.0)			
ATM Traffic Descriptor Present	Boolean	Yes or No	
Coding Standard	Integer	0 or 3	
Fwd Peak to Peak Cell Rate (CLP 0) Present	Boolean	Yes or No	
Fwd Peak to Peak Cell Rate (CLP 0) Value	Integer	0 to $2^{24}-1$	
Bwd Peak to Peak Cell Rate (CLP 0) Present	Boolean	Yes or No	

Bwd Peak to Peak Cell Rate (CLP 0) Value	Integer	0 to $2^{24}-1$	
Fwd Peak to Peak Cell Rate (CLP 0+1) Present	Boolean	Yes or No	
Fwd Peak to Peak Cell (CLP 0+1) Rate Value	Integer	0 to $2^{24}-1$	
Bwd Peak to Peak Cell Rate (CLP 0+1) Present	Boolean	Yes or No	
Bwd Peak to Peak Cell Rate (CLP 0+1) Value	Integer	0 to $2^{24}-1$	
Fwd Sustainable Cell Rate (CLP 0) Present	Boolean	Yes or No	
Fwd Sustainable Cell Rate (CLP 0) Value	Integer	0 to $2^{24}-1$	
Bwd Sustainable Cell Rate (CLP 0) Present	Boolean	Yes or No	
Bwd Sustainable Cell Rate (CLP 0) Value	Integer	0 to $2^{24}-1$	
Fwd Sustainable Cell Rate (CLP 0+1) Present	Boolean	Yes or No	
Fwd Sustainable Cell Rate (CLP 0+1) Value	Integer	0 to $2^{24}-1$	
Bwd Sustainable Cell Rate (CLP 0+1) Present	Boolean	Yes or No	
Bwd Sustainable Cell Rate (CLP 0+1) Value	Integer	0 to $2^{24}-1$	
Fwd Max Burst Size (CLP 0) Present	Boolean	Yes or No	
Fwd Max Burst Size (CLP 0) Value	Integer	0 to $2^{24}-1$	
Bwd Max Burst Size (CLP 0) Present	Boolean	Yes or No	
Bwd Max Burst Size (CLP 0) Value	Integer	0 to $2^{24}-1$	
Fwd Max Burst Size (CLP 0+1) Present	Boolean	Yes or No	

Fwd Max Burst Size (CLP 0+1) Value	Integer	0 to $2^{24}-1$	
Bwd Max Burst Size (CLP 0+1) Present	Boolean	Yes or No	
Bwd Max Burst Size (CLP 0+1) Value	Integer	0 to $2^{24}-1$	
Best Effort Indicator Present	Boolean	Yes or No	
Traffic Management Options Present	Boolean	Yes or No	
Tagging Forward	Boolean	Yes or No	
Tagging Backward	Boolean	Yes or No	
Broadband Bearer Capability IE			
Broadband Bearer Capability Present	Boolean	Yes or No	
Bearer Class	Enumeration	A, C, or X	
Timing Requirements Present	Boolean	Yes or No	
Timing Requirements Value	Integer	0 to 3	
Susceptible to clipping	Boolean	Yes or No	
User Plane Configuration	Enumeration	Point to Point or Point to Multipoint	
Broadband High Layer IE			
Broadband High Layer Present	Boolean	Yes or No	
Broadband High Layer Value	Octet String	Length 6 to 13 octets	
Broadband Low Layer IE			
Broadband Low Layer Present	Boolean	Yes or No	
User Information Layer 1 Present	Boolean	Yes or No	
User Information Layer 1	Integer	0 to 31	
User Information Layer 2 Present	Boolean	Yes or No	
User Information Layer 2	Integer	0 to 31	
Octet 6a/b Present	Boolean	Yes or No	
Mode of Operation 6a	Enumeration	Normal, Extended	
Q.933 use	Integer	0 to 3	
Window Size (k)	Integer	1 to 127	
User Specified layer 2 protocol information	Integer	0 to 127	

User specified layer 3 protocol information Present	Boolean	Yes or No	
Mode of Operation 7a	Enumeration	Normal, Extended	
Packet Window Size Present	Boolean	Yes or No	
Packet Window Size	Integer	1 to 127	
User Specified Layer 3 protocol Information	Integer	1 to 127	
ISO/IEC TR 9577 IPI	Integer	0 to 255	
OUI	Integer	0 to $2^{24}-1$	
PID	Integer	0 to $2^{16}-1$	
Broadband Repeat Indicator IE			
Broadband Repeat Indicator Present	Boolean	Yes or No	
Calling Party SubAddress IE			
Calling Party SubAddress Present	Boolean	Yes or No	
Calling Party SubAddress Type	Enumeration	NSAP, ATM End System	
Calling Party SubAddress Value	Octet String		
Called Party SubAddress IE			
Called Party SubAddress Present	Boolean	Yes or No	
Called Party SubAddress Type	Enumeration	NSAP, ATM End System	
Called Party SubAddress Value	Octet String		
Quality of Service IE			
QoS Present	Boolean	Yes or No	
QoS Forward	Enumeration	Class 0, 1, 2, 3, 4	
QoS Backward	Enumeration	Class 0, 1, 2, 3, 4	
Broadband Sending Complete			
Broadband Sending Complete Present	Boolean	Yes or No	
Transit Network Selection			
TNS Present	Boolean	Yes or No	
Type Present	Boolean	Yes or No	
Network ID	IA5 String		
Calling Party Number			
Calling Party Address Present	Boolean	Yes or No	

5.7.5 Procedural Information

In this subsection, identify requirements for testing, placed by the ATS specification, which may not be realizable by the SUT and which may result in abstract test cases which cannot be executed. For example, latency test cases cannot be executed on the architecture described in 4.1.3.

6 Test Suite Groups

The Test Suite is organized into the following Groups:

- Burst Throughput Test Group.
- Simultaneous Active Call Capacity Test Group.
- Latency Test Group.
- Sustained Throughput Test Group.

6.1 Sustained Throughput Test Group

Overview

Sustained Throughput Test Cases measure the long term call performance of the SUT. Measurements are based on a variety of call loading stimuli applied to the SUT over an extended period; measurements include:

- Offered SETUP Rate
- Accepted SETUP Rate
- Average CONNECT Rate
- Average RELEASE Rate
- Average RELEASE COMPLETE Rate
- Offered ADD PARTY Rate
- Accepted ADD PARTY Rate
- Average ADD PARTY ACK Rate
- Average DROP PARTY Rate
- Average DROP PARTY ACK Rate

These measurements can be made for Point-to-point, Point-to-multipoint and Add Party Calls through the SUT.

Test Case 1

- **Test Case Identification:** USP_Su_Ppt_Set_1.
- **Test Case Purpose:**
To characterize the performance of an SUT over an extended period of time when a constant rate of Point-to-point SETUP messages are applied to the SUT.
- **Test Case Procedure:**
The Tester generates a constant point-to-point rate of Setup Messages to the SUT as defined by the *Setup Rate* and halts after the *Test Case Duration*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The initiator sends a RELEASE message for each call after the call has been active for a time defined by the *Call Duration*. The Tester measures the average rate at which specific messages are seen on the interface between the Tester and the SUT.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Call Duration	Seconds	equal to or greater than 1	

- **Test Case Results:**
Primary
Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTs/sec)
Average Release Rate (RELS/sec)
Average Release Complete Rate (REL COMPs/sec)

Secondary

Test Case Duration
Number of Initiated Point-to-point Calls
Number of Active Point-to-point Calls
Number of Rejected Point-to-point Calls
Number of Terminated Point-to-point Calls

Test Case 2

- **Test Case Identification:** USP_Su_Pmt_Set_1.
- **Test Case Purpose:**
To characterize the performance of an SUT over an extended period of time when a constant rate of Point-to-multipoint SETUP messages are applied to the SUT.
- **Test Case Procedure:**
The tester generates a constant rate of point-to-multipoint Setup Messages to the SUT as defined by the *Setup Rate* and halts after the *Test Case Duration*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The initiator sends a RELEASE message for each call after the call has been active for a time defined by the *Call Duration*. The Tester measures the average rate at which specific messages are seen on the interface between the Tester and the SUT.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Call Duration	Seconds	equal to or greater than 1	

- **Test Case Results:**
Primary
Offered Setup Rate (SETUPs/sec)
Accepted Average Setup Rate (SETUPs/sec)
Average Connect Rate (CONNECTs/sec)
Average Release Rate (RELS/sec)
Average Release Complete Rate (REL COMPs/sec)

Secondary

Test Case Duration
Number of Initiated Point-to-multipoint Calls
Number of Active Point-to-multipoint Calls
Number of Rejected Point-to-multipoint Calls
Number of Terminated Point-to-multipoint Calls

Test Case 3

- **Test Case Identification:** USP_Su_Ppt_Set_2.
- **Test Case Purpose:**
To characterize the performance of an SUT over an extended period of time when a variable rate of Point-to-point SETUP messages are applied to the SUT.
- **Test Case Procedure:**
The tester generates a variable point-to-point Setup Message Rate to the SUT and halts after the time defined by the *Test Case Duration*. The test begins with a burst size defined by the *Initial Setup Rate*. Each burst is repeated for *Duration of Setup Rate* seconds, and then it is changed by *Setup Rate Step* until the *Final Setup Rate* is reached. Each call is released by the initiator after the call has been active for a time defined by the *Call Duration*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The Tester measures the average rate at which specific messages are seen on the interface between the Tester and the SUT.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Initial Setup Rate	Setups/Second	equal to or greater than 1	
Setup Rate Step	Integer	equal to or greater than 0	
Duration of Setup Rate	Seconds	equal to or greater than 1	
Final Setup Rate	Integer	equal to or greater than 1	
Call Duration	Seconds	equal to or greater than 1	

- **Test Case Results:**
Primary
Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTs/sec)
Average Release Rate (RELS/sec)
Average Release Complete Rate (REL COMPs/sec)

Secondary

Test Case Duration
 Number of Initiated Point-to-point Calls
 Number of Active Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls

Test Case 4

- **Test Case Identification:** USP_Su_Pmt_Set_2
- **Test Case Purpose:**
To characterize the operation of an SUT over an extended period of time when a variable rate of Point-to-multipoint SETUP messages are applied to the SUT.

- **Test Case Procedure:**
The Tester generates a variable point-to-multipoint Setup Message Rate to the SUT and halts after the time defined by the *Test Case Duration*. The test begins with a burst size defined by the *Initial Setup Rate*. Each burst is repeated for *Duration of Setup Rate* seconds, and then it is changed by *Setup Rate Step* until the *Final Setup Rate* is reached. Each call is released by the initiator after the call has been active for a time defined by the *Call Duration*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The Tester measures the average rate at which specific messages are seen on the interface between the Tester and the SUT.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Initial Setup Rate	Setups/Second	equal to or greater than 1	
Setup Rate Step	Integer	equal to or greater than 0	
Duration of Setup Rate	Seconds	equal to or greater than 1	
Final Setup Rate	Integer	equal to or greater than 1	
Call Duration	Seconds	equal to or greater than 1	

- **Test Case Results:**
Primary
Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTs/sec)
Average Release Rate (RELS/sec)
Average Release Complete Rate (REL COMPs/sec)

Secondary

Test Case Duration
Number of Initiated Calls
Number of Active Calls
Number of Rejected Calls
Number of Terminated Calls

Test Case 5

- **Test Case Identification:** USP_Su_Pmt_Apty.
- **Test Case Purpose:**
To characterize the operation of an SUT over an extended period of time when a variable rate of ADD PARTY messages are applied to the SUT.

- **Test Case Procedure:**

Preamble:

The tester establishes a point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test Case Body:

The tester adds parties to the active point-to-multipoint call with a constant rate of ADD PARTY messages, defined by the *Add Party Rate*. The Tester halts after the time defined by the *Test Case Duration*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. Each party is released by the initiator after it has been active for a time defined by the *Party Duration*. The Tester measures average rates at which specific messages are seen on the interface between the Tester and the SUT.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Party Duration	Seconds	equal to or greater than 1	

- **Test Case Results:**

Primary

Offered Add Party Rate (ADD PARTIES/sec).

Accepted Average Add Party Rate (ADD PARTIES/sec).

Average Add Party Ack Rate (ADD PARTY ACKs/sec).

Average Drop Party Rate (DROP PARTIES/sec)

Average Drop Party Ack Rate (DROP PARTY ACKs/sec).

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Active Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Number of Initiated Parties

Number of Active Parties

Number of Rejected Parties

Number of Terminated Parties

6.2 Simultaneous Active Call Capacity Test Group

Overview

Simultaneous Active Call Capacity Test Cases measure the maximum number of simultaneous active connections supported by the SUT; measurements include:

- maximum number of simultaneous point-to-point calls
- maximum number of simultaneous point-to-multipoint calls
- maximum number of simultaneous add parties for one point-to-multipoint call
- maximum number of simultaneous point-to-multipoint calls with n amount of Add Parties per call

These measurements can be made for point-to-point and point-to-multipoint calls through the SUT.

Test Case 6

- **Test Case Identification:** USP_Sac_Ppt_CEst.
- **Test Case Purpose:**
To measure the maximum number of simultaneous active Point-to-point calls supported by the SUT.
- **Test Case Procedure:**
The tester generates point-to-point SETUP messages defined by the *Setup Rate* to the SUT at a constant rate until the *Number of Rejects* by the SUT with a *Specific Cause Value* is reached.¹ Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Specific Cause	Integer	0-127	
Number of Rejects	Integer	equal to or greater than 1	

- **Test Case Results:**

Primary
Number of Active Point-to-point Calls

Secondary

Test Case Duration
 Number of Initiated Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls
 Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTS/sec)
 Number of occurrences of each Cause Value for all Rejected and Terminated Calls

¹ The call connection request could be rejected by the SUT for a variety of reasons, such as insufficient bandwidth or other unavailable resources. Because of this, there is no Cause Value that will indicate that the SUT has reached its maximum number of simultaneous active point-to-point connections. At the same time, it is possible that some calls could be rejected although the absolute maximum number of calls has not been reached (*i.e.*, No user responding, Recovery on Timer Expiry, *etc.*).

Test Case 7

- **Test Case Identification:** USP_Sac_Pmt_CEst_1.
- **Test Case Purpose:**
To measure the maximum number of simultaneous active Point-to-multipoint calls supported by the SUT.
- **Test Case Procedure:**
The tester generates point-to-multipoint SETUP messages to the SUT at a constant rate defined by the *Setup Rate* until the *Number of Rejects* by the SUT with a *Specific Cause Value* is reached.¹ Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Specific Cause	Integer	0-127	
Number of Rejects	Integer	equal to or greater than 1	

- **Test Case Results:**

Primary

Number of Active Point-to-multipoint Calls

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Offered Setup Rate (SETUPS/sec)

Accepted Average Setup Rate (SETUPS/sec)

Average Connect Rate (CONNECTS/sec)

Number of occurrences of each Cause Value for all Rejected and Terminated Calls

¹ The call connection request could be rejected by the SUT for a variety of reasons, such as insufficient bandwidth or other unavailable resources. Because of this, there is no one Cause Value that will indicate that the SUT has reached its maximum number of simultaneous active point-to-multipoint connections. At the same time, it is possible that some calls could be rejected although the absolute maximum number of calls has not been reached (*i.e.*, No user responding, Recovery on Timer Expiry, *etc.*).

Test Case 8

- **Test Case Identification:** USP_Sac_Pmt_PEst.
- **Test Case Purpose:** To measure the maximum number of simultaneous active parties to a single point-to-multipoint call that are supported by the SUT.
- **Test Case Procedure:**

Preamble:

The tester establishes a point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test Case Body:

The tester adds parties to the active root connection at a constant rate defined by the *Add Party Rate* until a specified *Number of Rejects* are received from the SUT with a *Specific Cause Value*.¹ Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Specific Cause	Integer	0-127	
Number of Rejects	Integer	equal to or greater than 1	

- **Test Case Results:**

Primary

Number of Active Parties

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Active Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Number of Initiated Parties

¹ The connection request could be rejected by the SUT for a variety of reasons, such as insufficient bandwidth or other unavailable resources. Because of this, there is no one Cause Value that will indicate that the SUT has reached its maximum number of simultaneous active parties to a single point-to-multipoint connection. At the same time, it is possible that some add parties could be rejected although the absolute maximum number of active parties has not been reached (*i.e.*, No user responding, Recovery on Timer Expiry, *etc.*).

Number of Rejected Parties
Number of Terminated Parties
Offered Add Party Rate (ADD PARTIES/sec)
Accepted Average Add Party Rate (ADD PARTIES/sec)
Average Add Party Ack Rate (ADD PARTY ACKs/sec)
Number of occurrences of each Cause Value for all Rejected and Terminated Calls

Test Case 9

- **Test Case Identification:** USP_Sac_Pmt_CEst_2.
- **Test Case Purpose:** To measure the maximum number of point-to-multipoint calls supported by the SUT that each have a user specified number of parties.
- **Test Case Procedure:**
The tester establishes a point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section, and then add parties to it at a constant rate defined by the **Add Party Rate**. Repeat this process until a specified **Number of Rejects** are received from the SUT with a **Specific Cause Value**.¹ Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The test case will not run beyond the time defined by the **Maximum Test Case Duration**.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	
Specific Cause	Integer	0-127	
Add Parties/Point to Multipoint call	Integer	equal to or greater than 0	
Number of Rejects	Integer	equal to or greater than 1	

- **Test Case Results:**
Primary
Number of Active Parties
Number of Active Point-to-multipoint Calls

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Number of Initiated Parties
 Number of Rejected Parties
 Number of Terminated Parties
 Offered Add Party Rate (ADD PARTIES/sec)
 Accepted Average Add Party Rate (ADD PARTIES/sec)
 Average Add Party Ack Rate (ADD PARTY ACKs/sec)
 Number of occurrences of each Cause Value for all Rejected and Terminated Calls

¹ The call connection request could be rejected by the SUT for a variety of reasons, such as insufficient bandwidth or other unavailable resources. Because of this, there is no one Cause Value that will indicate that the SUT has reached its maximum number of simultaneous active connections. At the same time, it is possible that some calls could be rejected although the absolute maximum number of calls has not been reached (*i.e.*, No user responding, Recovery on Timer Expiry, *etc.*).

6.3 Latency Test Group

Overview

Latency Test Cases measure the ‘message processing’ latency through the SUT based on a variety of call loading profiles applied to the SUT; measurements include:

- SETUP message Latency
- CONNECT message Latency
- Call Establishment Latency (SETUP Latency + CONNECT Latency)
- RELEASE message Latency
- ADD PARTY ACK message Latency
- ADD PARTY Call Establishment Latency (ADD PARTY Latency + ADD PARTY ACK Latency)
- DROP PARTY message Latency (DROP PARTY to DROP PARTY & DROP PARTY to RELEASE)

These measurements can be made for point-to-point, point-to-multipoint and Add Party Calls through the SUT. The latency test cases defined in this section cannot be used on SUTs that follow test architecture 4.1.3 “Terminal Signalling Performance Testing”.

Test Case 10

- **Test Case Identification:** USP_La_Ppt_Set.
- **Test Case Purpose:**
To measure the SETUP message latency through the SUT for Point-to-point calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-point SETUP messages to the SUT, and measures the time it takes for each message to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Setup Message Latency

Secondary
Test Case Duration
Number of Initiated Point-to-point Calls
Number of Active Point-to-point Calls
Number of Rejected Point-to-point Calls
Number of Terminated Point-to-point Calls

Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTS/sec)

Test Case 11

- **Test Case Identification:** USP_La_Ppt_Con.
- **Test Case Purpose:**
To measure the CONNECT message latency through the SUT for Point-to-point calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-point SETUP messages to the SUT, and measures the time it takes for each CONNECT messages to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Connect Message Latency

Secondary

Test Case Duration
 Number of Initiated Point-to-point Calls
 Number of Active Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls

Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTS/sec)

Test Case 12

- **Test Case Identification:** USP_La_Ppt_CEst.
- **Test Case Purpose:**
To measure the Call Establishment latency through the SUT for Point-to-point calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-point SETUP messages to the SUT, and measures the aggregate time for each SETUP and its corresponding CONNECT message to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will then provide the Call Establishment latency. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Call Establishment Latency

Secondary

Test Case Duration
 Number of Initiated Point-to-point Calls
 Number of Active Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls

Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTS/sec)

Test Case 13

- **Test Case Identification:** USP_La_Pmt_Set.
- **Test Case Purpose:**
To measure the SETUP message latency through the SUT for Point-to-multipoint calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-multipoint SETUP messages to the SUT, and measures the time it takes for each message to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Setup Message Latency

Secondary
Test Case Duration

Number of Initiated Point-to-multipoint Calls
Number of Active Point-to-multipoint Calls
Number of Rejected Point-to-multipoint Calls
Number of Terminated Point-to-multipoint Calls

Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTs/sec)

Test Case 14

- **Test Case Identification:** USP_La_Pmt_Con.
- **Test Case Purpose:**
To measure the CONNECT message latency through the SUT for Point-to-multipoint calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-multipoint SETUP messages to the SUT, and measures the time it takes for each CONNECT message to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average CONNECT Message Latency

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTS/sec)

Test Case 15

- **Test Case Identification:** USP_La_Pmt_CEst.
- **Test Case Purpose:**
To measure the Call Establishment latency through the SUT for Point-to-multipoint calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-multipoint SETUP messages to the SUT, and measures the aggregate time for each SETUP and its corresponding CONNECT message to propagate through the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The test case will then provide the Call Establishment latency. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Call Establishment Latency

Secondary
Test Case Duration
Number of Initiated Point-to-multipoint Calls
Number of Active Point-to-multipoint Calls
Number of Rejected Point-to-multipoint Calls
Number of Terminated Point-to-multipoint Calls

Offered Setup Rate (SETUPS/sec)
Accepted Average Setup Rate (SETUPS/sec)
Average Connect Rate (CONNECTS/sec)

Test Case 16

- **Test Case Identification:** USP_La_Ppt_Rel.
- **Test Case Purpose:**
To measure the RELEASE message latency through the SUT for Point-to-point calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**
Preamble:
The tester generates bursts of Point-to-point SETUP messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The bursts are repeated until the *Number of Calls to be Established* is reached.

Test Body:
The initiator sends RELEASE messages to terminate the established calls, and measures the time it takes for each RELEASE message to propagate through the SUT. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Release Message Latency

Secondary
Test Case Duration

Number of Initiated Point-to-point Calls
Number of Active Point-to-point Calls
Number of Rejected Point-to-point Calls
Number of Terminated Point-to-point Calls
Average Release Rate (RELS/sec)
Average Release CompleteRate (REL Completes/sec)

Test Case 17

- **Test Case Identification:** USP_La_Pmt_Rel.
- **Test Case Purpose:**
To measure the RELEASE message latency through the SUT for Point-to-multipoint calls.
- **Test Case Pre-Requisite:**
The SUT must be a Network.

- **Test Case Procedure:**

Preamble:

The tester generates bursts of Point-to-multipoint SETUP messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The bursts are repeated until the *Number of Calls to be Established* is reached.

Test Body:

The initiator sends RELEASE messages to terminate all of the calls, and measures the time it takes for each RELEASE message to propagate through the SUT. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary

Minimum, Maximum, and Average RELEASE Message Latency

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Active Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Average Release Rate (RELS/sec)

Average Release CompeteRate (REL Completes/sec)

Test Case 18

- **Test Case Identification:** USP_La_Pmt_APTy
- **Test Case Purpose:**
To measure the Add Party Latency through the SUT.
- **Test Case Pre-Requisite:**
The SUT must be a Network.

- **Test Case Procedure:**

Preamble:

The tester establishes a Point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test case Body:

The tester generates one or more bursts of ADD PARTY messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Parties to be Established*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table.

The tester measures the Add Party Latency through the SUT. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Parties to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary

Minimum, Maximum, and Average ADD PARTY Message latency

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Active Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Number of Initiated Parties

Number of Active Parties

Number of Rejected Parties

Number of Terminated Parties

Offered Add Party Rate (ADD PARTIES/sec)

Accepted Average Add Party Rate (ADD PARTIES/sec)

Average Add Party Ack Rate (ADD PARTY ACKs/sec)

Test Case 19

- **Test Case Identification:** USP_La_Pmt_APAK
- **Test Case Purpose:**
To measure the Add Party Acknowledgement Latency through the SUT.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**

Preamble:

The tester establishes a Point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test Case Body:

The tester generates one or more bursts of ADD PARTY messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Parties to be Established*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The Tester measures the Add Party Acknowledgement Latency. The test case will halt after the burst(s) have been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Number of Parties to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average ADD PARTY ACK Message latency

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Number of Initiated Parties
 Number of Active Parties
 Number of Rejected Parties
 Number of Terminated Parties

Offered Add Party Rate (ADD PARTIES/sec)
 Accepted Average Add Party Rate (ADD PARTIES/sec)
 Average Add Party Ack Rate (ADD PARTY ACKs/sec)

Test Case 20

- **Test Case Identification:** USP_La_Pmt_PEst
- **Test Case Purpose:**
To measure the Party Establishment Latency through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**

Preamble:

The tester establishes a Point-to-multipoint call through the SUT.

Test Case Body:

The tester generates one or more bursts of ADD PARTY messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Number of Parties to be Established*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The test case will measure the ADD PARTY Latency and the ADD PARTY ACK Latency and then add the measurements to provide the Party Establishment latency. The test case will halt after the burst has been generated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Number of Parties to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average Party Establishment Latency

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Number of Initiated Parties
 Number of Active Parties
 Number of Rejected Parties
 Number of Terminated Parties
 Offered Add Party Rate (ADD PARTIES/sec)
 Accepted Average Add Party Rate (ADD PARTIES/sec)
 Average Add Party Ack Rate (ADD PARTY ACKs/sec)

Test Case 21

- **Test Case Identification:** USP_La_Pmt_DPty.
- **Test Case Purpose:**
To measure the Drop Party Latency through the SUT.
- **Test Case Pre-Requisite:**
The SUT must be a Network.
- **Test Case Procedure:**

Preamble:

The tester establishes a root Point-to-multipoint connection through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section, and then adds the user defined number of parties with one or more bursts of ADD PARTY messages. The size of each burst is determined by the *Message Distribution* and the *Add Party Rate*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The bursts will be repeated until the *Number of Parties to be Established* is reached.

Test Case Body:

Once all of the parties have been added, the tester generates a Drop Party message to the SUT for each of the parties that were added to the root connection. As the parties are dropped, the Tester measures the Drop Party Latency. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Number of Parties to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Minimum, Maximum, and Average DROP PARTY Message Latency

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Number of Initiated Parties
 Number of Active Parties
 Number of Rejected Parties
 Number of Terminated Parties
 Average Drop Party Rate (DROP PARTIES/sec)
 Average Drop Party Ack Rate (DROP PARTY ACKS/sec)

6.4 Burst Throughput Group

Overview

Burst Throughput Test Cases measure the call rate that the SUT can perform for a burst of calls. These measurements are performed by applying a 'short' burst at the maximum rate. The measurements are performed by measuring the time to establish 'n' calls, release 'n' calls or perform 'n' call cycles through the SUT and then divide 'n' calls established, released or established & released by the amount of time. This will provide the measurements:

- Burst Call Establishment Burst Rate
- Burst Call Release Burst Rate
- Burst Call Cycle Burst Rate

These measurements can be made for Point-to-point, Point-to-multipoint and Add Party Calls through the SUT.

Test Case 22

- **Test Case Identification:** USP_Bt_Ppt_CEst
- **Test Case Purpose:**
To measure the Burst Throughput Call Establishment Rate of an SUT for point-to-point calls.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-point SETUP messages to the SUT and measures the time that it takes to establish each call, as well as the time to establish the burst of calls. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Call Establishment Burst Rate
Call Establishment Burst Time
Minimum, Maximum, and Average Call Establishment Time

Secondary
 Test Case Duration
 Number of Initiated Point-to-point Calls
 Number of Active Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls

 Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTS/sec)

Test Case 23

- **Test Case Identification:** USP_Bt_Pmt_CEst
- **Test Case Purpose:**
To measure the Burst Throughput Call Establishment Rate of an SUT for point-to-multipoint calls.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-multipoint SETUP messages to the SUT and measures the time it takes to establish each call, as well as the time to establish the burst of calls. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. The size of each burst is determined by the *Message Distribution* and the *Number of Calls to be Established*. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Calls to be established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Call Establishment Burst Rate
Call Establishment Burst Time
Minimum, Maximum, and Average Call Establishment Time

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls

Offered Setup Rate (SETUPS/sec)
 Accepted Average Setup Rate (SETUPS/sec)
 Average Connect Rate (CONNECTs/sec)

Test Case 24

- **Test Case Identification:** USP_Bt_Ppt_Rel
- **Test Case Purpose:**
To measure the Burst Throughput Call Release Rate of an SUT for point-to-point calls.
- **Test Case Procedure:**

Preamble:

The tester establishes a number of point-to-point connections determined by the *Number of Calls to be Generated* by sending SETUP messages to the SUT at the rate defined by the *Setup Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table.

Test Case Body:

Once all of the calls are active, the Initiator sends a RELEASE message for each connection and measures the time that it takes to tear down each call, as well as the total time to tear down all calls. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Number of Calls to be Generated	Integer	equal to or greater than 1	
Setup Message Distribution	Enumeration	Constant, Burst	
Release Message Distribution	Enumeration	Constant, Burst	
Release Rate	Releases/Second	equal to or greater than 1	

- **Test Case Results:**
Primary
Call Release Burst Rate
Burst Release Time
Minimum, Maximum, and Average Call Release Time

Secondary

Test Case Duration

Number of Initiated Point-to-point Calls
 Number of Active Point-to-point Calls
 Number of Rejected Point-to-point Calls
 Number of Terminated Point-to-point Calls

Average Release Rate (RELS/sec)
 Average Release Complete Rate (REL COMPS/sec)

Test Case 25

- **Test Case Identification:** USP_Bt_Pmt_Rel.
- **Test Case Purpose:**
To measure the Burst Throughput Call Release Rate of an SUT for point-to-multipoint calls.

- **Test Case Procedure:**

Preamble:

The tester establishes a number of point-to-multipoint connections determined by the *Number of Calls to be Established* by sending SETUP messages to the SUT at a rate defined by the *Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table.

Test Case Body:

Once all of the calls are active, the Initiator sends a RELEASE message for each connection and measures the time that it takes to tear down each call, as well as the total time to tear down all calls. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Number of Calls to be Generated	Integer	equal to or greater than 1	
Setup Message Distribution	Enumeration	Constant, Burst	
Release Message Distribution	Enumeration	Constant, Burst	
Release Rate	Releases/Second	equal to or greater than 1	

- **Test Case Results:**
Primary
Call Release Burst Rate
Burst Release Time
Minimum, Maximum, and Average Call Release Time

Secondary

Test Case Duration
 Number of Initiated Point-to-multipoint Calls
 Number of Active Point-to-multipoint Calls
 Number of Rejected Point-to-multipoint Calls
 Number of Terminated Point-to-multipoint Calls
 Average Release Rate (RELS/sec)
 Average Release Complete Rate (REL COMPs/sec)

Test Case 26

- **Test Case Identification:** USP_Bt_Ppt_CCyc.
- **Test Case Purpose:**
To measure the Burst Throughput Call Cycle Rate of an SUT for point-to-point calls.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-point SETUP messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. Once a call goes active on the Initiator's interface, it is released by sending a RELEASE message. The Tester measures the time it takes for each call to be initiated and then terminated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary

Call Cycle Burst Rate

Burst Call Cycle Time

Minimum, Maximum, and Average Call Cycle Time

Secondary

Test Case Duration

Number of Initiated Point-to-point Calls

Number of Active Point-to-point Calls

Number of Rejected Point-to-point Calls

Number of Terminated Point-to-point Calls

Offered Setup Rate (SETUPS/sec)

Accepted Average Setup Rate (SETUPS/sec)

Average Connect Rate (CONNECTS/sec)

Average Release Rate (RELS/sec)

Average Release Complete Rate (REL COMPS/sec)

Test Case 27

- **Test Case Identification:** USP_Bt_Pmt_CCyc
- **Test Case Purpose:**
To measure the Burst Throughput Call Cycle Rate of an SUT for point-to-multipoint calls.
- **Test Case Procedure:**
The tester generates one or more bursts of point-to-multipoint SETUP messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Setup Rate*. Calls are made from and to the address pairs defined in the global parameters section, in the order that they appear in the table. When the last entry of the table has been used, the next call will begin again with the first entry in the table. Once a call goes active on the Initiator's interface, it sends out a RELEASE message corresponding to that call. The Tester measures the time from each call initiation until that call is terminated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Setup Rate	Setups/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary

Call Cycle Burst Rate

Burst Call Cycle Time

Minimum, Maximum, and Average Call Cycle Time

Secondary

Test Case Duration

Number of Initiated Point-to-multipoint Calls

Number of Active Point-to-multipoint Calls

Number of Rejected Point-to-multipoint Calls

Number of Terminated Point-to-multipoint Calls

Offered Setup Rate (SETUPS/sec)

Accepted Average Setup Rate (SETUPS/sec)

Average Connect Rate (CONNECTS/sec)

Average Release Rate (RELS/sec)

Average Release Complete Rate (REL COMPS/sec)

Test Case 28

- **Test Case Identification:** USP_Bt_Pmt_PEst
- **Test Case Purpose:**
To measure the Burst Throughput Add Party Rate of an SUT.
- **Test Case Procedure:**
Preamble:
The tester establishes a single root point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test Case Body:

The tester adds parties to the root connection by sending a burst of ADD PARTY messages to the SUT, measuring the time that it takes for each party connection to go active. The size of each burst is determined by the *Message Distribution* and the *Number of Parties to be Established*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Number of Parties to be Established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**
Primary
Party Establishment Burst Rate
Party Establishment Burst Time
Minimum, Maximum, and Average Party Establishment Time

Secondary

Test Case Duration
Number of Initiated Parties
Number of Active Parties
Number of Rejected Parties
Number of Terminated Parties

Offered Add Party Rate (ADD PARTIES/sec)
Accepted Average Add Party Rate (ADD PARTIES/sec)
Average Add Party Ack Rate (ADD PARTY ACKs/sec)

Test Case 29

- **Test Case Identification:** USP_Bt_Pmt_DPty.
- **Test Case Purpose:**
To measure the Burst Throughput Drop Party Rate of an SUT.

- **Test Case Procedure:**

Preamble:

The tester establishes a single point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section. The tester then adds the *Number of Parties to be Established* to the root connection by sending one or more bursts of ADD PARTY messages. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. The size of each burst is determined by the *Message Distribution* and the *Add Party Rate*.

Test Case Body:

The tester drops all of the added parties with a burst of DROP PARTY messages. The Tester measures the time it takes for each party connection to be terminated. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Number of Parties to be Established	Integer	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary**Party Release Burst Rate****Party Release Burst Time****Minimum, Maximum, and Average Party Release Time****Secondary**

Test Case Duration

Number of Initiated Parties

Number of Active Parties

Number of Rejected Parties

Number of Terminated Parties

Average Drop Party Rate (DROP PARTIES/sec)

Average Drop Party Ack Rate (DROP PARTY ACKS/sec)

Test Case 30

- **Test Case Identification:** USP_Bt_Pmt_PCyc.
- **Test Case Purpose:**
To measure the Burst Throughput Party Cycle Rate of an SUT.

- **Test Case Procedure:**

Preamble:

The tester establishes a single point-to-multipoint call through the SUT between the address pairs defined in the first entry of the source/destination address pair table in the global parameters section.

Test Case Body:

The tester initiates one or more bursts of ADD PARTY messages to the SUT. The size of each burst is determined by the *Message Distribution* and the *Add Party Rate*. Parties are added from and to the address pairs defined in the global parameters section, in the order that they appear in the table starting with the second entry. When the last entry of the table has been used, the next call will begin again with the second entry in the table. As each party connection goes active, the initiator drops the party by sending a DROP PARTY message to the SUT, measuring the time that it takes for each party connection to terminate. The test case will not run beyond the time defined by the *Maximum Test Case Duration*.

- **Test Case Specific Parameters:**

Parameter Name	Parameter Type	Parameter Range	Parameter Value
Test Case Duration (optional)	Seconds	equal to or greater than 1	
Add Party Rate	Add Parties/Second	equal to or greater than 1	
Message Distribution	Enumeration	Constant, Burst	

- **Test Case Results:**

Primary**Party Cycle Burst Rate****Party Cycle Burst Time****Minimum, Maximum, and Average Party Cycle Time****Secondary**

Test Case Duration

Number of Initiated Parties

Number of Active Parties

Number of Rejected Parties

Number of Terminated Parties

Offered Add Party Rate (ADD PARTIES/sec)

Accepted Average Add Party Rate (ADD PARTIES/sec)

Average Add Party Ack Rate (ADD PARTY ACKs/sec)

Average Drop Party Rate (DROP PARTIES/sec)

Average Drop Party Ack Rate (DROP PARTY ACKs/sec)

7 Reporting Results

7.1 General Instructions

The test lab is expected to report results in such a way that they can be reproduced in other labs under similar conditions. This requires that the author of the test report does not simply report statistics for each test case, but that the configuration for each test case included in the report.

The sections that follow describe the results report for each test case, and should be repeated as necessary for each iteration of a test case with different results or parameters. A new set of PIXITs from section 5 must be included any time one of the global parameters change.

7.2 Global Parameters Reporting

Section 5 of the document provides the user with a set of PIXITs to be filled out to describe the general configuration of the test equipment and SUT. Section 5 must be filled out completely and included in the test report.

7.3 Test Case Specific Parameter Reporting

Section 6 of the document describes the test case behavior, and the required test case specific parameters. Along with the results for an individual test case, the test case specific parameter table from the test case must be filled out completely, and included in the test report.

7.4 Test Case Specific Result Tables

Test Case 1	USP_Su_Ppt_Set_1		
Statistic Name	Metric	Value	Units
Primary			
Offered Setup Rate	See section 2		Setups/Second
Accepted Setup Rate	See section 2		Setups/Second
Average Connect Rate	See section 3.16		Connects/Second
Average Release Rate	See section 3.16		Release/Second
Average Rel Comp Rate	See section 3.16		ReleaseComp/Second
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None

Test Case 2	USP_Su_Pmt_Set_1		
Statistic Name	Metric	Value	Units
Primary			
Offered Setup Rate	See section 2		Setups/Second
Accepted Setup Rate	See section 2		Setups/Second
Average Connect Rate	See section 3.16		Connects/Second
Average Release Rate	See section 3.16		Release/Second
Average Rel Comp Rate	See section 3.16		ReleaseComp/Second
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None

Test Case 3	USP_Su_Ppt_Set_2		
Statistic Name	Metric	Value	Units
Primary			
Offered Setup Rate	See section 2		Setups/Second
Accepted Setup Rate	See section 2		Setups/Second
Average Connect Rate	See section 3.16		Connects/Second
Average Release Rate	See section 3.16		Release/Second
Average Rel Comp Rate	See section 3.16		ReleaseComp/Second
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None

Test Case 4	USP_Su_Pmt_Set_2		
Statistic Name	Metric	Value	Units
Primary			
Offered Setup Rate	See section 2		Setups/Second
Accepted Setup Rate	See section 2		Setups/Second
Average Connect Rate	See section 3.16		Connects/Second
Average Release Rate	See section 3.16		Release/Second
Average Rel Comp Rate	See section 3.16		ReleaseComp/Second
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None

Test Case 5	USP_Su_Pmt_APtY		
Statistic Name	Metric	Value	Units
Primary			
Offered Add Party Rate	See section 2		Setups/Second
Accepted Add Party Rate	See section 2		Setups/Second
Average Add Party Ack Rate	See section 3.16		Connects/Second
Average Drop Party Rate	See section 3.16		DropParties/Second
Average Drop Party Ack Rate	See section 3.16		DropPartyAcks/Second
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None

Test Case 6	USP_Sac_Ppt_CEst			
Statistic Name	Metric	Value		Units
Primary				
Number of Active PTP Calls				None
Secondary				
Test Case Duration				Seconds
Number of Initiated PTP Calls				None
Number of Rejected PTP Calls				None
Number of Terminated PTP Calls				None
Offered Setup Rate	See Section 2			Setups/second
Accepted Average Setup Rate	See Section 2			Setups/second
Average Connect Rate	See Section 3.16			Connects/Second
Cause Value List		Cause Value	# of Occurrences	None
(Continued)				

Test Case 7	USP_Sac_Pmt_CEst_1			
Statistic Name	Metric	Value		Units
Primary				
Number of Active PMP Calls				None
Secondary				
Test Case Duration				Seconds
Number of Initiated PMP Calls				None
Number of Rejected PMP Calls				None
Number of Terminated PMP Calls				None
Offered Setup Rate	See Section 2			Setups/second
Accepted Average Setup Rate	See Section 2			Setups/second
Average Connect Rate	See Section 3.16			Connects/Second
Cause Value List		Cause Value	# of Occurrences	None
(Continued)				

Test Case 8	USP_Sac_Pmt_PEst			
Statistic Name	Metric	Value		Units
Primary				
Number of Active Parties				None
Secondary				
Test Case Duration				Seconds
Number of Initiated PMP Calls				None
Number of Active PMP Calls				None
Number of Rejected PMP Calls				None
Number of Terminated PMP Calls				None
Number of Initiated Parties				
Number of Rejected Parties				
Number of Terminated Parties				
Offered Add Party Rate	See Section 2			Setups/second
Accepted Average Add Party Rate	See Section 2			Setups/second
Average Add Party Ack Rate	See Section 3.16			Connects/Second
Cause Value List		Cause Value	# of Occurrences	None
(Continued)				

Test Case 9	USP_Sac_Pmt_CEst_2			
Statistic Name	Metric	Value		Units
Primary				
Number of Active PMP Calls				None
Number of Active Parties				None
Secondary				
Test Case Duration				Seconds
Number of Initiated PMP Calls				None
Number of Active PMP Calls				None
Number of Rejected PMP Calls				None
Number of Terminated PMP Calls				None
Number of Initiated Parties				None
Number of Rejected Parties				None
Number of Terminated Parties				None
Offered Add Party Rate	See Section 2			AddParties/second
Accepted Average Add Party Rate	See Section 2			AddParties/second
Average Add Party Ack Rate	See Section 3.16			AddPartyAcks/Second
Cause Value List		Cause Value	# of Occurrences	None
(Continued)				

Test Case 10	USP_La_Ppt_Set			
Statistic Name	Metric	Value		Units
Primary				
Minimum Setup Latency	See Section 3.1			None
Maximum Setup Latency	See Section 3.1			None
Average Setup Latency	See Section 3.1			None
Secondary				
Test Case Duration				Seconds
Number of Initiated PTP Calls				None
Number of Active PTP Calls				None
Number of Rejected PTP Calls				None
Number of Terminated PTP Calls				None
Offered Setup Rate	See Section 2			Setups/second
Accepted Average Setup Rate	See Section 2			Setups/second
Average Connect Rate	See Section 3.16			Connects/Second

Test Case 11	USP_La_Ppt_Con		
Statistic Name	Metric	Value	Units
Primary			
Minimum Connect Latency	See Section 3.1		None
Maximum Connect Latency	See Section 3.1		None
Average Connect Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/Second

Test Case 12	USP_La_Ppt_CEst		
Statistic Name	Metric	Value	Units
Primary			
Minimum Call Establishment Latency	See Section 3.6		None
Maximum Call Establishment Latency	See Section 3.6		None
Average Call Establishment Latency	See Section 3.6		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/Second

Test Case 13	USP_La_Pmt_Set		
Statistic Name	Metric	Value	Units
Primary			
Minimum Setup Latency	See Section 3.1		None
Maximum Setup Latency	See Section 3.1		None
Average Setup Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/Second

Test Case 14	USP_La_Pmt_Con		
Statistic Name	Metric	Value	Units
Primary			
Minimum Connect Latency	See Section 3.1		None
Maximum Connect Latency	See Section 3.1		None
Average Connect Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/Second

Test Case 15	USP_La_Pmt_CEst		
Statistic Name	Metric	Value	Units
Primary			
Minimum Call Establishment Latency	See Section 3.6		None
Maximum Call Establishment Latency	See Section 3.6		None
Average Call Establishment Latency	See Section 3.6		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/Second

Test Case 16	USP_La_Ppt_Rel		
Statistic Name	Metric	Value	Units
Primary			
Minimum Release Latency	See Section 3.1		None
Maximum Release Latency	See Section 3.1		None
Average Release Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Average Release Rate	See Section 3.16		Release/second
Average Release Complete Rate	See Section 3.16		ReleaseComp/Second

Test Case 17	USP_La_Pmt_Rel		
Statistic Name	Metric	Value	Units
Primary			
Minimum Release Latency	See Section 3.1		None
Maximum Release Latency	See Section 3.1		None
Average Release Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Average Release Rate	See Section 3.16		Release/second
Average Release Complete Rate	See Section 3.16		ReleaseComp/Second

Test Case 18	USP_La_Pmt_APty		
Statistic Name	Metric	Value	Units
Primary			
Minimum Add Party Latency	See Section 3.1		None
Maximum Add Party Latency	See Section 3.1		None
Average Add Party Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Offered Add Party Rate	See Section 2		AddParties/second
Average Add Party Rate	See Section 2		AddParties/second
Average Add Party Ack Rate	See Section 3.16		AddPartyAcks/second

Test Case 19	USP_La_Pmt_APAK		
Statistic Name	Metric	Value	Units
Primary			
Minimum Add Party Ack Latency	See Section 3.1		None
Maximum Add Party Ack Latency	See Section 3.1		None
Average Add Party Ack Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Offered Add Party Rate	See Section 2		AddParties/second
Average Add Party Rate	See Section 2		AddParties/second
Average Add Party Ack Rate	See Section 3.16		AddPartyAcks/second

Test Case 20	USP La Pmt PEst		
Statistic Name	Metric	Value	Units
Primary			
Minimum Party Establishment Latency	See Section 3.15		None
Maximum Party Establishment Latency	See Section 3.15		None
Average Party Establishment Latency	See Section 3.15		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Offered Add Party Rate	See Section 2		AddParties/second
Average Add Party Rate	See Section 2		AddParties/second
Average Add Party Ack Rate	See Section 3.16		AddPartyAcks/second

Test Case 21	USP_La_Pmt_DPTy		
Statistic Name	Metric	Value	Units
Primary			
Minimum Drop Party Latency	See Section 3.1		None
Maximum Drop Party Latency	See Section 3.1		None
Average Drop Party Latency	See Section 3.1		None
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Average Drop Party Rate	See Section 3.16		DropParties/second
Average Drop Party Ack Rate	See Section 3.16		DropPartyAcks/second

Test Case 22	USP_Bt_Ppt_CEst		
Statistic Name	Metric	Value	Units
Primary			
Call Establishment Burst Rate	# of calls established / Call Establishment Burst Time		Calls/second
Call Establishment Burst Time	See Section 3.7		seconds
Minimum Call Establishment Time	See Section 3.2		seconds
Maximum Call Establishment Time	See Section 3.2		seconds
Average Call Establishment Time	See Section 3.2		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/second

Test Case 23		USP_Bt_Pmt_CEst	
Statistic Name	Metric	Value	Units
Primary			
Call Establishment Burst Rate	# of calls established / Call Establishment Burst Time		Calls/second
Call Establishment Burst Time	See Section 3.7		seconds
Minimum Call Establishment Time	See Section 3.2		seconds
Maximum Call Establishment Time	See Section 3.2		seconds
Average Call Establishment Time	See Section 3.2		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/second

Test Case 24		USP_Bt_Ppt_Rel	
Statistic Name	Metric	Value	Units
Primary			
Call Release Burst Rate	# of calls released / Burst Release Time		Calls/second
Burst Release Time	See Section 3.8		seconds
Minimum Call Release Time	See Section 3.3		seconds
Maximum Call Release Time	See Section 3.3		seconds
Average Call Release Time	See Section 3.3		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Average Release Rate	See Section 3.16		Releases/second
Average Release Complete Rate	See Section 3.16		RelComps/second

Test Case 25	USP_Bt_Pmt_Rel		
Statistic Name	Metric	Value	Units
Primary			
Call Release Burst Rate	# of calls released / Burst Release Time		Calls/second
Burst Release Time	See Section 3.8		seconds
Minimum Call Release Time	See Section 3.3		seconds
Maximum Call Release Time	See Section 3.3		seconds
Average Call Release Time	See Section 3.3		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Average Release Rate	See Section 3.16		Releases/second
Average Release Complete Rate	See Section 3.16		RelComps/second
Test Case 26	USP_Bt_Ppt_CCyc		
Statistic Name	Metric	Value	Units
Primary			
Call Cycle Burst Rate	# of calls cycled / Burst Call Cycle Time		Calls/second
Burst Call Cycle Time	See Section 3.8		seconds
Minimum Call Cycle Time	See Section 3.3		seconds
Maximum Call Cycle Time	See Section 3.3		seconds
Average Call Cycle Time	See Section 3.3		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PTP Calls			None
Number of Active PTP Calls			None
Number of Rejected PTP Calls			None
Number of Terminated PTP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/second
Average Release Rate	See Section 3.16		Releases/second
Average Release Complete Rate	See Section 3.16		RelComps/second

Test Case 27	USP_Bt_Pmt_CCyc		
Statistic Name	Metric	Value	Units
Primary			
Call Cycle Burst Rate	# of calls cycled / Burst Call Cycle Time		Calls/second
Burst Call Cycle Time	See Section 3.8		seconds
Minimum Call Cycle Time	See Section 3.3		seconds
Maximum Call Cycle Time	See Section 3.3		seconds
Average Call Cycle Time	See Section 3.3		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated PMP Calls			None
Number of Active PMP Calls			None
Number of Rejected PMP Calls			None
Number of Terminated PMP Calls			None
Offered Setup Rate	See Section 2		Setups/second
Accepted Average Setup Rate	See Section 2		Setups/second
Average Connect Rate	See Section 3.16		Connects/second
Average Release Rate	See Section 3.16		Releases/second
Average Release Complete Rate	See Section 3.16		RelComps/second

Test Case 28	USP Bt Pmt PEst		
Statistic Name	Metric	Value	Units
Primary			
Party Establishment Burst Rate	# of parties / Burst Party Establishment Time		Calls/second
Burst Party Establishment Time	See Section 3.9		seconds
Minimum Party Establishment Time	See Section 3.4		seconds
Maximum Party Establishment Time	See Section 3.4		seconds
Average Party Establishment Time	See Section 3.4		seconds
Secondary			
Test Case Duration			seconds
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Offered Add Party Rate	See Section 2		AddParties/second
Accepted Average Add Party Rate	See Section 2		AddParties/second
Average Add Party Ack Rate	See Section 3.16		AddPartyAcks/second

Test Case 29	USP_Bt_Pmt_DPty		
Statistic Name	Metric	Value	Units
Primary			
Party Release Burst Rate	# of parties dropped/ Party Release Burst Time		Calls/second
Party Release Burst Time	See Section 3.10		seconds
Minimum Party Release Time	See Section 3.5		seconds
Maximum Party Release Time	See Section 3.5		seconds
Average Party Release Time	See Section 3.5		seconds
Secondary			
Test Case Duration			Seconds
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Average Drop Party Rate	See Section 3.16		DropParties/second
Average Drop Party Ack Rate	See Section 3.16		DropPartyAcks/second

Test Case 30	USP Bt Pmt PCyc		
Statistic Name	Metric	Value	Units
Primary			
Party Cycle Burst Rate	# of parties cycled/ Party Cycle Burst Time		Calls/second
Party Cycle Burst Time	See Section 3.10		seconds
Minimum Party Cycle Time	See Section 3.5		seconds
Maximum Party Cycle Time	See Section 3.5		seconds
Average Party Cycle Time	See Section 3.5		seconds
Secondary			
Test Case Duration			seconds
Number of Initiated Parties			None
Number of Active Parties			None
Number of Rejected Parties			None
Number of Terminated Parties			None
Offered Add Party Rate	See Section 2		AddParties/second
Accepted Average Add Party Rate	See Section 2		AddParties/second
Average Add Party Ack Rate	See Section 3.16		AddPartyAcks/second
Average Drop Party Rate	See Section 3.16		DropParties/second
Average Drop Party Ack Rate	See Section 3.16		DropPartyAcks/second

Appendix A Factors Affecting SUT Performance Measurements

Tester Performance Bias

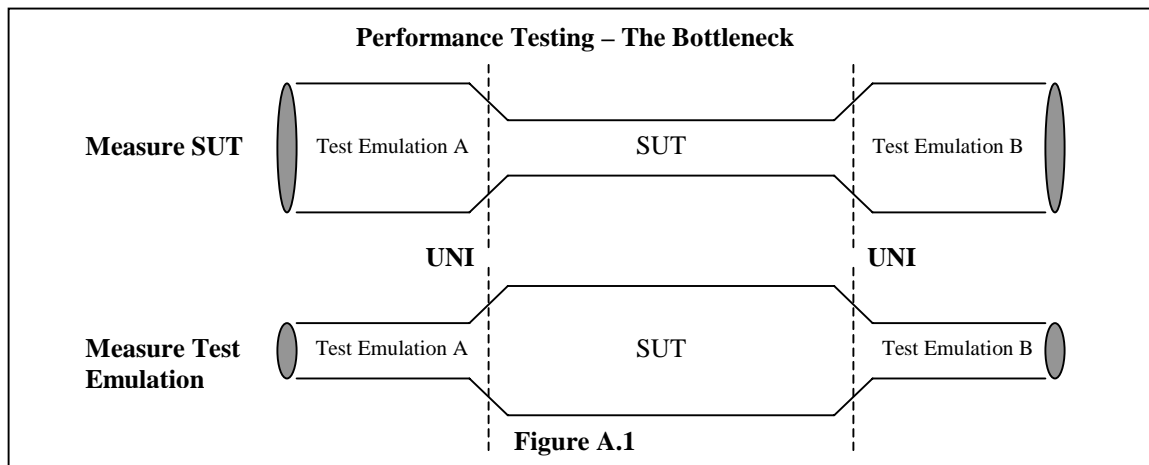
To properly assess performance, a tester must emulate the very behavior whose performance it seeks to quantify. In the sections that follow, the causes of tester bias will be addressed with respect to the following test types:

- Burst Throughput measurements
- Sustained Throughput/Latency measurements
- Message Latency measurements
- Simultaneous Active Call Limitations

In the examples given in this document, the SETUP message is used to demonstrate how performance measurements can be skewed by a tester. These same examples could be repeated using Adding Parties, Releasing of calls, or Call Cycling. The user should note that the measurements using other message types can be subject to the same pitfalls.

Tester Performance Influence on SUT Measurements

When measuring the “Maximum Performance” of an SUT, the user needs to consider the possibility that they have hit the maximum performance, not of the SUT, but rather that of the tester. We must ensure that the SUT is the only restriction on performance. Figure A.1 graphically illustrates two possible scenarios. One is a test setup where the critical section, or “bottle neck”, is the SUT, and the other shows it as the tester.



Burst and Sustained Call Establishment Rates

These two measurements are key to gauging the performance of an SUT, however the process of obtaining these results can introduce bias into the measurements if the SUT’s performance exceeds that of the tester.

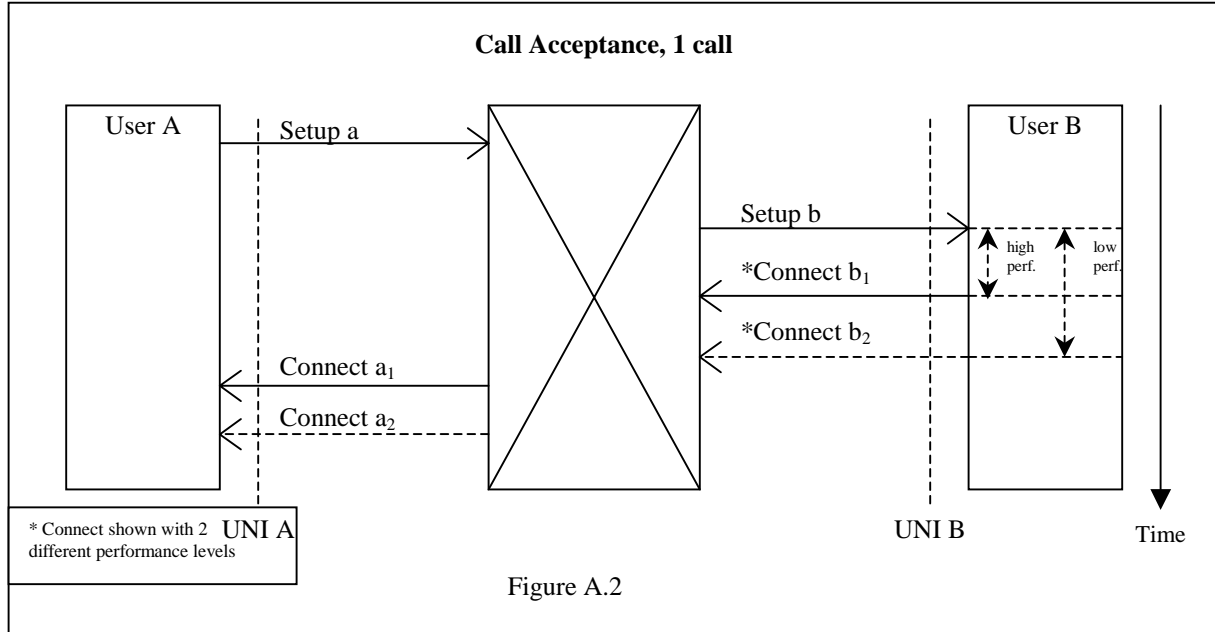
Opportunities for this bias to interfere with the measurements come in during the **initiation** and **acceptance** phases. We will consider these two phases independently, although their effects are additive.

Initiation of Connections

The rate at which the test unit can send SETUPS out on the wire can affect both the burst and sustained call establishment rates. Supposing that the tester’s emulation is capable of producing SETUPS at a rate of n per second, this rate is now a hard limit for the maximum rate at which we can observe calls going active on the interface. The operator must ensure that the rate at which the tester can send out SETUPS is greater than the rate at which the SUT can establish connections. One possible method of verifying this would be for the tester to generate SETUPS at its maximum rate and then to observe the SUT for connection failures or for a slower CONNECT rate.

Acceptance of Connections.

The rate at which connections can be established on an interface depends not solely on the efficiency of the SUT, but also on the rate at which connections can be established at the destination. First, consider establishing **one call**. Figure A.2 illustrates the major events that will determine the call establishment time. To highlight the effect of the tester's performance, 2 Connects are shown on the B interface. Connect b_1 represents a higher performance User, and Connect b_2 represents a lower performance User.



Here are a few points of interest in the figure:

- **Time between Setup a and Setup b** = **Setup Latency**
- **Time between Connect b_x and Connect a_x** = **Connect Latency**
- **Setup Latency + Connect Latency** = **Call Establishment Latency**
- **Time between Setup a and Connect a_x** = **Call Establishment Time**
- **Time between Setup b and Connect b_x** = **User B Call Establishment Time**

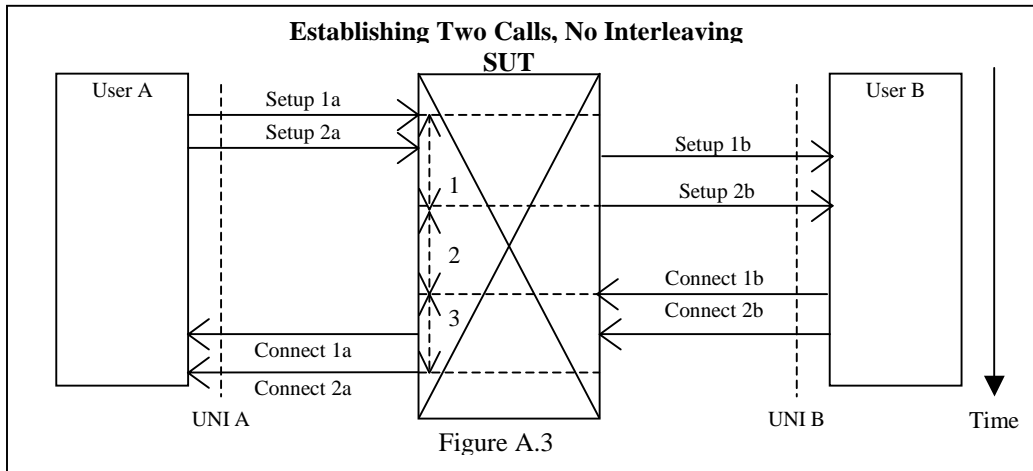
All of these times are measured on the wire.

Call Establishment Time = Call Establishment Latency + User B Call Establishment Time

In an ideal case, **User B Call Establishment Time = 0**. This would provide a situation in which the only delay in setting up the call is introduced by the SUT, thus giving us a proper indication of the true performance of the SUT. The larger the value of **User B Call Establishment Time**, the more the **Call Establishment Time** is skewed by the performance of the tester. If the tester were to respond more slowly to the SETUP b message, as shown with Connect b_2 , it can be seen that the **Call Establishment Time** would increase accordingly.

In the above example, the effect of the tester on the performance measured is significant. The Call Establishment Time, although used to describe the level of performance of an SUT, is seriously affected by the time that it takes for the destination user to accept the call.

To illustrate the effect the tester's performance on establishing multiple connections, Figure A.3 shows two calls being established with no interleaving occurring between SETUP and CONNECT messages on UNI B.



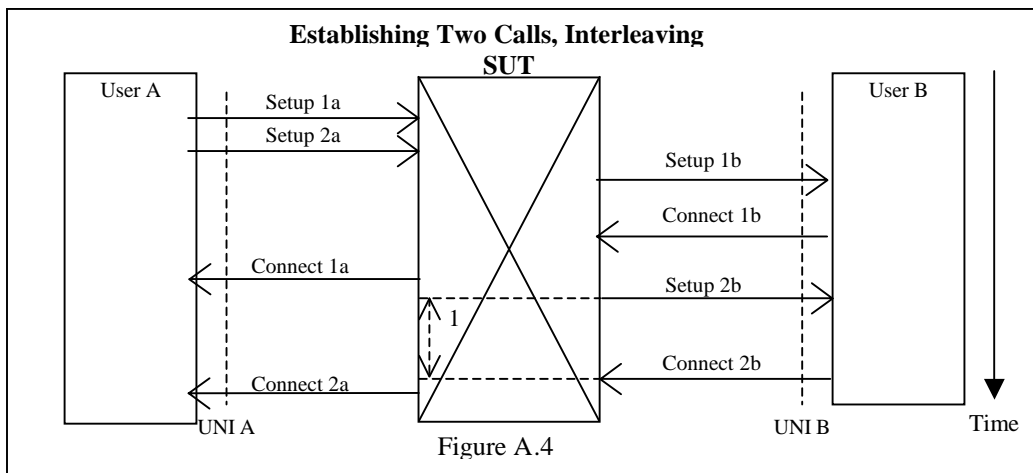
- Time between Setup xa and Setup xb = Setup Latency x
- Time between Connect xb and Connect xa = Connect Latency x
- Connect Latency x + Setup Latency x = Call Establishment Latency x
- Time between Setup xa and Connect xa = Call Establishment Time x
- Time between Setup xb and Connect xb = User B Call Establishment time x
- Time between Setup 1a and Connect 2a = Multi-Call Establishment Time
-

All of these times are measured on the wire

$$\text{Multi-Call Establishment Time} = (T_{\text{Setup 2b}} - T_{\text{Setup 1a}})1 + (T_{\text{Connect 1b}} - T_{\text{Setup 2b}})2 + (T_{\text{Connect 2a}} - T_{\text{Connect 1b}})3$$

Section “2” above has a significant role to play in determining the measured performance of the SUT, and is affected by the performance of the tester. If the performance of the tester were worse, the time for calls to be established on interface B would increase. This would then increase the time interval labeled “2”. This increase would then increase the Multi-Call Establishment Time.

Figure A.4 shows two calls being established, this time with connects being interleaved on the User B interface.



In the above diagram, SETUP and CONNECT messages are interleaved. This can impact the Mutli-Call Establishment Time, $T_{\text{Connect 2a}} - T_{\text{Setup 1a}}$. In Figure A.3, section 2 represented some time in which the SUT was forced to wait while User B processed the SETUP messages. In Figure A.4, the SUT is not forced to

wait for the CONNECT message of the first call, since it was received by the SUT while it was processing the second call's SETUP. The SUT may have been idle in the time period labeled "1", since the SUT had no messages that it could have processed or have sent until CONNECT 2b was received. This time could have been reduced by the User B emulation if it had been able to respond to the SETUP 2b message faster.

If we consider the ideal performance for the tester as discussed in the single call example, where the time for User B to respond to the SETUP with a CONNECT message was zero, we can see that the Multi-Call Establishment Time may have been reduced in this example as well. In this perfect case, there is no time in which the SUT has no message to process or transmit.

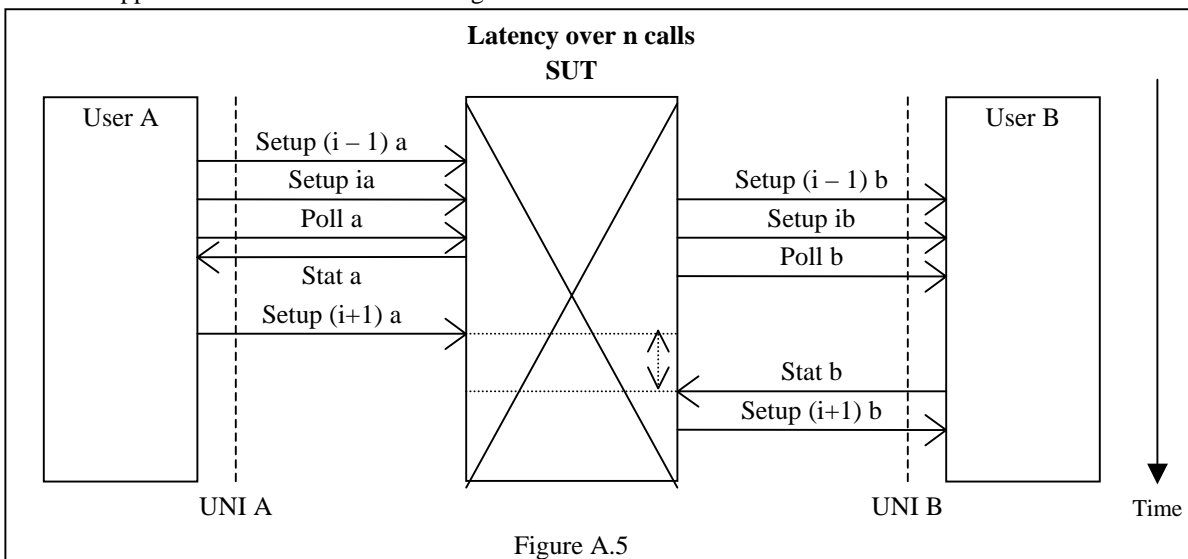
Correlation of Signalling Messages

Measurements of end-to-end signalling performance across multiple interfaces can be misrepresented if multiple signalling messages are in transit during a call burst cycle and no method is employed to correlate these messages to specific calls. Therefore, it is recommended that for SETUP and ADD PARTY messages the selector byte of the called party address (SEL) be incremented for each call in the call burst cycle. There is an upper bound of 256 calls per call burst cycle inherent with using SEL, which may be optionally extended by varying additional address information at the test suite user's discretion. Methods to correlate signalling messages other than SETUP and ADD PARTY are for further study.

Performance Effects on Latency - QSAAL Flow Control

The effect of QSAAL flow control on the transmission of messages can impose a bias. For SETUPS that at the end of the QSAAL credit window, the POLL-STAT response time can impose an artificial inflation on the SETUP latency.

The POLL-STAT response time illustrated below on interface B is determined not by the SUT, but by the tester. Suppose that the i 'th SETUP message hits the end of the credit window.



The SUT in the Figure A.5 cannot transmit the SETUP (i+1) b message because it has used up the credit window.

The amount of time that the SUT was *ready* to transmit the message, but was unable to, cannot be determined by simply examining message activity on the wire. From this perspective, the tester cannot distinguish between the actual latency of the message and any time spent waiting for the STAT message. There is no way of knowing how much time, if any, the SUT spent waiting with SETUP (i+1) b in its QSAAL buffer.

This inflated latency is demonstrated further in Figure A.6. One can see that QSAAL flow control can

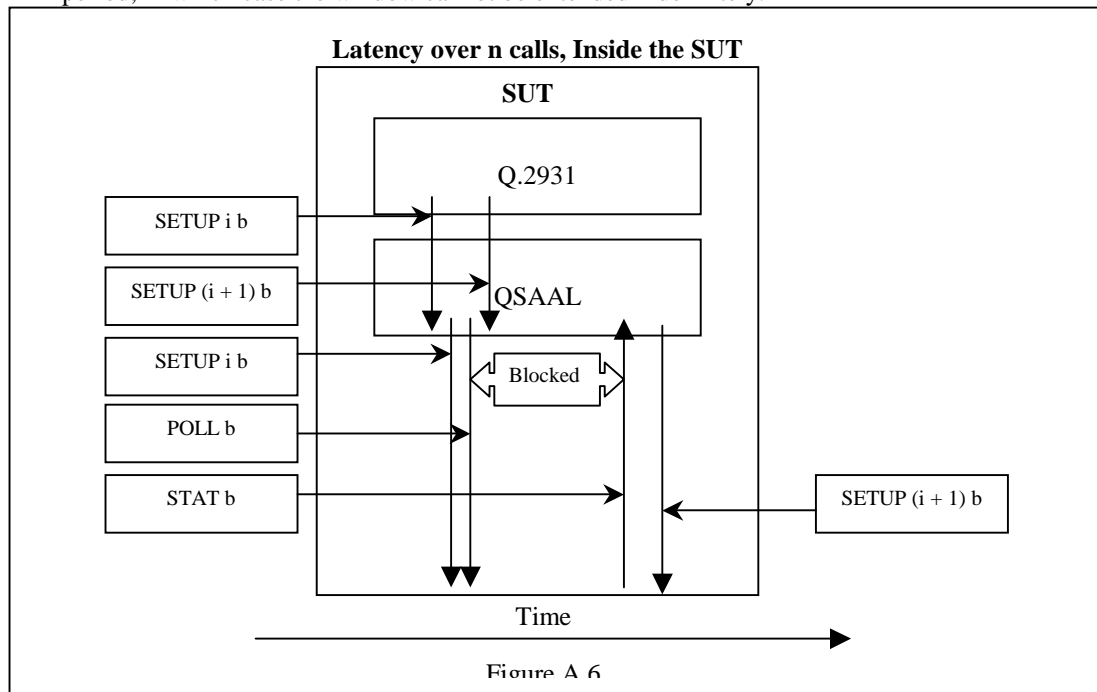
have a serious effect on the time that it takes for a message to propagate through the QSAAL layer and out on the wire. This increased time cannot be controlled by the SUT, and therefore cannot be counted against it.

In this case, the ideal situation is for a zero delay STAT response by the tester to the POLL from the SUT. This would prevent the tester from influencing latency measurements. A zero POLL-STAT response time is ideal, but unlikely. The tester should strive to minimize this time as much as possible to improve the accuracy of its measurement.

Although not mentioned above, CONNECT latencies can also be influenced by QSAAL flow control on interface A for similar reasons. These CONNECT and SETUP latency biases can affect the call establishment latencies as well.

In order to reduce or avoid this inaccuracy in measurement, the tester may:

- Improve POLL-STAT response time**
 This is the more challenging, but most desirable fix. Improving the POLL-STAT response will also involve improving call processing times, since the POLL won't be processed until the previous Q.2931[2] messages have been removed from QSAAL. Because this POLL-STAT response time cannot realistically be reduced to zero, there will be an error introduced. The higher the performance of the tester compared to the SUT, the less effect the error will have.
- Increase Credit Window size for tester**
 This change will allow the SUT to send out more SETUP and CONNECT messages before having to block waiting for a STAT response. If the window is increased sufficiently, an entire burst of calls can be established without the SUT having to block once. This will completely remove the above effect, unless the latencies are to be measured over a sustained period, in which case the window cannot be extended indefinitely.



Limits on the Number of Simultaneous Active Calls.

The maximum number of Simultaneous Connections across the SUT is a valuable statistic to know. This limitation may be restricted by limits imposed by the architecture of the SUT, or simply by the amount of bandwidth available. In either case, the tester must be able to meet and exceed the Limits performance of the SUT.

The maximum number of simultaneous active connections on the interface can be measured by slowly making calls through the SUT with the desired profile¹, until one is rejected due to some internal limit of the SUT being reached. If the tester cannot support as many active calls with the given call profile, it could never reach this situation, and thus never complete the test.

It is therefore vital that the tester be able to support more connections with the desired profile than the SUT is capable of.

Conformance to Protocol Standard

The purpose of performance measurement is to gauge the performance of the SUT when it is operating as per its UNI specification. In order to meaningfully assess the performance characteristics of an SUT, the tests must be done in the same environment as the SUT's intended use, which will undoubtedly conform to one of the UNI specifications. If the tester violates some aspect of the very UNI Signalling specification that it is attempting to performance test, the results will be meaningless. An SUT's true performance can be measured only in accordance with the relevant UNI specification.

¹ call profile – a particular set of Information Elements

Appendix B Factors Affecting SUT Performance

This Appendix is informative, and describes how the architecture or configuration of a particular SUT may affect its performance.

Multiple ports

The testing of an SUT can occur through one or more physical ports. Depending on the architecture of the SUT, tests conducted using varying numbers of ports may produce dissimilar results.

Consider the example of a single port test configuration (see Figure B.1) compared to a multiple port test configuration (see Figure B.2). In both cases the SUT is identical and consists of four ports all running from a single signalling engine.

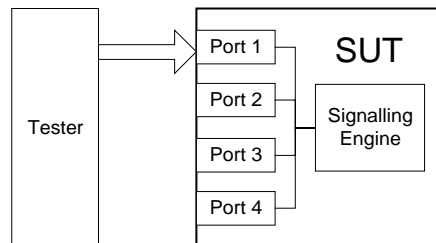


Figure B.1

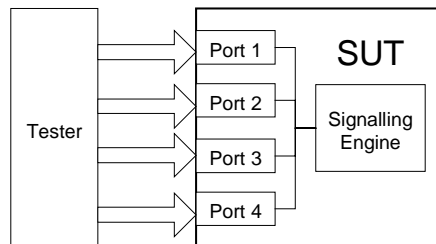


Figure B.2

Since the signalling engine has to serve four ports in the multiple port test, the individual performance of one of the four ports will naturally be lower than the performance of the port used in the single port test - it is served exclusively by the signalling engine.

It is also possible that the combined performance of all four ports in the multiple port configuration is not equivalent to the performance of a single port in the one port configuration. The additional overhead imposed on the signalling engine of serving four ports instead of just one may restrict its overall performance by a measurable amount.

There may be other SUT architectures that employ multiple signalling engines. As in the above scenarios, this may also impact signalling performance. The test executor should be aware that varying the number of ports or using test architectures that employ multiple signalling engines could have an effect on the performance measurements.

Performance Effects of the Signalling Channel Peak Cell Rate

The peak cell rate (PCR) of the signalling channel can affect the performance of the tester or SUT. The PCR controls the maximum rate at which cells can be transmitted into a virtual channel. It can limit the rate of signalling traffic exchanged between a tester and the SUT. If the signalling channel PCR limit were reached at any time during a test, the test results would not be an accurate assessment of the performance of the SUT. The PCR of the signalling channel should be set sufficiently high (in both the tester and SUT) to ensure that it does not affect the test results.