Quality Excellence for Suppliers of Telecommunications Forum (QuEST Forum)

TL 9000
Quality Management System

Measurements Handbook

Release 3.0

To the memory of
Terry Blok   Unisys
Hank Malec   3Com

Approved and Adopted
by the
QuEST Forum
Effective
March 31, 2001

Foreword

The *TL 9000 Quality Management System Measurements Handbook* was prepared in a cooperative effort by the members of the Quality Excellence for Suppliers of Telecommunications (QuEST) Forum. From the outset the QuEST Forum's goal has been to develop and maintain a consistent set of quality system requirements and measurements that, when implemented, will help provide telecommunications customers with faster, better and more cost-effective services.

This book complements the *TL 9000 Quality Management System Requirements Handbook* with measurements that reflect the performance of the industry and its products. QuEST Forum members, including service providers and suppliers, utilize measurements that are collected under the provisions of this handbook to improve their processes. By improving processes, the industry becomes more efficient and telecommunications customers, worldwide, derive the benefit of improved services.

The QuEST Forum is pleased to present this book in a common spirit of delighting our customers.

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QuEST Forum – Chairman

Olga Striltschuk, Motorola
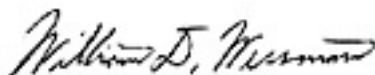QuEST Forum – Vice Chair

Steven Welch, SBC

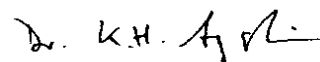Barry D'Amour, Nortel Networks

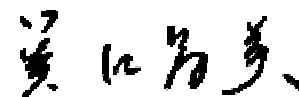Don Pickens, Bell South

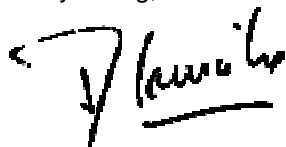Jerry Cates, Corning

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Preface

The Quality Excellence for Suppliers of Telecommunications Forum (QuEST Forum) was founded to foster continued improvements to the quality and reliability of telecommunications service. The founders took the critical initial step of establishing a common set of quality management system requirements and measurements by creating the *TL 9000 Quality Management System Requirements Handbook* and the *TL 9000 Quality Management System Measurements Handbook.* These handbooks are the result of a cooperative effort among members of the telecommunications industry.

The work of the QuEST Forum yields benefits to customers, their subscribers, and their suppliers. Membership is composed of telecommunication Service Providers, Suppliers, and Liaisons. Members fund and participate in the QuEST Forum, have defined voting rights, and are expected to contribute to the work of the QuEST Forum. Members vote on adoption of the TL 9000 structure, content, administration, and other questions coming before the QuEST Forum.

The QuEST Forum establishes and maintains a common set of quality management system requirements and measurements built on currently used industry standards including ISO 9001:2000. The requirements and measurements promote consistency and efficiency, reduce redundancy and improve customer satisfaction. They also enable suppliers to improve quality and reliability, reduce costs, and increase competitiveness.

Acknowledgements

The strength of the QuEST Forum is the outstanding capabilities and commitment of the members who represent their respective organizations at the QuEST Forum and Work Group Meetings. This exceptional talent produced the first *TL 9000 Quality Management System Measurements Handbook* in record time and now has completed this major update in less than one year. Individuals whose companies were customers, suppliers, and competitors accomplished the update of the Requirements handbook through extraordinary teamwork.

This outstanding accomplishment was facilitated in partnership with the American Society of Quality (ASQ) and The University of Texas at Dallas (UTD). Special thanks for their constant support and encouragement during the last three years of our development to Dr. Bill Osborne, Dean and Dr. Douglas E. Harris, Associate Dean, Erik Jonsson School of Engineering and Computer Science and to Paul Borawski, ASQ Executive Director and Brian LeHouillier, ASQ Director, Programs & Operations.

Personally, and for the entire QuEST Forum, I would like to thank the following QuEST Forum individuals and companies of the Measurements and Oversight work groups for their direct contributions to this update of the *TL 9000 Quality Management System Measurements Handbook*.

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QuEST Forum Project Director

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The QuEST Forum benefits from the continued and dedicated service of many individuals working towards the goals of the QuEST Forum. Without these individuals and their company's support, the QuEST Forum would not be successful in ensuring that the quality of telecommunication services to the end-user keep pace with changing technological opportunities in the twenty-first century.

A Board of Directors guides the QuEST Forum activities through a strategic plan, which is implemented by the work groups. The Measurements and Oversight work groups are credited for producing this document and they would like to recognize the individuals and companies that participated in the other work groups for providing invaluable service in support of the overall QuEST Forum Mission.

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Table of Contents

List of Figures

List of Tables

Section 1   Introduction

The TL 9000 handbooks (the *TL 9000 Quality Management System Requirements Handbook* and the *TL 9000 Quality Management System Measurements Handbook*) are designed specifically for the telecommunications industry to document industry quality management system requirements and measurements.

The *TL 9000 Quality Management System Requirements Handbook* establishes a common set of quality management system requirements for suppliers of telecommunications products: hardware, software, and services. The requirements built on existing industry standards, including ISO 9001. The *TL 9000 Quality Management System Measurements Handbook* defines a minimum set of performance measurements. The measurements are selected to guide progress and evaluate results of quality management system implementation.

1.1 Goals

The goals of TL 9000 are to:

- Foster quality management systems that effectively and efficiently protect the integrity and use of telecommunications products: hardware, software, and services,
- Establish and maintain a common set of quality management system requirements,
- Reduce the number of telecommunications quality management system standards,
- Define effective cost and performance-based measurements to guide progress and evaluate results of quality management system implementation,
- Drive continual improvement,
- Enhance customer-supplier relationships, and
- Leverage industry conformity assessment processes.

1.2 Purpose

The purpose of TL 9000 is to define the telecommunication quality management system requirements for the design, development, production, delivery, installation, and maintenance of products: hardware, software, and services. Included in TL 9000 includes performance-based measurements that quantify reliability and quality performance of these products. Long-term goals include both cost- and performance-based measurements.

1.3 Benefits of Implementation

Suppliers of telecommunication products, their customers, service providers, and the end subscriber benefit from the implementation of TL 9000.

Expected benefits are:

- Continual improvement of service to subscribers,
- Enhanced relationships between the organization and its customers,
- Standardization of quality management system requirements,

- Efficient management of external audits and site visits,
- Uniform measurements,
- Overall cost reduction and increased competitiveness,
- Enhanced management and improvement of the organization's performance, and
- Industry benchmarks for TL 9000 measurements.

1.4 Relationship to ISO 9001 and Other Requirements

The QuEST Forum maintains compatibility with other sets of requirements and standards. TL 9000 provides a telecommunications-specific set of requirements built on an ISO 9001:2000 framework. See the Bibliography for the standards and requirements that were considered during the development of TL 9000.

Characteristics of the TL 9000 relationship to other requirements are:

- TL 9000 includes ISO 9001:2000 and any future revisions will be incorporated,
- Conformance to TL 9000 constitutes conformance to corresponding ISO 9001 requirements, and
- It is the intent of the QuEST Forum that conformance to TL 9000 will eliminate the need for conformance to other telecommunications quality management standards.

1.5 Developing and Maintaining the Handbook(s)

The QuEST Forum is responsible for the development, publication, distribution and maintenance of the TL 9000 handbooks. Change requests for the handbooks, following initial publication, are to be submitted to the QuEST Forum Administrator. Any user of the handbooks may submit change requests. Change requests will be forwarded to the appropriate handbook section chairperson by the QuEST Forum Administrator and will be considered for the next revision. A change request/feedback form is available at the QuEST Forum web site (http://www.questforum.org/).

Final approval of all changes to TL 9000 handbooks will be by vote of the QuEST Forum voting members in accordance with the QuEST Forum's bylaws. Re-issue of the TL 9000 handbooks will be determined by the QuEST Forum, but not to exceed five years following the last issue date. When the QuEST Forum determines there are changes necessary in TL 9000 that could impact third party registration, then addenda or similar communication mechanisms will be employed to inform the industry of corrections and updates to the TL 9000 handbooks.

Section 2   Structure

**2.1 Overall
Structure**

TL 9000 is structured in layers (see Figure 2.1-1):

- International Standard ISO 9001:2000
- Common TL 9000 Requirements
- Hardware, Software, and Services Specific Quality Management System Requirements
- Common TL 9000 Measurements
- Hardware, Software, and Services Specific Quality Management System Measurements
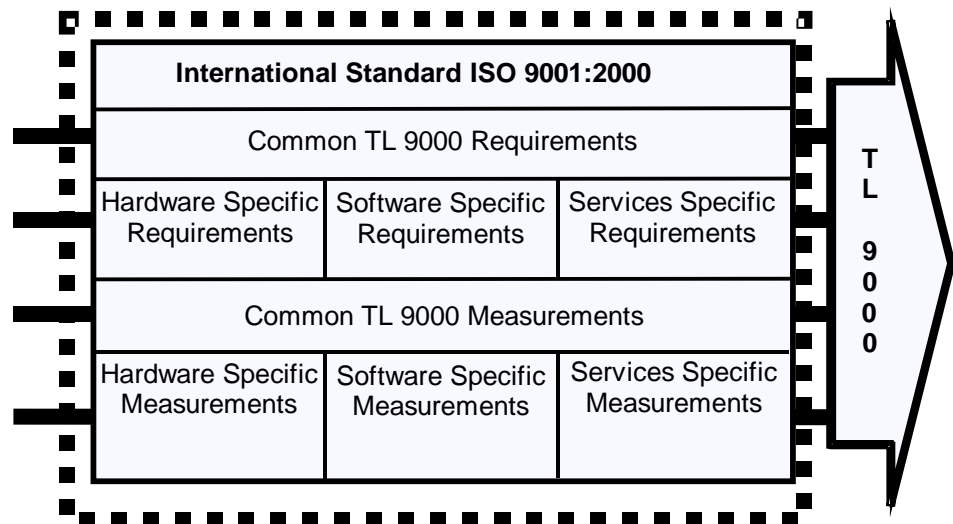
Figure 2.1-1 The TL 9000 Model

The QuEST Forum retains complete control over the content except for material that is copyrighted by others.

The word **"shall"** indicates mandatory requirements. The word **"should"** indicates a preferred approach. Organizations choosing other approaches must be able to show that their approach meets the intent of TL 9000. Where the words **"typical"** and **"examples"** are used, an appropriate alternative for the particular commodity or process should be chosen. Paragraphs marked **"NOTE"** are for guidance and not subject to audit.

Endnotes denoted by **[x]** represent bibliography source material that is not auditable (see "Bibliography").

2.2 Terminology

In this handbook the term supplier refers to the organization pursuing TL 9000 implementation, conformance, and/or registration.

2.3 Data Flow and Usage of Measurements

Figure 2.3-1 illustrates the data flow and usage of TL 9000 Quality Management System Measurements as described in this handbook.
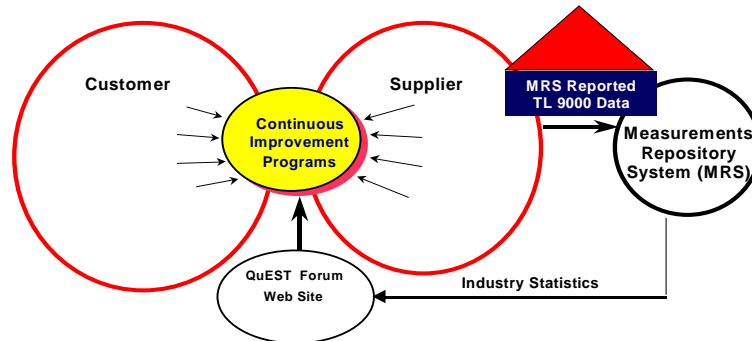
Figure 2.3-1 TL 9000 Measurement Data Flow and Usage

The use of measurements should be designed to meet the principles of the QuEST Forum, which are stated in subsection 3.3.

Usage Approach - Figure 2.3-1 depicts an environment where improvement opportunities are identified by an organization and its customer through information exchanges and from TL 9000 trend data.

a. Measurements may be used between an organization and its customer to set mutual targets to improve products. This helps build customer and organization relationships and establishes targets that best meet their needs.

b. Some of the TL 9000 measurements may be used as improvement measures by individual organizations. These measurements receive careful review to ascertain that the measures are indeed comparable. Measurements are monitored by the Measurements Administrator to assure that aggregation across organizations into summary statistics is valid and meaningful. The summary statistics definitions will be revised as needed. The definition of these measurements includes the designation "compared data."

c. Other measurements include the designation "research data". Research data shall not be used for comparison purposes. However, the Measurements Administrator will analyze the data to reveal possible industry trends. These analyses are reported only to the measurements work group for study to determine future uses.

d. The product category performance is improved as each organization compares its results against the summary statistics and improves its performance.

e. The QuEST Forum measurements database is not intended for use as a management tool to manage an organization supplying products, but as a data repository. Output from the database shall consist of statistical summary reports derived from the TL 9000 Measurements Repository System (MRS) for each measurement by product category.

Section 3 Measurements Processing, Usage and Responsibilities

3.1 Requirements for Measurements Usage

In order to fully meet the requirements of this handbook and the companion *TL 9000 Quality Management System Requirements Handbook*, the measurements requirement defined here shall be used by the organization:

a. Internally as a part of their continual improvement programs and management reports,

b. As appropriate, in customer-organization exchanges and continual improvement programs, and

c. When reporting to the Measurements Administrator, where indicated.

3.2 Principles of Measurements Processing

TL 9000 registration requires the fulfillment of the TL 9000 Quality Management System Requirements and the reporting of the TL 9000 Quality Management System Measurements data specific to that TL 9000 registration to the Measurements Administrator.

The following principles for processing the measurements are meant to foster an environment where customers and organizations can work together to drive continual improvement:

a. All applicable measurements for a product category as defined in the Measurement Applicability Table (Normalized Units), Appendix A, Table A-2 shall be reported.

b. Valid reasons for the exclusion of specific measurements from the scope of registration must be documented by the organization and available to the registrar (certification/registration body) and customer on request.

c. Organizations shall provide TL 9000 measurement data to the Measurements Administrator who will compile the data and calculate product category statistics, such as "Industry Mean", "Standard Deviation", "Median", "Range", "Number of Data Points", and "Best in Industry" for each product category, as appropriate. Results and reports produced by the Measurements Administrator will not identify individual organizations.

d. Customers who are members of the QuEST Forum shall provide the necessary TL 9000 field performance data to the suppliers in order to calculate the specific measurements.

e. A customer may request organizations that directly supply products to provide the TL 9000 measurements specific to that customer. This information exchange occurs strictly between the organization and the customer per mutual agreement. The QuEST Forum Administrator and Measurements Administrator are not involved in any way.

f. There will be no ranking of organizations by the QuEST Forum Administrator.

g. The processing of measurements shall not compromise the proprietary nature of the data.

3.3 Principles of Measurements Usage

The intended usage of TL 9000 measurements is to:

a. Provide industry performance information suitable for benchmarking,

b. Improve telecommunications processes and products,

c. Identify improvement opportunities, and

d. Standardize customer report cards or assessments.

3.4 Measurements Data Aggregation and Customer Base

3.4.1   Aggregation of Products

If an organization wishes to register multiple products in the same product category and clearly identifies them as separate in the registration scope, the organization may report the data for each product separately. Similarly, if an organization registers a business unit or a location, the organization has the option to determine which products will be registered and how the data will be aggregated.

3.4.2   Customer Base

a. Customer base refers to the defined group of customers that the organization's measurement data encompasses. The customer base options are:

   (1)   Forum Members: Only the organization's customers who are members of the QuEST Forum, or

   (2)   Total: All of the organization's customers for the product(s) to which the measurement applies.

b. The customer base shall be reported in each measurement data submission for each measurement as indicated in the measurement profile.

c. The organization shall report measurement data from only one customer base per individual measurement.

3.5 Responsibilities

3.5.1   QuEST Forum Administrator Responsibilities

The QuEST Forum Administrator shall:

a. Maintain complete security and confidentiality of an organization's information,

b. Develop, implement, publish and maintain formal operating procedures defining the TL 9000 measurement process,

c. Receive the "Data Confirmation Report" from the Measurements Administrator and forward the "Data Confirmation Report" to the organization,

d. Communicate to the organization missing or questionable data concerns as reported by the Measurements Administrator,

e. Maintain a membership database that includes registration and measurements submission history,

f. Publish and maintain industry reportable statistics by:

    (1)   Product category with data from a total customer base,

    (2)   Product category with data from only a QuEST Forum customer base, and

    (3)   All available data for a product category (i.e., 1 and 2),

Note: Measurements are reported only when there is a minimum of five data submissions from at least three companies for a given product category.

g. Provide and control access to the measurement data output through the QuEST Forum web site,

h. Develop and implement a disaster recovery plan for QuEST Forum Administrator related operations,

i. Support external audit or oversight of QuEST Forum Administrator activities, and

j. Immediately notify registered organizations and affected companies when updates to Measurement Applicability Table (Normalized Units), Appendix A, Table A-2 are released on the QuEST Forum web site (http://www.questforum.org/).

3.5.2   Measurements Administrator Responsibilities

The Measurements Administrator shall:

a. Maintain complete security and confidentiality of the data,

b. Develop, implement, publish, and maintain formal operating procedures defining the TL 9000 measurement process tools and techniques,

c. Receive and acknowledge receipt of data from organizations, including identifying missing or inaccurate data and reporting back to the QuEST Forum Administrator,

d. Calculate the industry statistics, such as "Industry Mean", "Standard Deviation", "Median", "Range", "Number of Data Points", and "Best in Industry", as appropriate, by product category using the appropriate data elements for each measurement that has compared data,

e. Compute industry statistics by:

    (1)   Product category with data from a total customer base,

    (2)   Product category with data from only a QuEST Forum customer base, and,

    (3)   All available data for a product category (i.e., 1 and 2),

f. Post compared data output to the web site at least quarterly,

g. Develop and implement a disaster recovery plan for related operations,

h. Support external audit or oversight of activities,

i. Determine when sufficient data has been collected per measurement product category to publish statistically valid results,

Note: Measurements are reported only when there is a minimum of five data submissions from at least three companies for a given product category.

j. Be responsible for the accurate representation of provided data,

k. Create and maintain user manuals,

l. Propose aggregation of product categories to produce meaningful measurements as a result of analysis of the inputs,

m. Analyze "research data" to reveal industry trends and report only to the measurements work groups, and

n. Analyze "research data" to determine if there are conditions under which the data could be compared and make recommendations only to the measurements work groups to achieve comparability.

3.5.3   Organization Responsibilities

The organization shall:

a. Have documented processes in place to capture and validate applicable measurement data such that source data records are available,

b. Collect, validate, and submit data per the defined measurement definitions to the Measurements Administrator using the provided tool(s),

c. Submit data on measurements that are within its scope of registration,

d. Submit a minimum of three consecutive months of data to the Measurements Administrator and receive a "Data Confirmation Report" acknowledging valid submissions to obtain TL 9000 registration,

e. Continue to submit data every calendar quarter after becoming registered no later than eight weeks after the end of each quarter,

f. Provide measurement data for new products within six months from General Availability of the product, if it falls within the scope of registration,

g. Compare internal measurements to the industry statistics and take steps to improve products and practices as appropriate,

h. Provide regular TL 9000 Quality Management System Measurements reports to its responsible management,

i. Correct any data discrepancies, and

j. Re-submit corrected data for any erroneous data submitted within the previous two years.

3.5.4   Customer Responsibilities

The customer shall:

a. Provide the necessary data to allow supplier organizations to generate the TL 9000 measurements,

b. Have processes in place to capture and validate applicable measurement data,

c. Use the TL 9000 measurements definitions for standardizing the supplier organization performance review process (e.g., report cards),

d. Establish joint improvement teams and objectives based on TL 9000 measurements and other required performance objectives, and

e. Consider using TL 9000 measurements as an input when determining life cycle costs.

3.5.5   QuEST Forum Responsibilities

The QuEST Forum shall:

a. Be responsible for the administration of the *TL 9000 Quality Management System Measurements Handbook*,

b. Ensure that the TL 9000 Quality Management System Measurements Handbook is publicly available. Publication, distribution and maintenance are performed under the direction of the QuEST Forum, which retains its copyright,

c. Be responsible for assuring the availability of appropriate training to help users correctly and consistently interpret the TL 9000 requirements and report the TL 9000 measurements,

d. Provide measurements process oversight,

e. Address all issues and concerns relating to the measurements process and provide a summary and recommendations to the appropriate QuEST Forum work group, and

f. Review proposed aggregations of product categories submitted by the Measurements Administrator.

3.5.6   Registrar Responsibilities

During each audit the registrars shall verify that:

a. Processes are in place to ensure data validity and integrity in accordance with the TL 9000 Quality Management System Measurements definitions and requirements,

b. All supplier organization responsibilities are met, and

c. All measurement process non-conformances are corrected within the registrar-specified timeframe.

Section 4   General Measurements Requirements

4.1 Measurements Listing

4.2 Measurements Reporting Requirements

4.2.1 Conformance to Measurements Profile

The supplier shall generate and distribute the measurement data to the Measurements Administrator (and to customers according to the principles of measurements processing as detailed in Section 3) as described by the profiles in this handbook for the applicable product categories. The measurement data shall conform to the requirements in the corresponding profile. Changes to reported data that are needed to comply with a new master version of Appendix A or a new version of the measurements handbook shall be completed within six months of their release. All data reported commencing with the second data submission after a new release of this handbook shall be in compliance with the new release of the handbook.

4.2.2 Applicable Product Categories

For each product the supplier shall identify product categories and applicable measurements according to Measurement Applicability Table (Normalized Units), Appendix A, Table A-2. Appendix A is current as of the release of this handbook. The Measurement Applicability Table is subject to periodic updates. To accommodate these changes, the master is available on the Quest Forum web site (http://www.questforum.org/). The master shall be used in conjunction with registrations and for all data submittals to the QuEST Forum database.

4.3 Measurements Data and Reports

4.3.1 Customer Source Data

When the customer does not provide data required for a measurement, the supplier shall not be required to report the measurement for that customer.

Organizations shall submit data for a measurement if any of their customers provide the information. Organizations are exempt from submitting measurement data to the Measurements Administrator if none of their customers provide the required information.

4.3.2 Acceptable Alternative Measurements

When the measurement profile states that RQMS (GR-929-CORE, Reliability and Quality Measurements for Telecommunications Systems (RQMS) [1]) alternative reporting is acceptable, under the "Method of Delivery and Reporting" topic in the profile, the following shall apply:

a. RQMS Data Acceptability

If a supplier is using the methods outlined in the latest issue of RQMS to calculate a specific measurement, those methods and the resulting data will be accepted in lieu of the TL 9000 definition if the following conditions are met:

(1) The data used for reporting to the QuEST Forum and its members include all applicable data as prescribed by the TL 9000 definition of the measurement and it is not limited to the RQMS client company subset of data.

(2) For product categories not subject to RQMS reporting, the TL 9000 definition shall be used.

b. TL 9000 Data Preference

In all cases, the TL 9000 definition of the measurement is the preferred method. Where none of a supplier's customers require the supplier to generate the RQMS reports, then the TL 9000 method shall be used. The supplier shall state which method is used when reporting this measurement.

NOTE: The intent of RQMS alternative measurements is to minimize redundant effort by suppliers when both RQMS and TL 9000 measurements are contractually required. In that case, compliance audits would accept an RQMS-based procedure coupled with meeting the conditions listed above as valid for calculating this measurement.

4.3.3   Report Frequency and Method

Unless otherwise specified by the profile, the supplier shall collect data monthly and report the required results quarterly to the QuEST Forum Measurements Administrator. The supplier is free to use whatever time periods or formats appropriate for reporting internally and to its customers. The quarterly update shall include the data points from the preceding three months. Except for pre-registration data submittals, all submissions shall be by calendar quarter.

4.3.4   Use of Fiscal Periods and Calendar Days

The supplier shall report TL 9000 measurement data based on calendar months or defined fiscal months. The supplier shall use the chosen method consistently. The supplier shall notify customers and the Measurements Administrator prior to changing methods. The supplier shall use calendar days for the measurements that involve number of days.

4.3.5   Reporting of Compared Data and Research Data

The supplier shall report data for all applicable measurements defined in this handbook to the Measurements Administrator according to the agreed rules. This reporting requirement applies whether the supplier uses the TL 9000 method or the RQMS alternative reporting and whether the measurement

includes the designation "compared data" (CD) or "research data" (RD). See the Measurements Summary Listing, Table A-5 in Appendix A.

NOTE: The designation "compared data" in the Method of Delivery and Reporting section of the profile means that industry statistics may be available from the QuEST Forum Administrator. However, the designation "research data" indicates that no comparable industry statistics are available and the Measurements Administrator will report analyses of industry trends only to the QuEST Forum measurements work group.

4.3.6   Product Exclusions

The supplier may exclude data on products that are no longer supported for its general customer base. This exclusion does not apply to individual field replaceable units that have been made obsolete by a later version unless those units are completely recalled from the field. Formal notification of placement of the product on "Additions and Maintenance" (A&M) or "Manufacturing Discontinued" (MD) status shall have been made to the customers for this exclusion to apply.

4.3.7   Measurement Applicability

Unless otherwise stated, measurements shall only apply to products during General Availability.

4.3.8   Calculation of Normalization Units

Where the normalization factor is traffic capacity based, such as DS1, OC-1, DSL or Terminations, the calculation shall be based on the true useable traffic capacity. Equipment within the system used to provide protection for the main traffic path shall not be included, as it does not add useable capacity to the system.

Section 5 Common Measurements

Common measurements are measurements that apply to all products: hardware, software, and services.

5.1 Number of Problem Reports (NPR)

5.1.1 General Description and Title

The Total Problem Reports (Complaints) Measurement is a measure of total problem reports as specified in the Measurement Applicability Table (Normalized Units), Appendix A, Table A-2. This measurement is adapted from RQMS [1] and is applied to all products: hardware (H), software (S), and services (V).

5.1.2 Purpose

This measurement is used to evaluate the number of customer originated problem reports (complaints) that are indicative of the quality of the product delivered during the operating life cycle of that product. Problem reports may have a negative impact to the supplier (such as rework), to the customer (such as scheduling repeat site visits) and may reduce end user loyalty. This measurement is intended to stimulate ongoing improvements in order to reduce the number of problem reports and reduce associated costs and potential revenue losses.

5.1.3 Applicable Product Categories

This measurement applies to product categories as shown in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

5.1.4 Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for the NPR Measurement:

- Annualization Factor (Afactor)
- General Availability
- No Trouble Found
- Official Fix
- Problem – Critical H/S
- Problem – Major H/S
- Problem – Minor H/S

- Problem Report
- Service Problem Report
- Severity Level

b. Counting Rules

The following rules shall apply in counting problem reports for the NPR measurement.

(1) In the case of hardware or software, problem reports associated with any and all in-service supported release versions shall be counted. A software release or a system is "in service" when it handles end-user traffic or transactions. This includes field trials prior to General Availability where end customers are affected.

(2) In the case of services, any formal report of a problem (complaint) after or during delivery of a service shall be counted. Service reports shall include the originator's name and a feedback mechanism for closure.

(3) Only customer-originated problem reports shall be counted.

(4) Any problem report after General Availability shall be counted unless otherwise specified.

(5) Identical problem reports, i.e., multiple reports of the same occurrence of the same problem at the same location at the same time, shall be counted as one problem report.

(6) Duplicate problem reports, i.e., the same fault has occurred either at a different customer location or at another time, shall each be counted as separate problem reports.

(7) Multiple problems recorded on the same problem report (as in a problem report form or screen) shall be counted separately, unless in the customer's view these problems are all related to the same manifestation of failure experienced by the customer.

(8) In order to obtain a comparable measure the supplier and customers shall map the severity of hardware or software problem reports according to the definitions contained in the glossary for critical, major and minor H/S problem reports. Whenever a problem clearly belongs in a given severity level per the glossary definition, then that severity level shall be used. If it is not clear which severity level applies, the customer's assignment of severity level shall be used.

(9) Problem reports on hardware or software products shall be counted in the severity classification in effect at the time the data is calculated for reporting to the Measurements Administrator.

(10) Temporary fixes, such as temporary patches or workarounds, are frequently used to resolve critical software or hardware problems. The official fix is often developed under a subsequent or "follow up" major or minor problem report that references the original critical problem report. A critical problem report of this type shall not be reclassified and shall be reported as a critical problem report. The subsequent major or minor problem report shall not be counted in NPR but is included in Problem Report Fix Response Time (FRT) and Problem Report Overdue Fix Responsiveness (OFR) measurements.

(11) NPR problem reports are counted in the month they are received and only in the month they are received.

c. Counting Rule Exclusions

The following shall be excluded from the problem report count for the NPR measurement:

(1) A problem report determined to represent an information request (IR) or request for a feature by agreement between the supplier and customer,

(2) A problem report related to use of the product in a manner not defined in the specification of the product by agreement between supplier and customer,

(3) Customer reports of routine events such as expected maintenance, normal field replaceable unit returns, or software upgrades, or

(4) Routine reports of outages, such as Service Failure Analysis Reports (SFAR).

d. Calculations and Formulas

(1) The measurements (see NPR1, NPR2, NPR3 and NPR4 in Table 5.1-1) shall be calculated monthly as the total number of incoming problem reports divided by the normalization factor listed in the Product Category Table, Measurement Applicability Table (Normalized Units), Appendix A, Table A-2 multiplied by the Annualization factor (Afactor).

(2) In the hardware and software product categories where the normalization factor is identified as "None" in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2, the supplier will still be required to track the number of problem reports and their resolution (In this case enter normalization factor = "none" in Table 5.1-3).

(3) When reporting RQMS alternative measurements for hardware and/or software, suppliers shall refer to IPR1, IPR2, and IPR3 in Table 5.1-2 to determine reporting conventions.

Notation

NU	=	Normalization Unit (NU) from Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
S	=	Normalization Factor; the total NU count
Afactor	=	The number of reporting periods in a year (see Glossary)
Np1	=	Number of Critical H/S Problem Reports in the reporting period
Np2	=	Number of Major H/S Problem Reports in the reporting period
Np3	=	Number of Minor H/S Problem Reports in the reporting period
Np4	=	Number of Service Problem Reports in the reporting period

Table 5.1-1 Number of Problem Reports (NPR) Measurement Identifiers and Formulas

Identifier	Title	Formula
NPR1	H/S Critical Problem Reports per NU per year	**Np1 x Afactor / S**
NPR2	H/S Major Problem Reports per NU per year	**Np2 x Afactor / S**
NPR3	H/S Minor Problem Reports per NU per year	**Np3 x Afactor / S**
NPR4	Service Problem Reports per NU per year	**Np4 x Afactor / S**

Table 5.1-2 Number of Problem Reports (IPR) RQMS Alternative Measurements

Identifier	Title
IPR1	Incoming Critical Problem Reports per system per month
IPR2	Incoming Major Problem Reports per system per month
IPR3	Incoming Minor Problem Reports per system per month

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 NPR Data Table (Table 5.1-3) – The NPR measurement shall be reported with data elements (or equivalent as defined by the QuEST Forum Administrator) for each month and each product category as follows:

Table 5.1-3 TL 9000 NPR Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**S** or **none**
Annualization Factor:	**Afactor** (see Glossary)
Measurement Identifier:	NPR
NPR1 Numerator:	**Np1**
NPR2 Numerator:	**Np2**
NPR3 Numerator:	**Np3**
NPR4 Numerator:	**Np4**

(3)   RQMS Alternative NPR Data Table (Table 5.1-4) – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as follows:

Table 5.1-4   RQMS Alternative NPR Data Table (IPR)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	Number of systems in service
Measurement Identifier:	IPR
IPR1 Numerator:	**IPR1n** – Number of incoming critical problem reports
IPR2 Numerator:	**IPR2n** – Number of incoming major problem reports
IPR3 Numerator:	**IPR3n** – Number of incoming minor problem reports

5.1.5   Sources of Data

Data for the NPR measurement is derived from information provided by customers and from supplier analysis as follows:

a. Customers

- Report problems to the supplier
- Report normalizing information for hardware or software categories to the supplier according to the Product Category Tables, Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

b. Suppliers

- Count reported problems by product category and customer base and convert to "number of problem reports" according to the applicable counting rules
- For service products, track and report service normalization unit
- Calculate the normalization factor
- When customer supplied data is insufficient, suppliers may calculate the normalizing information for hardware or software categories based on internal shipment or billing records for products within the scope of the applicable registration and according to the Product Category Tables, Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

5.1.6 Method of Delivery or Reporting

a. Compared Data (CD) or Research Data (RD):

Critical Problem Reports per NU	CD
Major Problem Reports per NU	CD
Minor Problem Reports per NU	CD
Service Problem Reports per NU	CD

b. RQMS Alternative Reporting:

Critical Problem Reports per NU	YES
Major Problem Reports per NU	YES
Minor Problem Reports per NU	YES
Service Problem Reports per NU	NO

5.1.7 Example Calculations

a. Example 1 – NPR for H/S Products

(1) Consider one month's data for a supplier of a particular operational support system (OSS) sold to both members and non-members of the QuEST Forum. There are 30 systems in service during the entire month and NU is "systems in service."

(2) The data reported is shown in Table 5.1-5.

Table 5.1-5   Example 1 – NPR H/S Data Report

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	4.2
Measurement Methodology:	TL 9000
Customer Base:	Total
Normalization Factor:	30
Annualization Factor:	12
Measurement Identifier:	NPR
NPR1 Numerator: Np1	0
NPR2 Numerator: Np2	3
NPR3 Numerator: Np3	45
NPR4 Numerator: Np4	NA

(3)   The calculation of the measurement would be:

Table 5.1-6   Example 1 – NPR Source Data and Measurement Calculations

Problem Reports	Severity	Afactor	Normalization Factor (S)	NPR Measurement Result	
Np1 = 0	Critical	12	30	**NPR1** = 0	Critical Problem Reports per system per year
Np2 = 3	Major	12	30	**NPR2** = 1.2	Major Problem Reports per system per year
Np3 = 45	Minor	12	30	**NPR3** = 18	Minor Problem Reports per system per year
Np4 = NA				**NPR4** = NA	Service Problem Reports are not applicable for this product

b.   Example 2 – NPR for Services Products

(1)   Consider one month's data for a supplier of a particular maintenance service sold to both members and non-members of the QuEST Forum. There are 20 units maintained during the entire month and NU is "units served."

(2)   Data reported is shown in Table 5.1-7.

Table 5.1-7   Example 2 – NPR Data Report (Services)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	7.3
Measurement Methodology:	TL 9000
Customer Base:	Total
Normalization Factor:	20
Annualization Factor:	12
Measurement Identifier:	NPR
NPR1 Numerator: Np1	NA
NPR2 Numerator: Np2	NA
NPR3 Numerator: Np3	NA
NPR4 Numerator: Np4	30

(3)   The calculation of the measurement is shown in Table 5.1-8.

Table 5.1-8   Example 2 – NPR Source Data and Measurements (Services)

Problem Reports	Severity	Afactor	Normalization Factor (S)	NPR Measurement Result	
Np1 = NA	Critical			**NPR1** = NA	H/S Critical Problem Reports are not applicable for services
Np2 = NA	Major			**NPR2** = NA	H/S Major Problem Reports are not applicable for services
Np3 = NA	Minor			**NPR3** = NA	H/S Minor Problem Reports are not applicable for services
Np4 = 30	Not applicable for Services	12	20	**NPR4** = 18	Service Problem Reports per unit maintained per year

5.2 Problem Report Fix Response Time (FRT)

5.2.1 General Description and Title

Problem Report Fix Response Time (FRT) is the supplier's overall responsiveness to reported problems. The Problem Report Fix Response Time applies to the delivery of the official fix in response to hardware/software (H/S) problem reports and to service (V) problem reports. This measurement is adapted from RQMS. [1]

5.2.2 Purpose

This measurement is used to quantify the responsiveness to problem reports and facilitate prompt fixes and closures of problem reports.

5.2.3 Applicable Product Categories

These measurements apply to product categories as shown in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

5.2.4 Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for the FRT Measurements:

- Closure Criteria
- Closure Date
- Closure Interval
- Fix
- Fix Response Time
- Official Fix
- Overdue Service Problem Report
- Problem - Critical H/S
- Problem - Major H/S
- Problem - Minor H/S
- Problem Report
- Severity Level
- Temporary Fix

b. Counting Rules

(1) Only Problem Reports that are originated by a customer and meet the criteria for Number of Problem Reports shall be included. All counting

rules and exclusions noted in section 5.1.4.b and 5.1.4.c also apply to FRT.

(2) The start of the interval for calculating FRT shall be considered as the receipt of that problem report by the supplier. If the severity of a problem report is modified, the FRT shall start at the receipt of the problem report.

(3) The end of the interval for calculating FRT shall be considered as the date that the official fix or closure criteria is made available. Should the problem report originator later reject the fix as incomplete or causing side effects, the problem report shall be re-classified as open.

(4) For FRT, problem reports are counted **ONLY** in the month they are due and not in the month they are fixed if different.

(5) The total FRT shall be reported in the severity classification at the time the fix is due to be closed.

(6) The customer has the final determination that a problem report is resolved. All resolutions must be acknowledged by the customer that the solution provided by the supplier meets the customer's requirements. This is particularly relevant to the resolution of duplicate problem reports where the criteria may vary by individual customer.

(7) Since this measurement is intended to quantify the supplier's fix response time, any extraordinary delays in the closure of a problem report caused by the customer may be deleted from the overall closure time. The supplier shall keep records of such delays with specific start and stop dates. Examples of this type of event are:
- Excess delay in testing of a proposed solution due to customer staffing constraints,
- After opening a problem report and being requested for needed data by the supplier, the customer delays supplying sufficient information for the supplier to commence problem resolution, and
- Not being able to get access to a customer facility to resolve a service problem report.

(8) If the deployment of the fix is delayed (or does not occur) specifically at customer request (and not because of supplier problems), the interval is defined as ending when the official fix is first made available for delivery. The delay interval shall not be included in the FRT calculation.

(9) If, with customer consent, the implementation of a fix is deferred (such as waiting for the next software update versus a patch) then the deferral interval shall not be included.

(10) The delivery of temporary fixes or workarounds in response to critical problem reports shall not be counted in this measurement. Subsequent or "follow up" major or minor problem reports opened to track the development and delivery of the official fix shall be included. When the official fix activity is tracked against the original critical problem report, then those reports shall be treated as major reports for FRT and OFR reporting.

(11) On customer approval, the time between the application of a temporary fix and the commitment date for a permanent fix may be discounted in the fix response time calculation. The customer must agree that the temporary fix meets their needs. Failure to provide an acceptable

resolution with a permanent fix by the negotiated commitment date will result in the restoration of all the discounted time.

c. Counting Rule Exclusions

All counting rule exclusions in 5.1.4.c also apply to FRT.

d. Calculations and Formulas

(1) Each of the FRT measurements (see FRT2, FRT3 and FRT4 in Table 5.2-1) shall be calculated monthly as the percentage of the total number of problems that were due to be closed during the month and that were delivered on time by the due threshold time. The due threshold time is:
   – 30 calendar days for major H/S problem reports and
   – 180 calendar days for minor H/S problem reports
   – A closure date agreement made between the customer and the supplier for all service problem reports. Expected closure intervals for services may be predetermined by a contractual agreement.

(2) When reporting RQMS alternative measurements for FRT measurements, suppliers shall refer to ORT2 and ORT3 in Table 5.2-2 to determine reporting conventions.

(3) FRT will be considered to be 100% when there are no problem reports due during the reporting period.

Notation

Fr2	=	Major H/S Fixes delivered on time
Fr3	=	Minor H/S Fixes delivered on time
Fr4	=	Service problem reports resolved on time
Fr2d	=	Number of major H/S fixes due to be closed
Fr3d	=	Number of minor H/S fixes due to be closed
Fr4d	=	Number of service problem reports due to be closed

**Table 5.2-1   Problem Report Fix Response Time (FRT)
Measurement Identifiers and Formulas**

Identifier	Title	Formula	Note
FRT2	H/S Major Problem Reports Fix Response Time	**(Fr2 / Fr2d) x 100**	% delivered on time
FRT3	H/S Minor Problem Reports Fix Response Time	**(Fr3 / Fr3d) x 100**	% delivered on time
FRT4	Service Problem Reports Fix Response Time	**(Fr4 / Fr4d) x 100**	% resolved on time

**Table 5.2-2   Problem Report Fix Response Time (ORT)
RQMS Alternative Measurements**

Identifier	Title
ORT2	% Major Problems Closed On Time
ORT3	% Minor Problems Closed On Time

e. Reported Data and Format

(1)   Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2)   TL 9000 FRT Data Table – The FRT measurement shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as shown in Table 5.2-3.

Table 5.2-3   TL 9000 FRT Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	**FRT**
FRT2 Numerator:	**Fr2**
FRT3 Numerator:	**Fr3**
FRT4 Numerator:	**Fr4**
FRT2 Denominator:	**Fr2d**
FRT3 Denominator:	**Fr3d**
FRT4 Denominator	**Fr4d**

(3)   RQMS Alternative FRT Data Table – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as shown in Table 5.2-4.

Table 5.2-4   RQMS Alternative FRT Data Table (ORT)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	ORT
ORT2 Numerator:	**Ort2n** – The total number of major fixes due to be closed during the three-month window that were delivered on time
ORT2 Denominator:	**Ort2d** – The total number of major fixes that were due to be delivered during the three-month window
ORT3 Numerator:	**Ort3n** – The total number of minor fixes due to be closed during the three-month window that were delivered on time
ORT3 Denominator	**Ort3d** – The total number of minor fixes that were due to be delivered during the three-month window

5.2.5   Sources of Data

The data for the FRT measurement are derived from information provided by customers and from supplier analysis as follows:

a. Customers

- Report problems to supplier
- Confer with supplier to establish severity classification for H/S
- Agree on service problem reports closure interval
- Agree with problem report closure decisions.

b. Suppliers

- Track problem reports, their severity (H/S), the agreed closure interval (services), and actual closure dates
- Count due, overdue and on-time fixes and problem reports, and compute the measurements according to the stated rules.

5.2.6   Method of Delivery or Reporting

a. Compared data (CD) or research data (RD):

Major H/S Problem Report Fix Response Time	CD
Minor H/S Problem Report Fix Response Time	CD
Services Problem Report Fix Response Time	CD

b. RQMS Alternative Reporting:

Major H/S Problem Report Fix Response Time	YES
Minor H/S Problem Report Fix Response Time	YES
Services Problem Report Fix Response Time	NO

5.2.7   Example Calculations

a. Example 1 – FRT for an H/S Product

(1)   Consider one month's data for a supplier of a particular OSS sold to both members and non-members of the QuEST Forum. There are five fixes to major problem reports due to be closed during the month and all five were delivered on time. There are 25 fixes to minor H/S problem reports due and 20 were delivered on time.

(2)   The FRT data reported is shown in Table 5.2-5.

Table 5.2-5   Example 1 – FRT Data Report

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	4.2
Measurement Methodology:	TL 9000
Customer Base:	Total
Measurement Identifier:	FRT
FRT2 Numerator: Fr2	5
FRT3 Numerator: Fr3	20
FRT4 Numerator: Fr4	NA
FRT2 Denominator: Fr2d	5
FRT3 Denominator: Fr3d	25
FRT4 Denominator: Fr4d	NA

(3)   The calculation of the FRT measurements would be:

Table 5.2-6   Example 1 – FRT Source Data and Measurement Calculation

Fixes On-Time	Severity	Fixes Due	FRT Measurement Results	
Fr2 = 5	Major	**Fr2d** = 5	**FRT2** = 100%	Major H/S Problem Report Fixes Delivered On Time
Fr3 = 20	Minor	**Fr3d** = 25	**FRT3** = 80%	Minor H/S Problem Report Fixes Delivered On Time
Fr4 = NA	Services	**Fr4d** = NA	**FRT4** = NA	Services Problem Reports are not applicable for this product

b. Example 2 – FRT for Services

(1)   Consider one month's data for a supplier of a particular installation service sold to both members and non-members of the QuEST Forum. There are 20 service problem reports due to be closed during the month and 16 were resolved on time.

(2)   FRT data reported is shown in Table 5.2-7.

Table 5.2-7   Example 2 – FRT Data Report (Services)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	7.1
Measurement Methodology:	TL 9000
Customer Base:	Total
Measurement Identifier:	FRT
FRT2 Numerator: Fr2	NA
FRT3 Numerator: Fr3	NA
FRT4 Numerator: Fr4	16
FRT2 Denominator: Fr2d	NA
FRT3 Denominator: Fr3d	NA
FRT4 Denominator: Fr4d	20

(3)   The calculation of the FRT measurements is shown in Table 5.2-8.

Table 5.2-8   Example 2 – FRT Source Data and Measurement Calculation (Services)

On-Time Closures	Fixes Due	FRT Measurement Results	
FR4 = 16	**Fr4d** = 20	**FRT4** = 80%	Service Problem Reports Resolved On Time

c. Example 3 – Effect of Customer Delay

Table 5.2-9   Example 3 – Effect of Customer Delay

Event	Event Date	Problem Due Date
Major Problem Report Received	March 1	March 31
Need for site access identified	March 10	March 31
Customer informs site not available until Apr.1	March 12	In suspense
Site Available	April 1	April 18

The effect of the site not being available is to move the due date of the problem report from March 31 to April 18. The difference is the length of the delay. The problem report would therefore be reported with the April data per counting rule 5.2.4 b. (4).

5.3 Overdue Problem Report Fix Responsiveness (OFR)

5.3.1 General Description and Title

Overdue Problem Report Fix Responsiveness (OFR) is the rate of closure of overdue major and minor H/S problem reports and all service problem reports. This measurement is adapted from RQMS. [1]

5.3.2 Purpose

This measurement is used to quantify the responsiveness to overdue problem reports and to facilitate prompt fixes and closures of overdue problem reports.

5.3.3 Applicable Product Categories

This measurement applies to product categories as shown in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

5.3.4 Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for the OFR Measurements:

- Closure Criteria
- Closure Date
- Closure Interval
- Fix
- Fix Response Time
- Official Fix
- Overdue Service Problem Report
- Problem - Critical H/S
- Problem - Major H/S
- Problem - Minor H/S
- Problem Report
- Severity Level
- Temporary Fix

b. Counting Rules

In addition to the rules contained in section 5.2, the following rules shall apply.

 (1) Overdue problem reports are those that are open beyond the due threshold time. The due threshold time is defined as:
- 30 calendar days for major H/S problem reports and
- 180 calendar days for minor H/S problem reports
- A closure date agreement made between the customer and the supplier for all service problem reports. Expected closure intervals for services may be predetermined by a contractual agreement.

 (2) Open Problem Reports shall be counted as overdue in each month during which they are open and overdue including the month they are closed.

  For example: If a problem report number 123 is open and overdue in month m and did not close by the last day of month m, then it shall count as overdue in month m and overdue in month m+1 even if it closed on day one of month m+1.

 (3) Penalty problem reports are counted in the OFR measurement and are applicable only to hardware and software products. A penalty problem report is defined as:
- For majors, all problem reports with age since opening which exceed 180 calendar days,
- For minors, all problem reports with age since opening which exceed 270 calendar days,
- Penalty problem reports shall also be counted as overdue problem reports (that is, double counting constitutes the "penalty").

c. Counting Rule Exclusions

 The counting rule exclusions in Section 5.2 shall apply.

d. Calculations and Formulas

Each of the OFR measurements (see OFR in Table 5.3-1) shall be calculated as follows:

- The sum of penalty problem reports for the month shall be added to the sum of the overdue problem reports for the month.
- The number of overdue problem reports closed are those overdue problem reports that were closed in the month.
- The measurement is computed as the number of overdue problem reports closed divided by the sum of overdue problem reports and the total number of penalty problem reports; the result shall be expressed as a percentage.
- The measurement shall be reported as 100% in the case where there are no overdue problem reports during the period.

Notation

Pro2	=	Number of overdue major H/S problem reports
Pro3	=	Number of overdue minor H/S problem reports
Pro4	=	Number of overdue service problem reports
Prp2	=	Number of major H/S penalty problem reports
Prp3	=	Number of minor H/S penalty problem reports
Prc2	=	Number of overdue major H/S problem reports closed
Prc3	=	Number of overdue minor H/S problem reports closed
Prc4	=	Number of overdue service problem reports closed

Table 5.3-1 Overdue Problem Report Fix Responsiveness (OFR) Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
OFR2	H/S Major Overdue Problem Report Fix Responsiveness	$(Prc2/[Pro2+Prp2]) \times 100$	% closed
OFR3	H/S Minor Overdue Problem Report Fix Responsiveness	$(Prc3/[Pro3+Prp3]) \times 100$	% closed
OFR4	Service Overdue Problem Report Fix Responsiveness	$(Prc4/Pro4) \times 100$	% closed

Table 5.3-2 Overdue Problem Report Fix Responsiveness (OPR) RQMS Alternative Measurements

Identifier	Title
OPR2	% Rate of Closures of Overdue Problem Reports – Major
OPR3	% Rate of Closures of Overdue Problem Reports – Minor

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 OFR Data Table – The OFR measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as shown in Table 5.3-3.

Table 5.3-3   TL 9000 OFR Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	OFR
OFR2 Numerator:	**Prc2**
OFR3 Numerator:	**Prc3**
OFR4 Numerator:	**Prc4**
OFR2 Denominator:	**Pro2**
OFR3 Denominator:	**Pro3**
OFR4 Denominator	**Pro4**
OFR2 Denominator 2nd Term:	**Prp2**
OFR3 Denominator 2nd Term:	**Prp3**

(3)   RQMS Alternative OFR Data Table – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as shown in Table 5.3-4.

Table 5.3-4   RQMS Alternative OFR Data Table (OPR)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	OPR
OPR2 Numerator:	**Opr2n** – The sum of the overdue major problem reports closed in the three-month period.
OPR2 Denominator:	**Opr2d** – The sum of penalty major problem reports for the three-month period added to the sum of the overdue major problem reports for the same period
OPR3 Numerator:	**Opr3n** – The sum of the overdue minor problem reports closed in the three-month period
OPR3 Denominator:	**Opr3d** – The sum of penalty minor problem reports for the three-month period added to the sum of the overdue minor problem reports for the same period

5.3.5 Sources of Data

The data for the OFR measurement are derived from information provided by customers and from supplier analysis as follows:

a. Customers

- Report problems to supplier
- Confer with supplier to establish severity classification for H/S
- Agree on service problem reports closure interval
- Agree with problem report closure decisions.

b. Suppliers

- Track problem reports, their severity (H/S), the agreed closure interval (services), and actual closure dates
- Count due, overdue and on-time fixes and problem reports, and compute the measurements according to the stated rules.

5.3.6 Method of Delivery or Reporting

a. Compared data (CD) or research data (RD):

Major H/S Overdue Problem Report Fix Responsiveness	RD
Minor H/S Overdue Problem Report Fix Responsiveness	RD
Services Overdue Problem Report Fix Responsiveness	RD

b. RQMS Alternative Reporting:

Major H/S Overdue Problem Report Fix Responsiveness	YES
Minor H/S Overdue Problem Report Fix Responsiveness	YES
Services Overdue Problem Report Fix Responsiveness	NO

5.3.7 Examples

a. Example 1 – OFR for an H/S Product

(1) At the beginning of the month, there were six major H/S problem reports that were overdue (age > 30 calendar days). One of these became a penalty major H/S problem report during the month (age > 180 calendar days). Two of the six overdue reports were closed during the month. There was no overdue minor H/S problem report at the beginning of the month. However, by the end of the month five minor H/S problem reports for which fixes had been due during the month had become overdue. One of these overdue minor H/S problem reports was closed before the end of the month.

(2) OPR data reported is shown in Table 5.3-5.

Table 5.3-5   Example 1 – OFR Data Report

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	4.2
Measurement Methodology:	TL 9000
Customer Base:	Total
Measurement Identifier:	OFR
OFR2 Numerator: Prc2	2
OFR3 Numerator: Prc3	1
OFR4 Numerator: Prc4	NA
OFR2 Denominator: Pro2	6
OFR3 Denominator: Pro3	5
OFR4 Denominator: Pro4	NA
OFR2 Denominator – 2nd Factor: Prp2	1
OFR3 Denominator – 2nd Factor: Prp3	0

(3)   The calculation of the OFR measurements for the month is shown in Table 5.3-6.

Table 5.3-6   Example 1 – OFR Source Data and Measurement Calculation

Closed Overdue Problems	Severity	Fixes Overdue	Penalty Problem Reports	OFR Measurement Result
Prc2 = 2	Major	**Pro2** = 6	**Prp2** = 1	**OFR2** = 2 / (6+1) x 100 = 28.6% % Overdue Major Problem Reports Closed
Prc3 = 1	Minor	**Pro3** = 5	**Prp3** = 0	**OFR3** = 1 / (5+0) x 100 = 20% % Overdue Minor Problem Reports Closed
Prc4 = NA	Services	**Pro4** = NA	not applicable	Services Problem Reports are not applicable for this product

b.   Example 2 – OFR for a Services Product

(1)   At the beginning of the month, there were two Service problem reports that were overdue (age greater than the agreed closure interval). One of the two overdue reports was closed during the month.

(2)   OFR data reported would be as shown in Table 5.3-7.

Table 5.3-7   Example 2 – OFR Data Report (Services)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	7.1
Measurement Methodology:	TL 9000
Customer Base:	Total
Measurement Identifier:	OFR
OFR2 Numerator: Prc2	NA
OFR3 Numerator: Prc3	NA
OFR4 Numerator: Prc4	1
OFR2 Denominator: Pro2	NA
OFR3 Denominator: Pro3	NA
OFR4 Denominator: Pro4	2
OFR2 Denominator – 2nd Factor: Prp2	NA
OFR3 Denominator – 2nd Factor: Prp3	NA

(3)   The calculation of the OFR measurements for the month is shown in Table 5.3-8.

Table 5.3-8   Example 2 – OFR Source Data and Measurement Calculation (Services)

Closed Overdue Problems	Severity	Fixes Overdue	Penalty Problem Reports	OFR Measurement Result
Prc4 = 1	not applicable	**Pro4** = 2	not applicable	**OFR4** = 1 / 2 x 100 = 50% % Overdue Service Problem Reports Closed

5.4 On-Time Delivery (OTD)

5.4.1 General Description and Title

On-Time Delivery (OTD) is a measure of timeliness of all product orders delivered to customers.

5.4.2 Purpose

This measurement is used to evaluate the supplier's on-time delivery performance in order to meet the customer's need for timely product delivery and to meet end-customer expectations.

5.4.3 Applicable Product Categories

This measurement applies to product categories as shown in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2. It does not apply to continuous services (e.g., Customer Support Service) where service is measured by service problem reports.

5.4.4 Detailed Description

a. Terminology

A service order is an order for service having a Customer Requested Completion Date (CRCD), but not an installed system order. An example of a service order is when a supplier is contracted by a customer to install and/or engineer a product that is manufactured by another supplier. Services may include engineering and/or installation.

The Glossary includes definitions for the following terms used for the OTD measurement:

- Installed System
- Installed System Order
- On-Time Installed System Delivery
- On-Time Item(s) Delivery

b. Counting Rules

   (1) A system that includes any combination of hardware, software, and service applications is counted as one order.

   (2) Acceptance shall be defined according to purchase order and/or contract terms and conditions unless notified otherwise by the customer.

(3) Due dates and delivery dates are considered to be one 24-hour period (customer's calendar day).

(4) Early order completions or deliveries are considered to have missed the delivery date unless authorized by the customer.

(5) Actual Completion Date (ACD) is the date when service is complete at a job site and accepted by the customer.

(6) Customer Requested Date (CRD) is the desired delivery date of items, systems or services as defined by the customer's purchase order or contract. CRD is the initial requested date or, in the case of customer requested changes, the revised date.

(7) The monthly OTD data shall include all orders having CRD occurring during the same month.

(8) Actual On-Job Date (AOJD) identifies the date when the shipment actually was delivered at the ship-to address. This date is derived by adding the transportation interval to the actual ship date.

(9) CRD is either CRCD or CROJD depending on order type. Customer Requested Completion Date (CRCD) is the date requested by the customer that orders are completed. Customer Requested On Job Date (CROJD) is the date requested by the customer of shipment delivery.

(10) Order types can be: installed system, items, or service.

(11) A service order is one having a CRCD, but not an installed system order. Services may include installation and/or engineering.

(12) Compound orders designated by the customer for a single delivery ("must ship complete" orders) shall be treated in aggregate. If one line item is late, then all line items shall be counted as late.

c. Counting Rule Exclusions

(1) Late Orders Received (LOR) are those for which CRD is earlier than Date Order Received, and are excluded from the measurement.

d.   Calculations and Formulas

(1) On-Time Delivery (OTD) (see OTD in Table 5.4-1) is the percentage of orders/items accepted on the Customer Requested Date (CRD) where CRD is equal to either ACD or AOJD depending on order type.

(2) OTD is calculated as 100 multiplied by the number of orders/items accepted on the CRD during the month divided by the number of orders/items for which CRD occurred during the month.

(3) OTD is comprised of three measurements of order fulfillment, as follows:
   – Percentage of installed system orders accepted on Customer Requested Completion Date (CRCD),
   – Percentage of line items accepted on Customer Requested On-Job Date (CROJD), and
   – Percentage of service orders accepted on Customer Requested Completion Date (CRCD).

Notation

Cs	=	Number of installed systems for which CRCD occurred during the month
Ss	=	Number of installed systems accepted on the CRCD during the month
Ci	=	Number of items for which CROJD occurred during the month
Si	=	Number of items accepted on the CROJD during the month
Cv	=	Number of service orders for which CRCD occurred during the month
Sv	=	Number of service orders accepted on the CRCD during the month

**Table 5.4-1   On-Time Delivery (OTD)
Measurement Identifiers and Formulas**

Identifier	Title	Formula	Note
OTIS	On-time Installed System Delivery	**$(Ss / Cs) \times 100$**	% accepted on CRD
OTI	On-time Items Delivery	**$(Si / Ci) \times 100$**	% accepted on CRD
OTS	On-time Service Delivery	**$(Sv / Cv) \times 100$**	% accepted on CRD

e. Reported Data and Format

    (1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

    (2) TL 9000 OTD Data Table – The OTD measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product or product/service category as follows (Table 5.4-2):

Table 5.4-2   TL 9000 OTD Data Table

Year:	YYYY
Month	MM
Reporting ID:	Provided by the QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	OTD
OTIS Numerator:	**Ss**
OTI Numerator:	**Si**
OTS Numerator:	**Sv**
OTIS Denominator:	**Cs**
OTI Denominator:	**Ci**
OTS Denominator:	**Cv**

5.4.5   Sources of Data

OTD data is derived from one or more of the following sources:

a. Supplier's order entry department,

b. Installation teams, and

c. Customer data.

5.4.6   Method of Delivery or Reporting

a. Compared data (CD) or research data (RD):

On-time Installed System Delivery	CD
On-time Items Delivery	CD
On-time Service Delivery	CD

b. RQMS Alternative Reporting:

None

5.4.7   Examples

a. Table 5.4-3 illustrates computation of OTD measurement from a series of installations of systems per purchase order (PO).

Table 5.4-3   Example 1 – On-Time Installed System (OTIS)

	Purchase Order	CRD mm/dd	Line Item	Quantity Ordered	Quantity Installed	Date Installed	Date Accepted	On-time Installations	Note
	A	03/10	1	5	5	3/10		1	
			2	6	6	3/10			
			3	4	4	3/10	3/10		
	B	03/20	1	8	4	3/22		0	1
					4	3/23			
			2	12	6	3/22			
					6	3/25	3/25		
	C	03/21	1	2	2	3/21		0	
			2	2	1	3/21			
					1	3/22	3/22		
	D	02/15	1	7	7	3/15		NA	2
			2	1	1	3/15	3/15		
	E	03/25	1	1	1	3/25	4/15	0	3
	Number of Orders	Number of System CRDs Due in Month (**Cs**)						On-time Purchase Orders (**Ss**)	
TOTALS:	**5**	**4**						**1**	
March	**OTD** (**Ss/Cs**)							**OTIS = 25.0%**	4

NOTES:

1. Order B – 2 line items were split into 4 partial installations – each with a separate date installed.
2. PO system D CRD was not counted in the total of 4 for March as it had a February CRD.
3. PO E Service Order while installed on time, did not meet customer acceptance until supplier changes were completed and after the CRD and therefore was not on time.
4. The CRD installed system OTDI performance for March was 25% or 1(CRD met) / 4 (CRDs due).
5. It should be noted the line items and associated quantities are shown for completeness. They have no direct impact in the calculation of OTD for installed systems other than the system installation has not been completed until the last line item has been accepted.

b. Table 5.4-4 illustrates computation of OTD measurement from a series of services per purchase order (PO).

Table 5.4-4   Example 2 – On-Time Service Delivery (OTS)

	PO	CRD mm/dd	Line Item	Quantity Ordered	Quantity Completed	Compl. Date mm/dd	Accep-tance mm/dd	OTS CRD	Note
	F	3/10	1	5	5	3/10		1	
			2	6	6	3/10			
			3	4	4	3/10	3/10		
	G	3/20	1	8	4	3/22		0	
					4	3/23			
			2	12	6	3/22			
					6	3/25	3/25		
	H	3/21	1	2	2	3/21		0	
			2	2	1	3/21			
					1	3/22	3/22		
	I	2/15	1	7	7	3/15		NA	1
			2	1	1	3/15	3/15		
	J	3/25	1	1	1	3/15	3/25	0	2
	Number of Orders	CRDs Due in March Cv						On-time Orders SV	
TOTAL:	5	4						1	
March	OTD Sv/Cv							OTS = 25%	3

NOTES:
1. PO system I CRD was not counted in the total of 3 for March as it had a February CRD date and it was previously counted.
2. Service Order was completed but not accepted for early delivery. Thus, CRD was not met.
3. The CRD OTD performance for March was 25% or 1(CRD met) / 4 (CRDs due).
4. It should be noted the line items and associated quantities are shown for completeness. The service has not been delivered until the last item has been accepted.

c. Table 5.4-5 illustrates computation of OTD measurement from a series of delivered line items per purchase order (PO).

Table 5.4-5   Example 3 – On-Time Item Delivery (OTI)

	PO	Line Item	Qty Ordered	CRD	Split Order	Qty Delivered	Actual	OTD CRD	Note
	K	1	5	3/10		5	3/10	1	
		2	6	3/12		6	3/13	0	
		3	4	3/17		4	3/18	0	
	L	1	8	3/20		8	3/22	0	
		2	12	3/22	y	6	3/22	0	1
					y	6	3/25	0	1
		3	2	3/29		2	?	0	2
		4	2	3/30		2	3/30	1	
	M	1	7	2/15		7	3/15	NA	3
		2	1	2/15		1	3/15	NA	3
	N	1	20	3/25	y	10	3/25	0	4
					y	10	3/25	1	4
	O	1	2	3/10		2	3/5	0	5
	Number of Orders	Number of Line Items		CRDs Due in March C_i				On-time Orders S_i	
TOTAL:	**4**	**9**		**9**				**3**	
March		**OTD S_i/C_i**						**OTI = 33%**	**6**

NOTES:
1. Line item L2 was not on time for CRD because only ½ of the items were delivered to CRD.
2. "?" - OTD date could not be confirmed and therefore the line item is assumed to have missed OTD.
3. PO line items M1 and M2 CRDs were not counted in the total of 9 for March as they had Feb CRD dates and were previously counted.
4. Line item N1 is counted as 1 on time line item because while both portions of the split shipments were delivered on time, it is still just 1 line item on the order.
5. Line item O1 was delivered early. Thus, CRD was not met.
6. The CRD OTD performance for March was 33% or 3 (CRD met) / 9 (CRDs due).

d. The data that would be reported for the above examples
are in Table 5.4-6.

Table 5.4-6 Example 1, 2, 3 – On-Time Delivery Data Report (OTD)

Year	2000
Month:	03
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Total
Measurement Identifier:	OTD
OTIS Numerator: Ss	1
OTIS Denominator: Cs	4
OTI Numerator: Si	3
OTI Denominator: Ci	9
OTS Numerator: Sv	1
OTS Denominator: Cv	4

Section 6 Hardware and Software Measurements

Hardware and Software measurements apply to all hardware and software products. They do not apply to services.

6.1 System Outage Measurement (SO)

6.1.1 General Description and Title

System Outage (SO) applies only to hardware and software products. SO measures the loss of primary functionality of all or part of any telecommunications system. The SO measurement expresses the annualized total number (outage frequency) and total duration (downtime) of outages experienced by a system. These measures translate directly into system Mean Time Between Failures (MTBF) and system availability, respectively. The SO measurements are calculated for both overall (all causes) and for supplier-attributable causes. Supplier-attributable availability / unavailability is often specified in system reliability performance requirements.

6.1.1 Note 1: Bolded text in the definition column of the Product Category Applicability Table A-1 indicates the primary function of the product category. This is the function to use for outage measurements.

6.1.2 Purpose

This measurement is used to evaluate the downtime performance and outage frequency delivered to the end user during field operation with a goal to reduce both the frequency and duration of outages and their associated cost and revenue impact.

6.1.3 Applicable Product Categories

This measurement applies to product categories as shown in Appendix A. Products specifically not included are single circuit packs or non-system products for which the term outage has no meaning.

6.1.4 Detailed Description

The supplier shall provide two sets of measurements for each product category code: (1) *overall* outage frequency and downtime, and (2) *supplier attributable* outage frequency and downtime.

a. Terminology

Downtime Performance Measurement (DPM):
DPM applies only to suppliers that elect RQMS equivalent reporting. DPM is the expected long-term average sum, over one operating year, of the time duration of events that prevent a user from requesting or receiving services. A failure that causes service interruption contributes to the outage downtime of that service. Outage downtime is usually expressed in terms of minutes per system per year.

Outage Frequency Measurement (OFM):
OFM applies only to suppliers that elect RQMS equivalent reporting. OFM is the expected long-term average number of events, per unit time, that cause a loss of services to the service provider Outage frequency is usually expressed in terms of incidents per system per year.

The Glossary includes definitions for the following terms used for the SO measurement:

- Customer Base
- Scheduled Outage
- Total System Outage

b. Counting Rules

Unless an exclusion applies, all outages representing loss of functionality shall be counted as follows:

(1) Complete loss of primary functionality of all or part of a system for a duration greater than 30 seconds is counted. For a scheduled event, a duration greater than 15 seconds is counted.

Examples of loss of functionality include:
- In switching systems, loss of origination **or** termination capability for **all or part** of the office is counted.
- In a tandem office or Signaling Transfer Point (STP), any total loss of Common Channel Signaling (CCS) is counted as total loss of functionality.
- In a mated pair Service Control Point (SCP), only binodal outages resulting in complete loss of processing.
- Service order processing system cannot process any orders and new orders cannot be entered.

(2) Scheduled outages are counted unless the system is allocated a maintenance window and, during that window, the system is not required to be in service.

(3) Outages attributed to the customer are counted as part of the overall outage measurement.

(4) A supplier attributable outage is an outage primarily triggered by

    a) the system design, hardware, software, components or other parts of the system, or

    b) scheduled events necessitated by the design of the system, or

    c) supplier support activities including documentation, training, engineering, ordering, installation, maintenance, technical assistance, software or hardware change actions, etc.

(5) For systems that are not continuously operational (24X7), count only outages and duration that occur during the operational window.

(6) If redundancy is available for a particular product but the customer chooses not to purchase it, count the outage as follows:

    a) For TL 9000 reporting methodology include the event in "All Causes" category.

    b) For RQMS reporting methodology include the event in "Service Provider Attributable" category.

(7) Outages are counted in a product only when the failure is within the product itself.

(8) Counting by Release and by Host / Remote Systems – The following shall apply:

    a) Performance of individual releases is not counted separately.

    b) Performance of host systems and remote systems of a product type is not counted separately.

c. Counting Rule Exclusions

The exclusions to counting all outages are as follows:

(1) Outages due to natural disasters are not counted.

(2) A remote system in stand-alone mode (when its functionality continues after losing its connection with the host) is not considered out of service, as this is not a complete loss of functionality.

(3) A CCS outage in an end office is not counted, as this is not a complete loss of functionality.

(4) Loss of feature functionality, such as Calling Number Delivery, etc., is not counted.

(5) Outages caused by other products in the network are excluded, e.g., a failure within an OC192 ring is counted against the OC192 product that caused the event and is excluded from all the attached multiplexers.

d. Calculations and Formulas

(1) The measurement is calculated monthly for overall and supplier attributable outages.

(2) When reporting RQMS alternative measurements for product categories where one of the RQMS designations, "end and / or tandem office", "wireless", DWDM-FR, DWDM-PL, DCS, ATM Node, Trunk Gateway, Access Gateway, SNC or "NGDLC" applies, suppliers shall refer to Table 6.1-2 for reporting requirements.

(3) When reporting RQMS alternative measurements for product categories where the RQMS designations in (2) above do not apply, suppliers shall refer to Table 6.1-3 for reporting requirements.

Notation

P	=	Overall Weighted Outage Minutes
Ps	=	Supplier Attributable Weighted Outage Minutes
Q	=	Overall Weighted Outages
Qs	=	Supplier Attributable Weighted Outages
S	=	Normalization Factor, the total number of normalization units that are in service during the month
Afactor	=	Annualization Factor (see Glossary)
NU	=	Normalization Unit (NU) from Measurement Applicability Table (Normalized Units), Appendix A, Table A-2

Table 6.1-1   System Outage Measurement (SO) Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
SO1	Annualized Weighted Outage Frequency	**Q x Afactor / S**	Weighted outages per NU per year
SO2	Annualized Weighted Downtime	**P x Afactor / S**	Minutes per NU per year
SO3	Annualized Supplier Attributable Outage Frequency	**Qs x Afactor / S**	Weighted outages per NU per year
SO4	Annualized Supplier Attributable Downtime	**Ps x Afactor / S**	Minutes per NU per year

Table 6.1-2   System Outage Measurements (SOE)
RQMS Alternative Measurements
End Office and/or Tandem Office,
Wireless Products, and NGDLC Products

NOTE: Report only the measurements in this table that are applicable to the specific product as defined by RQMS. [1]

Identifier	Title
rDPMsn	Supplier Attributable Total Outage Minutes per System per Year – remote only
hDPMsn	Supplier Attributable Total Outage Minutes per System per Year – host only
rDPMcn	Service Provider Attributable Total Outage Minutes per System per Year – remote only
hDPMcn	Service Provider Attributable Total Outage Minutes per System per Year – host only
rOFMsn	Supplier Attributable Total Outages per System per Year – remotes
hOFMsn	Supplier Attributable Total Outages per System per Year – hosts
rOFMcn	Service Provider Attributable Total Outages per System per Year – remotes
hOFMcn	Service Provider Attributable Total Outages per System per Year – hosts

Table 6.1-3   System Outage Measurements (SOG)
RQMS Alternative Measurements
General Series

Identifier	Title
DPMn	Total Outage Minutes Per System Per Year –overall
DPMsn	Total Outage Minutes Per System Per Year –supplier attributable
OFMn	Total Outages Per Year – overall
OFMsn	Total Outages Per Year – supplier attributable

(4)   Detailed formulas for the downtime numerator quantities P, Ps, Q, and Qs and for the normalization factor S are given in the following analysis.

Notation

N	=	Number of systems in service at the end of the month
M	=	Number of outages
P$_i$	=	Duration of the ith outage (i = 1,…, m)
A$_i$	=	Number of units (lines, DS1s, etc) affected in outage I
S$_n$	=	Number of units (lines, DS1s, etc) in system n
S	=	Number of units (lines, DS1s, etc) in the total population

$$S = \sum_{n=1}^{N} S_n$$

Downtime Formulas

Systems of Uniform Size

For the special case of products of uniform system size where only total system outages are possible, the downtime calculation is comparable to the current RQMS calculation for end offices. Downtime is computed as follows for monthly data:

$$DT = 12x \frac{\sum_{i=1}^{m} P_i}{N} \qquad \textbf{(6.1-1)}$$

Examples include toll ticketing, voice messaging, SMDR, dispatch systems, etc.

All other Systems

Downtime for all other products (where systems consist of lines, ports, terminations, or other normalization units) is computed as follows for monthly data:

$$DT = 12 \ x \ \frac{\sum_{i=1}^{m} A_i P_i}{\sum_{n=1}^{N} S_n} \qquad \textbf{(6.1-2)}$$

Outage Frequency Formulas

Systems of Uniform Size
For the special case of products of uniform system size where only total system outages are possible, outage frequency is comparable to the current RQMS calculation for end offices. Outage frequency is computed as follows for monthly data:

$$\text{OF} = 12 \text{ x } \frac{m}{N} \tag{6.1-3}$$

Examples include toll ticketing, voice messaging, SMDR, dispatch systems, etc.

All other Systems

Outage Frequency for all other products (where systems consist of lines, ports, terminations, or other normalization units) is computed as follows for monthly data:

$$\text{OF} = 12 \text{ x } \frac{\sum_{i=1}^{m} A_i}{\sum_{n=1}^{N} S_n} \tag{6.1-4}$$

Because A is expressed in normalization units per system outage and S is total normalization units, the units of this calculation is **Outages per Year**, and is independent of the units chosen for normalization. This measurement is a downtime "pain index" as viewed from the user's perspective. The perspective of system performance delivered to a termination is equivalent to system performance because each termination appears on exactly one system.

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 SO Data Table 6.1-4 – The SO measurement shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as follows:

Table 6.1-4   TL 9000 SO Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**S**
Annualization Factor:	**Afactor** (see Glossary)
Measurement Identifier:	SO
P:	**DT** – Calculated downtime in minutes/year for all causes
Ps:	**DT** – Calculated downtime in minutes/year for all supplier-attributable causes
Q:	**OF** – Calculated outage frequency in occurrences/year for all causes
Qf:	**OF** – Calculated outage frequency in occurrences/year for supplier-attributable causes

(3)   RQMS Alternative SO Data Table – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) from the applicable Table 6.1-2 or Table 6.1-3, for each month as follows:

Table 6.1-5   RQMS Alternative SO Data Table (SOE)

NOTE: If separation of host and remote systems does not apply, report all items under the host category.

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**rS** – Total systems deployed per RQMS – remote only
	hS – Total systems deployed per RQMS – host only
Measurement Identifier:	SOE
rDPMsn:	Annualized supplier attributable total outage minutes – remote only
hDPMsn:	Annualized supplier attributable total outage minutes – host only
rDPMcn:	Annualized service provider attributable total outage minutes – remote only
hDPMcn:	Annualized service provider attributable total outage minutes – host only
rOFMsn:	Annualized supplier attributable total outage frequency – remote only
hOFMsn:	Annualized supplier attributable total outage frequency – host only
rOFMcn:	Annualized service provider attributable total outage frequency – remote only
hOFMcn:	Annualized service provider attributable total outage frequency – host only

Table 6.1-6   RQMS Alternative SO Data Table (SOG)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**S** – Total systems deployed per RQMS
Measurement Identifier:	SOG
DPMn:	Annualized total outage minutes for all causes
DPMsn:	Annualized supplier attributable outage minutes
OFMn:	Annualized total outage frequency for all causes
OFMsn:	Annualized supplier attributable outage minutes

6.1.5 Sources of Data

Customers shall report all outage data and system population of their end users to the supplier. If outage data is not supplied, then the supplier is not responsible for reporting this measurement.

6.1.6 Method of Delivery or Reporting

a. Compared Data (CD) or Research Data (RD):

Overall System Downtime	CD
Overall System Outage Frequency	CD
Supplier Attributable System Downtime	CD
Supplier Attributable System Outage Frequency	CD

b. RQMS Alternative Reporting:

Overall System Downtime	YES
Overall System Outage Frequency	YES
Supplier Attributable System Downtime	YES
Supplier Attributable System Outage Frequency	YES

6.1.7 Example Calculations

a. Example 1 – System Outage Reporting

From a population of 200 systems which can be considered either to be operational or not operational (such as toll ticketing, voice messaging, SMDR, dispatch system, etc.) Outages of 20 minutes, 40 minutes, and 60 minutes occurred during the month, which were attributable to the supplier and one outage of 10-minutes duration was not attributable. The calculations follow:

$$\mathbf{DT} = \mathbf{12x} \frac{\sum_{i=1}^{m} \mathbf{Pi}}{\mathbf{N}} \quad \text{(downtime calculation 6.1-1)}$$

DTc = 12 (20+40+60+10) / 200 = 1560 / 200
DTc = <u>7.8 minutes / yr</u>

DTs = 12 (20+40+60) / 200
DTs = <u>7.2 minutes / yr</u>

$$\mathbf{OF} = \mathbf{12 \ x} \frac{\mathbf{m}}{\mathbf{N}} \quad \text{(outage frequency calculation 6.1-3)}$$

OFc = 12 (4/200) = <u>0.24 occurrence / yr</u>
OFs = 12 (3/200) = <u>0.18 occurrence / yr</u>

b. Example 2 – End Office System Outage Reporting

Consider a population of four central office systems comprising 1600 terminations distributed as 100, 200, 300, and 1000 terminations per system. The 100- and 1000-termination systems are host systems and each experienced one 10-minute total outage during the month. The 200- and 300-termination switches are remote systems. The 200-termination system incurred a 20-minute outage affecting 50 terminations. All of the outages are attributed to the supplier.

$$DT = 12 \ x \ \frac{\sum\limits_{i=1}^{m} A_i P_i}{\sum\limits_{n=1}^{N} S_n} \quad \text{(downtime calculation 6.1-2)}$$

DTs = DTc = 12 {(10 min)(100 terms)+(10 min)(1000 terms)
                    +(20 min)(50 terms)} ÷ 1600 terms
DTs = DTc = 12 (1000 + 10,000 + 1000) ÷ 1600
                    = 12 x 12,000 ÷ 1600 = <u>90.0 min / yr</u>

$$OF = 12 \ x \ \frac{\sum\limits_{i=1}^{m} A_i}{\sum\limits_{n=1}^{N} S_n} \quad \text{(outage frequency calculation 6.1-4)}$$

OFs = OFc = 12 (100 terms + 1000 terms + 50 terms) ÷ 1600 terms
OFs = OFc = 12 (1150) ÷ 1600 = <u>8.625 occurrence / yr</u>

This measurement translates directly to real performance delivered to the end user. A typical system (or a typical line on a typical system) will experience 8.625 outages totaling 90.0 minutes in a year based on performance in the current month. From equation 6.1-6, the availability for this system is {525,600 – 90} / 525,600 = 0.999829. This measurement also translates to performance delivered to customer. The customer (service provider) will experience 9.0 outages per system per year (not weighted by duration of outage or by size of system).

Table 6.1-7   Example 2 –SO Data Report for March 2001

Year:	2001
Month:	3
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Forum
Normalization Factor:	4
Annualization Factor:	12
Measurement Identifier:	SO
P:	90.0
Ps:	90.0
Q:	8.625
Qs:	8.625

c. Example 3 – Transport System - Digital Cross Connect

Consider a population of a given product consisting of various sized cross connects interfacing with the network at various signal levels. From the quantity of each type of port card and its traffic capacity in terms of DS1 equivalents, excluding units used for protection, the total average capacity of these systems during the month can be determined. Note that this is a "per DS1-equivalent port" number. For this example, assume that in the systems there are 200 OC-3 port cards (16,800 DS1 equivalents), 400 DS3 / STS1 units (11,200 DS1 equivalents), and 1,000 units with 4 DS1 ports each (4,000 DS1 equivalents) for a total capacity of 32,000 DS1 equivalent ports. The outages for the month are all supplier attributable and are given in the following table. The table is constructed to calculate formulas 6.1-2 and 6.1-4.

Table 6.1-8   Example 3 –SO Measurement Calculation for a Transport System

Outage Length (minutes) (P_i)	Signal Type	Signal Quantity	DS1 Equivalents (A_i)	Number of Outages	Weighted Frequency (DS1 x number) $Q=S_i$	Weighted Time (DS1 x minutes) (A_i x P_i)
60	DS3	1	1 x 28	1	28	1680
3	DS1	8	8 x1	1	8	24
16	DS1	1	1 x 1	1	1	16
5	OC-3	1	1 x 84	1	84	420
Total month m, Q, P				M = 4	Q = 121*	P = 2140*
Annualized				48	1452	25680

*reported items

Dividing the annualized totals by the 32,000 DS1 capacity (S = 32,000 DS1 Equivalents), the normalized downtime numbers are:

Table 6.1-9   Example 3 – Normalized SO Measurement Calculation for a Transport System

Digital Cross-connect	Overall	Supplier Attributable	Unweighted
Downtime (min / equivalent DS1 / yr)	0.8025	0.8025	
Outage Frequency (Count / equivalent DS1 / yr)	0.045	0.045	0.0015

This represents delivered annualized performance on a per-DS1 basis. Each equivalent DS1 will experience 0.045 outages totaling 0.8025 minutes in a year. From Equation 6.1-6, as defined subsequently in Section 6.1.8 Reliability Conversions, availability for this system is {525,600 – 0.8025} / 525,600 = 0.9999984. Due to the mix of port cards in this example, the four outages experienced by the TSP in the month represent 1.5 outages per 1,000 equivalent DS1s per year (unweighted).

Table 6.1-10   Example 3 – Transport SO Data Report for March 2001

Year:	2001
Month:	3
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Forum
Normalization Factor:	32000
Annualization Factor:	12
Measurement Identifier:	SO
P:	0.8025
Ps:	0.8025
Q:	0.045
Qs:	0.045

6.1.8   Reliability Conversions

NOTE: The following analysis provides formulas to convert outage frequency and downtime to other reliability measurements for reference. Equation 6.1-5 provides conversion from outage frequency to mean time between failures (MTBF). Equation 6.1-6 provides conversion from downtime (expressed in minutes) to system availability. System availability / unavailability and MTBF are alternative expressions of system reliability found in some requirement specifications.

MTBF = Mean Time Between Failures (reference only)

MTBF = {(365)(24)} $\div$ **OF** = mean hours to failure $\qquad$ **(6.1-5)**

This calculation represents the mean (average) number of hours between system outages.

A = Availability (Reference only)

A = Probability that the system is operational when required
A = Up time $\div$ Total time
A = {(365)(24)(60) – DT} $\div$ **{(365)(24)(60)}**
A = {525,600 – DT} $\div$ **525,600** $\qquad$ **(6.1-6)**

NOTE: Availability is often expressed as a percentage rather than as shown above.

U = Unavailability (reference only)

U = Probability that the system is not operational when required
U = 1 – A $\qquad\qquad\qquad$ **(6.1-7)**
For five minutes per system per year of downtime, availability is 0.9999905, or "five nines." and unavailability is $1 - A = 9.5 \times E\text{-}6$. For 50 minutes of downtime, $A = 0.999905$, or "four nines," and unavailability is $1 - A = 9.5 \times E\text{-}5$.

Customer Aggregation

A customer can determine the overall system availability delivered to its end users by aggregating the system availability from his various suppliers as follows, where Ax, Ay, or Az is the availability of system type X, Y, or Z, where Px, Py, or Pz is the probability that a termination is served by system type X, Y, or Z (determined by ratio of terminations or systems), and where Px + Py + Pz = 1.

$$A_{TSP} = A_X P_X + A_Y P_Y + A_Z P_Z \qquad \text{(6.1-8)}$$

Section 7   Hardware Measurements

7.1   Return Rates (RR)

7.1.1   General Description and Title

This profile defines four return rate measurements:

- Initial Return Rate (IRR) – return rate of units during the first six months after initial shipment (months zero through six of shipment),
- One-Year Return Rate (YRR) - return rate of units during the first year following the Initial Return Rate period (months seven through 18 of shipment),
- Long-Term Return Rate (LTR) - return rate of units any time following the One-Year Return Rate period (months 19 and later after shipment), and
- Normalized One-Year Return Rate (NYR) – the normalized return rate of units during the One-Year Return Rate period.

7.1.2   Purpose

The purpose of this measurement is to:

- Provide a measure of the quality of the product as initially received by the customer and during subsequent in-service operation,
- Determine areas needing corrective action or most likely benefiting from continuous improvement activity, and
- Provide input data needed to calculate equipment life cycle costs.

7.1.3   Applicable Product Categories

a. This measurement applies to product categories as shown in Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

b. In general, these measurements apply to:
- Any system comprised of field replaceable units (FRUs)
- A system which itself is an FRU
- The individual FRUs themselves.

c. These measurements apply equally to any FRU shipped either in a system or separately.

d. These measurements are not intended for items shipped in bulk such as:
- Cable
- Optical fiber
- Mechanical hardware, for example, metallic connectors, optical connectors, conduit, mounting hardware, labels, etc.

NOTE: The Initial Return Rate measurement for items warehoused outside of the supplier's control, for an extended period before placement in service, may not accurately reflect the actual return rate for product in service. This may also be true of items sold through distributors.

NOTE: Long-Term Return Rates may become inaccurate for older products as units are taken out of service.

NOTE: The return rate for low cost items after the expiration of any warranty period is likely to be inaccurate if purchasing a new item is no more expensive than repairing the failed one.

7.1.4   Detailed Descriptions

a. Terminology

The Glossary includes definitions for the following terms used for this measurement:

- Annualization Factor (**A**factor**)**
- Basis Shipping Period
- Field Replaceable Unit
- Return

b. Counting Rules

The following rules shall apply when counting returns and shipments for the return rate measurements.

(1)   All returns except as noted in "Counting Rule Exclusions" are counted in these calculations. See "Return" in the Glossary and the rules below for the exact definition used here.

(2)   Only returns from the basis shipping period corresponding to the specific measurement shall be counted.

(3)   The supplier shall document, for the specific measurement, the method of determining which of the returns are from the corresponding basis shipping period. This may be determined by any of the following methods:

- Serialized shipment records of the returned unit,
- A shipment or warranty start date code marked on the unit,
- A shipment date associated with a customer order, and
- A manufactured date associated with a lot number.

NOTE: The last method would require the determination of an accounting for a standard time delay between the date of manufacture and shipment.

(4)   Units that fail due to the problem corrected by a recall before they can be rotated are to be counted as returns.

(5) Units damaged during normal shipping handling where the container itself is not damaged due to abnormal shipping conditions are counted as returns.

(6) No trouble found units, i.e., returned units determined by the supplier's organization to meet supplier's specifications are included in return totals.

NOTE: Returns and shipments should only be reported once when submitting data to the QuEST Forum Measurements Administrator. When a unit may be used in more than one product, it may not be practical or possible to identify with which product a return or shipment is associated. In such cases, the supplier should apportion the returns and shipments appropriately among all products in which the unit is used.

c. Counting Rule Exclusions

The following may be excluded from the return and shipment counts for the return rate measurements.

(1) Working or untested units returned as part of a formal rotation or recall program are not considered returns for the purposes of these measurements.

(2) Units damaged during shipping or while in service due to vehicular accidents, water leakage, electrical spikes outside of specified limits, or other environmental factors outside those conditions for which the equipment was designed, may be excluded.

(3) Items that were ordered in error, purposely ordered in excess, or consignment items that have not been found defective may also be excluded from the measure.

(4) All returns from laboratory systems and / or First Office Application (FOA) systems may be excluded from these measurements.

d. Calculations and Formulas

(1) The measurements shall be calculated according to the formulas shown in Table 7.1-1. The formulae for IRR and LTR are not normalized but are expressed in percentage returns per year. The formula for YRR is normalized with the normalization units given in the Measurement Applicability Table (Normalized Units), Appendix A, Table A-2.

(2) The return rates are annualized.

(3) Normalization of System Numbers – The YRR shall be normalized with units defined in the Measurement Applicability Table (Normalized

Units), Appendix A, Table A-2 when reported to the Measurements Administrator.

- A general formula (normalized return rate) of this normalization of a return rate measurement would take the form of:

Normalized return rate =
                  Returns x Afactor / Normalization Factor

- Example Calculations (see 7.1.7.b) illustrate computation of normalized return rates.

(4) Initial Return Rate (IRR) – The Initial Return Rate measures the rate of return of product during the reporting period from the population of units shipped during the prior month through six months prior to the reporting period. This basis shipping period is assumed to represent the initial return rate of the product during installation, turn-up, and testing. Returns from units shipped during the current month are also included.

(5) One-Year Return Rate (YRR) – The One-Year Return Rate measures the rate of return of product in its first year of service life following the initial period included in IRR. It is based on the number of returns during the reporting period from the population of units shipped seven to eighteen months prior to the reporting period. This basis shipping period is assumed to represent the operation during any early life period.

(6) Long-Term Return Rate (LTR) – The Long-Term Return Rate measures the rate of return of product more than eighteen months from time of shipment. It is based on the number of returns during the reporting period from the population of units shipped more than eighteen months prior to the reporting period. This rate represents the mature return rate of the product.

(7) Normalized One-Year Return Rate (NYR) – The normalization of the One-Year Return Rate allows this circuit pack return measure to be compared between like products with different architecture.

Notation

NU	=	Normalization Unit (NU) from Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
S	=	Normalization Factor; the total NU count shipped in the one-year basis shipping period.
Afactor	=	Annualization Factor, the number of reporting periods in a year (see glossary)
Ri	=	Number of returns in the IRR basis shipping period
Ry	=	Number of returns in the YRR basis shipping period
Rt	=	Number of returns in the LTR basis shipping period
Si	=	Number of FRUs shipped during the IRR basis shipping period
Sy	=	Number of FRUs shipped during the YRR basis shipping period
St	=	Number of FRUs shipped during the LTR basis shipping period

Table 7.1-1   Return Rates (IRR, YRR, LTR, and NYR)
Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
IRR	Initial Return Rate	**(Ri / Si) x Afactor x 100**	% per year
YRR	One-Year Return Rate	**(Ry / Sy) x Afactor x 100**	% per year
LTR	Long-Term Return Rate	**(Rt / St) x Afactor x 100**	% per year
NYR	Normalized One-Year Return Rate	**(Ry / S) x Afactor**	Returns per NU

e. Reported Data and Format

(1)   Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2)   Data shall be reported for IRR, YRR and LTR. Compared data industry statistics are based only on the normalized YRR measurement.

(3)   TL 9000 Return Rate Data Table - The return rates shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as follows:

Table 7.1-2   TL 9000 RR Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**S** (value for computing NYR)
Annualization Factor:	**A**factor (see Glossary)
Measurement Identifier:	RR
IRR Numerator:	**Ri**
YRR Numerator:	**Ry**
LTR Numerator:	**Rt**
IRR Denominator:	**Si**
YRR Denominator:	**Sy**
LTR Denominator:	**St**

7.1.5   Source(s) of Data

The supplier should have available, as a part of its data systems the information listed above needed to calculate these measurements. This includes:

a. FRU shipping records – These are required to determine which units received for repair are "initial returns," "one-year returns" or "long- term returns" and determine the respective populations.

b. FRU returns records – The supplier's return records shall include the identifier necessary to match returns with shipment records.

c. Third party returns records – Units returned to a third party repair agency by the customer or repaired by the customer itself shall be included in the return counts when available. To have accurate measurements, it is necessary for the customer to make it a contractual requirement of their third party repair agencies to supply this data to the original equipment manufacturers.

7.1.6   Method of Delivery or Reporting

At present, only NYR is considered to have compared data. The IRR, YRR, and LTR data shall also be reported to the Measurements Administrator for future use.

a. Compared data (CD) or research data (RD):

Initial Return Rate	RD
One-Year Return Rate	RD
Long-Term Return Rate	RD
Normalized One-Year Return Rate	CD

b. RQMS Alternative Reporting:

None

Due to the nature of the changes to the return rate measurement in release 3.0 of the handbook, the release 2.5 return rate measurements are not comparable to return rate measurements in release 3.0 and later versions of the handbook.

7.1.7   Example Calculations

a. Example Without Normalization
In a given reporting month, all returns are divided into three groups, according to when they were shipped. For example, for the reporting month of January 1999, returns are divided into the following groups (as illustrated in Figure 7.1-1):

- **Initial Returns:** From units shipped in the period from July 1, 1998, through January 31, 1999.

- **One-Year Returns:** From units shipped in the period from July 1, 1997 through June 30, 1998.

- **Long-Term Returns:** From units shipped prior to July 1, 1997.

						1998						1999
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
One-Year Returns						Initial Returns						

1996							1997					
DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Long-Term Returns							One-Year Returns					

Figure 7.1-1 Shipping Date Groups for Computing Return Rates

Table 7.1-3 shows shipments for July 1997 through December 1999, plus all shipments prior to July 1997. In addition, it shows returns for January 1999 through December 1999, broken out by month of shipment as determined by shipping records. The highlighted first row of data in Table 7.1-3 shows the breakdown by month of shipment for the 355 returns received during January 1999. For example, in January 1999, 22 returns were received from the 8253 units shipped in July 1997, and 11 returns were received from the 9243 units shipped in August 1997.

Table 7.1-3   Example Returns

Ship Date → Return Mo.↓	Jun-97 & before	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98
Jan-99	39	22	11	17	19	16	24	11	7	14	10	6	6
Feb-99	44	9	11	16	13	8	16	11	9	15	9	11	13
Mar-99	42	11	14	17	21	15	17	7	8	12	14	12	12
Apr-99	46	12	12	12	15	14	22	9	11	8	10	11	16
May-99	31	11	19	16	17	21	12	9	10	10	9	16	11
Jun-99	35	10	15	16	11	28	19	9	8	15	8	9	7
Jul-99	48	7	13	17	14	17	17	9	5	4	10	13	9
Aug-99	36	10	1	7	19	17	15	13	5	12	6	16	12
Sep-99	46	8	16	16	16	19	24	6	3	7	12	8	14
Oct-99	41	15	10	11	18	13	14	3	14	9	11	13	13
Nov-99	32	16	13	12	17	14	15	6	7	5	11	10	7
Dec-99	30	5	21	17	13	20	14	3	9	12	10	3	13
Ship-ments:	30000	8253	9243	9261	9721	10131	10140	6263	6436	7244	7275	7396	8263

Table 7.1-3 (continued) Example Returns

Ship Date → Return Mo.↓	Jul-98	Aug-98	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Jun-99	Jul-99
Jan-99	14	16	20	39	36	23	5						
Feb-99	12	6	18	24	26	30	33	1					
Mar-99	14	14	15	18	24	20	23	31	5				
Apr-99	12	17	18	7	23	22	25	23	27	2			
May-99	12	14	16	15	12	25	22	27	26	33	4		
Jun-99	14	14	6	15	13	15	30	24	20	28	27	1	
Jul-99	14	11	12	17	6	15	18	24	29	26	27	31	1
Aug-99	15	14	19	16	13	15	15	11	38	26	28	26	35
Sep-99	11	12	12	13	9	16	14	13	17	16	31	28	25
Oct-99	10	12	6	6	9	12	19	22	14	19	18	26	32
Nov-99	11	8	16	19	20	16	14	11	19	19	13	22	35
Dec-99	8	13	11	9	12	11	19	16	12	12	24	15	16
Shipments:	8833	8954	9368	9818	9787	10528	10644	11321	11332	11674	12151	12460	13494

Table 7.1-3 (continued) Example Returns

Ship Date → Return Mo.↓	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Total Returns:
Jan-99						355
Feb-99						335
Mar-99						366
Apr-99						374
May-99						398
Jun-99						397
Jul-99						414
Aug-99	5					445
Sep-99	33	4				449
Oct-99	25	30	4			449
Nov-99	28	23	34	3		476
Dec-99	21	32	22	36	4	463
Shipments	13670	13933	13725	14467	14905	

The annualized return rates for the month of January 1999, are calculated as:

$$\text{Initial Return Rate} = \frac{(\text{Returns of units shipped Jul-98 through Jan-99}) \times 12 \times 100}{\text{Total Shipments for Jul-98 through Dec-98}}$$

$$= \frac{(14+16+20+39+36+23+5) \times 12 \times 100}{8833+8954+9368+9818+9787+10528}$$

$$= 3.20\%$$

During January 1999, the number of returned units was calculated as follows:

> 14 returns of units shipped in July 1998,
> 16 returns of units shipped in August 1998,
> 20 returns of units shipped in September 1998, and so on, including
> 5 returns of units shipped in the month of January 1999,
> for a total number of initial returns of 153.

The corresponding field population is determined by the sum of the shipment quantities shown in the bottom row of Table 7.1-3 for the months of July 1998 through December 1998. Note that the returns of units shipped in January are included in order to count all returns during the month, and to be alerted to any developing problems. However, shipments during January are excluded because most units will not have been placed into operation.

$$\text{One-Year Return Rate} = \frac{(\text{Returns of units shipped Jul-97 through Jun-98}) \times 12 \times 100}{\text{Total Shipments for Jul-97 through Jun-98}}$$

$$= \frac{(22+11+17+19+16+24+11+7+14+10+6+6) \times 12 \times 100}{(8253+9243+9261+9721+10131+10140+6263+6436+7244+7275+7396+8263)}$$

$$= 1.96\%$$

$$\text{Long-Term Return Rate} = \frac{(\text{Returns from shipments prior to Jul-97}) \times 12 \times 100}{\text{Total Shipments prior to Jul-97}}$$

$$= \frac{39 \times 12 \times 100}{30000}$$

$$= 1.56\%$$

Calculating the return rates for all months in 1999 gives:

	Initial Return Rate	One-Year Return Rate	Long-Term Return Rate
Jan-99	3.20%	1.96%	1.56%
Feb-99	2.80%	1.72%	1.66%
Mar-99	2.66%	1.96%	1.69%
Apr-99	2.44%	1.96%	1.73%
May-99	2.74%	1.86%	1.70%
Jun-99	2.57%	1.65%	1.80%
Jul-99	2.69%	1.50%	1.84%
Aug-99	2.80%	1.81%	1.52%
Sep-99	2.47%	1.55%	1.86%
Oct-99	2.39%	1.55%	1.66%
Nov-99	2.39%	1.73%	1.56%
Dec-99	2.14%	1.57%	1.55%

b. Examples With Normalization

(1)   Example 1 – Normalized One-Year Return Rate

A supplier makes an HDSL transmission system consisting of the following products:

i.   HDSL Central Office Transceiver Unit (HTU-C) – One HTU-C is required per HDSL line deployed.
ii. HDSL Remote Transceiver Unit (HTU-R) – One HTU-R is required per HDSL line deployed.
iii. HDSL Range Extender (HRE) – Zero to two HREs may be used per HDSL line deployed.
iv. HDSL Fuse / Alarm Controller (HFAC) – One HFAC is required per HDSL shelf, which may be used to deploy up to 13 HDSL lines.
v.   HDSL Central Office Terminal Controller (HCOT-CTL) – One HCOT-CTL can control up to 100 shelves.
vi. HDSL E220 Shelf – One shelf can accommodate up to 13 HDSL transceiver units.

Only products i through v are field replaceable units.

To calculate the normalized YRR, returns are aggregated for the entire HDSL product category and the normalizing factor is applied to the category as a whole:

i.   HDSL Central Office Transceiver Unit (HTU-C)
Returns in the reporting period (one [1] month):   50
Shipments in the basis period (one [1] year):   100,000

ii. HDSL Remote Transceiver Unit (HTU-R)
Returns in the reporting period: 40
Shipments in the basis period: 100,000

iii. HDSL Range Extender
Returns in the reporting period: 5
Shipments in the basis period: 50,000

iv. HDSL Fuse/Alarm Controller
Returns in the reporting period: 3
Shipments in the basis period: 10,000

v.   HDSL Central Office Terminal Controller
Returns in the reporting period: 0
Shipments in the basis period: 500

The normalizing factor for xDSL products is the number of DSL lines deployed. Since one HTU-C and one HTU-R are required to deploy a single HDSL line, the total number of lines deployed in the basis period is 100,000.

The normalized One-Year Return Rate would be:

[(50 + 40 + 5 + 3 + 0) x 12] / 100,000 = 0.012 returns / yr. / DSL line

(2)   Example 2 – Normalized One-Year Return Rate

A supplier makes a local switch consisting of the following products:
i.   POTS line card – Each POTS line card has 16 POTS lines.
ii.   Trunk line card – Each trunk line card has four trunk lines.
iii. ISDN line card – Each ISDN line card has eight basic rate ISDN lines, each of which has two terminations. Each ISDN line card has an identical card providing protection for the first card.
iv.   Miscellaneous circuit packs – Besides the previous three circuit packs there are 30 other pack codes. They do not supply termination service, but are needed to support the office.

During the basis period for the YRR, this supplier installed one switch with the line cards and other circuit packs listed below. To calculate the normalized YRR, returns are aggregated for the entire switch and the normalizing factor is applied to the category as a whole.

i.   POTS Line Card
      Returns in the reporting period (one [1] month):   10
      Shipments in the basis period (one [1] year):   1,000

ii.   Trunk Line Card
      Returns in the reporting period: 5
      Shipments in the basis period: 500

iii. ISDN Line Card
      Returns in the reporting period: 2
      Shipments in the basis period: 500
      Active cards with 1:1 protection: 250

iv.   Miscellaneous Circuit Packs
      Returns in the reporting period: 2

The normalizing factor for Switching and Routing System Elements is 1 termination. The total of all terminations for this switch is:

$$(1,000 \times 16) + (500 \times 4) + (250 \times 8 \times 2) = 22,000$$

The normalized One-Year Return Rate per 1 termination for the switch circuit pack shipments is:

$$(10 + 5 + 2 + 2) \times 12 \times 1/ 22,000 = 0.010364 \text{ returns / yr / termination}$$

FYR Denominator = 1,000 + 500 + 250 + 2 = 1,752

(3)   Example 2 – Return Rate Data Table

The following table shows how data from the above example would be reported to the Measurements Administrator. For completeness, the report includes examples of IRR and LTR data that were not discussed in the example.

Table 7.1-4   Example 2 – Return Rate Data Table

Year:	1999
Month	01
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	1.1
Measurement Methodology:	TL 9000
Customer Base:	Total
Normalization Factor:	22000
Annualization Factor:	12
Measurement Identifier:	RR
IRR Numerator: R_i	14
YRR Numerator: R_y	19
LTR Numerator: R_t	30
IRR Denominator: S_i	1200
YRR Denominator: S_y	1752
LTR Denominator: S_t	4500

Section 8   Software Measurements

8.1   Software Installation and Maintenance

8.1.1   General Description and Title

Software Installation and Maintenance (SWIM) measurements track the installation of new releases and the maintenance effort associated with the software. These measurements are adapted from RQMS. [1]

8.1.2   Purpose

This measurement is used to evaluate the level of defective software installations and defective maintenance activities with a goal of minimizing associated customer impacts. This section defines the measurements associated with the installation and maintenance of product software. The measurements in this section are provided to aid the service provider and the supplier in understanding the effort involved in the installation of new software generic/releases and the efforts involved in the maintenance of the software generic/release. For the purpose of these measurements, maintenance covers the activities to correct defects and/or to add additional functionality to the generally available generic/release.

Due to the wide assortment of products available and the various mechanisms used to install and maintain software, three options are provided for the measurements. The supplier, with service provider input, is to select one of the options for a particular product based on the most applicable choice.

8.1.3   Applicable Product Categories

This measurement applies to product categories as shown in Appendix A.

8.1.4   Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for software update measurements:
- General Availability
- Patch
- Patch – Defective Corrective
- Patch – Defective Feature
- Patch – Official
- Release Application

NOTE: A software update is a set of changes to a release and is commonly referred to as a "dot" or "point" release. A software update completely replaces existing product code with a new generic/release as opposed to entering patches into a generic/release. Software updates differ from patching in the manner in which software changes are made to a system.

Software Updates are used to install the new generic/release and to provide temporary fixes and new functionality (dot or point releases) between releases.

b. Measurement Options:

The measurement options outlined below group the installation and maintenance activities together. In this way, the relationship between the installation and maintenance efforts is apparent. Suppliers providing data shall submit their results in accordance with the measurements contained in the selected option.

The selection criteria for the three options are described as follows:

Insertion of New Release	Maintenance	
	Patching	**S/W Update**
S/W Release Application	Option 1	
S/W Update		Option 2
S/W Update	Option 3	

Option 1 — Software Release Application and Patching:

This option groups the measurements for Software Release Application and Patching together for those products that use Software Release Application as the installation methodology for the new release and patching is used as the maintenance mechanism. The guidelines for using this option are:

- Installation of a new generic/release by a Software Application completely replaces the existing code in the product.
- Patching is used as the ONLY maintenance mechanism to provide fixes for defects and to provide additional functionality between generics/releases. A Patch, by definition, affects only a portion of the software in the generic/release.
- The methodology used to install the generic/release is usually significantly different from the processes to install a Patch.

These methodologies commonly apply to End and Tandem offices, STPs, etc.

The following software measurements apply to option 1:

- Release Application Aborts (RAA)
- Corrective Patch Quality (CPQ)
- Feature Patch Quality (FPQ)

Option 2 — Software Updates:

This option is applicable to the products that use Software Updates exclusively for both the installation of the generic/release and the maintenance of the software after installation. The guidelines for using this option are:

- A Software Update completely replaces the existing code in the product.
- Software Updates are used to install a new generic/release and to perform changes to the software between releases.
- The process to install a new generic/release and to perform changes between releases is essentially the same.
- Software updates introduced between generics/releases provide fixes for defects and may also provide additional functionality. This software is commonly referred to as a point or dot release.

This methodology is commonly applied to Transport products.

Software Updates (SWU) is the only software measurement applicable to option 2.

Option 3 — Software Update and Patching:

For some products, the supplier uses the S/W Update process to install a new generic/release and uses both S/W Updates (point or dot releases) and Patches to perform maintenance. This approach is used by the supplier to address urgent field affecting issues in a timely fashion while retaining the option to maintain the software using S/W Updates where integration testing, etc., can be better performed for large changes. The guidelines for using this option are:

- A Software Update completely replaces the existing code in the product.
- Software Updates are used to install a new generic/release and to perform changes to the software between releases.
- Software Updates introduced between generics/releases, provide fixes to defects and may also provide additional functionality. This software is commonly referred to as a point or dot release.
- Patching is used as a maintenance mechanism to provide fixes to defects and to provide additional functionality between generics/releases. A Patch, by definition, affects only a portion of the software in the generic/release.
- The methodology used for S/W Updates is usually significantly different from the processes to install a Patch.

The following software measurements apply to option 3:

- Software Update (SWU)
- Corrective Patch Quality (CPQ)
- Feature Patch Quality (FPQ)

8.1.5   Release Application Aborts (RAA)

8.1.5.1 General Description and Title

The Release Application Aborts measurement (RAA) is the percentage of release applications with aborts. This measurement is derived from RQMS. [1]

8.1.5.2 Purpose

This measurement is used to evaluate the percentage of release applications with aborts with a goal of minimizing the service provider risk of aborts when applying a software release.

8.1.5.3 Applicable Product Categories

This measurement applies to product categories as shown in Appendix A.

8.1.5.4 Detailed Description

a. Terminology

The Glossary contains definitions for the following term used for the RAA measurement:

- General Availability

b. Counting Rules

(1)   A release is counted on General Availability.
(2)   Only supplier attributable aborts shall be counted.
(3)   The application/installation interval shall start 24 hours prior to scheduled cutover and shall end seven days after cutover.
(4)   A Release Application Abort (RAA) is the regression to a previous release within seven days of cutover or the reschedule of the release application within 24 hours of cutover.
(5)   The percentage for each month shall be calculated using the cumulative number of release application attempts at the end of the month for that release.
(6)   The data shall include the three most dominant releases for each product being reported. If fewer than three releases exist, the data shall include all existing releases.

c. Counting Rule Exclusions

None

d. Calculations and Formulas

(1) The measurement shall be calculated monthly for each release as the percentage of the cumulative number of application attempts for which a new release has been applied or committed to be applied and for which a release application abort has occurred.

(2) For each of the three most dominant releases, the supplier shall provide the number of release application attempts for the month and the number of systems that encountered any abort during the release application/installation interval. The supplier shall report this data monthly.

(3) When reporting RQMS alternative measurements, suppliers shall refer to RAQ0, RAQ1, RAQ2, Rar0, Rar1, Rar2, in Table 8.1.5-2 to determine reporting conventions.

(4) The reported data and each of the computed measurements are totaled/aggregated to one value per registered entity per product category per month.

Notation

Release N		The most recent dominant release reported.
Release N-1		The previous release reported.
Release N-2		The release previous to N-1 that is reported.
Ra0	=	Cumulative number of release application attempts for Release N
Ar0	=	Cumulative number of release application aborts for Release N
Ra1	=	Cumulative number of release application attempts for Release N-1
Ar1	=	Cumulative number of release application aborts for Release N-1
Ra2	=	Cumulative number of release application attempts for Release N-2
Ar2	=	Cumulative number of release application aborts for Release N-2

**Table 8.1.5-1 Release Application Aborts (RAA)
Measurement Identifiers and Formulas**

Identifier	Title	Formula	Note
RAA0	Release Application Aborts – Release N	**(Ar0 / Ra0) x 100**	% of systems with aborts
RAA1	Release Application Aborts – Release N-1	**(Ar1 / Ra1) x 100**	% of systems with aborts
RAA2	Release Application Aborts – Release N-2	**(Ar2 / Ra2) x 100**	% of systems with aborts

Table 8.1.5-2 Release Application Aborts (RAQ)
RQMS Alternative Measurements

Identifier	Title
RAQ0	Cumulative % of Systems Experiencing an Abort during Release Application – Release N
RAQ1	Cumulative % of Systems Experiencing an Abort during Release Application – Release N-1
RAQ2	Cumulative % of Systems Experiencing an Abort during Release Application – Release N-2
Rar0	Cumulative Number of Release Application Attempts – Release N
Rar1	Cumulative Number of Release Application Attempts – Release N-1
Rar2	Cumulative Number of Release Application Attempts – Release N-2

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 RAA Data Table – The RAA measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category combination as in Table 8.1.5-3.

Table 8.1.5-3 TL 9000 RAA Data Table

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	RAA
RAA0 Numerator:	**Ar0**
RAA1 Numerator:	**Ar1**
RAA2 Numerator:	**Ar2**
RAA0 Denominator:	**Ra0**
RAA1 Denominator:	**Ra1**
RAA2 Denominator:	**Ra2**

(3)   RQMS Alternative RAA Data Table – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category combination as defined in Table 8.1.5-4.

Table 8.1.5-4 RQMS Alternative RAA Data Table (RAQ)

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	RAQ
RAQ0 Numerator:	Cumulative number of systems experiencing an abort during release application for Release N
RAQ1 Numerator:	Cumulative number of systems experiencing an abort during release application for Release N-1
RAQ2 Numerator:	Cumulative number of systems experiencing an abort during release application for Release N-2
RAQ0 Denominator:	Cumulative number of release applications for Release N (**Rar0**)
RAQ1 Denominator:	Cumulative number of release applications for Release N-1 (**Rar1**)
RAQ2 Denominator:	Cumulative number of release application attempts for Release N-2 (**Rar2**)

8.1.5.5 Sources of Data

a. Suppliers shall capture data relative to numbers of release application aborts.

b. Customers shall provide the suppliers (via the mutually agreed procedure) with timely feedback related to any aborts that were encountered. If customers perform the release application, they must provide the supplier with the planned and actual dates for each software application and identify the applications that aborted due to supplier attributable causes.

8.1.5.6 Method of Delivery or Reporting

a. Compared Data (CD) or Research Data (RD):

    Release Application Aborts   CD

b. RQMS alternative reporting:

    Release Application Aborts   YES

8.1.5.7 Example Calculations

a. Example 1 – A supplier is upgrading three active releases (from prior releases to release N, N-1 and N-2). Release application counts and those encountering release application aborts are shown in Table 8.1.5-5.

Table 8.1.5-5 Example 1 – RAA Source Data and Measurement Calculation

Month	1	2	3	4	5	6	7	8	9	10	11	12	13
	Dec 2000	Jan 2001	Feb 2001	Mar 2001	Apr 2001	May 2001	Jun 2001	Jul 2001	Aug 2001	Sep 2001	Oct 2001	Nov 2001	Dec 2001
Number of Release Applications In Month													
Release N	1	4	6	14	22	39	45	52	54	50	47	36	30
Release N-1	1	3	5	12	20	39	46	51	52	45	48	33	29
Release N-2	1	2	5	10	20	40	45	46	45	43	44	30	24
Number of Release Applications that Encountered Release Application Aborts in Month													
Release N	0	0	0	0	1	0	1	0	1	0	1	0	0
Release N-1	0	0	0	1	0	1	1	1	1	1	0	0	1
Release N-2	0	0	0	1	0	1	1	1	1	1	1	1	0
Cumulative Release Application Attempts													
Ra0 Release N	1	5	11	25	47	86	131	183	237	287	334	370	400
Ra1 Release N-1	1	4	9	21	41	80	126	177	229	274	322	355	384
Ra2 Release N-2	1	3	8	18	38	78	123	169	214	257	301	331	355
Cumulative Release Application Aborts													
Ar0 Release N	0	0	0	0	1	1	2	2	3	3	4	4	4
Ar1 Release N-1	0	0	0	1	1	2	3	4	5	6	6	6	7
Ar2 Release N-2	0	0	0	1	1	2	3	4	5	6	7	8	8
Release Application Aborts Measurement (Cumulative %)													
RAA0 Release N	0.00	0.00	0.00	0.00	2.13	1.16	1.53	1.09	1.27	1.05	1.20	1.08	1.00
RAA1 Release N-1	0.00	0.00	0.00	4.76	2.44	2.50	2.38	2.26	2.18	2.19	1.86	1.69	1.82
RAA2 Release N-2	0.00	0.00	0.00	5.56	2.63	2.56	2.44	2.37	2.34	2.33	2.32	2.41	2.25

b. For the month of December 2001, the TL 9000 data reported for the above example is shown in Table 8.1.5-6.

Table 8.1.5-6 Example 1 – RAA TL 9000 Data Report

Year:	2000
Month:	12
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Forum
Measurement Identifier:	RAA
RAA0 Numerator: Ar0	4
RAA1 Numerator: Ar1	7
RAA2 Numerator: Ar2	8
RAA0 Denominator: Ra0	400
RAA1 Denominator: Ra1	384
RAA2 Denominator: Ra2	355

8.1.6 Corrective Patch Quality (CPQ) and Feature Patch Quality (FPQ)

8.1.6.1 General Description and Title

The Corrective Patch and Feature Patch measurements are used to monitor the maintenance activities associated with a generic/release. Corrective Patch Quality is the percentage of official corrective patches that are determined to be defective. Feature Patch Quality is the percentage of official feature patches that are determined to be defective. These measurements are adapted from RQMS. [1]

8.1.6.2 Purpose

This measurement is used to evaluate the percentage of defective official patches with a goal of minimizing service provider risk of failure.

8.1.6.3 Applicable Product Categories

This measurement applies to product categories as shown in Appendix A.

8.1.6.4 Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for these measurements:

- General Availability
- Official Patch
- Patch
- Patch – Defective Corrective
- Patch – Defective Feature

b. Counting Rules

(1) Non-identical patches packaged together in one administrative unit shall be counted individually even if the package can be installed during one craftsperson task.

(2) Identical patches distributed to multiple processors (or units) in the same system shall be counted only once provided they can be installed during one craftsperson task.

(3) If several separate patches are provided to effect a single change (such as covering different parts of the code) that are separately identifiable to the customer, they shall each be counted separately.

(4) A patch is counted on General Availability of the patch. For example, patches are counted when either (1) on-site and ready for system installation or (2) available for downloading by the customer to the site.

(5) Patches included with a release that require additional effort to implement shall be counted as patches.

(6) A defective patch shall be counted against the month during which the patch was found defective.

(7) The data shall include the three most dominant releases for each product being reported. If fewer than three releases exist, the data shall include all existing releases.

c. Counting Rule Exclusions

(1) Patches shall not be counted when included in the release by the supplier prior to the shipment of that release for the first Service Provider General Availability.

d. Calculations and Formulas

(1) These measurements (see Table 8.1.6-1 Patch Quality (CPQ and FPQ) shall be calculated monthly by release. Each measurement is calculated by multiplying 100 by the number of defective patches identified during the month and dividing by the number of patches that became available for general release during the month.

(2) For CPQ, the supplier shall provide, by release, the total monthly number of official corrective patches delivered and the number of official corrective patches identified as defective.

(3) For FPQ, the supplier shall provide, by release, the total monthly number of official feature patches delivered and the number of official feature patches identified as defective.

(4) When reporting RQMS alternative measurements, suppliers shall refer to Table 8.1.6-2 Patch Quality (DCP and DFP) – RQMS Alternative Measurements to determine reporting conventions.

Notation

Release N		The most recent dominant release reported.
Release N-1		The previous release reported.
Release N-2		The release previous to N-1 that is reported.
DPc0	=	Number of defective corrective patches for the month for release N
DPc1	=	Number of defective corrective patches for the month for release N-1
DPc2	=	Number of defective corrective patches for the month for release N-2
Pc0	=	Total number of corrective patches that became available for general release during the month for release N
Pc1	=	Total number of corrective patches that became available for general release during the month for release N-1
Pc2	=	Total number of corrective patches that became available for general release during the month for release N-2
DPf0	=	Number of defective feature patches for the month for release N
DPf1	=	Number of defective feature patches for the month for release N-1
DPf2	=	Number of defective feature patches for the month for release N-2
Pf0	=	Total number of feature patches that became available for general release during the month for release N
Pf1	=	Total number of feature patches that became available for general release during the month for release N-1
Pf2	=	Total number of feature patches that became available for general release during the month for release N-2

Table 8.1.6-1 Patch Quality (CPQ and FPQ)
Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
CPQ0	Defective Corrective Patches – Release N	**(DPc0 / Pc0) x 100**	% defective per month
CPQ1	Defective Corrective Patches – Release N-1	**(DPc1 / Pc1) x 100**	% defective per month
CPQ2	Defective Corrective Patches – Release N-2	**(DPc2 / Pc2) x 100**	% defective per month
FPQ0	Defective Feature Patches – Release N	**(DPf0 / Pf0) x 100**	% defective per month
FPQ1	Defective Feature Patches – Release N-1	**(DPf1 / Pf1) x 100**	% defective per month
FPQ2	Defective Feature Patches – Release N-2	**(DPf2 / Pf2) x 100**	% defective per month

Table 8.1.6-2 Patch Quality (DCP and DFP)
RQMS Alternative Measurements

Identifier	Title
DCP0	Monthly Number of Defective Corrective Patches Identified – Release N
DCP1	Monthly Number of Defective Corrective Patches Identified – Release N-1
DCP2	Monthly Number of Defective Corrective Patches Identified – Release N-2
DFP0	Monthly Number of Defective Feature Patches Identified – Release N
DFP1	Monthly Number of Defective Feature Patches Identified – Release N-1
DFP2	Monthly Number of Defective Feature Patches Identified – Release N-2
CPr0	Monthly Number of Corrective Patches Delivered – Release N
CPr1	Monthly Number of Corrective Patches Delivered – Release N-1
CPr2	Monthly Number of Corrective Patches Delivered – Release N-2
FPr0	Monthly Number of Feature Patches Delivered – Release N
FPr1	Monthly Number of Feature Patches Delivered – Release N-1
FPr2	Monthly Number of Feature Patches Delivered – Release N-2

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 Data CPQ or FPQ Table – The CPQ and FPQ measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category combination as follows:

Table 8.1.6-3 TL 9000 CPQ or FPQ Data Table

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	CPQ or FPQ
CPQ0 or FPQ0 Numerator:	**DPc0** (for CQP) or **DPf0** (for FPQ)
CPQ1 or FPQ1 Numerator:	**DPc1** (for CQP) or **DPf1** (for FPQ)
CPQ2 or FPQ2 Numerator:	**DPc2** (for CQP) or **DPf2** (for FPQ)
CPQ0 or FPQ0 Denominator:	**Pc0** (for CQP) or **Pf0** (for FPQ)
CPQ1 or FPQ1 Denominator:	**Pc1** (for CQP) or **Pf1** (for FPQ)
CPQ2 or FPQ2 Denominator:	**Pc2** (for CQP) or **Pf2** (for FPQ)

    (3)   RQMS Alternative CPQ or FPQ Data Table – The RQMS alternative measurements for CPQ and FPQ shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category combination as follows:

Table 8.1.6-4 RQMS Alternative CPQ or FPQ Data Table (DCP or DFP)

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	DCP or DFP
DCP0 or DFP0 Numerator:	Number of defective (corrective / feature) patches for release N
DCP1 or DFP1 Numerator:	Number of defective (corrective / feature) patches for release N-1
DCP2 or DFP2 Numerator:	Number of defective (corrective / feature) patches for release N-2
DCP0 or DFP0 Denominator:	Number of (corrective / feature) patches delivered for release N (**CPr0** or **FPr0**)
DCP1 or DFP1 Denominator:	Number of (corrective / feature) patches delivered for release N-1 (**CPr1** or **FPr1**)
DCP2 or DFP2 Denominator:	Number of (corrective / feature) patches delivered for release N-2 (**CPr2** or **FPr2**)

8.1.6.5 Sources of Data

Suppliers shall collect all data necessary to support this measurement.

8.1.6.6 Method of Delivery or Reporting

a. Compared Data (CD) or Research Data (RD)

Corrective Patch Quality	CD
Feature Patch Quality	RD

b. RQMS Alternative Reporting:

Corrective Patch Quality	YES
Feature Patch Quality	YES

8.1.6.7 Example Calculations

a. The following example illustrates calculation of the corrective patch quality measurement. Calculation of the feature patch quality measurement is analogous.

Example 1 - Corrective Patch Quality Measurement:

A supplier has three active releases (N, N-1, and N-2). Corrective patch distribution and bad corrective patch counts were as shown in Table 8.1.6-5.

Table 8.1.6-5 Example 1 – CPQ Source Data and Measurement Calculation

Month:		1	2	3	4	5	6	7	8	9	10	11	12	13
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2001
Number of Corrective Patches Issued In Month														
Pc0	Release N	52	53	48	35	34	34	32	30	28	30	25	24	22
Pc1	Release N-1	55	55	50	40	36	32	34	36	33	32	26	24	24
Pc2	Release N-2	60	55	50	47	42	35	35	31	32	30	29	27	25
Number of Defective Corrective Patches Identified in Month														
DPc0	Release N	0	1	0	0	0	1	0	0	0	0	0	1	0
DPc1	Release N-1	1	0	0	1	0	0	1	0	0	0	1	0	1
DPc2	Release N-2	1	0	0	2	0	0	0	1	0	1	1	0	0
Defective Corrective Patch Measurement - % Defective														
CPQ0	Release N	0	1.89	0	0	0	2.94	0	0	0	0	0	4.17	0
CPQ1	Release N-1	1.82	0	0	2.50	0	0	2.94	0	0	0	3.85	0	4.17
CPQ2	Release N-2	1.67	0	0	4.26	0	0	0	3.23	0	3.33	3.45	0	0

b. For the month of November 2000, the TL 9000 CPQ data reported is shown in Table 8.1.6-12.

Table 8.1.6-6 Example 1 – CQP Data Report

Year:	2000
Month	11
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Forum
Measurement Identifier:	CPQ
CPQ0 Numerator: DCP0	0
CPQ1 Numerator: DCP1	1
CPQ2 Numerator: DCP2	1
CPQ0 Denominator: PC0	25
CPQ1 Denominator: PC1	26
CPQ2 Denominator: PC2	29

8.1.7   Software Update Quality (SWU)

8.1.7.1 General Description and Title

A variety of new products have been developed that use an alternative approach to install new generic/releases and maintenance software (point or dot releases) into the product. Software updates replaces the existing code with new software. The mechanism used to install the generic/release and the point or dot releases are essentially the same. The service provider is concerned with the quality of the software and the number of changes the supplier makes during the release's lifecycle. Software Update Quality (SWU) quantifies the percentage of these updates that are defective.

A software update is used:

- To install a new generic/release into a product.
- Between generics/releases to effect a series of changes to fix problems or to implement new features that the service provider may wish to deploy on a timely basis rather than wait for a new generic/release.

8.1.7.2 Purpose

This measurement is used to evaluate the level of defective software updates with a goal of minimizing associated customer risks.

8.1.7.3 Applicable Product Categories

This measurement applies to the product categories as shown in Appendix A per the rules for software measurement option selection noted above.

8.1.7.4 Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for these measurements:

- General Availability

b. Counting Rules

Software Updates

The following rules shall apply to the Software Update measurements:

   (1)   A software update is counted on General Availability.

(2)   Software updates shall be considered delivered when they are delivered to the destination(s) designated by the customer.
For example, software updates are considered delivered when on-site, or ready for system installation, or available for downloading by the customer to the site.

(3)   The data shall include the three most dominant releases for each product being reported. If fewer than three releases exist, the data shall include all existing releases.

Defective Software Update

A defective software update is a software update that:

(1)   is withdrawn or has its distribution curtailed due to a supplier attributable problem

(2)   causes a critical or major supplier attributable problem within 6 months of general availability of the software

(3)   does not correct the targeted problem(s) or provide the intended feature functionality

The following rules shall apply to counting defective software updates:

(1)   A defective software update shall be counted against the month during which the software update was found defective and the release for which it was intended to update.

(2)   The data shall include the three most dominant releases for each product being reported. If fewer than three releases exist, the data shall include all existing releases.

(3)   For this calculation, the volume of software updates and defective software updates shall include the software update used to install the release and all the maintenance software updates (point or dot releases) associated with the release.

c. Counting Rule Exclusions

None

d. Calculations and Formulas

(1)   The measurement (see SWU0, SWU1 and SWU2 in Table 8.1.7-1) shall be calculated monthly as the cumulative percentage of defective software updates by release since General Availability.

(2)   The percentage for each month shall be calculated by dividing the cumulative number of defective software updates by the cumulative number of software updates deployed for the release.

(3)   The supplier shall provide, by release, the total monthly number of software updates delivered and the number of defective software updates identified.

(4) When reporting RQMS alternative measurements, suppliers shall refer to DSU0, DSU1, and DSU2 in Table 8.1.7-2 to determine reporting conventions.

(5) The reported data and each of the computed measurements are totaled/aggregated to one value per registered entity per product category per month.

Notation

Release N		The most recent dominant release reported.
Release N-1		The previous release reported.
Release N-2		The release previous to N-1 that is reported.
Du0	=	Cumulative number of defective software updates for release N
Du1	=	Cumulative number of defective software updates for release N-1
Du2	=	Cumulative number of defective software updates for release N-2
Us0	=	Cumulative number of software updates for release N
Us1	=	Cumulative number of software updates for release N-1
Us2	=	Cumulative number of software updates for release N-2

Table 8.1.7-1 Software Update Quality (SWU) Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
SWU0	Defective Software Updates – Release N	$(Du0 / Us0) \times 100$	Cumulative % defective
SWU1	Defective Software Updates – Release N-1	$(Du1 / Us1) \times 100$	Cumulative % defective
SWU2	Defective Software Updates – Release N-2	$(Du2 / Us2) \times 100$	Cumulative % defective

Table 8.1.7-2 Software Update Quality (DSU) RQMS Alternative Measurements

Identifier	Title
DSU0	Cumulative Number of Defective Software Updates – Release N
DSU1	Cumulative Number of Defective Software Updates – Release N-1
DSU2	Cumulative Number of Defective Software Updates – Release N-2

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) TL 9000 Data SWU Table – The SWU measurements shall be reported with data elements (or equivalent as defined by the Measurements

Administrator) for each month and each product category combination as follows:

Table 8.1.7-3 TL 9000 SWU Data Table

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	TL 9000
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	SWU
SWU0 Numerator:	**Du0**
SWU1 Numerator:	**Du1**
SWU2 Numerator:	**Du2**
SWU0 Denominator:	**Us0**
SWU1 Denominator:	**Us1**
SWU2 Denominator:	**Us2**

(3) RQMS Alternative SWU Data Table – The RQMS alternative measurements shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category combination as follows:

Table 8.1.7-4 RQMS Alternative SWU Data Table (DSU)

Year:	YYYY
Month:	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Measurement Methodology:	RQMS
Customer Base:	Either **Total** or **Forum**
Measurement Identifier:	DSU
DSU0:	Cumulative number of defective software updates for release N
DSU1:	Cumulative number of defective software updates for release N-1
DSU2:	Cumulative number of defective software updates for release N-2

8.1.7.5 Sources of Data

Customers shall provide feedback to the supplier on the results (successful or unsuccessful) of any customer installed software update. Suppliers shall collect all data necessary to report these measurements to the Measurements Administrator.

8.1.7.6 Method of Delivery or Reporting

a. Compared data (CD) or research data (RD):

    Software Update Quality   CD

b. RQMS Alternative Reporting:

    Software Update Quality   YES

8.1.7.7 Example Calculations

Example 1 – A supplier of a software driven product distributes software updates in the interim between releases. Table 8.1.7-5 shows the history of updates for a 6-month period. Table 8.1.7-6 shows the data report for June 2000.

Table 8.1.7-5 Example 1 – SWU Source Data and Measurement Calculation

(Product Category 2.1)

Release ID	Month: Number of Updates	Jan 2000	Feb 2000	Mar 2000	Apr 2000	May 2000	Jun 2000
D4 (N)	Cumulative (Us0)					25	55
D4 (N)	Cum. Defectives (Du0)					2	4
D4 (N)	Current					25	30
D4 (N)	Current Defectives					2	2
SWU0	**Cumulative % Defective**					**8%**	**7.3%**
D2 (N-1)	Cumulative (Us1)			10	15	30	50
D2 (N-1)	Cum. Defectives (Du1)			2	3	4	6
D2 (N-1)	Current			10	5	15	20
D2 (N-1)	Current Defectives			2	1	1	2
SWU1	**Cumulative % Defective**			**20%**	**20%**	**13.3%**	**12%**
C25 (N-2)	Cumulative (Us2)	11	15	18	25	28	29
C25 (N-2)	Cum. Defectives (Du2)	1	1	1	2	4	4
C25 (N-2)	Current	2	4	3	7	3	1
C25 (N-2)	Current Defectives	0	0	0	1	2	0
SWU2	**Cumulative % Defective**	**9.1%**	**6.7%**	**5.6%**	**8.0%**	**14.3%**	**13.8%**

Table 8.1.7-6 Example 1 – SWU Data Table
Report for June 2000

Year:	2000
Month	6
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	2.1
Measurement Methodology:	TL 9000
Customer Base:	Forum
Measurement Identifier:	SWU
SWU0 Numerator: Du0	4
SWU1 Numerator: Du1	6
SWU2 Numerator: Du2	4
SWU0 Denominator: Us0	55
SWU1 Denominator: Us1	50
SWU2 Denominator: Us2	29

Section 9   Services Measurements

9.1   Service Quality (SQ)

9.1.1   Description and Title

Service Quality is a measure of conformance of a service to specified criteria.

9.1.2   Purpose

This measurement is used to provide quality measurement information for establishing the evaluation and continuous improvement of the service.

This section does not contain all the Service Measurements. Section 5 also contains measurements associated with Service namely, Service Problem Reports, Service Fix Response Time, Service Overdue Problem reports, On-Time Installed System, and On-time Service Delivery.

9.1.3   Applicable Product Categories

This measurement applies to service categories as shown in Appendix A.

9.1.4   Detailed Description

a. Terminology

The Glossary includes definitions for the following terms used for these measurements:

- Installation and/or Engineering Audit
- Maintenance
- Service Categories

b. Counting Rules

(1)   Failure of any unit during the repair warranty period shall be counted as a defective repair unit.

(2)   Audits performed at "installation" shall include supplier caused installation engineering defects and installation defects.

(3)   Definitions for defects, service volume (Normalization Unit) and measurement units for the applicable product categories are given in Table 9.1-1.

c. Counting Rule Exclusions

(1) Customer Support Center activities that are turned into customer problem reports are not to be included in this measure.

(2) Maintenance visits or callbacks shall not be counted if it is determined that they were attributable to incorrect information supplied by the customer as mutually agreed between parties. A maintenance visit is a site visit to a customer's location for the purpose of performing maintenance. A maintenance callback is a site visit to a customer's location for the purpose of maintenance rework.

Table 9.1-1   Definitions of Defects, Service Volume and Units of Measure by Service Product Categories for Service Quality Measurements

Service Category	Counted Item (defect)	Service Volume (Abbreviation)	% SQ
Installation	Number of non-conforming audits	Total number of installation and/or engineering audits (number of audits)	% SQ
Maintenance	Number of maintenance callbacks	Total number of maintenance visits (number visits)	% SQ
Repair	Number of defective repair warranty units	Total number of repaired units (number of repairs)	% SQ
Customer Support Service	Number of resolutions exceeding agreed time	Total number of calls (number of calls)	% SQ
Support Service	Number of defects	Total number of transactions (number of transactions)	% SQ

NOTE: Service volume is a measure of the amount of service delivered.

NOTE: A nonconforming audit is one that fails to satisfy specified acceptance requirements.

d. Calculations and Formulas

The method to compute service quality is percentage conforming (% SQ). To determine the percentage conforming to specified criteria the percentage of non-conformances shall be counted and subtracted from 100%. Percentage of non-conformance shall be calculated as the total number of defects divided by the total number of opportunities for defects.

% Service Quality (% SQ) = (1 – counted item/service volume) x 100

Detailed service quality measurements formulas (SQ1, SQ2, SQ3, SQ4, and SQ5) appear in Table 9.1-2.

Notation

(Items are counted according to above stated rules)

NU	=	Service volume unit (normalization unit)
S1	=	Installation service audits
S2	=	Maintenance service volume
S3	=	Repair service volume
S4	=	Customer Support Service service volume
S5	=	Support service volume
Sd1	=	Number of installation non-conforming audits
Sd2	=	Number of maintenance callbacks
Sd3	=	Number of defective repair warranty units
Sd4	=	Number of Customer Support Service resolutions exceeding specified agreed time
Sd5	=	Number of support service defects

Table 9.1-2   Service Quality (SQ) Measurement Identifiers and Formulas

Identifier	Title	Formula	Note
SQ1	Conforming Installation and/or Engineering Audits	**(1-Sd1/S1) x 100**	% audits conforming
SQ2	Successful Maintenance Visits	**(1-Sd2/S2) x 100**	% visits without maintenance callbacks
SQ3	Successful Repairs	**(1-Sd3/S3) x 100**	% successful repairs
SQ4	Conforming Customer Support Service Resolutions	**(1-Sd4/S4) x 100**	% calls resolved within agreed time
SQ5	Conforming Support Service Transactions	**(1-Sd5/S5) x 100**	% transactions without Defect

e. Reported Data and Format

(1) Data shall be reported quarterly. Each report shall include data for the three months in the quarter.

(2) SQ Data Table – The SQ measurement shall be reported with data elements (or equivalent as defined by the Measurements Administrator) for each month and each product category as shown in Table 9.1-3.

Table 9.1-3   TL 9000 SQ Data Table

(Report one value each for S1-S5, SQ1-SQ5, and Sd1-Sd5)

Year:	YYYY
Month	MM
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	From Measurement Applicability Table (Normalized Units), Appendix A, Table A-2
Customer Base:	Either **Total** or **Forum**
Normalization Factor:	**S1, S2, S3, S4, or S5** (as appropriate for the specific measurement reported)
Measurement Identifier:	**SQ1, SQ2, SQ3, SQ4, or SQ5**
SQ Numerator:	**Sd1, Sd2, Sd3, Sd4, or Sd5** (as appropriate)

9.1.5   Sources of Data

See Table 9.1-4.

Table 9.1-4   SQ Data Sources

Category	Source of Data
Installation and/or Engineering Audits	Supplier to count number of non-conforming supplier installation and/or engineering and audits
Maintenance	Supplier to count maintenance revisits
Repair	Supplier to count number of repaired units that failed within repair warranty period
Customer Support Service	Supplier to count number of Customer Support Service resolutions exceeding specified time
Support Service	Supplier to count number of Support Service defects

9.1.6 Method of Delivery or Reporting

a. Compared Data (CD) or Research Data (RD)

Conforming Installations and/or Engineering Audits	RD
Successful Maintenance Visits	CD
Successful Repairs	CD
Conforming Customer Support Service Resolutions	CD
Conforming Support Service Transactions	RD

b. RQMS Alternative Reporting:

None

9.1.7 Example Calculations

a. Example 1 – Installation

(1) Data Collected and Results

Table 9.1-5 Example 1 – Source Data for Installation SQ

	January	February	March	April
Number of Non-conforming Installation and/or Engineering Audits	5	1	0	6
Total Number of Installation and/or Engineering Audits	100	50	75	80
Service Quality Measurement	95%	98%	100%	92.5%

    i. Computation for the month of January:
(1-5/100) x 100 = 95%

    ii. Data Report for January 2000 is shown in Table 9.1-6.

Table 9.1-6 Example 1 – Data Report for Installation SQ

Year:	2000
Month	01
Reporting ID:	Provided by QuEST Forum Administrator
Product Category Code:	7.1
Measurement Methodology:	TL 9000
Customer Base:	Forum
Normalization Factor:	100
Measurement Identifier:	SQ1
SQ Numerator:	5

b. Example 2 – Repair

    (1)   Data Collected and Results

Table 9.1-7   Example 2 – Source Data for Repair SQ

	January	February	March	April
Number of Defective Repaired Units within Repair Warranty	2	0	1	4
Total Number of Repaired Units	30	20	75	120
Service Quality Measurement	93.3%	100%	98.6%	96.6%

    (2)   Computation for the month of January:

$$(1-2/30) \times 100 = 93.3\%$$

    (3)   Data report is analogous to the Installation example.

c. Example 3 – Maintenance

    (1)   Data Collected and Results

Table 9.1-8   Example 3 – Source Data for Maintenance SQ

	January	February	March	April
Number of Maintenance callbacks	2	0	1	4
Number of Maintenance Visits	30	20	75	120
Quality Service Measurement	93.3%	100%	98.6%	96.6%

    (2)   Computation for the month of January:

$$(1-2/30) \times 100 = 93.3\%$$

    (3)   Data report is analogous to the Installation example.

d. Example 4 – Customer Support Service

    (1)   Data Collected and Results

Table 9.1-9   Example 4 – Source Data for Customer Support Service SQ

	January	February	March	April
Number Of Call Resolutions That Exceeded The Specified Time Allotment	15	40	10	4
Total Number Of Calls Which Came Into Customer Support Service	2000	5000	2750	3000
Service Quality Measurement	99.25%	99.2%	99.6%	99.8%

(2)   Computations for the month of January:

        (1-15/2000) x 100 = 99.25%

(3)   Data report is analogous to the Installation example.

e.   Example 5 – Support Service Example

This example references a cable locator service with a defined defect as a cut cable due to incorrect identification.

(1)   Data collected and results

Table 9.1-10   Example 5 – Source Data for Support Service SQ

	January	**February**	**March**	**April**
Cut Cables *(Number of Defects)*	5	2	0	4
Number of Cables Identified *(Number of Opportunities for Defects)*	1000	500	750	300
Service Quality Conformance Measurement	99.5%	99.6%	100%	98.6%

(2)   Computation for the month of January:

        (1-5/1000) x 100 = 99.5%

(3)   Data report is analogous to the Installation example.

Appendix A   Product Category Tables

This Appendix is current with the release of this handbook. However, these tables in this appendix are subject to revision. See the QuEST Forum web site (http://www.questforum.org/) for the latest version. The latest version shall be used in conjunction with registrations.

Suppliers shall classify their products and report measurements according to the listed product categories. The Measurement Applicability Table (Normalized Units), Table A-2, lists specific measurements that apply to each category as well as the normalized units and other information necessary for compiling measurement reports.

1.   List of Tables

Table A-1. Product Category Definitions
Table A-2. Measurement Applicability Table (Normalized Units)
Table A-3. Transmission Standard Designations and Conversions
Table A-4. Optical and Electrical Equivalency
Table A-5. Measurements Summary Listing

2.   Product Category Definitions

Table A-1 contains definitions of product categories to be used by suppliers in categorizing their products.

2.1   Rules for Classification of Products

A supplier will not be required to report measurements for a given product in multiple product categories. Therefore, any product from a given supplier must be classified in exactly one product category.

1. General-purpose products (e.g., computers) will be classified by specific function (e.g., signaling) when provided as a system designed for that function. Otherwise, they will be classified in a separate category, (e.g., Common Systems-Computers) designed for the general-purpose product.

2. A product will be classified according to its primary function. For example, a digital transmission facility product with performance monitoring will be classified as a transmission product instead of an operations and maintenance product.

3. The standard for classification is the product category, not the possible uses to which the product may be put. For example, if a product classification falls in the Outside Plant category, all products that are consistent with that category will be classified as such, even if the exact same product is

sometimes used in the customer premises and even if a particular supplier's product is sold primarily into the customer premises market.

2.2   Principles for Construction of the Product Category Table

a. Product categories should fall into a clearly defined hierarchy of classification.

b. There are well-established rules for classification.

c. Product categories should not be separated artificially if they can be logically aggregated.

d. Product categories should have clear definitions, which lend themselves to unambiguous interpretation.

e. For each category, the level to which measurements may be aggregated shall be defined.

f. Each product category specification shall consist of standard elements.

g. The placement of the product in the hierarchy will reflect the dominant use of the product.

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
1	*Switching*	*Equipment for the physical or virtual interconnection of communication channels in response to a signaling system. The switching category is broadly defined to include packet or circuit switched architectures.*	
1.1	Circuit Switch	Equipment for the **termination of subscriber lines and/or trunk lines and the dynamic interconnection of these ports** or channels in a digital transmission facility. A circuit switch establishes a dedicated circuit, as opposed to a virtual circuit, in response to a signal. Stored Program Control (SPC) is the most common type of switching equipment used at end offices and tandem offices. These systems use either analog or digital switching. The switching system used must have the capability to send, receive and be actuated by signals, e.g., access line signals, or inter-office in-band or common-channel signaling. This category includes all circuit switches regardless of transmission medium, i.e., wireline, or wireless.	• End-office • Tandem • Tandem access • Remote • Service Switching Point [SSP] • Mobile Switching Center [MSC]
1.2	*Packet Switch*	*Equipment for switching or routing data on virtual, as opposed to dedicated, circuits. The service is packet switched in that the customer's data is transported as a sequence of data blocks (packets) that do not exceed a specified size. This packetization permits data from many data conversations to share a given transmission facility economically through statistical multiplexing. Such data conversations are known as virtual circuits, which are full duplex and connection-oriented.*	

Note 1   The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.

Note 2   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 3   Bolded text in the product category definition indicates the primary function of the product category. This is the function to use for outage measurements.

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
1.2.1	Public Packet Switched Network (PPSN)	Equipment for the **provision** of connection-oriented, **packet-switched communication services** designed to provide economical data transport based on internationally standardized packet protocols. The packet switch is the primary switching element of the network allowing efficient connectivity to many customers. The access concentrator concentrates traffic from lower-speed access lines for more efficient packet-switch port usage and performs any necessary protocol conversion via the Packet Assembler/Disassembler (PAD) function.	• X.25 packet switch • Access concentrator / PAD
1.2.2	IP Packet Switch / Router	Equipment that moves variable-length **IP (Internet Protocol) packets** from source to destination. Routing generally uses software algorithms to optimize one or a combination of data-transport "measurements" such as delay, the use of reliable paths, "hops" between servers, etc. Switching is generally faster than routers since the decision as to where to send the packet is done by hardware, but are also limited to less sophisticated algorithms than are routers to determine which path the packets should use. Most systems provide a combination of routing and switching, as appropriate, to best serve the needs of the user.	
1.2.3	Asynchronous Transfer Mode (ATM) Switch	Switching equipment that operates at OSI Level 2 (hardware layer) to move fixed-length (53-byte) **data cells** from source to destination over virtual paths or channels. ATM is designed to support mixed data types (voice, video, computer communications, etc.), provides selectable Quality of Service guarantees and easily enables billing for data switching services. Throughput of up to 622 Mbps is commonly available in ATM Switches.	
1.2.4	Frame Relay Switch	Switching equipment that operates at OSI Level 2(hardware) to move variable-length **Frame Relay Frames** over virtual circuits from source to destination. Data are moved without data integrity checks or flow control at up to T3 rates.	

Note 1   **The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.**

Note 2   **Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.**

Note 3   **Bolded text in the product category definition indicates the primary function of the product category. This is the function to use for outage measurements.**

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
2	*Signaling*	*Equipment for the provision of signaling, i.e., states applied to operate and control the component groups of a telecommunications circuit to cause it to perform its intended function. Generally speaking, there are five basic categories of "signals" commonly used in the telecommunications network. Included are supervisory signals, information signals, address signals, control signals, and alerting signals. This category includes those signaling products that function within the telecommunications network and excludes (possibly similar) products that would normally provide enhanced services outside the network, or on the customer premises such as ACD, IVR, or voice messaging systems.*	
2.1	Service Control Point (SCP)	A signaling point that functions as a **database to provide information to another SCP or Service Switching Point (SSP)**. Transaction Capabilities Application Part (TCAP) queries and responses are used to communicate with the SCP as is done for 800 Data Base Service and ABS. SCPs may support one or more services per SCP and SCPs may be deployed singularly as stand-alone nodes, as mated pairs, or as multiple replicates (more than 2) to increase their availability. SCPs, connected to STPs, are associated with applications that consist of service-specific software and a database of customer-related information. This product category includes conventional SCP equipment, plus other platforms such as service nodes, intelligent peripherals, or service resource facilities, which may combine capabilities of a SCP, SSP or that may be used to provide AIN functionality or other enhanced services within the network.	• Service Control Point • Service nodes • Service resource facilities

Note 1   The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.

Note 2   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 3   Bolded text in the product category definition indicates the primary function of the product category. This is the function to use for outage measurements.

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
2.2	Signaling Transfer Point (STP)	A signaling point with the function of **transferring signaling messages** from one signaling link to another and considered exclusively from the viewpoint of the transfer. An STP is a specialized routing signaling point (SP). It is an SS7-based packet switch that transfers SS7 messages to and from other SPs and is always deployed in mated pairs for reliability. The STP uses the Message Transfer Part (MTP) and the Signaling Connection Control Part (SCCP) of the SS7 protocol to screen and route messages destined for other nodes in the SS7 network. It functions as an SS7 network routing hub, interfacing with SPs only through SS7 links and not voice or data trunks. Within the LEC CCS network structure, STPs are architecturally referred to as either Local STPs (LSTPs) or Regional STPs (RSTPs).	
2.3	Home Location Register (HLR)	Equipment to provide a permanent database used in wireless applications to identify a subscriber and to contain subscriber data related to features and services. It stores information such as service profiles, location and routing information for roamers, service qualification, interface for moves, adds and changes. It communicates with other HLRs and provides access to maintenance functions such as fault information, performance data, and configuration parameters.	
3	*Transmission*	*Equipment for the connection of the switched and interoffice networks with individual customers. An integral part of the distribution network is the loop, which connects the customer to the local central office (CO), thus providing access to the interoffice network.*	
3.1	*Outside Plant*	*The part of the telecommunications that is physically located outside of telephone company buildings. This includes cables, supporting structures, and certain equipment items such as load coils. Microwave towers, antennas, and cable system repeaters are not considered outside plant.*	

Note 1   The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.

Note 2   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 3   Bolded text in the product category definition indicates the primary function of the product category. This is the function to use for outage measurements.

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.1.1	*Transmission Medium*	*Optical fiber, metallic cable, or other physical medium for the transmission of analog or digital communications.*	
3.1.1.1	*Metallic Products*	*Metallic as opposed to optical or wireless transmission media.*	
3.1.1.1.1	Metallic Conductor Cable	Metallic pairs of conductors housed in a protective cable	• Metallic cable • Central office coaxial cable • Hybrid coaxial/twisted pair drop
3.1.1.1.2	Metallic Connectors	Devices used to terminate a metallic cable.	• Coaxial connectors • Coaxial distribution connectors
3.1.1.2	*Optical Fiber Products*	*Optical, as opposed to metallic or wireless transmission media.*	
3.1.1.2.1	Optical Fiber and Cable	Glass fiber wherein light is propagated and any associated covering.	• Loose tube cable • Single Tube Bundled Cables • Single Tube Ribbon Cables • Tight Buffered Cables • Indoor Fiber Optic Cables • Single Mode Fiber • Multi-mode Fiber • Dispersion Shifted Fiber
3.1.1.2.2	Optical Connectors	Device used to terminate an optical cable	• Optical SC,ST, or MT connectors • Connectorized cable assemblies, e.g., optical fiber ribbon fanouts

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Note 3   Bolded text in the product category definition indicates the primary function of the product category. This is the function to use for outage measurements.

Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.1.1.3	*Transmission Sub-systems*	*Sub-systems embedded in the transmission medium other than cable or connectors*	
3.1.1.3.1	Active Sub-systems	Active sub-systems containing electronics	• Coaxial drop amplifiers • Fiber optic data links
3.1.1.3.2	Passive Optical Sub-systems	Optical sub-systems containing no electronics	• Wavelength Division Multiplexer [WDM] • Add drop multiplexers • Fiber optic dispersion compensators • Optical isolators • Filters • Attenuators
3.1.1.3.3	Ancillary Sub-Systems	Other transmission sub-systems not specifically covered in other transmission component categories. Typically passive.	• Surge protectors • Bonding and grounding hardware • Taps
3.1.2	*Physical Structure*	*Equipment for the support of telephone transmission media. These physical structures include poles, towers, conduits, and equipment enclosures such as huts.*	
3.1.2.1	Enclosures	Enclosures for network equipment located in the outside plant.	• Fiber optic splice enclosures • ONU enclosures • Organizer assemblies • Seal assemblies • Controlled environment Vaults

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.1.2.2	Support structures	Products for the physical support of transmission media or enclosures.	• Telephone poles • Pedestals • Microwave / radio towers
3.1.2.3	Conduits	Channels for the containment of optical fiber or metallic cable.	• Innerduct • Multi-bore conduit • PVC pipe
3.2	*Transport Equipment*	*Equipment located in the central office or at the customer premises, but inside the network demarcation point, for the transmission of digital or analog communication over transmission media. This product category includes equipment for terminating, interconnecting, and multiplexing communications circuits.*	
3.2.1	*Cross Connect Systems*	*Equipment to provide a physical termination point for physical cables and individual conductors. They can be manual or automated, metallic or optical. Cross-connect systems, such as distributing frames, Digital Signal Cross Connects (DSXs) and Fiber Distributing Frames (FDFs) provide the following basic functions: cross-connection of network distribution facilities and equipment in the central office, electrical protection for conductive media, test access, temporary disconnection, and termination points for facilities and equipment.*	
3.2.1.1	Manual Cross Connect Systems	Equipment to provide a physical termination point for physical cables and individual conductors where changes in connections are performed manually. These can be metallic or optical systems such as distributing frames or Fiber Distributing Frames (FDFs) provide the following basic functions: cross-connection of network distribution facilities and equipment in the central office, electrical protection for conductive media, test access, temporary disconnection, and termination points for facilities and equipment.	• Digital Signal Cross Connect Panel (DSX) • Fiber Distribution Frame (FDF) • Feeder Distribution Interface (FDI)

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.2.1.2	Digital Cross Connect Systems	Equipment to provide a physical termination point for physical cables and individual conductors where changes in connections are performed electronically. These can be metallic or optical systems such as digital cross connect systems (DCS) that provide cross-connection of network distribution facilities and equipment in the central office, electrical protection for conductive media, test access, temporary disconnection, and termination points for facilities and equipment.	• Digital Cross-connect System (DCS) • Electronic DSX • Active Optical DSX
3.2.2	*Carrier Systems / Multiplexers*	*Equipment for transmitting multiple communication channels over a single transmission facility. This category includes equipment for transmission over interoffice trunks, for example, from central to remote offices.*	
3.2.2.1	*Interoffice / Long Haul*	*Equipment for transmission between central offices, between exchanges, or between carriers, as opposed to transmission between an end office and a remote location, typical of a loop carrier.*	
3.2.2.1.1	Metallic Carrier System	**Carrier** system that uses metallic transmission medium.	• Analog carrier (N-,L- carrier) • D4, D5 digital carrier
3.2.2.1.2	*Optical Carrier System*	*Carrier system that uses optical transmission medium.*	
3.2.2.1.2.1	SONET / SDH Transport Systems	Fully featured **digital transmission** system employing optical medium	• OC-3, 12, 48, or 192 SONET equipment configurable as linear or ring. • Similar for STM-x SDH equipment

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| \multicolumn{5}{c}{**Table A-1 Product Category Definitions**} |
Category Code	Category:	Definition:		Examples:
3.2.2.1.2.2	WDM / DWDM / Optical Amplification Products	Shelf level systems used for multiplexing, de-multiplexing, or amplification of **optical signals.** Lack the built in protection, electrical conversion and other features of a SONET Transport System.		• Wavelength Division Multiplexer [WDM] • Dense Wavelength Division Multiplexer
3.2.2.1.3	Microwave	Carrier system that employs fixed **microwave transmission**.		• 6, 8, 11, or 18 gigahertz microwave radio
3.2.2.2	Loop Carrier	Equipment for deploying multiple **voice or digital channels** over fewer physical channels than would be otherwise required (a "pair gain" function). Loop carriers are typically digital systems which employ time-domain multiplexing (TDM) but may include analog systems as well. Loop carrier systems consist of a Central Office Terminal (COT) located near the switching system, a Remote Terminal (RT) located near the customer to be served and a transmission facility connecting the COT to the RT. Individual communications circuits (such as POTS and Foreign Exchange [FX]) are accepted as separate inputs at the COT (RT), time-division multiplexed (in a digital loop carrier) by the loop carrier system and reproduced at the RT (COT). There is an analog-to-digital (A/D) conversion of analog inputs to the DLC and these signals, which are carried digitally within the DLC, undergo a digital-to-analog (D / A) conversion when output at the COT or RT. The transmission facility used by a loop carrier may be metallic cable pairs, repeated metallic cable pairs, or optical fibers.		• Digital loop carrier (DLC) • Universal digital loop carrier (UDLC) • SLC remote terminal • Integrated digital loop carrier • Analog loop carrier

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Note 2   **Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.**

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.2.3	Line Terminating Equipment / Distributing Frames	Equipment to provide the termination point for voice-grade and voice-grade compatible facilities and equipment in a central office. It is composed of protectors, connectors and terminal strips or blocks. Distributing frames are categorized as either conventional or modular.	• Tall conventional distributing frames • Low-Profile Conventional Distribution Frames (LPCDFs) • Conventional protector frames • Combined Main Distributing Frame (CMDF) • Subscriber Main Distributing Frame (SMDF) • Trunk Main Distributing Frame (TMDF) • Intermediate Distributing Frame (IDF) • Tie-Pair Distributing Frame (TPDF). • Office repeater bays
3.2.4	Digital Subscriber Line (DSL)	Equipment for the transport of high-speed digital data on the embedded copper plant. DSL typically will operate over nonrepeatered, POTS-like, conditioned unloaded loops out to CSA ranges. This product category includes central office and remote units, regenerators or range extenders, and supporting equipment.	• ISDN • HDSL • ADSL • DDS
3.3	*Wireless Transmission*	*Equipment for analog or digital transmission to the subscriber unique to wireless services. This category does not include interoffice or long haul wireless carrier systems.*	

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Note 2   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
3.3.1	Base Station Equipment	Equipment which provides the **interface between wireless systems and the Public Switched Telephone Network (PSTN).** It provides, for example, electrical signaling isolation as well as switching, routing, billing, and features capabilities. It provides subsystems for vocoding and selecting hand off decision.	• BSC • BSS
3.3.2	Base Transceiver System (BTS)	Equipment that provides the **radio link to the mobile subscribers**. It is connected to the BSC though a backhaul interface between the BSC and BTS for both vocoded and overhead packet traffic. This includes terminals and repeaters.	• BTS • Wireless Repeaters
3.3.3	Pilot Beacon Unit (PBU)	Equipment whose primary purpose is to **transmit an ANSI J-STD-008 Pilot channel and ANSI J- STD-008 Sync channel and a partial ANSI J-STD-008 Paging channel.** The PBU is intended to notify a mobile unit of a change in CDMA coverage and can be used to assist in the execution of cellular CDMA-AMPS and inter-frequency CDMA-CDMA hand-off. It is designed with the capability for extended temperature and environmental operation ranges.	
4	*Operations & Maintenance*	*Equipment, systems, and services for the management, upkeep, diagnosis and repair of the communications network.*	
4.1	*Test Systems*	*Equipment to support testing of the network. This category includes permanently installed equipment used to provide a centralized test capability or local test access, as opposed to portable equipment, as might be carried by a craftsperson.*	
4.1.1	Test Access Equipment	Equipment to provide test access to transmission circuits. Test access equipment is in series with the customer circuit at all times and therefore directly affects the circuit reliability. This equipment is designed with transmission equipment issues in mind. This equipment may have analog and perhaps a variety of digital (i.e., T1, E1) types.	

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
4.1.2	Test Equipment, Embedded	Equipment to perform tests on transmission circuits. This equipment is designed with transmission equipment issues in mind. Test equipment is NOT generally in series with the customer circuit and may be connected to a variety of access equipment and network elements with integral access features. This equipment may have analog and perhaps a variety of digital (i.e., T1, E1) types. Failure of this equipment doesn't bring down customer circuits; however, it inhibits the ability to maintain the network and to restore lost service.	
4.1.3	Test Support Software	Computer software that runs on a general purpose computer (office environment) and perhaps the maintenance network that the computer uses to **communicate with the CO access and test equipment.**	
4.2	*Operations Support Systems*	*Systems that provide TMN (Telecommunication Management Network) compliant, flexible, scaleable, and interoperable solutions to automate service activation, service assurance, and network capacity management processes to worldwide existing and emerging network services and equipment providers.*	
4.2.1	On Line Critical	Real time **network management systems**, demanding high availability, typically 24 hours a day and 7 days per week.	• Network traffic management • Surveillance of 911 • Fire alarms
4.2.2	On Line Non-critical	Real time **network management systems** with lower availability demands than on line critical systems.	• Provisioning • Dispatch • Maintenance
4.2.3	Off Line	Traditional **business systems** that are run off line sometimes in batch mode, typically overnight and do not have high availability expectations.	• Inventory • Billing records • Service creation platform

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Note 2   **Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.**

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
4.3	Ancillary Operations and Maintenance Products	**Tools, test equipment,** and other **specialized products** used to support the operations and maintenance of the communications network but not part of the permanent network	• Optical splicers • Single fiber fusion splicers • Mass fiber fusion splicers • Mechanical splicers • Portable test equipment • Optical connector tools • Cleavers
5	*Common Systems*	*Any of a variety of specialized generic, shared equipment to support network elements. Common systems include power systems and the Network Equipment-Building System (NEBS) that provides space and environmental support for network elements. These systems are located in central offices and remote building locations.*	
5.1	Synchronization	Equipment for operating digital systems at a common clock rate **(frequency synchronization).** This category includes primary reference sources and other timing signal generators that produce a timing signal traceable to UTC.	• Stratum 1,2, 3E domestic, TNC, LNC and Type 1 International • GPS timing receivers, cesium, loran, or CDMA RF pilot timing reference generators.

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Table A-1 Product Category Definitions				
Category Code	Category:	Definition:		Examples:
5.2	General Purpose Computers	A category reserved for computer complexes (one or more interconnected machines) that perform **general business function**s for a TSP but which do not provide any telephony transmission or storage service to subscribers or other TSP customers, or which may provide such services, but are not sold to the service provider as part of a system designed exclusively for that purpose. The purposes to which such machines may be put include but are not limited to: • Accounting systems • Billing systems • Legal systems • Ordering systems • Business Information systems • HR functions • Engineering and support functions • Marketing and Sales functions		• Terminals • PCs • Workstations • Mini, mid, mainframes
5.3	Power Systems	Equipment for the provision of **power to network equipmen**t. Power systems provide two principal functions: the conversion of the commercial AC power source to DC voltages required by the network equipment and the generation and distribution of emergency (reserve) power when the commercial power is interrupted. This category also includes the ringing plant, a redundant plant which supplies the ringing voltage, frequency, tones, and interrupter patterns		• AC rectifiers/battery chargers • Battery systems • Uninterruptible Power Supplies (UPS) • DC to AC inverters • DC to DC bulk converters • AC and DC switch gear • Ring generator • Power distribution panels

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
6	*Customer Premises*	*Equipment installed beyond the network demarcation point. Although commonly installed on the subscriber's premises, equipment with essentially identical function installed in the service provider's facility may also be classified as customer premises equipment.*	
6.1	*Enhanced Services Platforms*	*Systems that provide an environment in which service-specific application programs can execute and an infrastructure by which those application programs can provide enhanced services. Although each enhanced services platform has a corresponding service creation environment, that creation environment is sometimes packaged separately and may execute on a different platform.*	
6.1.1	Interactive Voice Response (IVR) Platforms	Equipment used to allow menu **navigation and information retrieval**, often from legacy databases external to the IVR platform itself.	
6.1.2	Messaging Platforms	Equipment for **storage and retrieval of voice and/or fax messages**	Voice mail systems
6.1.3	Multi-Application Platforms	Equipment which provides an environment rich in capabilities so that multiple, possible disparate **services** can be provided concurrently.	Unified/Universal Messaging (system providing a subscriber the means, from a given device, to manipulate messages originated on like or different devices. Such devices include, but are not limited to, conventional telephone handsets, wireless handsets, PC terminals, fax machines, and email)

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
6.2	*Terminal Equipment*	*Equipment connected to the network demarcation point that provides a service to the subscriber. Terminal equipment includes telephone sets, whether wireline, cordless, cellular, PCS, or other voice terminals, fax machines, answering machines, modems, data service units (DSUs), or ISDN terminal adapters.*	
6.2.1	*Voice Terminals*	*Conventional, wireless, cellular, PCS, or other voice terminal equipment.*	
6.2.1.1	Wireline Telephone Sets	Telephone sets connected to conventional wireline (POTS) circuits.	• POTS telephone sets • Cordless telephones
6.2.1.2	Wireless Subscriber User Terminals	The subscriber user terminal made to transmit and receive voice and/or data communication using Telecommunication Infrastructure equipment not requiring hard lines as a means of transport. User terminals may be of any functional technology available for public use.	• Wireless single mode user terminal • Wireless mobile user terminal • Wireless stationary user terminal • Wireless multi-mode user terminal • Wireless multi-purpose user terminal • Wireless Global user terminal
6.2.2	Fax equipment	Equipment for sending or receiving facsimile (fax) over conventional voice-grade lines.	
6.2.3	Data Modems	Equipment for digital communications over voice-grade lines	
6.2.4	Digital Data Service Units	Equipment for the interconnection of data terminal equipment (DTE) with a digital communications service. Such equipment typically provides a network interface and one or more DTE interfaces and may be configurable.	• DDS CSU / DSU • ISDN CSU / DSU • IDSN terminal adapter • T1 CSU DSU

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
6.3	Automatic Call Distribution (ACD) systems	Equipment for the **distribution of incoming calls** to any of a number of destinations based on some programmed logic. ACD systems are typically used in Customer Support service or sales centers.	
6.4	Private Branch Exchange (PBX)	Equipment to provide **circuit switched voice and fax communications** services, optimized for medium to large sized customer sites. Now is evolving to utilize ATM and IP networks and support multimedia communications.	
6.5	Small Communications System (Key Telephone System)	Equipment to provide circuit **switched voice and FAX communications services**, optimized from small to medium sized customer sites. Now is evolving to utilize IP networks.	
7	*Services*	*Result generated by activities at the interface between the supplier and the customer and by supplier internal activities to meet the customer needs.* *NOTES:* *1. The supplier or the customer may be represented at the interface by personnel or equipment,* *2. Customer activities at the interface with the supplier may be essential to the service delivery,* *3. Delivery or use of tangible products may form part of the service delivery, and* *4. A service may be linked with the manufacture and supply of tangible product. [4]*	
7.1	Installation Service	Contracted service to position, configure, and/or adjust a product.	
7.2	Engineering Service	Contracted service to design and/or develop a product. This includes, but is not limited to, the documentation necessary for positioning, configuring, connecting, and/or adjusting.	
7.3	Maintenance Service	Contracted service to maintain customer's equipment and/or systems.	
7.4	Repair Service	Contracted service to repair customer's equipment and/or systems	

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
7.5	Customer Support Service	Contracted service to process customer requests. This service may include call answering, response to general inquiries, information requests, and information sharing. When the customer support service center also handles product problem reports, those problem reports shall be included in the appropriate product category measurements and not in this category.	Call Center, web-based support, Dispatch Centers, etc.
7.6	Procurement Services	Contracted services for the procurement of reuse and new equipment	Typically includes refurbishing/retesting
7.7	Logistical Services	Contracted service for the distribution of equipment between the organization and customer	Typically includes strictly warehousing and transportation
7.8		Reserved for future use	
7.9	General Support Service	Contracted service that is not included in another product category.	
8	*Components and Subassemblies*	*Individual components or assemblies provided for use in telecommunications systems excluding those already covered by a specific product category in another product family. These items would typically be used by other suppliers and not sold directly to service providers except as replacement parts.*	
8.1	Components	Individual self-contained devices without separable parts.	Crystals, ASIC's, Lasers, optical detectors, any individual piece part
8.2	*Subassemblies*	*A device made up of a number of components for use in a telecommunications system. This device is a portion of the completed system, but would not make up the entire system.*	
8.2.1	Simple	Less than 11 components or 49 solder connections excluding connectors	VCXO's

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Table A-1 Product Category Definitions			
Category Code	Category:	Definition:	Examples:
8.2.2	Medium Complexity	More than 10 components or 48 solder connections but less than 51 components or 241 solder connections excluding connectors.	• Multi die hybrids • Optical assemblies • DC/DC converter "bricks"
8.2.3	High Complexity	More than 50 components or 240 solder connections but less than 501 components or 2401 solder connections excluding connectors	• Medium sized printed circuit assemblies
8.2.4	Very High Complexity	More than 500 components or 2400 solder connections excluding connectors	• Single board computers

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3. Measurement Applicability Table (Normalized Units)

3.1 Measurements Without Normalization Factors

The measurements Fix Response Time (FRT), Overdue Fix Responsiveness (OFR), and On-Time Delivery (OTD) are applicable and required for ALL product categories, with the exception of OTD for Customer Support Service (category 7.5) where resolution time is the service quality measurement. These measurements (FRT, OFR and OTD) do not require product specific normalization. In the interest of saving space, they are not listed in the following table but data must be submitted for each of these three measurements for all products. Use the following table to determine the normalization units and applicability of the rest of the measurements.

3.2 Other Rules and References

Where the normalization factor is traffic capacity based, such as DS1, OC-1, DSL or Terminations, the calculation shall be based on the true useable traffic capacity. Equipment within the system used to provide protection for the main traffic path shall not be included, as it does not add useable capacity to the system.

Software measurements are based on the three most dominant releases.

% = 100 x Quantity Defective / Total Quantity. "%" is applicable to "Software Only" measurements.

"NA" means the measurement is not applicable for the product category.

"None" means that no common normalization factor has been identified for the product category; however, data shall be submitted for the measurement.

The column headings in Table A-2 are general descriptions covering several sub-measurements in some cases. For cross-references to the detailed descriptions of the measurements elsewhere in this document, find measurement/ sub-measurement symbols in Table A-5 Measurement Summary Listing.

3.3 Measurement Summary Listing

Table A-5 is a listing of the measurements included in this handbook with the symbols used in data reporting, the applicability to hardware, software, and/or services (H, S, V), and a reference to the table in this handbook with data reporting details. The symbols listed here are referenced by the normalization unit and applicability table to clarify the general descriptions used as column headings

Table A-2 Measurement Applicability Table (Normalized Units)								
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)		
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	RR (all)	NPR (all)	CPQ (all)	FPQ (all)	SWU (all)	RAA (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		IPR (all)	DPQ (all)	DFP (all)	DSU (all)	RAQ (all)
1	*Switching*								
1.1	Circuit Switch	Minutes/ system/ year	Outages/ system/ year	Returns/ termination/ year	Problem Reports/ system/year	%	%	%	%
1.2	*Packet Switch*								
1.2.1	Public Packet Switched Network (PPSN)	Minutes/ system/ year	Outages/ system/ year	Returns/ termination/ year	Problem Reports/ system/year	%	%	%	%
1.2.2	IP Packet Switch/Router	Minutes/ NC/ year	Outages/NC/ year	Returns/ termination/ year	Problem Reports/ system/year	%	%	%	%
1.2.3	Asynchronous Transport Mode (ATM) Switch	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
1.2.4	Frame Relay Switch	Minutes/ system/ year	Outages/ system/ year	Returns/ termination/ year	Problem Reports/ system/year	%	%	%	%
2	*Signaling*								
2.1	Service Control Point (SCP)	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%

Note 1　　The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.

Note 2　　Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3　　Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4　　If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	RR (all)	NPR (all)	CPQ (all)	FPQ (all)	SWU (all)	RAA (all)
RQMS Alternative Symbols (see Table A-5)		r,h,DPMs,c	r,h,OFMs,c		IPR (all)	DPQ (all)	DFP (all)	DSU (all)	RAQ (all)
2.2	Signaling Transfer Point (STP)	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
2.3	Home Location Register (HLR)	NA	NA	NA	Problem Reports/ system/year	%	%	%	%
3	*Transmission*								
3.1	*Outside Plant*								
3.1.1	*Transmission Medium*								
3.1.1.1	*Metallic Cable Products*								
3.1.1.1.1	Metallic Conductor Cable	NA	NA	NA	None	NA	NA	NA	NA
3.1.1.1.2	Metallic Connectors	NA	NA	NA	Problem Reports/ unit shipped/ year	NA	NA	NA	NA
3.1.1.2	*Optical Fiber Products*								
3.1.1.2.1	Optical Fiber and Cable	NA	NA	NA	None	NA	NA	NA	NA

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Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	RR (all)	NPR (all)	CPQ (all)	FPQ (all)	SWU (all)	RAA (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		IPR (all)	DPQ (all)	DFP (all)	DSU (all)	RAQ (all)
3.1.1.2.2	Optical connectors	NA	NA	NA	Problem Reports/ unit shipped/ year	NA	NA	NA	NA
3.1.1.3	*Transmission Sub-systems*								
3.1.1.3.1	Active Sub-systems	NA	NA	Returns/ unit/ year	Problem Reports/ unit/year	NA	NA	NA	NA
3.1.1.3.2	Passive Optical Sub-systems	NA	NA	Returns/ unit/ year	Problem Reports/ unit/year	NA	NA	NA	NA
3.1.1.3.3	Ancillary Sub-systems	NA	NA	Returns/ unit/ year	Problem Reports/ unit/year	NA	NA	NA	NA
3.1.2	*Physical Structure*								
3.1.2.1	Enclosures	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	NA	NA	NA	NA

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.
Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.
Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
3.1.2.2	Support Structures	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	NA	NA	NA	NA
3.1.2.3	Conduits	NA	NA	Returns/ unit/ year	Problem Reports/ meter shipped/ year	NA	NA	NA	NA
3.2	*Transport Equipment*								
3.2.1	*Cross Connect Systems*								
3.2.1.1	Manual Cross Connect Systems	NA	NA	Returns/ DS1/ year	Problem Reports/ system/year	NA	NA	NA	NA
3.2.1.2	Digital Cross Connect Systems	Minutes/DS1/ year	Outages/DS1 / year	Returns/ DS1/ year	Problem Reports/ system/year	%	%	%	%
3.2.2	*Carrier Systems/Multiplexers*								
3.2.2.1	*Interoffice/Long Haul*								
3.2.2.1.1	Metallic Carrier System	Minutes/DS1/ year	Outages/ DS1/ year	Returns/ DS1/ year	Problem Reports/ system/year	%	%	%	%

Note 1 The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.

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Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
3.2.2.1.2	*Optical Carrier System*								
3.2.2.1.2.1	SONET/SDH Transport Systems	Minutes/ OC-1/ year	Outage/ OC-1/ year	Returns/ OC-1/ year	Problem Reports/ network element/year	%	%	%	%
3.2.2.1.2.2	WDM/DWDM/Optical Amplification Products	Minutes/ OC-1/ year	Outages/ OC-1/ year	Returns/ OC-1/ year	Problem Reports/ network element/year	%	%	%	%
3.2.2.1.3	Microwave	Minutes/ DS1/ year	Outages/ DS1/ year	Returns/ DS1/ year	Problem Reports/ network element/year	%	%	%	%
3.2.2.2	Loop Carrier	Minutes/ DS1/ year	Outages/ DS1/ year	Returns/ DS1/ year	Problem Reports/ DS1/year	%	%	%	%
3.2.3	Line Terminating Equipment/Distributing Frames	NA	NA	Returns/ termination / year	Problem Reports/ termination/ year	%	%	%	%

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Note 2 Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

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Note 4 If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)								
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)		
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
3.2.4	Digital Subscriber Line (DSL)	NA	NA	Returns/ DSL line/ year	Problem Reports/ DSL line/year	%	%	%	%
3.3	*Wireless Transmission*								
3.3.1	Base Station Controller (BSC) and Base Station System (BSS)	Minutes/ system/ year	Outages/ system/ year	Returns/ unit/ year	Problem Reports/ system/year	%	%	%	%
3.3.2	Base Transceiver System (BTS)	Minutes/ system/ year	Outages/ system/ year	Returns/ unit/ year	Problem Reports/ system/year	%	%	%	%
3.3.3	Pilot Beacon Unit (PBU)	Minutes/ system/ year	Outages/ system/ year	Returns/ unit/ year	Problem Reports/ system/year	%	%	%	%
4	*Operations & Maintenance*								
4.1.	*Test Systems*								
4.1.1	Test Access Equipment	NA	NA	Returns/ unit/ year	Problem Reports/ system/year	%	%	%	%

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
4.1.2	Test Equipment, Embedded	NA	NA	Returns/ unit/ year	Problem Reports/ system/year	%	%	%	%
4.1.3	Test Support Software	Minutes/ system/ year	Outages/ system/ year	NA	Problem Reports/ system/year	%	%	%	%
4.2	*Operations Support Systems*								
4.2.1	On Line Critical	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
4.2.2	On Line Non-Critical	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
4.2.3	Off Line	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
4.3	Ancillary Operations and Maintenance Products	NA	NA	NA	None	NA	NA	NA	NA
5	*Common Systems*								

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		*Hardware and Common Hardware Software*				*Software Only (Per Applicable Option)*			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
5.1	Synchronization	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	NA	NA	NA	NA
5.2	General Purpose Computers	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
5.3	Power Systems	Minutes/ system/ year	Outages/ system/ year	Returns/ unit/ year	Problem Reports/ system/year	NA	NA	NA	NA
6	*Customer Premises*								
6.1	*Enhanced Services Platforms*								
6.1.1	Interactive Voice Response (IVR) Platforms	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
6.1.2	Messaging Platforms	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
6.1.3	Multi-Application Platforms	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
6.2	*Terminal Equipment*								

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Note 2 Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3 Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4 If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)									
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
6.2.1	*Voice Terminals*								
6.2.1.1	Wireline Telephone Sets	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	%	%	%	%
6.2.1.2	Wireless Subscriber User Terminals	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	%	%	%	%
6.2.2	Fax Equipment	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	%	%	%	%
6.2.3	Data Modems	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	%	%	%	%
6.2.4	Digital Data Service Units	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	%	%	%	%

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2 Measurement Applicability Table (Normalized Units)								
Product Category		Hardware and Common Hardware Software				Software Only (Per Applicable Option)		
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	**RR** (all)	**NPR** (all)	**CPQ** (all)	**FPQ** (all)	**SWU** (all)	**RAA** (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c	r,h,**OFM**s,c		**IPR** (all)	**DPQ** (all)	**DFP** (all)	**DSU** (all)	**RAQ** (all)
6.3	Automatic Call Distribution (ACD) Systems	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
6.4	Private Branch Exchange (PBX)	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%
6.5	Small Communications System (Key Telephone System)	Minutes/ system/ year	Outages/ system/ year	Returns/ system/ year	Problem Reports/ system/year	%	%	%	%

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Table A-2		Measurement Applicability Table (Normalization Units)		
Product Category		*Applicability and Normalization Units for Services*		
Code	Description	Service Problem Reports	Service Quality	Return Rate
TL 9000 Measurement Symbols (see Table A-5)		NPR (all)	SQ	RR (all)
RQMS Alternative Symbols (see Table A-5)		NA	NA	
7	*Services*			
7.1	Installation Service	Problem Reports/ job/year	% audits conforming	NA
7.2	Engineering Service	Problem Reports/ job/year	NA	NA
7.3	Maintenance Service	Problem Reports/ unit maintained/ year	% visits without maintenance callbacks	NA
7.4	Repair Service	Problem Reports/ unit repaired/ year	% of successful repairs	NA
7.5	Customer Support Service	Problem Reports/ 1000 requests/ year	% requests resolved within agreed time	NA
7.6	Procurement Services	Problem Reports/ unit/year	NA	Returns/ unit/year
7.7	Logistical Services	Problem Reports/ unit/year	NA	NA
7.8	Reserved for future use			
7.9	General Support Service	Problem Reports/ unit /year	% transactions without defect	NA

Table A-2   Measurement Applicability Table (Normalized Units)
Note 1   The information in this table may have changed. See the QuEST Forum web site, http://www.questforum.org/ for the latest information.
Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.
Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.
Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

Product Category		Hardware and Common Hardware Software				Software Only			
Code	Description	Downtime Performance H, S	Outage Frequency H, S	Return Rate H	Problem Reports H,S	Corrective Patch Quality	Feature Patch Quality	Software Update Quality	Release Application Aborts
TL 9000 Measurement Symbols (see Table A-5)		SO2; SO4;	SO1;SO3;	RR (all)	NPR (all)	CPQ (all)	FPQ (all)	SWU (all)	RAA (all)
RQMS Alternative Symbols (see Table A-5)		r,h,**DPM**s,c_	r,h,**OFM**s,c		IPR (all)	DPQ (all)	DFP (all)	DSU (all)	RAQ (all)
8	*Components and Subassemblies*								
8.1	Components	NA	NA	NA	Problem Reports/ unit shipped/ year	NA	NA	NA	NA
8.2	*Subassemblies*								
8.2.1	Simple	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped / year	NA	NA	NA	NA
8.2.2	Medium Complexity	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped/ year	NA	NA	NA	NA
8.2.3	High Complexity	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped / year	NA	NA	NA	NA
8.2.4	Very High Complexity	NA	NA	Returns/ unit/ year	Problem Reports/ unit shipped / year	NA	NA	NA	NA

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Note 2   Measurements FRT, OFR & OTD are applicable and must be reported for all product categories except for OTD for 7.5.

Note 3   Product Categories listed in RED and *italicized* will be used for possible Data Aggregation only. Measurements must be submitted per the lower Product Category listing.

Note 4   If the normalization factor contains the word "shipped", then the quantity shipped in the 12 months ending prior to the month being reported shall be used.

4. Equivalency Tables

Tables A-3 and A-4 are included for convenience only.

Table A-3 Transmission Standard Designations and Conversions

Electrical	Frequency	Equivalent
NORTH AMERICAN		
DS0	64 Kb	1 Trunk
DS1	1.544 Mb	24 DS0
VT 1.5	1.728 Mb	1 DS1, 24 DS0
DS1C	3.152 Mb	2 DS1, 48 DS0
DS2	6.312 Mb	4 DS1, 96 DS0
DS3	44.736 Mb	28 DS1, 672 DS0
STS-1	51.84 Mb	1 DS3, 28 DS1, 672 DS0
STS-3	155.52 Mb	3 DS3, 84 DS1, 2,016 DS0
STS-12	622.08 Mb	12 DS3, 336 DS1, 8,064 DS0
STS-48	2488.32 Mb	48 DS3, 1,344 DS1, 32,256 DS0
STS-192	9953.28 Mb	192 DS3, 5,376 DS1, 129,024 DS0
INTERNATIONAL (PDH)		
E1 - 2 Mbits/sec	2,048 Mb	30 64 Kb Channels
E2 - 8 Mbits/sec	8,448 Mb	4 2 Mbit/s, 120 64 Kb Channels
E3 - 34 Mbits/sec	34,368 Mb	4 8 Mbit/s, 16 2 Mbit/s, 480 64 Kb Channels
E4 - 140 Mbits/sec	139,264 Mb	4 34 Mbits/s, 64 2 Mbit/s, 1,920 64 Kb Channels
565 Mbits/sec	636,000 Mb	4 140 Mbit/s, 16 34 Mbit/s, 64 8 Mbit/s, 256 2 Mbit/s, 7,680 64 Kb Channels

Table A-4 Optical and Electrical Equivalency

Optical	Electrical	Frequency	Equivalent
		NORTH AMERICAN (SONET)	
OC-1	STS-1	51.84 Mb	1 OC-1, 1 DS3, 28 DS1, 672 DS0
OC-3	STS-3	155.52 Mb	3 OC-1, 3 DS3, 84 DS1, 2,016 DS0
OC-12	STS-12	622.08 Mb	12 OC-1, 12 DS3, 336 DS1, 8,064 DS0
OC-48	STS-48	2,488.32 Mb	48 OC-1, 48 DS3, 1,344 DS1, 32,256 DS0
OC-192	STS-192	9,953.28 Mb	192 OC-1,192 DS3, 5,376 DS1, 129,024 DS0
OC-768	Not available	39,680 Mb	Not available
OC-1536		158,720Mb	Not available
		INTERNATIONAL (SDH)	
STM-1o (OC-3)	STM-1e	155.52 Mb	1 E4, 4 E3, 64 E1, 1,920 Channels
STM-4o (OC-12)	STM-4e	622.08 Mb	4 E4, 16 E3, 256 E1, 7,680 Channels
STM-16o (OC-48)	STM-16e	2,488.32 Mb	16 E4, 48 E3, 1,024 E1, 30,720 Channels
STM-64o (OC-192)	STM-64e	9,953.28 Mb	64 E4, 192 E3, 4,096 E1, 122,024 Channels
Not applicable	VC-11 (VT1.5)	1.644 Mb (1.544 Mb)	1 DS1
Not applicable	VC-12 (E1)	2.240 Mb (2.048 Mb)	1 E1 (2 Mb)
Not applicable	VC-2 (VT6)	6.784 Mb (6.312 Mb)	
Not applicable	VC-3 (E3)	48.960 Mb (34.368 Mb)	1 E3 (34 Mb)
Not applicable	VC-4 (E4)	150.336 Mb (139.264 Mb)	1 E4 (140 Mb)

5.   Measurement Summary Listing

Table A-5 is a listing of the measurements included in this handbook showing: (1) the symbols used in data reporting, (2) the applicability to hardware, software, and/or services (H, S, V), and (3) a reference to the table with data reporting details. The symbols listed here are also included in Table A-2, Measurement Applicability Table (Normalized Units), to clarify the general descriptions in the column headings.

Table A-5 Measurements Summary Listing

Table A-5. Measurements Summary Listing.						
Para-graph	**Measurement** Sub-Measurement	Measur ement Symbol	Sub -measur ement Symbol	Applic-ability (H/S/V)	Reported Items (Table)	Compared or Research Data
5.1	**Number of Problem Reports Formulas: Table 5.1-1**	**NPR**		**H,S,V**	**5.1-3**	
	H/S Critical Problem Reports per Normalization Unit		NPR1	H,S		compared
	H/S Major Problem Reports per Normalization Unit		NPR2	H,S		compared
	H/S Minor Problem Reports per Normalization Unit		NPR3	H,S		compared
	Service Problem Reports per Normalization Unit		NPR4	V		compared
	Number of Problem Reports - RQMS Alternative Formulas: Table 5.1-2	IPR		H,S	5.1-4	
	Incoming Critical Problem Reports per System per Month		IPR1	H,S		compared
	Incoming Major Problem Reports per System per Month		IPR2	H,S		compared
	Incoming Minor Problem Reports per System per Month		IPR3	H,S		compared
5.2	**Problem Report Fix Response Time Formulas: Table 5.2-1**	**FRT**		**H,S,V**	**5.2-3**	
	H/S Major Problem Reports Fix Response Time		FRT2	H,S		compared
	H/S Minor Problem Reports Fix Response Time		FRT3	H,S		compared
	Service Problem Reports Fix Response Time		FRT4	V		compared
	Problem Report Fix Response Time - RQMS Alternative Formulas: Table 5.2-2	ORT		H,S	5.2-4	
	% Major Problems Closed On Time		ORT2	H,S		compared
	% Minor Problems Closed On Time		ORT3	H,S		compared
5.3	**Overdue Problem Report Fix Responsiveness Formulas: Table 5.3-1**	**OFR**		**H,S,V**	**5.3-3**	

Para-graph	Measurement Sub-Measurement	Measur-ement Symbol	Sub-measur-ement Symbol	Applic-ability (H/S/V)	Reported Items (Table)	Compared or Research Data
	H/S Major Overdue Problem Reports Fix Responsiveness		OFR2	H,S		research
	H/S Minor Overdue Problem Reports Fix Responsiveness		OFR3	H,S		research
	H/S Service Overdue Problem Reports Fix Responsiveness		OFR4	V		research
	Overdue Problem Report Fix Responsiveness - RQMS Alternative Formulas: Table 5.3-2	OPR		H,S	5.3-4	
	% Rate of Closures of Overdue Problem Reports – Major		OPR2	H,S		research
	% Rate of Closures of Overdue Problem Reports - Minor		OPR3	H,S		research
5.4	**On-Time Delivery** **Formulas: Table 5.4-1**	**OTD**		**H,S,V**	**5.4-2**	
	On-Time Installed System Delivery		OTIS	H,S,V		compared
	On-Time Items Delivery		OTI	H,S		compared
	On-Time Service Delivery		OTS	V		compared
6.1	**System Outage** **Formulas: Table 6.1-1**	**SO**		**H,S**	**6.1-4**	
	Annualized Weighted Outage Frequency		SO1	H,S		compared
	Annualized Weighted Downtime		SO2	H,S		compared
	Annualized Supplier Attributable Outage Frequency		SO3	H,S		compared
	Annualized Supplier Attributable Downtime		SO4	H,S		compared
	System Outage - RQMS Alternative for End Office and/or Tandem Office, Wireless Products and NGDLC Products Formulas: Table 6.1-2	SOE		H,S	6.1-5	
	Supplier Attributable Total Outage Minutes per System per Year – Remote Only		rDPMs	H,S		compared
	Supplier Attributable Total Outage Minutes per System per Year - Host Only		hDPMs	H,S		compared
	Service provider Attributable Total Outage Minutes per System per Year - Remote Only		rDPMc	H,S		compared
	Service provider Attributable Total Outage Minutes per System per Year - Host Only		hDPMc	H,S		compared
	Supplier Attributable Total Outages per System per Year - Remotes		rOFMs	H,S		compared
	Supplier Attributable Total Outages per System per Year - Hosts		hOFMs	H,S		compared
	Service Provider Attributable Total Outages per System per Year - Remotes		rOFMc	H,S		compared

Table A-5. Measurements Summary Listing.

Para-graph	Measurement Sub-Measurement	Measurement Symbol	Sub -measurement Symbol	Applic-ability (H/S/V)	Reported Items (Table)	Compared or Research Data
	Service Provider Attributable Total Outages per System per Year – Hosts		hOFMc	H,S		compared
	System Outage - RQMS Alternative - General Series Formulas: Table 6.1-3	SOG		H,S	6.1-6	
	Total Outage Minutes per System per Year – Overall		DPM	H,S		compared
	Total Outage Minutes per System per Year - Supplier Attributable		DPMs	H,S		compared
	Total Outages per Year - Overall		OFM	H,S		compared
	Total Outages Per Year - Supplier Attributable		OFMs	H,S		compared
7.1	**Return Rates Formulas: Table 7.1-1**	**RR**		**H**	**7.1-2**	
	Initial Return Rate		IRR	H		research
	One-Year Return Rate		YRR	H		research
	Long-Term Return Rate		LTR	H		research
	Normalized One-Year Return Rate		NYR	H		compared
8.1.5	**Release Application Aborts Formulas: Table 8.1.5-1**	**RAA**		**S**	**8.1.5-3**	
	Release Application Aborts - Release N		RAA0	S		compared
	Release Application Aborts - Release N-1		RAA1	S		compared
	Release Application Aborts - Release N-2		RAA2	S		compared
	Release Application Aborts - RQMS Alternative Formulas: Table 8.1.5-2	RAQ		S	8.1.5-4	
	Cumulative % of Systems Experiencing an Abort during Release Application - Release N		RAQ0	S		compared
	Cumulative % o Systems Experiencing an Abort during Release Application - Release N-1		RAQ1	S		compared
	Cumulative % of Systems Experiencing an Abort during Release Application - Release N-2		RAQ2	S		compared
	Cumulative Number of Release Application Attempts - Release N		Rar0	S		compared
	Cumulative Number of Release Application Attempts - Release N-1		Rar1	S		compared
	Cumulative Number of Release Application Attempts - Release N-2		Rar2	S		compared
8.1.6	**Corrective Patch Quality Formulas: Table 8.1.6-1**	**CPQ**		**S**	**8.1.6-3**	
	Defective Corrective Patches - Release N		CPQ0	S		compared

Table A-5. Measurements Summary Listing.

Para-graph	Measurement Sub-Measurement	Measurement Symbol	Sub-measurement Symbol	Applic-ability (H/S/V)	Reported Items (Table)	Compared or Research Data
	Defective Corrective Patches - Release N-1		CPQ1	S		compared
	Defective Corrective Patches - Release N-2		CPQ2	S		compared
	Corrective Patch Quality - RQMS Alternative Formulas: Table 8.1.6-2	DCP		S	8.1.6-4	
	Monthly Number of Defective Corrective Patches Identified - Release N		DCP0	S		compared
	Monthly Number of Defective Corrective Patches Identified - Release N-1		DCP1	S		compared
	Monthly Number of Defective Corrective Patches Identified - Release N-2		DCP2	S		compared
	Monthly Number of Corrective Patches Delivered - Release N		CPr0	S		compared
	Monthly Number of Corrective Patches Delivered - Release N-1		CPr1	S		compared
	Monthly Number of Corrective Patches Delivered - Release N-2		CPr2	S		compared
8.1.6	**Feature Patch Quality** **Formulas: Table 8.1.6-1**	**FPQ**		**S**	**8.1.6-3**	
	Defective Feature Patches - Release N		FPQ0	S		research
	Defective Feature Patches - Release N-1		FPQ1	S		research
	Defective Feature Patches - Release N-2		FPQ2	S		research
	Feature Patch Quality - RQMS Alternative Formulas: Table 8.1.6-2	DFP		S	8.1.6-4	
	Monthly Number of Defective Feature Patches Identified - Release N		DFP0	S		research
	Monthly Number of Defective Feature Patches Identified - Release N-1		DFP1	S		research
	Monthly Number of Defective Feature Patches Identified - Release N-2		DFP2	S		research
	Monthly Number of Feature Patches Delivered - Release N		FPr0	S		research
	Monthly Number of Feature Patches Delivered - Release N-1		FPr1	S		research
	Monthly Number of Feature Patches Delivered - Release N-2		FPr2	S		research
8.1.7	**Software Update Quality** **Formulas: Table 8.1.7-1**	**SWU**		**S**	**8.1.7-3**	
	Defective Software Updates - Release N		SWU0	S		compared
	Defective Software Updates - Release N-1		SWU1	S		compared
	Defective Software Updates - Release N-2		SWU2	S		compared
	Software Update Quality – RQMS Alternative Formulas: Table 8.1.7-2	DSU		S	8.1.7-4	

Table A-5. Measurements Summary Listing.

Para-graph	Measurement Sub-Measurement	Measurement Symbol	Sub-measurement Symbol	Applic-ability (H/S/V)	Reported Items (Table)	Compared or Research Data
Table A-5. Measurements Summary Listing.						
	Cumulative Number of Defective Software Updates – Release N		DSU0	S		compared
	Cumulative Number of Defective Software Updates – Release N-1		DSU1	S		compared
	Cumulative Number of Defective Software Updates – Release N-2		DSU2	S		compared
9.1	**Service Quality** **Formulas: Table 9.1-2**	**SQ**		**V**	**9.1-3**	
	Conforming Installations and/or Engineering		SQ1	V		research
	Successful Maintenance Visits		SQ2	V		compared
	Successful Repairs		SQ3	V		compared
	Conforming Customer Support Service Resolutions		SQ4	V		compared
	Conforming Support Service Transactions		SQ5	V		research

Appendix B TL 9000 Customer Satisfaction Measurements Guidelines

The *TL 9000 Quality Management System Requirements Handbook* contains requirements for measuring customer satisfaction. The design of the mechanism for collecting data from customers will necessarily be unique to each organization. This appendix offers guidelines to assist organizations in the design or review of their own customer feedback program.

B. Measurements Profile for Customer Satisfaction Mechanism

1 Profile for Customer Satisfaction Measurements

The following measurements profile provides basic guidelines for a customer feedback mechanism and references a detailed example of a customer satisfaction survey. Results may be provided to customer organizations that have direct experience with the supplier organization's products or performance that these organizations may include, for example, Quality, Purchasing, Operations, Engineering, Planning, Logistics, and Technical Support.

1.1 Purpose

These measurements are used to measure and improve the degree of customer satisfaction with an organization and its products from a customer point of view to help the organization to improve the satisfaction of its customers.

1.2 Applicable Product Categories

All products delivered through a purchase order and fulfillment process are applicable. This should include stock items as well as items that are made-to-order.

1.3 Detailed Description

Feedback is obtained through various mechanisms (such as satisfaction surveys and front line customer technical support input). The surveys should determine the importance of the items surveyed as well as how satisfied customers are. Analysis should include trends and rates of improvement.

1.4 Sources of Data

Both customers and supplier organizations collect data on satisfaction with an organization's products.

1.5 Method of Delivery or Reporting

Both customers and supplier organizations should administer the mechanism for determining customer satisfaction. Results should be obtained at least once per

year and reported according to each customer or organization firm's own formats and procedures.

1.6   Example

For an example survey, see the QuEST Forum web site (http://www.questforum.org/). The following are typical survey topics:

Quality of Delivery
- Delivers on time
- Meets due date without constant follow-up
- Lead time competitiveness
- Delivers proper items
- Delivers proper quantities
- Accurate documentation and identification
- Handles emergency deliveries

Quality of Pricing
- Competitive pricing
- Price stability
- Price accuracy
- Advance notice on price changes

Quality of Customer Service
- Compliance to contract terms
- Supplier organization representatives have sincere desire to serve
- Provides feedback from factory
- Recognizes cost effectiveness
- Market insight
- Training provided on equipment/products
- Support on professional and technical matters
- Invoicing efficiency
- Issuing credit notes
- Order acknowledgement
- Adherence to company policy

Quality of Product
- Product reliability/durability/meets specifications
- Product documentation, instructions, technology
- Product packaging, suitability, environmental aspects
- Contract service quality

Glossary   Abbreviations, Acronyms and Definitions

This Glossary contains a list of abbreviations and acronyms followed by definitions of terms. Definitions of terms that appear only in the Product Category Table, Table A-1, are not provided here.

ABBREVIATIONS and ACRONYMS	
A&M	Additions and Maintenance
ABS	Alternate Billing Service
ACD	Actual Completion Date
ACD	Automatic Call Distribution
Afactor	Annualization Factor
AIN	Advanced Intelligent Network
AOJD	Actual On-Job Date
ATM	Asynchronous Transfer Mode
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver System
CCS	Common Channel Signaling
CO	Central Office
COT	Central Office Terminal
CPQ	Corrective Patch Quality
CRCD	Customer Requested Completion Date
CRD	Customer Requested Date
CROJD	Customer Requested On-Job Date
DCS	Digital Cross Connect System
DIS	Digital Interface System
DPM	Downtime Performance Measurement
DS(x)	Digital Signal Level
DSX	Digital Signal Cross Connect
DWDM	Dense Wavelength Division Multiplexer
E(x)	European Digital Rate
FAX	Facsimile (Electronic)
FDF	Fiber Distribution Frame
FDI	Feeder Distribution Interface
FPQ	Feature Patch Quality
FRT	Fix Response Time
FRU	Field Replaceable Unit
GA	General Availability
H	Hardware
H/S	Hardware Common to Software
HLR	Home Location Register
IRR	Initial Return Rate

ABBREVIATIONS and ACRONYMS	
IP	Internet Protocol
IP	Intelligent Peripheral
IR	Information Request
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response
LEC	Local Exchange Carrier
LOR	Late Orders Received
LSTP	Local Signaling Transfer Point
LTR	Long-term Return Rate
MD	Manufacturing Discontinued
MSC	Mobile Switching Center
MTBF	Mean Time Between Failure
NA	Not Applicable
NGDLC	Next Generation Digital Loop Carrier
NPR	Number of Problem Reports
NTF	No Trouble Found
NYR	Normalized One-Year Return Rate
OC-(xxx)	North American Equivalent Optical Rate
OFM	Outage Frequency Measurement
ONU	Optical Network Unit
OPR	Overdue Problem Report
OSS	Operational Support System
OTD	On-Time Delivery
OTI	On-Time Item Delivery
OTIS	On-Time Installed System Delivery
OTS	On-Time Service Delivery
PBX	Private Branch Exchange
PDH	Plesiochronous Digital Hierarchy
PO	Purchase Order
POTS	Plain Old Telephone Service
RAA	Release Application Aborts
RQMS	Reliability and Quality Measurements for Telecommunications Systems
RSTP	Regional Signaling Transfer Point
RT	Remote Terminal
S	Software
SCP	Service Control Point
SDH	Synchronous Digital Hierarchy
SFAR	Service Failure Analysis Report
SLC	Subscriber Line Concentrator
SO	System Outage
SONET	Synchronous Optical Network Element
SPC	Stored Program Control
SQ	Service Quality
SS7	Signaling System 7

ABBREVIATIONS and ACRONYMS	
SSP	Service Switching Point
STM-(x)e	Synchronous Transport Module, Electrical
STM-(x)o	Synchronous Transport Module, Optical
STP	Signaling Transfer Point
STS	Synchronous Transport Signal
SWIM	Software Insertion and Maintenance
SWU	Software Update Quality
TCAP	Transactional Capabilities Application Part
UDLC	Universal Digital Loop Carrier
V	Service
VC	Virtual Container
VT	Virtual Tributary
WDM	Wave Division Multiplexers
xDLC	Digital Loop Carrier
xDSL	Digital Subscriber Line
YRR	One-Year Return Rate

Note: The following terms are used in this handbook or in the companion *TL 9000 Quality Management System Requirements Handbook.*

Accredited Registrars	Qualified organizations certified by a national body (e.g., the Registrar Accreditation Board in the U.S.) to perform audits to TL 9000 and to register the audited company when that they are shown as conforming to the TL 9000 requirements.
Annualization Factor (Afactor)	This factor is applied to annualize the return rate. It is the number of reporting periods in one year.

Report Period Type	Afactor
Calendar Month	12
4 Week Fiscal Month	13
5 Week Fiscal Month	10.4
6 Week Fiscal Month	8.7
28 Day Month	13.04
29 Day Month	12.59
30 Day Month	12.17
31 Day Month	11.77

Basis Shipping Period	A length of time during which Field Replaceable Units (FRUs) are shipped to the customer. Specifically the period during which the FRUs that comprise the population for determining the return rate were shipped.
Certification	Procedure(s) by which a third party gives written assurance that a product, process or quality management system conforms to specified requirements.
Certification Mark	The mark used to indicate successful assessment to and conformance to the requirements of a quality management system.
Closure Criteria	Specific results of actions that the customer agrees are sufficient to resolve the customer's problem report.
Closure Date	The date on which a problem report is resolved, as acknowledged by the customer.
Closure Interval	The reference point is the length of time from origination of a problem report to the agreed closure date.
Compared Data	Measurements that are adequately consistent across organizations and appropriately normalized such that comparisons to aggregate industry statistics are valid. Only industry statistics based on "compared data" as designated within each measurement profile are posted on the QuEST Forum Web Site at http://www.questforum.org/. See also Research Data.

Configuration Management	A discipline applying technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report changes, processing and implementation status, and verify conformance to specified requirements.
Customer Base	The defined group of customers that the supplier organization's measurement data encompasses. The customer base options are as follows: − Forum Members: only the supplier organization's customers that are members of the QuEST Forum. This is the minimum customer base. − Total: all of the supplier organization's customers for the product(s) to which the measurement applies.
Design Change	Changes affecting form, fit, or function including ISO 9000:2000 definition for "Design and Development".
Deviation	A departure from a plan, specified requirement, or expected result.
Disaster Recovery	The response to an interruption in the ability to recreate and service the product and service throughout its life cycle by implementing a plan to recover an organization's critical functions.
Engineering Complaint	A mechanism used to document a problem to the supplier for resolution. Problems reported may include unsatisfactory conditions or performance of a supplier products or services, as defined in GR-230-CORE.
Electrostatic Discharge	The transfer of charge between bodies at different electrical potential.
Field Replaceable Unit	A distinctly separate part that has been designed so that it may be exchanged at its site of use for the purposes of maintenance or service adjustment.
Fix	A correction to a problem that either temporarily or permanently corrects a defect.
Fix Response Time	The interval from the receipt of the original problem report to the organization's first delivery of the official fix.
General Availability	The period of time when a product is available to all applicable customers.
Installation and/or Engineering Audit	An organization's final internal audit of an installation and/or engineering project. This audit takes place prior to customer acceptance.
Installed System	A system installed by the supplier of the system hardware and/or software or by another supplier of installation services.

Installed System Order	An order for a system engineered, furnished and installed by the organization of the system hardware and/or software and having a Customer Requested Complete Date.
Life Cycle Model	The processes, activities, and tasks involved in the concept, definition, development, production, operation, maintenance, and, if required, disposal of products, spanning the life of products.
Maintenance	Any activity intended to keep a functional hardware or software unit in satisfactory working condition. The term includes tests, measurements, replacements, adjustments, changes and repairs.
Manufacturing Discontinued	A product at the end of its life cycle that is no longer generally available.
Measurement	Term used to replace the term, "metrics", previously used in TL 9000 standards and requirements. Companies collect measurement data as defined in the *TL 9000 Quality Management System Measurements Handbook*.
Method	A means by which an activity is accomplished which is not necessarily documented but which is demonstrated to be consistent and effective throughout the organization.
No Trouble Found	Supplier organization tested returned item where no trouble is found.
Normalization Factor	The total number of normalization units in the product or product population to which a measurement is applied. The measurement denominator reduces measurements on different populations to comparable per unit values.
Official Fix	A fix approved by the supplier organization and made available for general distribution.
On-Time Installed System Delivery	Percentage of Installed Systems delivered on time to Customer Requested Completion Date
On-Time Item(s) Delivery	Percentage of items delivered on time to Customer Requested On Job Date.
On-Time Service Delivery	Percentage of Services completed on time to Customer Requested Completion Date.
Overdue Service Problem Report	A service problem report that has not been resolved on or before a particular date as agreed by the customer and supplier.
Patch	An interim software change between releases delivered or made available for delivery to the field. It consists of one or more changes to affected parts of the program. Patches may be coded in either source code or some other language.

Patch – Defective Corrective	A patch that includes any of the following: a) cannot be installed, b) does not correct the intended problem, c) is withdrawn because of potential or actual problems, d) causes an additional critical or major problem.
Patch – Defective Feature	A patch that: a) cannot be installed, b) fails to provide the intended feature capability, c) is withdrawn because of potential or actual problems, d) causes an additional critical or major problem.
Patch - Official	A corrective or feature patch for which delivery to all affected deployed systems has begun.
Plan	A scheme or method of acting, proceeding, etc., developed in advance.
Problem Escalation	The process of elevating a problem to appropriate management to aid in its resolution.
Problem - Critical H/S	Conditions that severely affect service, capacity/traffic, billing and maintenance capabilities and require immediate corrective action, regardless of time of day or day of the week as viewed by a customer on discussion with the supplier. For example: – A loss of service that is comparable to the total loss of effective functional capability of an entire switching or transport system, – A reduction in capacity or traffic handling capability such that expected loads cannot be handled, – Any loss of safety or emergency capability (e.g., 911 calls).
Problem - Major H/S	Conditions that cause conditions that seriously affect system operation, maintenance and administration, etc. and require immediate attention as viewed by the customer on discussion with the supplier. The urgency is less than in critical situations because of a lesser immediate or impending effect on system performance, customers and the customer's operation and revenue. For example: – reduction in any capacity/traffic measurement function, – any loss of functional visibility and/or diagnostic capability, – short outages equivalent to system or subsystem outages, with accumulated duration of greater than 2 minutes in any 24 hour period, or that continue to repeat during longer periods, – repeated degradation of DS1 or higher rate spans or connections, – prevention of access for routine administrative activity, – degradation of access for maintenance or recovery operations, – degradation of the system's ability to provide any required critical or major trouble notification, – any significant increase in product related customer trouble reports, – billing error rates that exceed specifications, – corruption of system or billing databases.

Problem - Minor H/S	Conditions that do not significantly impair the function of the system. Problems that do not significantly impair the functioning of the system and do not significantly affect service to customers. These problems are not traffic affecting. Note: Engineering complaints are classified as minor unless otherwise negotiated between the customer and supplier.
Problem Report	All forms of problem reporting and complaints registered from the customer such as written reports, letters and telephone calls that are recorded manually or entered into an automated problem reporting tracking system.
Product Category	The recognized grouping of products for reporting TL 9000 measurements.
Program	A planned, coordinated group of activities, procedure(s), etc., often for a specific purpose.
QuEST Forum	Quality Excellence for Suppliers of Telecommunications is a partnership of telecommunications suppliers and service providers. The QuEST Forum's mission is developing and maintaining a common set of quality management system requirements for the telecommunications industry worldwide, including reportable cost and performance-based measurements for the industry.
Registrar	Certification/Registration Body. Also see Accredited Registrar.
Release Application	The process of installing a generally available release in a customer's in-service product.
Reliability	The ability of an item to perform a required function under stated conditions for a stated time period.
Research Data	Measurements that are not consistent from one organization to another and/or are not possible to normalize and consequently cannot be compared to aggregate industry statistics. Industry statistics from research data are analyzed for trends and reported to the measurements work groups. See also "compared data."
Return	Any unit returned for repair or replacement due to any suspected mechanical or electrical defect occurring during normal installation, testing, or in-service operation of the equipment.
Risk Management	A proactive approach for enabling business continuity. A loss prevention methodology that encompasses identification and evaluation of risk, selection of risks to control, identification of preventive actions, cost benefit, analysis and implementation of mitigating plans.

Scheduled Outage	An outage that results from a scheduled or planned maintenance, installation, or manual initialization. This includes such activities as parameter loads, software/firmware changes and system growth.
Service Categories	Product categories that refer to services.
Service Problem Report	A formal report of dissatisfaction because a contractual service requirement was not met. Service problems may be either tangible or intangible.

– Tangible problems are those indicating dissatisfaction with the result of the service.
– Intangible problems are those indicating dissatisfaction with personnel.

Service problem reports may be reported via any media.

Service Providers	A company that provides telecommunications services.
Severity Level	The classification of a problem report as critical, major or minor. See "problem – critical H/S," "Problem – major H/S," and "problem – minor H/S."
Subscriber	A telecommunication's services customer.
Support Service Transaction	The complete cycle from a service request through the completion of the service by the supplier.
System Test	Testing conducted on a complete integrated system to evaluate the system's conformance to its specified requirements.
Temporary Fix	A fix that is delivered to a limited number of systems in the field for the purposes of verification or to solve system problems requiring immediate attention. A temporary fix is usually followed by an official fix.
Test Plan	Describes the scope, strategy, and methodology for testing.
Total System Outage	A failure that results in the loss of functionality of the entire system.
Virus, Software	A computer program, usually hidden within another seemingly innocuous program, which produces copies of itself and inserts them into other programs and that usually, performs a malicious action (such as destroying data).
Work Instructions	Type of document that provides information about how to perform activities and processes consistently.

ISO 9000:2000 Defined Terms [7]

A

audit 3.9.1
audit client 3.9.8
audit conclusions 3.9.7
agreed criteria 3.9.4
audit evidence 3.9.5
audit findings 3.9.6
audit programme 3.9.2
audit scope 3.9.3
audit team 3.9.10
auditee 3.9.9
auditor 3.9.11
auditor qualifications 3.9.13

C

capability 3.1.5
characteristic 3.5.1
concession 3.6.11
conformity 3.6.1
continual improvement 3.2.13
correction 3.6.6
corrective action 3.6.5
criteria 3.9.4
customer 3.3.5
customer satisfaction 3.1.4

D

defect 3.6.3
dependability 3.5.3
design and development 3.4.4
deviation permit 3.6.12
document 3.7.2

E

effectiveness 3.2.14
efficiency 3.2.15

G

grade 3.1.3

I

information 3.7.1
infrastructure 3.3.3
inspection 3.8.2
interested party 3.3.7

M

management 3.2.6
management system 3.2.2
measurement control system 3.10.1
measurement process 3.10.2
measuring equipment 3.10.4
metrological characteristic 3.10.5
metrological confirmation 3.10.3
metrological function 3.10.6

N

nonconformity 3.6.2

O

objective evidence 3.8.1
organization 3.3.1
organizational structure 3.3.2

P

preventive action 3.6.4
procedure 3.4.5
process 3.4.1
product 3.4.2
project 3.4.3

Q

qualification process 3.8.6
qualified auditor 3.9.14
quality 3.1.1
quality assurance 3.2.11
quality characteristic 3.5.2
quality control 3.2.10
quality improvement 3.2.12
quality management 3.2.8
quality management system 3.2.3
quality manual 3.7.4
quality objective 3.2.5
quality plan 3.7.5
quality planning 3.2.9
quality policy 3.2.4

R

record 3.7.6
regrade 3.6.8
release 3.6.13
repair 3.6.9
requirement 3.1.2
review 3.8.7
rework 3.6.7

S

scrap 3.6.10
specification 3.7.3
supplier 3.3.6
system 3.2.1

T

technical expert <audit> 3.9.12
test 3.8.3
top management 3.2.7
traceability 3.5.4

V

validation 3.8.5
verification 3.8.4

W

work environment 3.3.4

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