Excalibur Engineering, Inc.

QUALITY SYSTEM MANUAL

APPROVED BY 

Quality Manager

Revision: 14	Date: 3/11/16	Approved by: B. Valenti

Excalibur Engineering, Inc.
QUALITY POLICY

Excalibur Engineering, Inc. (E.E.) is committed to providing total customer satisfaction by understanding and responding to our customer requirements, needs, and expectations; providing technically qualified personnel to perform calibrations in accordance with approved procedures, authorized OEM Manuals or industry standards; using technically advanced equipment; and providing error-free documentation and data.

The objectives of this Quality Management System are:

1. To always meet our "On Time, Your Way" corporate motto;
2. To satisfy customer requirements by thoroughly understanding their requirements, needs, and expectations;
3. To meet the requirements established in ISO/IEC-17025, ANSI/NCSL-Z540-1, and ISO-9001, as applicable, and satisfies the needs of accreditation organizations;
4. To continuously measure and improve the quality of service offered to our customers; and,
5. To ensure that all **Excalibur Engineering** employees understand and implement this quality management system and are committed to the requirements defined herein.

Revision History

Revision	Date	Purpose	Made By
01	9/30/06	Format for ISO 17025	Quality Manager
02	2/29/08	1. Update Attachment 1, Org. Chart. 2. Update locations of copies of Quality Manual; QSM 4.3.3.1. 3. Clarify customer notification of changes to work performed; QSM 4.7.6. 4. Change CAR documents to CAPA documents in QSM 4.14.2. 5. Add statement to QSM 5.1.4 stating location of job descriptions within the QSM.	Quality Manager
03	5/29/09	1. Update Attachment 1, Org. Chart. 2. Section 4.1; Changed title of General Manager to Operations Manager where appropriate.	Quality Manager
04	9/27/09	1. Update temperatures in 5.2.2.1	Quality Manager
05	11/15/09	1. Section 4.1.10; Added 4.1.10.2 & 4.1.10.3 2. Section 4.3; Added 4.3.13	Quality Manager
06	5/15/2010	1. Section 4.1.2.A, Corrected spelling. 2. Section 4.1.2.B, Changed Alternate to Operations Manager. 3. Section 4.2.2.6, Defined type of Forms.	Quality Manager
07	2/29/2012	1) 4.1.2.F 2) Quality Policy – Corrected ISO/IES to ISO/IEC 3) 4.2.2.6 (added) 4) 4.2.3.2 5) 4.3.11 6) 4.8.1 7) 4.9.1 8) 4.9.1.1 9) 4.9.2.2 10) 4.12.3 11) 5.8.2 12) Table 1	Quality Manager
08	8/15/2013	1. Updated Organization Chart	Quality Manager

09	10/01/14	1) 4.1 Added reference to Englewood Lab 2) 4.1.2 Changed General Manager to Operations Manager 3) 4.17 Added designee as signatory 4) 5.2.4 Added designee as signatory 5) Attachment 1 Updated Org Chart 6) Attachment 2 Updated Scope of Accreditation	Quality Manager
10	01/18/2015	1) Changed 4.3.1 to acknowledge initial and date of hand changes 2) Added description of contract review for Englewood facility to 4.4.2 3) Changed 4.5. Added listing on the MRA as acceptable 4) Changed 5.2.4 to reflect monthly downloading of environmental data. 5) Changed wording of 5.3.1.2 to ensure customer acceptance of any limited calibration 6) Changed 5.4 to reflect the Technical Manager as having responsibility to ensure availability of standards to properly perform calibrations. 7) Changed 5.5.10 to reflect current model of standard.	Quality Manager
11	02/19/2015	1) Added statement to 4.14.2 that internal audits are to include onsite capabilities of all facilities.	Quality Manager
12	02/27/2015	1. Reworded section 4.1.2.1 F for clarification.	Quality Manager
13	2/15/2016	1. Removed Section 5.4.3.6 2. Updated Organizational Chart (Attachment 1) 3. Updated Scope (Attachment 2)	Quality Manager
14	2/26/2016	1. Updated Section 4.3.13 2. Updated Section 4.3.5	Quality Manager

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4.1 Organization

4.1.1 Corporate Identity

.1 The laboratory is identified as Excalibur Engineering, Inc., located at 9201 Irvine Blvd., Irvine, CA 92618 with a satellite facility located at 14 Inverness Dr. East Ste. B106 Englewood, Colorado 80112. The Excalibur Engineering organizational chart is located at the end of this quality manual. Excalibur Engineering, Inc. shall be referred to as E.E. throughout the rest of this document.

.2 Excalibur Engineering, Inc., capabilities for performing repair and calibration of measuring and test equipment (M&TE) are defined in Attachment 2. The management and administrative sections of this quality management system apply to all Excalibur Engineering, Inc., activities. Certain technical requirements apply only to accredited metrology disciplines. When requested, on-site (customer location) calibrations shall be performed in accordance with the requirements contained within this quality management system.

4.1.2 Organization and Management

.1 Organizational Authority, responsibility, and designated alternates are as follows:

A) **Operations Manager:** Reports to the Board of Directors of E.E.

Authority/Responsibility Overall budgeting. Final decision on hiring and firing, in consult with the appropriate manager, absent of gross violation of employee Handbook. Assigning deadlines to appropriate managers. Employee discipline and employee reviews, in consult with the appropriate manager. Customer orders shall be reviewed to ensure that EE has the capability of meeting customer expectations and requirements. Control of collection of Quality records

Alternates: Any board member.

B) **Quality Manager**: Reports to Operations Manager or may bypass Operations Manager if given sufficient cause.

Authority/Responsibility Responsible for ensuring the quality system is maintained, implemented, understood, and to ensure that EE personnel are free from any undue pressures that might adversely affect the quality of their work at all levels of the organization. The Quality Manager is the Management Representative responsible for reporting on the performance and improvement of the quality system. Initiates corrective action reports. Implements, directs and oversees all changes regarding quality documents. Responsible for all audit functions. Issuance of quality assurance and technician stamps. Updating and maintaining primary and secondary standards documentation. Performing reverse recall

reviews and customer complaint resolution.

Alternate: Operations Manager or designee.

C) **Technical Manager:** Interfaces with the Quality Manager for quality related issues and Operations Manager for production issues.

Authority/Responsibility Directs technicians in all production aspects relating to the calibration process and for updating technical training jackets. Ensures technicians follow all company rules. Assigns technicians work schedules, monitors turn around time, and aids in customer complaint resolutions as it affects production processes.

Alternate: Quality Manager.

D) **Office Manager:** Interfaces with the Technical Manager, Operations Manager and Technicians on issues relating to scheduling of calibration work and purchasing of parts and material used in the repair and calibration of customer assets.

Authority/Responsibility Directs calibration support personnel in all aspects relating to documentation, labeling and data entry in support of calibration technicians. Orders replacement parts and material repair and calibration of customer and E.E. owned equipment. Provide customer support and quotations in support of repair of customer equipment.

Alternate: Operations Manager

E) **Support Personnel:** Report to Operations Manager.

Authority/Responsibility Follow all company rules. Perform any functions as directed by the Operations Manager excluding calibration or repair. Responsible to double check all shipping and purchase order documents. Responsible for maintaining the manual and procedure library.

F) **Technicians** Report to Technical Manager, or Operations Manager in Technical Manager's absence, for production issues and interfaces with the Quality Manager for quality related issues.

Authority/Responsibility Responsible for ensuring the integrity of calibrations performed, including associated paperwork. Complete work orders and affix calibration labels and stamp when completely satisfied calibration has been performed in accordance with specifications. When a unit is repaired, the instrument is passed to the Calibration Laboratory for final calibration.

G) **All employees** are responsible for the quality of the products and services under their control and for following procedural requirements during all processes they are involved in. All employees have the responsibility and authority to identify quality problems; to initiate and provide solutions to quality problems; to verify implementation; and, to resolve deficiencies that affect quality.

4.1.3 Resources

.1 The Operations Manager has assigned trained personnel to manage, perform and verify activities affecting quality. Personnel assigned these tasks are qualified on the basis of experience and/or training.

.2 The Operations Manager shall ensure that the quality of the work performed is not influenced by any undue internal/external commercial, financial, or other pressures or influence. This is accomplished by establishing fair and reasonable goals and expectations. Efficient work practices, individual accountability and adhering to the quality guidelines ensure that personnel performance eliminates negative influences.

.3 The Operations Manager shall maintain job descriptions for managerial, technical, and key support personnel involved in calibrations.

4.1.4 Management Requirements

.1 All management staff positions have a designated alternate with sufficient experience and expertise to perform the duties of the primary staff position.

.2 E.E. ensures that its personnel are aware of the relevance and importance of their activities and how the contribute to the achievement of the objectives of the management system through the initial review of this manual and periodic briefings.

.3 The management of E.E. shall ensure that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system.

4.1.5 Management Representative

.1 The Management Representative is the Quality Manager and is responsible for ensuring that this quality system is maintained, understood and implemented at all levels of the organization. The Management Representative is also responsible for reporting on the performance of the Quality System during the annual management review meeting.

4.1.6 Quality Policy

.1 The Quality Policy at Excalibur Engineering is affirmed in a statement from the Operations Manager of Excalibur Engineering and is located in the front of this Quality Manual. The Quality Policy has been communicated to all employees.

4.1.7 Laboratory Objectives

.1 Maintain metrological standards of measurements within a defined scope of capability. Measurement standards and calibration devices shall be traceable to the international system of units (SI) via nationally recognized standards maintained by NIST (National Institute of Standards and Technology), other national laboratories with which NIST has appropriate measurement agreements, or accepted values of intrinsic standards or natural physical constants.

.2 Provide reliable and responsive calibration services over a range of measurements and to a level of uncertainty suited to the needs of our customers.

4.1.8 Management Review

.1 A formal management review of the quality system will be performed annually to ensure it's continuing suitability and effectiveness in satisfying the requirements of ISO/IEC-17025, ANSI Z540, ISO 9001, as applicable, and Excalibur Engineering Quality Policy and objectives.

.2 The annual management review meeting will be chaired by the Operations Manager of Excalibur Engineering. Attending this management review meeting will be the Quality Manager and a representative from each department. This aforementioned review meeting shall include the evaluations of:

.1 Results of internal and external audits.

.2 Results of corrective/preventive action reports.

.3 Results of supplier corrective action reports.

.4 Customer feedback (positive and negative).

.5 Excalibur Engineering goals, objectives, and Quality Policy.

.6 Suitability and effectiveness of the quality system in meeting ISO/IEC-17025, ISO 9001, and ANSI/NCSL Z540 as well as E.E. policies and procedures.

.7 Relevant factors such as quality control activities, resources and staff training needs.

.8 Reports from managerial and supervisory personnel, as applicable.

.9 Results of review checks.

.10 Changes in the volume and type of work.

.11 Results of interlaboratory comparisons or Proficiency Tests.

.12 Any recommendations for improvement.

.3 The results of this review as well as any resulting action assignments shall be documented and transmitted to all applicable participants. The Operations Manager of Excalibur Engineering is responsible for ensuring that all action items resulting from the management review are reconciled in a timely manner.

.4 Records of the management review meeting and associated completed action items shall be maintained in accordance with documented procedures.

4.1.9 Confidentiality

.1 No information shall be divulged, other than the legal name of our customers, to any outside source, without the express approval of the Operations Manager. If a customer has proprietary or confidential information that they

consider sensitive, EE personnel shall annotate that request in the company profile. Additionally, E.E.'s certificate of calibration includes a statement of non-reproduction. E.E. faxes shall have "confidential" preprinted on the fax cover sheet.

4.1.10 Conflict of Interest

.1 Excalibur Engineering employees shall avoid any conflict of interest that jeopardizes the customer relationship.

.2 Unacceptable activities include, but are not limited to:

1. Knowingly accepting assignments that are outside E.E. capabilities.
2. Knowingly committing to delivery dates that cannot be met.
3. Involvement with E.E. competitors or competitors of E.E. clients beyond a professional working relationship.
4. Not disclosing activities, that may be considered unacceptable to E.E. or its clients, when entering into agreements where these activities may be of relevance.
5. Any other activity that would reasonably be expected to be unacceptable.

3. In case of doubt about the acceptability of an activity, the Quality Manager shall be consulted. It is the responsibility of the **Quality Manager** to evaluate the activity, taking into account the interest of all stakeholders in Excalibur Engineering, including:

1. Owner(s)/Shareholder(s)
2. Employees
3. Clients
4. Suppliers/Vendors
5. Accreditation/Certification Bodies

4.2 Management System

4.2.1 General

.1 The Quality Program described in this manual applies to all calibration activities performed in our laboratory and customer facilities and encompasses the control systems necessary to provide qualified personnel, material, and services in accordance with ISO/IEC-17025, ISO 9001, ANSI/NCSL Z540 and contractual requirements. This system provides for activities affecting quality to be achieved under controlled conditions in an appropriate environment and it takes into account the need for test equipment, tools, and skills to attain the required quality.

.2 All personnel are required to read the Quality System Manual and Desk Top Procedures. They are required to sign that they have read and understood these documents before starting work.

.3 The management at E.E. is committed to ensuring that the Quality Management System will be fully developed and implemented and will continually strive to improve its effectiveness.

.4 From top management on down, all personnel at E.E. must remember the importance of meeting customer as well as statutory and regulatory requirements.

4.2.2 The Quality Management System consists of:

.1 Quality System Manual - describes Excalibur Engineering approach to ISO/IEC-17025, ISO 9001, as applicable, ANSI/NCSL Z540 and contractual requirements.

.2 Desk Top Procedures - documents specific calibration functions, training requirements, and administrative support activities.

.3 Calibration Procedures - defines specific details of how the work is to be completed.

.4 Service Manuals - defines repair, adjustment, and calibration processes.

.5 QA Forms.

.6 Calibration Procedures Master List – Lists all approved calibration procedures.

4.2.3 Quality Planning

.1 Unique quality plans are not necessary for providing calibration services. Excalibur Engineering has implemented a system of procedures defining specific requirements that are implemented by trained and qualified personnel.

.2 Top management will always ensure that the integrity of the management system shall be maintained when changes to the management system are planned and/or implemented. This may be done either by electronic notification or group training (which ever is more applicable to the change) whenever a change to the Quality System is planned or implemented.

4.2.4 Periodic Review of Quality Management System

.1 Quality Management System documents shall be reviewed annually as part of the management review process.

4.2.5 Implementing Planned Changes to the QMS.

.1 To the maximum extent possible, management will ensure the integrity of the management system is maintained when changes to the management system are planned and implemented. This may be done either by electronic notification or group training (which ever is more applicable to the change) whenever a change to the Quality System is planned or implemented. Upon notification of the change, all affected personnel will verify and report any conflicts that may have been overlooked.

4.3 Document and Data Control

4.3.1 E.E. controls and maintains all quality management system documents as stated below. A side bar in the right margin shall highlight changes to quality management system documents, unless otherwise stated in the Revision Status Table. All hand changes are initialed and dated by the original approving authority.

4.3.2 All personnel are required to read the Quality Assurance Manual and Desk Top Procedures. They are required to sign that they have read and understood those documents before starting work.

4.3.3 Quality Assurance Manual, Desk Top Procedures, and forms shall be kept as follows:

.1 One, signed, controlled paper copy in Quality Manager's files located in the cabinet adjacent to the Quality Manager's desk.

.2 The most recent revision as a "read only" version on the network (need not be signed).

.3 LIST-01 provides the current list of all quality forms and documents and should be consulted for the most up-to-date forms and documents. LIST-01 may be found on the server in the Quality folder.

4.3.4 EE personnel are allowed to download and print "information only" copies of the Quality Manual and Desk Top Procedures. It is the individual's responsibility to ensure that the "information only" copy is the latest revision before use.

4.3.5 Before a calibration procedure is issued or modified (i.e. for an added option), it must be checked for compliance by a knowledgeable designee of the Quality Manager and documented on form QA-7.

4.3.6 Service manuals shall be maintained in the technical library. Only one copy of each service manual for specific instruments shall be maintained. Designated support personnel shall maintain service manual and procedure libraries.

4.3.7 The Metrology Program is backed up daily and the backup copy shall be taken offsite nightly. There shall be only one working copy of the Metrology Program.

4.3.8 Customer Profiles sheets are developed and controlled by the Calibration Sales Manager. The controlled copy of the Customer Profile Sheet is maintained electronically. By default, the Customer Profile Sheets are approved when migrated to the LAN. The Calibration Sales Manager may make hard copy of the Customer Profile Sheets. Records of this controlled distribution shall be retained. EE personnel are allowed to download and print "information only" copies of the Customer Profile Sheets. It is the individual's responsibility to ensure that the "information only" copy is the latest revision before use.

4.3.9 Approved signatories shall be those persons authorized for procedure/change approvals, to approve Certificates of Calibration, and to perform calibrations. These individuals are noted on form QA-14 and QA-15 filed in the Operations

Manager's files.

4.3.10 Revisions to documents and data shall be reviewed and approved by the original approving organization, unless specifically designated otherwise. Amendments shall be distributed in a timely manner.

4.3.11 Control of documents and data ensures that the pertinent issues are available to all personnel performing activities. Obsolete and/or invalid documents are promptly removed from all points of issue and use; refer to Desk Top Procedure 22 and Table 1 for retention times. Historical copies shall be archived and marked as "No Longer in Use".

4.3.12 Management system documents generated by the laboratory shall be uniquely identified to include the date of issue, revision identification, page number and/or a mark to indicate the end of the document and the issuing authority(ies).

4.3.13 Documents maintained in computerized systems will be controlled in the following manner.

1. The Quality Manager has overall responsibility for maintenance of all quality documents.
2. All employees have access to the quality and technical electronic documents in read-only format on the server, however, only the Quality Manager is allowed to move or change quality and technical electronic records.
3. The Quality Document Master List must be updated after the Quality Manager has approved the revised or new document.
4. All records are retained for a period of three years. It is the responsibility of the Quality Manager to dispose of/archive records when appropriate.

4.4 Review of Requests, Tenders, and Contracts

4.4.1 General

.1 The controls defined in this Quality System Manual apply to all customer orders received by Excalibur Engineering. No equipment or service shall be processed/performed without a valid hard copy purchase order number or customer authorizing document.

4.4.2 Customer Order Review

.1 Purchase orders are considered contracts. These shall be reviewed by the Operations Manager or designee for applicability to quality and technical requirements. If there are any discrepancies or required deviations, they will be resolved with the customer before processing the item for induction. Service agreements may be used to further solidify calibration contracts. If there is unique arrangement by the customer, these requirements shall be documented on a Customer Profile Form (QA-17). All purchase orders for the Englewood facility are reviewed in the corporate office. Manfacturer and model number are verified upon receipt in Englewood.

.1 When reviewing requirements for an "Accredited" calibration, the Calibration Requirements form (QA-25) must be completed

and signed by the customer. Any modifications required after the customer has agreed and signed require customer notification and approval prior to continuation.

.2 Before inducting any item for calibration, the laboratory shall insure that the requirements, including the methods to be used, are adequately defined, documented and understood and that the laboratory has the capability and resources to meet the requirements.

.3 In the absence of specific instructions from our customer, all calibrations shall be performed in accordance with ISO/IEC 17025 requirements.

.4 Measurement uncertainty should be discussed with the customer to ensure that the customer's specifications can be satisfied.

.5 The equipment is then forwarded to the laboratory for calibration.

.6 Amendments to customer orders are processed, as was the original order.

.7 Records of contract reviews, as well as pertinent discussions with the customer, shall be maintained in accordance with documented procedures.

.8 If the customer equipment is to be subcontracted, the supplier is to be qualified in accordance with paragraph 4.5 of this quality manual. The customer is to be notified in writing and shall be requested to provide written authorization to subcontract, if not specifically stated in the customer procurement document.

4.5 Subcontracting of Tests and Calibrations

4.5.1 Suppliers of calibration shall be evaluated and placed on the Approved Suppliers List. Evaluation of calibration vendors will be by an on-site audit, Quality Survey and/or review of their NVLAP certification, ISO 17025, and/or ISO 9001 Accreditation. Laboratories accredited to 17025 through and accrediting body listed on the Mutual Recognition Agreement will be approved for the parameters within their scope of accreditation. For subcontractors who do not perform within-scope subcontract calibrations (reference paragraph 4.5.2) qualification can be based on compliance to ISO 9002 and/or ANSI/NCSL Z540-1. As applicable, suppliers will then be categorized and accepted according to their level of qualifications and specification adherence. Use of customer-approved supplier is allowed with appropriate authorizing documentation. Customers shall be advised in writing, whenever their equipment is to be out-sourced, and when appropriate receive customer authorization in writing for the out-sourcing service.

.1 If the use of a customer approved supplier is required, E.E. is not responsible to the customer for the subcontractor's work. Otherwise, E.E. is responsible for the work of any approved subcontractor it deems necessary to use.

4.5.2 E.E. generally does not subcontract work covered by our scope of accreditation. In the unlikely event that within-scope subcontracting is required, the supplier must either submit an ISO 17025 accreditation certification or have an ISO 17025 quality management system that has been successfully audited by E.E. technical

and quality personnel.

4.5.3 There may be occasions when the OEM is the only source of calibration. OEMs are evaluated by desktop audit or review of their ISO certifications prior to placement on the ASL.

4.5.4 The Quality Manager, or designee, shall be responsible for reviewing all incoming documentation and certifications along with EE customer complaint file when reviewing the subcontractor's performance. If the subcontractor/supplier's performance is found not to meet the requirements of this manual, appropriate action may be undertaken by the Quality Manager, or designee.

4.6 Purchasing Services and Supplies

4.6.1 Parts and components used in the repair and calibration of customer equipment are inspected at receipt and are functionally tested during calibration (Prior to purchase, verify with customer that replaced item meets customers requirements for Like-for-Like replacement part requirements as needed.). Vendors of parts, components and miscellaneous materials are not required to be evaluated for placement on the Approved Suppliers List. The critical attributes of these items are that they meet purchase order requirements and that the customers' equipment can be successfully calibrated.

4.6.2 Receipt inspection of parts and components is defined in paragraph 4.17 of this quality manual. Calibration is defined in the specific Calibration Procedure, Service Manual, or industry standard.

4.6.3 Return of customer equipment shall be by freight carriers designated by the customer or selected by Excalibur Engineering.

4.6.4 Records of acceptable subcontractors shall be maintained in accordance with documented procedures.

4.6.5 Purchasing Data

.1 E.E.'s purchase order shall specify appropriate specifications and requirements to the supplier. When subcontracting "Accredited" calibration services, the selected vendor **MUST** be accredited to ISO 17025 or be a National Laboratory (NMI) and the requested service must be within their accredited scope. The Quality Manager, or designee, shall inspect and verify compliance to the purchase order before releasing supplier calibrated equipment. The copy of purchase order or packing slip shall be attached to the work order and kept on file as a quality record.

.2 All Purchase Orders are reviewed and approved by the Operations Manager or designee prior to release. Amendments to procurement documents are subject to the same requirements and controls as were utilized in the preparation of the original.

4.6.6 Verification of Purchased Product

.1 When source surveillance is employed as the method of product verification

and release the Purchase Order form shall identify specific requirements to the vendor.

.2 When specified by contract, code or federal regulations, customers shall be afforded the right to verify that product conforms to specified procurement requirements at Excalibur Engineering vendor's facilities. When customer verification occurs Excalibur Engineering shall retain the responsibility for product conformance and release.

4.7 Service to the Client

4.7.1 Customer equipment received at Excalibur Engineering for calibration shall be received and verified against the customers supplied documents as applicable. The assigned individual shall verify that the customer's equipment is adequately identified, that there is no apparent damage to the equipment (unless pre-identified by the customer), and that the equipment identification matches the customer paperwork.

4.7.2 Any concerns regarding the acceptability of the customers' equipment upon receipt shall be reconciled with the customer prior to forwarding the equipment to the calibration laboratory.

4.7.3 Customer equipment is inducted in accordance with desktop procedures.

4.7.4 Any problems to the customer's equipment caused by Excalibur Engineering after receipt shall be reviewed by the Operations Manager or the Quality Manager for report ability to the customer and determination if a corrective action report is required. A corrective action report shall be written if the customer's equipment is lost, damaged, or becomes unsuitable for use due to the fault of Excalibur Engineering. The Quality Manager or Operations Manager shall ensure that further processing of the equipment is halted and shall consult with the customer to determine what action is to be taken. (i.e. replacement or repair).

4.7.5 Excalibur Engineering shall afford all customers the opportunity to clarify any request and to monitor our calibration practices and performance in relation to work performed for **that** customer.

4.7.6 When required, the customer shall be notified of any changes to procedures or practices that effect work performed.

4.7.7 Excalibur Engineering reserves the right to prohibit customers from reviewing information, data, and/or calibration/repair activities being performed for another customer.

4.7.8 Customer feedback is defined in Subsection 4.8 of this quality manual.

4.7.9 Servicing, as described in ISO-9001, is not applicable to Excalibur Engineering activities.

4.8 Complaints

4.8.1 E.E. personnel receiving a complaint from a customer, regarding a customer - documented requirement, shall notify the Quality Manager. The Quality Manager shall review and correct the problem as necessary to satisfy customer's

documented requirement.

4.8.2 Periodically, the Operations Manager shall solicit customer feedback (both positive and negative) as part of the continuous improvement process. Feedback shall be documented and evaluated. Negative feedback shall be documented as a customer complaint.

4.9 Control of Nonconforming Testing and/or Calibration Work

4.9.1 General

.1 Within Excalibur Engineering, nonconforming items may fall within but are not limited to the following categories:

- Measuring and test equipment received from suppliers without proper paperwork.
- Discrepancies cited during the calibration activity.
- Unapproved deviations from established/approved calibration procedures.
- Improper use of test equipment.
- Excalibur Engineering equipment that has as-found data exceeding manufacturers published specifications.
- Equipment received back from Vendors in a damaged condition.

4.9.2 The following are specific actions to be taken if these particular types of non-conforming work occur.

.1 Standards with out-of-tolerance are removed from service and their conditions are all noted on form QA–12 whenever Excalibur Engineering owned equipment has as-found data exceeding documented acceptance criteria. The Quality Manager and Technical Manager will evaluate the data to determine the extent of the out-of-tolerance condition and its impact on calibrations. If the condition is found not to impact the ability of the item to meet the laboratories requirements, the Quality Manager may place it back into service under a Limited Calibration status.

.1 A reverse recall will be performed on all standards with as-found deficiencies as far back as the last calibration or verification check whichever is earliest.

.2 Upon review of the out-of-tolerance data, the Quality Manager will notify and provide the necessary data to any customers that may be affected by the out-of-tolerance condition and coordinate any recalls that may be required.

.2 Measuring and test equipment received from suppliers damaged or without proper paperwork shall be put into a designated hold area until the receiving issues are resolved. Should the equipment be returned in a damaged or otherwise unfit condition, a supplier corrective action report may be written in accordance with desktop procedures.

.3 Discrepancies cited during the calibration activity and actions taken to resolve the issues shall be noted on the calibration certificate.

.4 Items reworked or repaired during the calibration activity shall be documented on the calibration certificate.

.5 When the evaluation indicates that the nonconforming work could recur or there is doubt about the compliance of the laboratory's operations with its own policies and procedures, corrective action procedures will be promptly followed as outlined in section 4.11 of this manual. Corrective action records are maintained as quality records in accordance with documented procedures.

4.10 Improvement

4.10.1 E.E. continually improves the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.

4.11 Corrective Action

4.11.1 Conditions that are adverse to quality, either item related, process, or programmatic, shall be identified and corrected in a timely manner.

4.11.2 When it is determined that an adverse quality condition exists; a Corrective Action Report shall be recorded in the Corrective Action Log. The Corrective Action Report shall identify the appropriate information as indicated.

4.11.3 The Quality Manager, or designee, shall complete the Corrective Action Log by documenting the root cause of the issue; action taken to correct the issue; and, the action taken to prevent recurrence.

4.11.4 The Operations Manager shall verify implementation and effectiveness of the corrective action.

4.11.5 When a departure or nonconformance to the quality system is identified the Quality Manager shall ensure that the appropriate areas of activities are audited as soon as possible.

4.12 Preventive Action

4.12.1 The Operations Manager of Excalibur Engineering is responsible for evaluating preventive actions reported through the corrective action system. During the management review of the Quality System, the Operations Manager of Excalibur Engineering shall evaluate work operations; customer complaints; previous audit results and Corrective/Preventive Action (QA-01) documents to determine if a negative trend has developed. Actions will be taken to eliminate negative trends.

4.12.2 A proactive process for identifying potential negative programmatic or technical issues and needed improvements shall be implemented. Potential sources for preventive action implementation, either technical or concerning this quality management system, shall be identified by one or more of the following:

.1 Customer feedback database;

.2 Results of department metrics;

.3 Results of interlaboratory comparisons; and/or,

.4 Results of calibration certificates review.

4.12.3 Upon review of available data, the Quality Manager will initiate a Preventive Action Report as appropriate. Records of corrective and preventive actions shall be maintained as quality records and shall be reviewed by executive management during the periodic management review of the quality system.

4.13 Control of Records

4.13.1 Desktop procedures have been developed to define controls for the identification, collection, indexing, access, filing, storage, maintenance, and disposition of quality and technical records. The records shall include at least the following: results of management reviews, inspections, tests, audits, corrective and preventive action reports, contract review records, records of acceptable subcontractors, records of calibration, factors affecting uncertainty and training records. All observations, letters of authorization, calculations, notes, factors affecting uncertainty and staff records associated with the equipment calibration are attached to, or recorded on, the work traveler and maintained.

4.13.2 All records shall be legible and stored in a manner that permits adequate retrieval and prevents damage, deterioration and loss. Record retention times have been established for all records as outlined in the Desktop Procedures Manual, Table 1.

4.13.3 Excalibur Engineering customers are granted free access to all records controlled under the auspices of this quality system that are relevant and that pertain to the particular customer.

4.13.4 All Excalibur Engineering employees have been instructed to transmit calibration results and information regarding a particular customer only to that customer (individual will be identified). No allowances for customers to review or receive other customer's records will be allowed.

4.14 Internal Audits

4.14.1 The Quality Manager is responsible for training and qualifying personnel to participate in EE internal and supplier audits. Personnel performing audits shall be independent of the area audited.

4.14.2 An internal audit of the Quality System shall be carried out under the direction of the Quality Manager at least annually and shall address all elements of the management system to include onsite functions of all facilities. The Quality Manager, or designee, shall prepare a report that identifies the quality elements audited, CAPA documents written as a result of deficiencies found during the audit, and audit checklists and present it to responsible management. The Quality Manager, or designee, shall investigate audit findings and determine timely corrective action and measures to be taken to prevent recurrence of the adverse conditions. Follow-up audit activities shall verify and record the implementation and effectiveness of the corrective action taken. Customers shall be notified should the results of the audit indicate that laboratory results are affected.

4.14.3 The completed audit package shall be given to the Operations Manager for

retention.

4.15 Product Identification and Traceability

4.15.1 Customer equipment is routed with a copy of the work order. Identification shall include the customer's name, date received, PO number, quantity of items received and the time received in the laboratory.

4.15.2 All Excalibur Engineering measuring and test equipment and measurement standards shall be assigned a unique identification number. This number is referenced on all associated calibration documents to provide traceability directly to the equipment throughout the calibration process.

4.15.3 Parts and/or components used in the repair of measuring and test equipment do not require unique identification and/or traceability to the end use. Parts and/or components are stored in bins and are identified by part number or description.

4.16 Process Control

4.16.1 After acceptance of the customers' equipment at receipt the responsible individual places the equipment into a container, or on the shelf, with a copy of the work order. The work order documents customer requirements and identifies the equipment to be calibrated and types of services to be provided.

4.16.2 Trained personnel, or qualified vendors, using a work order, equipment manufacturer manuals and/or general knowledge performs repair activities, if required or applicable. Repair activities are validated by final calibration of the equipment. Calibration activities shall be controlled and executed in accordance with documented procedures.

4.16.3 Preventive maintenance of measuring and test equipment shall be performed when required by the associated calibration procedure or the service manual.

4.16.4 Acceptance criteria (measured values) shall be documented in calibration procedures, service manuals, or by the customer accepting the measured value.

4.17 Inspection and Testing

4.17.1 Inspection

.1 Parts, components and miscellaneous materials used in the repair of measuring and test equipment shall be inspected at receipt by trained personnel to ensure that the items procured meet purchase order requirements.

.2 Supplies, reagents and consumable materials that may affect the quality of tests and/or calibrations will not be used until they have been inspected and/or verified as complying with standard specifications or requirements defined in the methods for the tests and/or calibrations concerned. Materials will be stored in Quality Assurance until released to the appropriate Laboratory.

.3 E.E. shall generate a work order with a unique number for all items processed for calibration. The computer generated work order remains with the instrument until a PC label is attached and the repair/calibration of the instrument is completed.

.4 The E.E. work order is created using an off-the-shelf software program that has a pass / fail column for incoming, in-process and final inspection. *This pass/fail category is not applicable to EE*. Receipt inspection requirements are performed by receiving and shipping personnel as identified in desktop instructions. In-process inspections are not applicable to calibration services. Final inspection is the Quality Manager's or designee's final review of the Calibration Certificate and associated data reports, as applicable. When the activity is successfully completed the Quality Manager or designee will sign the Calibration Certificate. Any deviations discovered before/after beginning calibration, shall be annotated on the work order and the customer shall be contacted. If any customer equipment becomes lost or damaged while in the possession of EE the repair and replacement shall be at E.E. expense.

.5 For conditions that are identified as outside normal requirements, label PC-3 "Special Calibration" shall be used to document that condition. The condition shall be noted on the Certificate of Calibration as well. The customer will be contacted before the affected device is shipped.

.6 If any item is unacceptable it is segregated and put on hold until adequate reconciliation is performed. The Quality Manager shall make the determination if a Corrective Action Report is to be issued.

4.17.2 Inspection and Tests Records

.1 Receiving inspection and calibration records shall be maintained in accordance with desktop procedures.

4.18 Inspection and Test Status

4.18.1 Receiving inspection status for Excalibur Engineering equipment and customer equipment shall be documented. Only equipment that was received in proper condition and accepted at receipt can be released to the laboratory.

4.18.2 Test status for measuring and test equipment is documented on the calibration certificate and by labeling.

4.18.3 Unsatisfactory conditions identified during the calibration process shall be documented in the "Remarks" section or the "As Found" part of the calibration report along with the actions taken to correct the unsatisfactory condition.

4.18.4 When required, customers will be notified immediately of any Out-of-Tolerance conditions so they may immediately assess any impact on their manufactured product.

4.19 Statistical Techniques

4.19.1 E.E. does not perform any statistical techniques during the calibration process.

4.20 Design Control

4.20.1 Design Control activities are not applicable to Excalibur Engineering services.

Section 5.0 - Technical Requirements

5.1 Personnel

5.1.1 Training Requirements

.1 All personnel employed as of December 1, 1999 are qualified based on their training and/or experience as of that date. Records of training and qualification for personnel who performed and verified work affecting quality are available.

.2 Laboratory Management, as part of the annual Management Review as well as on an ongoing basis, will review current and projected work requirements to assess the need for additional training of assigned personnel. Identified training needs will be evaluated to ascertain whether the training can be completed in-house or not, and when the training can be completed as dictated by the urgency of the requirement.

A. Upon completion of training, the appropriate manager will follow up to insure that the training provided the appropriate skill set and will fulfill the needs of the laboratory.

5.1.2 Qualifications

.1 All personnel employed/contracted in the position of calibration technician shall have training and direct experience in one of the following:

A. Military school for calibration/repair and have been awarded the appropriate MOS., AFSC or NEC certification and 3 years minimum field experience; or,

B. Two years continuous training at a state accredited institute for higher learning in an appropriate discipline or on the job training of at least two years and a satisfactory employment interview for the function assigned. A minimum of four years of industrial experience in the function assigned is required.

.2 Personnel not satisfying the requirements of A or B above shall have their work reviewed and work order countersigned by a qualified technician.

.3 The Technical Manager shall ensure that personnel qualification status is kept current on each technical employee and review current and projected work requirements to assess the need for additional training of assigned personnel.

5.1.3 Training and Qualification Records

.1 Training records shall be kept in the Quality Manager's files and will reflect authorizations, competence, educational and professional qualifications, training, skills and experience of all technical personnel including contracted personnel.

.2 To assure the Quality of Test and Calibration results, each technician is required to complete an annual "review check" of a calibration completed in the laboratory. The results of that review along with a copy of the Certificate

of Completion for the item witnessed will be kept in the technicians training file.

5.1.4 Job Descriptions

.1 Job descriptions shall be maintained for managerial, technical, and key support personnel involved in the tests and/or calibrations. Job descriptions may be found in section 4.1.2 of this manual.

5.2 Accommodation and Environmental Conditions

5.2.1 Measuring and test equipment shall be calibrated and utilized in an environment controlled to the extent necessary to assure continued measurements of required accuracy, giving due consideration to temperature, humidity and other controllable factors affecting precision instruments.

.1 It is the responsibility of the **Technician** to check the environmental and operating conditions before performing calibrations and to record the results on the *Certificate of Calibration.* If the environmental conditions are found to be out of specifications as defined in 5.2.2.1 of this manual, the affected laboratory will discontinue all calibrations until environmental conditions are reestablished.

5.2.2 Calibration Environment

.1 The calibration environment in laboratory shall be as follows:

DISCIPLINE	RANGE	SHIFT PER HOUR	HUMIDITY
Dimensional/Mechanical	18-24 ° C	2 ° C	20 % TO 55 %
Electrical/Electronic	19-25 ° C	3° C	20 % TO 60 %
Repair/Temperature	17-27 ° C	N/A	N/A

***Note**: Due to the use of temperature baths, local area monitoring should be used in the temperature/repair laboratory if calibrations are performed.*

5.2.3 The calibration environment onsite at a customer's site shall be monitored for both humidity and temperature by a calibrated device. Technicians shall ensure that calibrations performed on site meet the minimum specification for the type of device being calibrated or perform corrections when appropriate.

5.2.4 The laboratory shall monitor the temperature and humidity by means of a calibrated thermohumidigraph. The Quality Manager shall maintain the charts from the thermohumidigraphs. The Quality Manager or designee will also download, review and file the monitored graphs from the "Accredited" Dickson Data Logger on a monthly basis. Thermometer and dehumidifiers shall be set such that the laboratory satisfies the aforementioned requirements.

.1 If, during review by Quality, either the temperature or humidity are found to

be out of limits for the discipline being calibrated, the UUT will be brought back into the appropriate laboratory for re-calibration.

5.2.5 Calibrations shall be separated by discipline and be performed in the area in which it has been determined optimum for that discipline.

5.2.6 Access to the calibration laboratory shall be limited to E.E. personnel and accompanied guest only. The main laboratory door shall be clearly marked as to function and further shall have an "***employees only*** " sign. The back laboratory door shall be used in emergency only.

5.2.7 All personnel shall perform housekeeping where appropriate. Standards shall be stored in the laboratory or issue/receive area only and due care shall be taken not to stack instruments higher than seven feet. Whenever possible, large, heavy test equipment shall not be located on technician bench risers. The laboratory shall be kept neat and equipment stored appropriately at all times. Documentation shall be kept in a secure, dry area.

5.3 Test and Calibration Methods and Method Validation

5.3.1 E.E. documented instructions may take several forms, these instructions may be but are not limited to: N.I.S.T. periodicals, ANSI Standards, manufacturer manuals, U.S. Military procedures, procedures on GIDEP and internally developed procedures. All documentation should be kept as current as reasonably feasible and a list of internal procedures shall be updated by technical support designee in the appropriate laboratory and identified by QA form QA-11.

.1 When not specified by the customer, E.E. will use methods from one of the above sources as long as it is appropriate and allows the laboratory to meet the manufacturer's specifications.

.2 Whenever there is a need to adjust or modify a procedure or method due to standards or other resource availability, the change will be evaluated and the modification, its parameters and ability to meet manufacturers specifications will be documented on Form QA-11 by appropriate personnel. Any limitation of performance must be accepted by the customer.

5.3.2 All E.E. procedures shall contain at least the following:

.1 The accuracy of the device under test; however stated.

.2 The accuracy of the devices used to test; however stated.

.3 The generic description of the devices used to test.

.4 The generic description of the methodologies used.

5.3.3 Accuracy of calibration shall be checked by individual attesting "Reviewed by" on form QA-7. The responsible signatory on the Certificate of Calibration shall check data transfers before issuing a certificate.

5.3.4 Automated laboratory procedures are maintained as follows:

.1 All data sheets shall be part of an approved procedure. The original data sheets shall be kept on a laboratory master server and reprinted as needed.

.2 Calibration software shall be documented to the extent needed that a qualified technician may carry out certification or verification. Verification of all software shall be reviewed and controlled by E.E. Form QA-10 shall be used to document this verification and will be filed by the Quality Manager.

.3 All computer generated data sheets and procedures relating to calibration shall be stored on the computer system and backed up daily and removed nightly. A copy of a master disk and back up data shall be under the control of the Operations Manager.

5.3.5 Consumable materials required for use in calibration shall be compared against the purchase order when received. Consumable materials have no effect on the quality of the calibration. This material shall be presented to the Quality Manager who shall make a determination as to whether an MSDS is required. The material shall be stored in a dry area and flammable materials stored in an appropriate metal container.

5.3.6 There are no laboratory-developed methods and non-standard methods are not used.

5.3.7 E.E. shall ensure accuracy of calibration by evaluating procedures for adherence to 5.3.2 and annotate Form QA-7 for compliance to the various specifications. Measuring and test equipment shall have their uncertainty documented and maintained by the Quality Manager. Methods for performing uncertainty are described in desktop procedures. Uncertainty calculations shall be subjected to appropriate checks and documented.

5.3.8 Calculations shall also be subjected to appropriate checks and documented by the Quality Manager.

5.3.9 The laboratory shall inform the customer when the method proposed by the customer is considered to be inappropriate or out of date.

5.4 Equipment

5.4.1 The Technical Manager shall ensure that all items of equipment are available as required to perform correct calibrations. If a device is leased or borrowed, the device shall be subject to the same requirements as an E.E. standard.

.1 It is the Laboratory Manager's responsibility to insure that only trained and authorized personnel operate this equipment.

5.4.2 Before being placed into service, all laboratory standards and devices will be assigned a unique Asset number and be calibrated or checked to establish that it meets the laboratory's specification requirements and complies with the relevant standard specifications. Standards that are being returned from loan or rental agreements will be treated as new items and have a complete calibration performed to insure the functionality and accuracy. Laboratory devices shall be maintained as follows:

.1 All E.E. standards shall have a history folder maintained by the Quality Manager. All history folders shall be maintained in one location and be uniquely identified by asset #'s and all unique work performed shall be

documented on form QA-2.

.2 Any E.E. personnel suspecting an instrument may have had it's integrity affected shall notify the Quality Manager or take appropriate steps such as the verification of suspected problem as soon as possible.

.3 E.E. standards shall be labeled clearly with form PC-1 (Rejected) filled out by the individual noticing the discrepancy.

.4 Standards with out of tolerance conditions are all noted on form QA –12. As this condition falls under the area of "Non-conforming work" it will be processed as stated in paragraph 4.9.2.1 of this manual.

.5 E.E. standards are identified for operational status by PC series of labels.

.6 E.E. standards shall be inducted and kept in the awaiting maintenance area while out of service or where appropriately designated by the Quality Manager.

.7 Manufacturer's user and/or maintenance instructions, if available, will be uniquely identified and maintained in the technical library in the repair laboratory.

.8 Records are maintained as above and documented on QA-2 as follows:

A. Description (name).

B. Manufacturer, model number, serial number and asset number where applicable.

C. All items are assumed to be in the laboratory or in the possession of a technician unless noted on form QA-3.

D. Date device calibrated and due are recorded on form QA-2.

E. Results of maintenance are kept in the same historical folder, these may be annotated on the Certificate of Calibration or on form QA-2 and include modification, damage, malfunction and any measured valued found to be out of tolerance.

.9 Reference standards shall be calibrated before and after any adjustment.

5.4.3 Unless otherwise specified, the following guidelines are set in place to determine and document laboratory standard interval adjustments. Complete justification for the interval changes to be documented as required on the Standard History Document (QA-2) and Calibration Extension Notification. (QA-4).

.1 Reverse recall to be done on all standards being considered for interval change.

.2 The interval may be extended up to double the current interval (not to exceed twice the manufacturers recommended calibration cycle) for any standard found to be in tolerance with less than one use per week.

.3 For any standard in tolerance three successive times, the interval may be extended up to double the current interval.

.4 Any standards having been found out of tolerance in two successive times to be a high candidate for either retirement or halving the calibration.

.5 That on an instrument new to our system, that the interval to default to the manufacturer's recommended interval.

5.4.4 The Quality Manager shall generate a recall of E.E. standards by the Metrology Program at least monthly. This report will be reviewed and all due or past due standards will be inducted for calibration or other appropriate action will be taken.

5.4.5 E.E. shall use manufacturer's recommendation for establishing intervals or customer identified intervals for customer owned equipment. The Quality Manager shall have the authority to change intervals based on the following:

.1 Usage.

.2 Failures.

.3 Consecutive "In Tolerance / As Found" calibration reports.

5.4.6 Service Labels

.1 All labels shall be affixed to equipment for ease of viewing.

A. PC-1 **Rejected -** Used when a standard is suspected of not meeting specifications, when an E.E. standard is out of date, or when a customer's device is rejected.

B. PC-2 **Calibration Label -** Used when a device meets all criteria in this document.

.1 "ID #" should normally be the Certificate of Calibration unique number.

.2 "Cal" shall be the date calibrated in numeric month, day, and year sequence.

.3 "Due" shall be the date due for re-calibration in numeric month, day and year sequence.

C. PC-3 **Special Calibration Label** - Label shall be signed by technician performing calibration identifying the limitations.

D. PC-4 **Warranty Void Seal -** Label shall be affixed by the technician performing calibration or by shipping personnel.

E. PC-5 **Performance Verification -** This label shall be used when a device requires periodic maintenance but does not require calibration.

.1 "ID#" should normally be the "Certificate of Calibration" unique number.

.2 "Cal" shall be the date the performance verification was performed.

.3 "Due" shall be the date the performance verification is due.

F. PC-6 **No Calibration Required** - This label shall be used when a device either:

.1 Does not require periodic maintenance.

.2 When a device is not used for quantitative measurements

.2 All PC labels except PC-4 (Warranty Seal) require the initials or signature or numeric identification of the individual performing the action.

5.4.7 Authorized Personnel

.1 Only personnel identified by the Quality Manager are authorized to apply, remove, and/or revise inspection status indicators or work orders.

5.4.8 Test and calibration equipment, including both hardware and software, shall be safeguarded from adjustments that would invalidate the test and/or calibration results.

5.5 Measurement Traceability

5.5.1 E.E. has an automated system that does not allow a Certificate of Calibration to be printed if an expired standard has been used. This system is updated by the Quality Manager and has password protection.

5.5.2 Measurements made by E.E. shall be traceable to S.I. units or N.I.S.T. unless no standard exists or the measurement is traceable to a known physical constant or performed in a ratio metric manner. Any deviation from the above shall be documented on the Certificate of Calibration. The Certificate of Calibration shall state which metrological specifications the measurement meets.

.1 External calibration service providers must be able provide proof of traceability for both customer sub-contracted and E.E. equipment calibrations. Calibration certificates issued by these providers shall contain measurement results, including measurement uncertainty and/or a statement of compliance with a metrological specification.

.2 When equipment is subcontracted for “Accredited” calibration services, the selected vendor must be accredited to ISO 17025 or be an NMI and the services provided must fall within their accredited scope.

5.5.3 In those cases where traceability to S.I. units or N.I.S.T. is not obtained, traceability requirements shall be satisfied by ratio type measurements or mutual consent standards coupled with suitable reference materials.

.1 Currently, E.E. does not have any requirement to participate in any inter-laboratory comparisons.

5.5.4 E.E. reference standards are marked legibly and shall only be used for verification purposes or calibration. These standards shall be subject to the same criteria as all other devices received for calibration. As most E.E. reference standards are used as check standards for verification of accuracy they are subject to periodic checks throughout the calibration cycle.

.1 Intermediate Check Procedure (ICP-01) will be completed once a month for the purpose of verifying the stability and drift rate of model 5522A, Fluke Multifunction Calibrator.

5.5.5 Reference materials, where possible, shall be traceable to S.I. units of measurement in accordance with the requirements described herein.

5.6 Sampling

5.6.1 Sampling is not part of the calibration process employed by Excalibur Engineering.

5.7 Handling of Test and Calibration Items

5.7.1 All E.E. standards and customer measuring devices shall be handled with appropriate care to prevent any damage to the device.

5.7.2 All devices shipped are insulated to prevent damage to the equipment. For electronic/electrical equipment a minimum of 4 inches of non-crushable foam should surround the equipment. For mechanical, pressure gauges, DMM/DVM's bubble wrap and/or popcorn packing shall be used. An appropriate sized shipping container shall be used.

5.7.3 All devices delivered by E.E. shall be shipped on a bed of at least two inches of shock absorbent material.

5.7.4 Any devices received from a common carrier or received damaged from a customer shall be annotated on the shipper and both shipper and customer notified as soon as possible. The damage information shall be transferred to the work order. Freight carrier's services are not critical to product quality.

5.7.5 The laboratory and the issue and receive area shall be kept stable and enclosed as much as possible. All devices received by E.E. for calibration shall be stored in either issue and receive or the laboratory, and only on appropriate shelving. E.E shall only use a padded delivery vehicle for pick-ups and deliveries.

.1 Although customer equipment is maintained in a secure and monitored environment, there are currently no facilities for storage of material that may be of a classified/sensitive nature. Customers must remove any classified or sensitive material from equipment prior to delivery to E.E.

5.7.6 All requirements of SB198 shall be followed in the case of hazardous materials consumed in the calibration process. The Safety Officer shall be consulted any time a hazardous incident presents itself.

5.7.7 Label PC-4, "Warranty Void Seal" shall be affixed to operator accessible adjustments on all devices received for calibration by E.E. where appropriate and/or which if removed would invalidate the calibration.

5.8 Assuring the Quality of Test and Calibration Results

5.8.1 Review checks shall be performed as follows:

.1 E.E. shall implement review checks to ensure the validity of measurements. The Quality Manager, Operations Manager, or members of the board may have at any time a piece of equipment re-calibrated in part or whole by a qualified technician. These checks shall be documented on the applicable internal work order as to parameter checked and pass/fail.

.2 When a measurement is in doubt, personnel shall notify another qualified individual who shall check the validity of measurement and note it on the work order. This may involve another standard or using a reference standard in order to verify results.

.3 Once a year a review check of a calibration completed by each technician shall be performed. This review check shall be documented on the work order with a copy placed in the employee's training file.

.4 E.E. analyzes the Quality Control data and where they are found to be outside pre-defined criteria, such as outlined in calibration procedures, planned action is taken to correct the problem and prevent incorrect results from being reported per Section 4.9.2 of the Quality Manual.

5.8.2 Proficiency Testing

.1 Proficiency testing shall be carried out using **accredited** Proficiency Testing providers to the maximum extent possible. As is reasonably feasible, proficiency testing will be completed per the following schedule commencing Spring of 2012.

a. Spring – Year 1: DCV, ACV, DCI, ACI and Resistance (Generate and Measure).

b. Fall – Year 1: Oscilloscopes

c. Spring – Year 2: Capacitance (Generate)

d. Fall – Year 2: Thermocouples

e. Spring – Year 3: Attenuation (Measure)

f. Fall – Year 3: RF Power measurement

g. Spring – Year 4: Audio Distortion (Measure)

h. Fall – Year 4: Amplitude Modulation, Frequency Modulation and Phase Modulation (Measure)

.2 Results and subsequent analysis of all proficiency tests will be maintained on file as well as provided to the appropriate agencies as required. When submitting to A2LA, use of the required form (A2LA Proficiency Testing Data Submission) is required.

5.9 Reporting of Results

5.9.1 The results of each calibration or test completed, both in-house and at a customer's location shall be accurately, clearly, unambiguously, and objectively reported on a Calibration Certificate and attachments, as necessary. The certificate shall relate only to quantities and the results of functional tests.

5.9.1.1 Certificates may be issued with a statement of compliance (i.e., conformance to a specification) relating to the metrological aspects of specifications. In such cases the laboratory shall ensure that. Any information not reported to the customer shall be retained with the paper copy of the work order.

5.9.1.1a The specification is a national or international standard or one that has been agreed to or defined by the customer.

5.9.1.1b The measurements needed to determine conformance are within the accredited scope of the laboratory.

5.9.1.1c When parameters are certified to be within specified tolerance, the associated uncertainty of measurement is recorded and maintained for future reference.

5.9.1.1d When parameters are certified to be within specified tolerance, the associated uncertainty of the measurement result is properly taken into account with respect to the tolerance by a documented procedure or policy implemented by the laboratory that defines the decision rules used by the laboratory for declaring in or out of tolerance conditions.

5.9.1.1e The certificate relates only to metrological quantities and states which clauses of the specification are certified to have been met.

5.9.1.2 If a calibration certificate contains a statement of the measurement result and the associated uncertainty, the uncertainty statement must contain an explanation of the meaning of the uncertainty statement such as "This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2." Refer to the Desk Top Procedure 21 for methods of reporting.

5.9.1.3 The numerical value of the expanded uncertainty shall be given to two significant figures.

5.9.2 Calibration Certificates shall include the following information:

.1 Title, e.g., "Calibration Report" or "Calibration Certificate;"

.2 Name and address of laboratory, and location where the calibration was carried out if different from the address of Excalibur Engineering;

.3 Unique identification of the certificate or report, and of each page, and the total number of pages;

.4 Name and address of customer;

.5 Description and identification of the item calibrated;

.6 Characterization and condition of the calibration item;

.7 Date of receipt of the calibration item where this is critical to the validity and application of the results and the date on which the calibration was completed;

.8 Identification of the calibration procedure used;

.9 Any deviation from, additions to, or exclusions from the calibration procedure, and any other information relevant to the calibration, such as environmental conditions that may influence the calibration;

.10 As-found and As-left data;

.11 No recommendation shall be made as to the calibration interval unless

specifically requested by the customer;

.12 The designated limits of permissible error;

.13 The standards used to perform the calibration;

.14 A statement of accuracy, and, when the customer requests data (as-found/as-left) the measurement uncertainty for each stated value shall be included. When statements of compliance are made, the uncertainty of measurement shall be taken into account.

.15 Details of any servicing, adjustments, repairs, or modifications performed;

.16 Any limitation in use;

.17 The signature and title of the person accepting responsibility for the content of the certificate and date of issue;

.18 A statement that the certificate shall not be reproduced except in full, without the written approval of Excalibur Engineering;

.19 Traceability statement;

.20 A statement to the effect that the results relate only to the item or items tested or calibrated.

.21 If opinions or interpretations are included, the laboratory shall document the basis on which the opinion/interpretation have been made. Opinions and interpretations shall be clearly marked as such on the report.

.22 Any additional information which may be required by the specific method, customers or groups of customers.

.23 When referenced, TUR's shall be calculated using the expanded uncertainty of the measurement, not the "collective uncertainty of the measurement standards". Implicit uncertainty statements must be accompanied by words to the effect that the TUR was calculated using expanded measurement uncertainty and must state the confidence level and coverage factor, for example, "The TUR was calculated using the expanded measurement uncertainty at approximately the 95% confidence level using a coverage factor of K=2".

5.9.3 Amendments

.1 If a record is changed a new certificate is issued. The new certificate shall be stamped with a stamp indicating that the certificate is a "supplementary report" to the original Certificate of Calibration.

5.9.4 Transmission of Results to Customers

.1 Should Excalibur Engineering be requested to electronically transfer results of calibrations to the customer the individual transmitting the information shall complete a facsimile sheet identifying:

1. The individual the information is sent to;

2. A statement of confidentiality; and,

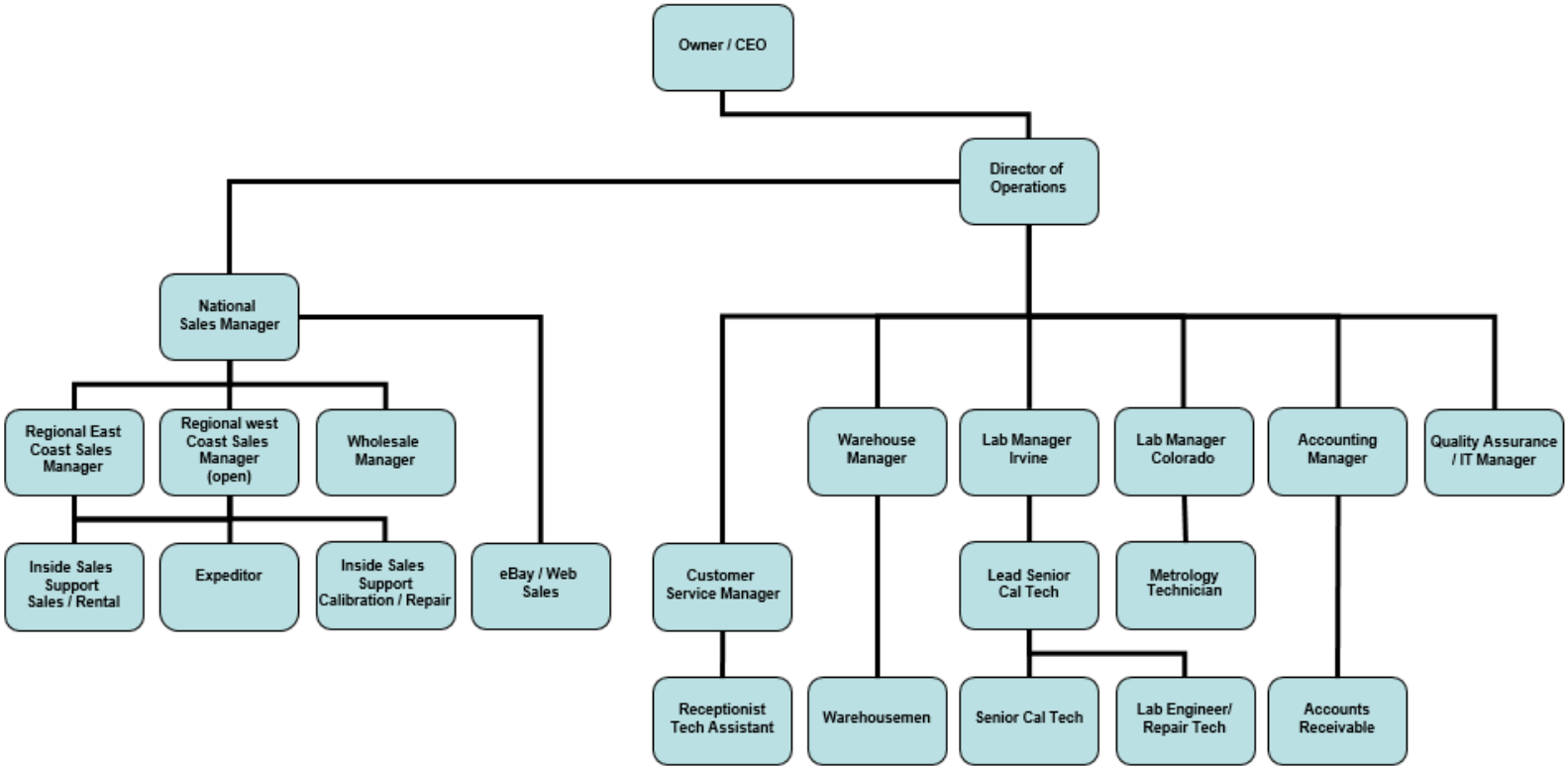
3. A request for acknowledgment.

5.9.5 When calibrations are performed by approved contractors, Excalibur Engineering shall issue a Calibration Certificate identifying the contractor and shall attach the contractor's Calibration Certificate.

ATTACHMENT 1

Organization Chart

EXCALIBUR ENGINEERING, INC.



Attachment 2 Scope of Accreditation

I. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calipers	Up to 6 in Up to 12 in	490 µin 990 µin	Gage blocks
Micrometers	Up to 4 in Up to 6 in	16 µin 52 µin	Gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Voltage[3] – Generate	(0 to 330) mV (0 to 3.3) V (0 to 33) V (30 to 330) V (100 to 1020) V	7.6 µV 38 µV 0.42 mV 5.9 mV 20 mV	Fluke 5522A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage[3] – Measure	100 mV 1 V 10 V 100 V 1000 V	0.8 µV 4.2 µV 44 µV 0.62 mV 6.0 mV	Agilent 3458A

DC Current[3] – Generate	(0 to 330) µA (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 20.5) A	68 nA 0.37 µA 3.6 µA 36 µA 0.26 mA 1.2 mA 6.1 mA 22 mA	Fluke 5522A
Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current[3] – Measure, Fixed Points	1 µA 10 µA 100 µA 1 mA 10 mA 100 mA 1 A 20 A 100 A 1000 A	0.24 nA 0.35 nA 2.8 nA 25 nA 0.25 µA 4.0 µA 0.12 mA 6.9 mA 6.9 mA 0.31 A	Agilent 3458A Agilent 3458A, Fluke Y5020 Agilent 3458A, Honeywell 1166 Agilent 3458A, Guideline 9230A-1000
Resistance[3] – Measure	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.22 mΩ 1.9 mΩ 13 mΩ 0.13 Ω 1.3 Ω 19 Ω 0.61 kΩ 55 kΩ	Agilent 3458A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Resistance[3] – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	0.48 mΩ 1.70 mΩ 3.2 mΩ 9.2 mΩ 31 mΩ 94 mΩ 0.32 Ω 0.93 Ω 3.1 Ω 11 Ω 36 Ω 0.20 kΩ 1.4 kΩ 8.5 kΩ 59 kΩ 0.97 MΩ 16 MΩ	Fluke 5522A (Applies to 4-wire compensation only)

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage[3] – Generate			
(1.0 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	49 µV 11 µV 13 µV 38 µV 0.13 mV 0.31 mV	Fluke 5522A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.11 mV 55 µV 60 µV 0.12 mV 0.29 mV 0.72 mV	
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	1.0 mV 0.55 mV 0.68 mV 1.0 mV 2.4 mV 8.4 mV	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage[3] – Generate			
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	10 mV 5.5 mV 8.4 mV 12 mV 31 mV	Fluke 5522A
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	64 mV 71 mV 87 mV 0.1 V 0.7 V	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.31 V 0.26 V 0.31 V	
AC Voltage[3] – Measure			
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	59 µV 31 µV 41 µV 0.11 mV 36 mV 3.9 mV	Agilent 3458A
100 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	1.3 mV 1.0 mV 1.7 mV 3.4 mV 8.2 mV 6.4 mV	
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	25 mV 23 mV 23 mV 39 mV 0.12 mV	
(100 to 1000) V	40 Hz to 1 kHz (1 to 20) kHz	0.42 mV 0.61 mV	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current[3] – Measure			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.42 µA 0.18 µA 94 nA 94 nA	Agilent 3458A
(1 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	0.41 mA 0.17 mA 81 µA 54 µA 82 µA	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4.1 mA 1.8 mA 8.0 mA 1.2 mA 3.1 mA	
(1.1 to 20) A	60 Hz	1.4 mA	Agilent 3458A, Fluke Y5020
(20 to 100) A	60 Hz	6.9 mA	Agilent 3458A, Honeywell 1166
AC Current[3] – Generate			
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.75 µA 0.58 µA 0.5 µA 1.1 µA 2.7 µA 5.4 µA	Fluke 5522A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	6.9 µA 4.2 µA 3.4 µA 6.6 µA 16 µA 33 µA	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Current[3] – Generate (cont)			
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	59 µA 31 µA 16 µA 30 µA 67 µA 0.13 mA	Fluke 5522A
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.59 mA 0.31 mA 0.15 mA 0.35 mA 0.7 mA 1.4 mA	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.2 mA 0.65 mA 7.5 mA 32 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	5.5 mA 1.9 mA 19 mA 78 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	8.6 mA 13 mA 0.33 A	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	29 mA 35 mA 0.61 A	
Capacitance[3] – Generate			
(0.04 to 1.1) nF (1.1 to 3.3) nF (3.3 to 110) nF (110 to 330) nF	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 10 kHz 10 Hz to 10 kHz	16 pF 26 pF 0.29 nF 0.86 nF	Fluke 5522A

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Capacitance[3] – Generate (cont)			
(0.33 to 1.1) µF	(10 to 600) Hz	2.9 nF	Fluke 5522A
(1.1 to 3.3) µF	(10 to 300) Hz	8.6 nF	
(3.3 to 11) µF	(10 to 150) Hz	29 nF	
(11 to 33) µF	(10 to 120) Hz	0.16 µF	
(33 to 110) µF	(10 to 80) Hz	0.6 µF	
(110 to 330) µF	(0 to 50) Hz	1.8 µF	
0.33µF to 1.1 mF	(0 to 20) Hz	5.9 µF	
(1.1 to 3.3) mF	(0 to 6) Hz	18 µF	
(3.3 to 11) mF	(0 to 2) Hz	59 µF	
(11 to 33) mF	(0 to 0.6) Hz	0.27 mF	
(33 to 110) mF	(0 to 0.2) Hz	1.3 mF	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices[3] – Measure and Generate			
Type K	(-200 to -100) °C	0.34 °C	Fluke 5522A
	(-100 to -25) °C	0.20 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 1000) °C	0.28 °C	
	(1000 to 1372) °C	0.93 °C	
Type T	(-250 to -150) °C	0.63 °C	
	(-150 to 0) °C	0.26 °C	
	(0 to 120) °C	0.19 °C	
	(120 to 400) °C	0.17 °C	
Type J	(-210 to -100) °C	0.28 °C	
	(-100 to -30) °C	0.19 °C	
	(-30 to 150) °C	0.17 °C	
	(150 to 760) °C	0.20 °C	
	(760 to 1200) °C	0.62 °C	
Type N	(-200 to -100) °C	0.41 °C	
	(-100 to -25) °C	0.24 °C	
	(-25 to 120) °C	0.21 °C	
	(120 to 410) °C	0.20 °C	
	(410 to 1300) °C	0.63 °C	

Electrical Calibration of Thermocouple Indicating Devices[3] – Measure and Generate (cont)			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.50 °C 0.19 °C 0.17 °C 0.19 °C 0.23 °C	Fluke 5522A
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.36 °C 0.34 °C 0.39 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.37 °C 0.68 °C 0.73 °C	
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820 °C	0.44 °C 0.35 °C 0.64 °C 0.66 °C	
Type C	(0 to 150)°C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.31 °C 0.28 °C 0.31 °C 0.75 °C 1.0 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.38 °C 0.28 °C 0.20 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.28 °C	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Oscilloscopes[3] –			
DC Voltage:			
50 Ω	(0 to ± 6.6) V	27 mV	Fluke 5522A/SC1100
1 MΩ	(0 to ± 130) V	64 mV	
AC Voltage (Square wave):			
50 Ω	±1 mV_{pk-pk} to ±6.6 V_{pk-pk}	20 mV_{pk-pk}	
1 MΩ	±1 mV_{pk-pk} to ±130 V_{pk-pk}	0.13 V_{pk-pk}	
Leveled Sine Wave (Amplitude)	50 kHz to 100 MHz	0.19 V	
	100 MHz to 300 MHz	0.22 V	
	300 MHz to 600 MHz	0.32 V	
	600 MHz to 1.1 GHz	0.24 V	
Time Markers	5 s to 50 ms	25 ms	
	20 ms to 100 ns	49 ns	
	50 ns to 20 ns	0.12 ps	
	10 ns	25 fs	
	5 ns to 2 ns	12 fs	
Wave Generator:			
50 Ω	1.8 mV_{pk-pk} to 2.5 V_{pk-pk}	74 mV_{pk-pk}	
1 MΩ	1.8 mV_{pk-pk} to 55 V_{pk-pk}	1.6 V_{pk-pk}	
Pulse Generator: (4 to 500) ns width	10 mV to 2.5 V	0.29 µs	
Fast Edge: 50 Ω < 300 ps rise time	4 m V_{pk-pk} to 2.5 V_{pk-pk}	0.34 ns	

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
RF Power – Measure 30 MHz to 50 GHz	(0 to 70) dB (71 to 120) dB	0.98 dB 1.1 dB	Agilent E4448A with N5532A opt. 550
Audio Distortion – Measure 20 Hz to 250 kHz	(0.01 to 100) %	0.064%	Agilent E4448A

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
Amplitude Modulation – Measure			
AM Depth:			
100 kHz to 10 MHz	50 Hz to 10 kHz, 5 % to 99 %	 0.84%	Agilent E4448A
10 MHz to 3 GHz	50 Hz to 100 kHz, 5 % to 20 % 20 % to 99 %	 0.57% 0.86%	
(3 to 26.5) GHz	50 Hz to 100 kHz, 5 % to 20 % 20 % to 99 %	 1.0% 1.7%	
(26.5 to 31.15) GHz	50 Hz to 100 kHz, 5 % to 20 % 20 % to 99 %	 1.5% 2.2%	
(31.15 to 50) GHz	50 Hz to 100 kHz, 5 % to 20 % 20 % to 99 %	 5.9% 6.7%	
AM Distortion:			
100 kHz to 10 GHz	20 Hz to 1 kHz > 1 % > 3 %	 0.91% 0.34%	
10 MHz to 26.5 GHz	20 Hz to 1 kHz > 1 % > 3 %	 1.1% 0.45%	
(26.5 to 50) GHz	20 Hz to 1 kHz > 1 % > 3 % > 5 %	 7.0% 2.3% 1.7%	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Frequency Modulation – Measure			
FM Deviation:			
250 kHz to 10 MHz	20 Hz to 10 kHz Dev/Rate > 0.2 Dev/Rate > 1.2	 1.7% 1.1%	Agilent E4448A
10 MHz to 6.6 GHz	50 Hz to 200 kHz Dev/Rate > 0.2 Dev/Rate > 0.45	 1.7% 1.1%	
(6.6 to 13.2) GHz	50 Hz to 200 kHz Dev/Rate > 0.2 Dev/Rate > 8	 2.8% 1.1%	
(13.2 to 31.15) GHz	50 Hz to 200 kHz Dev/Rate > 0.2 Dev/Rate > 16	 4.3% 1.1%	
(31.5 to 50) GHz	50 Hz to 200 kHz Dev/Rate > 0.2 Dev/Rate > 32	 9.6% 1.1%	
FM Distortion:			
1 MHz to 6.6 GHz	20 Hz to 1 kHz Dev 500 Hz to 2 kHz Dev ≥ 2.0 kHz	 0.34% 0.11%	
(6.6 to 13.2) GHz	20 Hz to 1 kHz Dev > 2.3 kHz Dev ≥ 4.5 kHz	 0.34% 0.11%	
(13.2 to 31.15) GHz	20 Hz to 1 kHz Dev > 2.7 kHz Dev ≥ 6.0 kHz	 0.34% 0.11%	
(31.15 to 50) GHz	20 Hz to 1 kHz Dev > 4.0 kHz Dev ≥ 12.0 kHz	 0.34% 0.11%	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Phase Modulation – Measure			
PM Deviation:			
100 kHz to 6.6 GHz	> 0.3 rad >0.7 rad	3.4% 1.1%	Agilent E4448A
(6.6 to 13.2) GHz	> 0.6 rad > 2.0 rad	3.4% 1.1%	
(13.2 to 26.5) GHz	> 1.2 rad > 4.0 rad	3.4% 1.1%	
(26.5 to 31.15) GHz	> 1.3 rad > 4.0 rad	3.4% 1.1%	
(31.15 to 50) GHz	> 2.4 rad > 8.0 rad	3.4% 1.1%	
PM Distortion:			
1 MHz to 6.6 GHz	(20 to 500) Hz > 0.8 rad ≥ 2.5 rad 500 Hz to 1 kHz > 0.4 rad ≥ 1.0 rad	 3.4% 1.1% 3.4% 1.1%	
(6.6 to 13.2) GHz	(20 to 500) Hz > 1.8 rad ≥ 5.5 rad 500 Hz to 1 kHz ≥ 0.8 rad ≥ 2.5 rad	 3.4% 1.1% 3.4% 1.1%	
(13.2 to 31.15) GHz	(20 to 500) Hz > 3.5 rad ≥ 10.0 rad 500 Hz to 1 kHz > 1.2 rad ≥ 4 rad	 3.4% 1.1% 3.4% 1.1%	
(31.15 to 50) GHz	(20 to 500) Hz > 7.5 rad ≥ 19.0 rad 500 Hz to 1 kHz > 3.0 rad ≥ 8.0 rad	 3.4% 1.1% 3.4% 1.1%	

IV. Time & Frequency

Parameter/Range	Frequency	CMC[2] (±)	Comments
Frequency – Measuring Equipment	10 MHz	5.7 X 10-12 Hz/Hz	Fluke 910R
Frequency Accuracy – Measure	0.001 Hz to 50 GHz	5.7 X 10-12*f*	Frequency counter *f* = frequency

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[1] This laboratory offers commercial calibration service.

[2] Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration and this laboratory meets A2LA R104 - General Requirements: Accreditation of Field Testing and Field Calibration Laboratories for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] The measurements stated are generated with the Fluke 5522A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[5] The measurands stated are measured with the Agilent 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

[6] In the statement of Calibration and Measurement Capability (CMC), percentages are to be read as percent of reading unless otherwise noted.

[7] This accreditation covers calibrations performed at the main laboratory listed above, and the calibrations listed below, performed at the satellite facility laboratory listed below: