

Viasat, Inc.	Process Area: Quality	Document Number: PR001362	Revision: 001
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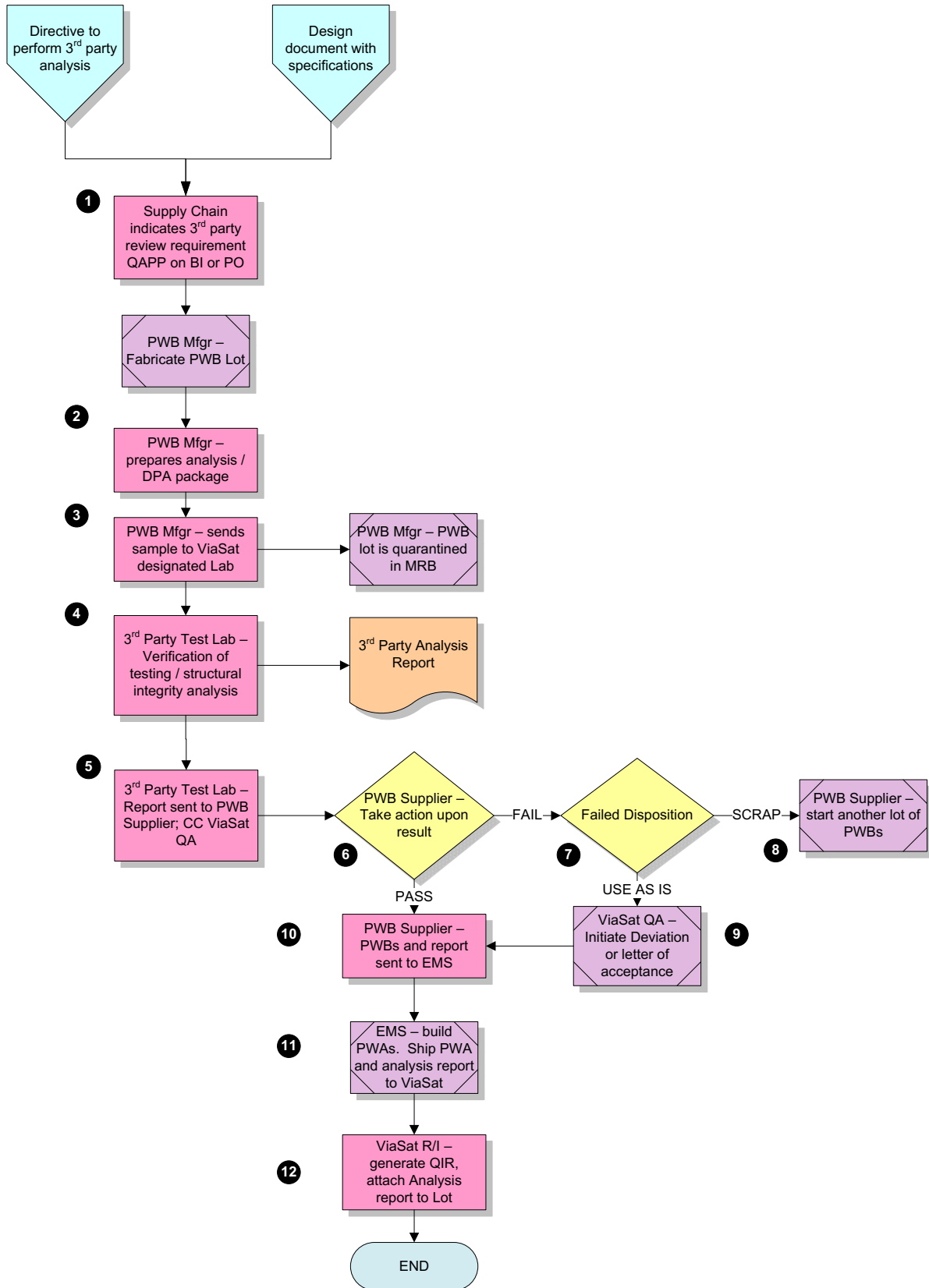
1 Purpose and Scope

The purpose of this procedure is to define the process required for a third party test lab (inspection service) to perform analysis of completed Printed Wiring Boards (PWB's) to assure compliance to IPC standards and Viasat specifications.

This third party review may be a customer requirement, used to verify a new PWB supplier or to analyze designs. The third party review consists of a standard "verification of testing per IPC 6012 (for Rigid PWB's) / IPC 6013 (for Flex PWB's) table 4.3". If there is an additional requirement for structural integrity analysis on a Destructive Physical Analysis (DPA) sample; that shall be explicitly specified.

The scope of this procedure details how to invoke this requirement on internal procurement, design and, inspection documentation. The scope also covers the communication of this requirement to the PWB manufacturer or the Electronics Manufacturing subcontractor (EMS). Finally, this scope covers the fulfillment of the requirement including record keeping of the results at Viasat.

2 Process Flow Diagram



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3 Activity Descriptions

The following table lists and describes the activities required to generate the output.

Activities

No.	Task Name	Role	Task Description
1	PO Setup	Viasat Supply Chain	<ul style="list-style-type: none"> Indicate Requirement (QAPP 58) for third party lab analysis on PO.
2	Fab PWB	PWB Supplier	<ul style="list-style-type: none"> PWB Supplier prepares review / DPA package.
3	Prep for Analysis	PWB Supplier	<ul style="list-style-type: none"> PWB Supplier sends sample to Viasat designated Lab for analysis. Lot is quarantined in MRB.
4	Analysis	Third Party Test Lab	<ul style="list-style-type: none"> Verification of testing / structural integrity analysis (using a DPA) per IPC 6012 / 6013 performed by Viasat designated Lab per specified requirements. Analysis report is prepared.
5	Results	Third Party Test Lab	<ul style="list-style-type: none"> Report is tied to specific manufacturing lot/date code or serial number and sent to PWB Supplier. Courtesy copy of the Report is sent to Viasat Quality Engineer.
6	Supplier Evaluation	PWB Supplier	<ul style="list-style-type: none"> PWB Supplier holds PWBs and conducts an internal evaluation.
7	MRB Disposition	PWB Supplier	<ul style="list-style-type: none"> Evaluation disposition = Use As Is or Scrap
8	Scrap disposition	PWB Supplier	<ul style="list-style-type: none"> Evaluation disposition = Scrap – PWB supplier builds replacement lot and submits review / DPA package once completed.
9	UAI Disposition	Viasat	<ul style="list-style-type: none"> Evaluation disposition = Use As Is – generate a deviation or letter of acceptance to use PWB Lot that failed testing.
10	PWB Release	PWB Supplier	<ul style="list-style-type: none"> Evaluation disposition = Pass or Use As Is - PWB Supplier releases PWBs and Analysis report to Electronic Manufacturing Services (EMS) Supplier.
11	PWA Build	EMS	<ul style="list-style-type: none"> Build up PWA's and ship to Viasat with Analysis report.
12	Viasat RI record keeping	Viasat QA	<ul style="list-style-type: none"> R/I Inspector generate a QIR in Oracle under the PWA Part Number. Analysis report is attached to the QIR in Oracle QA system.

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4 Inputs

- Directive to require a third party lab analysis and /or structural integrity analysis (using a DPA).
- Engineering documentation specifies requirements, locations of sampling, and frequency.

5 Outputs

- Compliant PWB's as verified by independent third party lab.
- Completed DPA report for compliant PWB's filed by assembly part number in QIR.
- Satisfied customer that Viasat is producing compliant product as verified by third party.

6 References

Documents

- PR000512 – Quality Assurance Procurement Provisions (QAPP)
- IPC-6012 – Qualification and Performance Specification for Rigid Printed Boards
- IPC-6013 – Qualification and Performance Specification for Flexible Printed Boards

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Appendix A

A.1 Flow down Instructions to suppliers

Instructions to PWB Fabricator (flowed down through EMS or Viasat as required):

1. PWB Manufacturer shall provide acceptance report of third-party evaluation of each PWB lot by Viasat approved third party lab prior to final acceptance and shipping to Viasat or EMS.
2. Inspection shall be per IPC-6012 for Rigid PWB's; (IPC-6013 for Flex PWB's) class 3, Table 4.3.
3. Additional testing and analysis for "Structural Integrity After Stress" is also required. This shall be done on a sample destructive-physical analysis (DPA) specimen from production lot per IPC-6012 for Rigid PWB's; (IPC-6013 for Flex PWB's); Table 4.3 Structural Integrity After Stress". Please refer to the sampling locations shown on the Viasat drawing or Viasat reference documents for specific area's to be micro-sectioned for this DPA testing and analysis.
4. PWB manufacturer shall prepare proper micro-sections, related samples and required documentation to third party lab for this analysis. One board from each production lot that has passed electrical testing and has passed quality conformance acceptance, and has the equivalent to the thinnest copper plating within the lot or sample as defined on the PO shall be evaluated by DPA. The DPA board shall be prepared in accordance with IPC-TM-650 Method number 2.6.8.
5. PWB manufacturer shall submit proper micro-sections, related samples and required documentation to third party lab for this analysis.
6. Remaining PWB's shall be quarantined at the PWB manufacturer and not released for shipment until successful completion of third party evaluation.
7. All samples and related data shall be retained by the PWB manufacturer for a minimum of 7 years unless otherwise specified.

Instructions to Third Party Inspection Lab:

1. Provide inspection and analysis services for PWB sample specimens supplied by PWB manufacturer.
2. Inspection shall be per IPC-6012 for Rigid PWB's; (IPC-6013 for Flex PWB's) Table 4.3.
3. Additional testing and analysis is also required. This shall be done on a supplied sample DPA per each panel per IPC-6012 for Rigid PWB's; (IPC-6013 for Flex PWB's) Table 4.3 "Structural Integrity After Stress" section. Please refer to the sampling locations shown on the drawing or reference documents for specific area's to be micro-sectioned for this DPA testing and analysis.
4. Upon completion of analysis, provide detailed report (see Appendix B sample) including images of findings to supplying PWB Manufacturer and Viasat Quality Assurance within 2 working days of submittal.
5. Upon completion of analysis all specimens and samples shall be returned to the PWB manufacturer.

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Appendix B

B.1 Sample Analysis Report – Cover Sheet

CUSTOMER NAME

IPC-6012B

RIGID PRINTED BOARD

STRUCTURAL INTEGRITY

Sample Identification:

Report Number:

TEST RESULTS SUMMARY:

The test results indicate that the samples tested met or exceeded the requirements as specified in the indicated test method within this report and the applicable master drawing requirements, Class 2. Actual detailed test results are enclosed.

The master drawing was supplied with the samples submitted for evaluation.

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B.2 Sample Analysis Report – Sheet 2

SUBMISSION IDENTIFICATION

The following sample(s) were submitted and received in a suitable condition for testing as requested:

TEST SAMPLES SUBMITTED:

REPORT DATE:

PURCHASE ORDER NUMBER:

SAMPLE IDENTIFICATION:

DATECODE:

MFR:

* * * * *

IN ACCOUNT WITH:

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B.3 Sample Analysis Report – Sheet 3

TEST SPECIMEN

Rigid printed wiring board sample(s) were submitted for structural integrity analysis.

REFERENCE

Master Drawing; IPC-6012B; IPC-A-600; IPC-TM-650, Method 2.1.1.2.

IPC-6012B:

3.6 Structural Integrity Printed boards shall meet structural integrity requirements for thermally stressed (after solder float) evaluation test coupons specified in 3.6.2. Although the A and B or A/B coupons are assigned for this test, production boards may be used in lieu of the A and B or A/B coupons and are preferred for product that contains surface mount and vias or surface mount mixed with through-hole technology. Holes selected shall be equivalent to those specified for test coupons. The production boards and all other test coupons in the quality conformance test circuitry which contain plated-through holes shall be capable of meeting the requirements of this section.

Structural integrity shall be used to evaluate test coupons or production boards from Type 2 through Type 6 boards by microsectioning techniques. Characteristics not applicable to Type 2 boards (i.e., requirements for innerlayer separations, innerlayer inclusions, and inner foil cracks) are not evaluated. Dimensional measurements that are only possible through the use of microsectioning techniques are also defined in this section. Blind and buried vias shall meet the requirements of plated-through holes. Refer to IPC-2221 for appropriate coupon design of blind and buried vias for plated hole evaluation.

The evaluation of all properties and requirements shall be performed on the thermally stressed test coupon and all requirements must be met; however, per supplier election, certain properties and conditions as defined in the following paragraph(s), which are not affected by thermal stressing, may be evaluated in a test coupon(s) that has not been thermally stressed.

a) When a supplier elects to evaluate the unstressed test coupon for the properties listed in (b), he may do so at any operation following the copper plating operation. If the board undergoes additional thermal excursions above the T_g (glass transition temperature) after copper plating, the unstressed test coupon being evaluated shall also be subjected to these thermal excursions.

b) The properties which are not affected by thermal stress include but are not limited to: copper voids, plating folds/inclusions, burrs and nodules, glass fiber protrusion, wicking, final coating plating voids, etchback, negative etchback, plating/coating thickness, internal and surface copper layer or foil thickness.

B.4 Sample Analysis Report – Sheet 4

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3.6.1 Thermal Stress Testing Test coupons or production boards shall be thermally stressed in accordance with IPC-TM-650, Method 2.6.8.

Following stress, test coupons or production boards shall be microsectioned. Microsectioning shall be accomplished per IPC-TM-650, Method 2.1.1, or 2.1.1.2 on test coupons or production boards. Evaluation of all applicable holes and vias, including blind and buried, for all such structures found on the finished printed board shall be inspected in the vertical cross section in accordance with Table 4-3. The grinding and polishing accuracy of the microsection shall be such that the viewing area of each of the holes is within 10% of the drilled diameter of the hole.

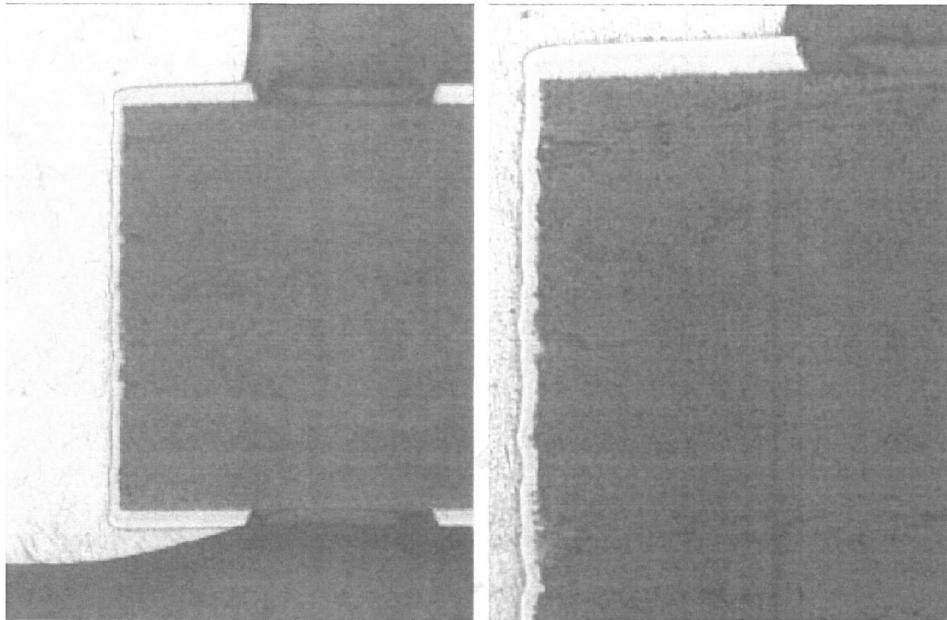
Plated-through holes shall be examined for foil and plating integrity at a magnification of 100X ± 5%. Referee examinations shall be accomplished at a magnification of 200X ± 5%. Each side of the hole shall be examined independently. Examination for laminate thickness, foil thickness, plating thickness, lay-up orientation, lamination and plating voids, and so forth, shall be accomplished at magnifications specified above. For foils less than 3/8 oz., higher magnifications may be required to confirm minimum thickness requirement. Plating thicknesses below 1.0 µm [39.4 µin] shall not be measured using metallographic techniques. Note: When agreed by user and supplier, alternate techniques may be used to supplement microsection evaluation.

RIGID BOARD MICROSECTIONAL ANALYSIS

CUSTOMER NAME: <input style="width: 90%;" type="text"/>	REPORT DATE: <input style="width: 80%;" type="text"/>
SAMPLE IDENTIFICATION: <input style="width: 90%;" type="text"/>	
TEST TECHNICIAN: <input style="width: 90%;" type="text"/>	

PLATING THICKNESS			STRUCTURAL INTEGRITY				
PLATED-THRU HOLE THICKNESS:			PROPERTY	REQUIREMENT (Class 2 and 3)	ACC	REJ	COMMENTS
Hole #1 Average PTH Cu	0.00138"	3.6.2.1	Plating Integrity	No separation of plating layers, plating cracks or interconnection contamination or separation	X		Meets Requirement
Hole #2 Average PTH Cu	0.00133"	3.6.2.2	Plating Voids	One non-circumferential allowed <5% PWB Thickness	X		None Found
Average of Hole #'s 1, 2, 3	0.00133"	Table 3-6	Plating Folds/Inclusions	Must be enclosed and min Cu thickness is met	X		None Found
SURFACE CONDUCTOR THICKNESS:			Table 3-6	Burrs and Nodules	Allowed if minimum hole diameter is met	X	Meets Requirement
Conductor #1 Cu	0.00258"	Table 3-6	Glass Fiber Protusion	Allowed if minimum isolated plating thickness is met	X		Meets Requirement
Conductor #2 Cu	0.00271"	Table 3-6	Wicking	0.003937" max [Class 2]; 0.003150" max [Class 3]	X		Meets Requirement
FOILS AND DIELECTRICS			Table 3-6	Interlayer Inclusions	None allowed		Not Applicable
CONSTRUCTION	LYR	THICKNESS	Table 3-6	Internal Foil Cracks	None allowed		Not Applicable
COPPER FOIL	1	0.00121"	Table 3-6	External Foil Cracks	"D" & "B" cracks not allowed. "A" cracks allowed	X	None Found
DIELECTRIC	1/2	0.05900"	Table 3-6	Barrel/Corner Cracks(E/F)	None allowed	X	None Found
COPPER FOIL	2	0.00121"	Table 3-6	Interlayer Separation	None allowed		Not Applicable
			Table 3-6	External Edge Separation	Allowed if it does not extend past vertical edge	X	None Found
			Table 3-6	Plating Separation	None allowed	X	None Found
			Table 3-6	Plated Barrel Separation	Dimensional and plating requirements must be met	X	Meets Requirement
			Table 3-6	Lifted Lands (After Stress)	Allowed if visual (section 3.3.4) are met	X	Meets Requirement
			3.6.2.3	Laminate Voids	Voids in Zone B not greater than 0.003150"	X	<0.00315"
			3.6.2.4	Laminate Cracks	Cracks in Zone B not greater than 0.003150"	X	None Found
			3.6.2.5	Delamination or Blistering	No evidence of delamination or blistering; Class 2 & 3	X	None Found
			3.6.2.6	Etchback (When Specified)	0.000197" to 0.003150"; Preferred depth 0.000512"		Not Applicable
			3.6.2.7	Smear Removal	Shall not be etched back more than 0.000984"		Not Applicable
			3.6.2.8	Negative Etchback	Shall not exceed requirements in Figure 3-6		Not Applicable
			3.6.2.9	Annular Ring, Internal	90° breakout [Class 2]; 0.000984" min [Class 3]		Not Applicable
			3.6.2.10	Lifted Lands	Lifted lands are allowed after thermal stress	X	Meets Requirement
			3.6.2.11	Copper Plating, Average	0.000787" Avg [Class 2]; 0.000984" Avg [Class 3]	X	0.00133"
			3.6.2.11	Copper Plating, Minimum	0.000709" Min [Class 2]; 0.000787" Min [Class 3]	X	Meets Requirement
			3.6.2.12	Internal Cu Foil Thickness	See IPC-6012, Table 3-7 and Master Drawing		Not Applicable
			3.6.2.13	External Conductor Thkns	See IPC-6012, Table 3-8 and Master Drawing	X	Meets Requirement
			3.6.2.14	Metal Core Spacing	0.003937" Minimum		Not Applicable
			3.6.2.15	Dielectric Thickness	Shall be specified in the procurement documentation	X	Meets Requirement
			3.6.2.16	Material Fill	60% min for buried; Blind vias per Master Drawing		Not Applicable
			3.6.2.17	Nail Heading	Allowed; Process Indicator		Not Applicable
ADDITIONAL REQUIREMENTS							
			Table 3-2	Blind Via	0.000787" Avg [Class 2]; 0.000984" Avg [Class 3]		Not Applicable
			Table 3-2	Blind Micro Vias	0.000472" Avg [Class 2]; 0.000472" Avg [Class 3]		Not Applicable
			Table 3-2	Buried Via Cores	0.000592" Avg [Class 2]; 0.000592" Avg [Class 3]		Not Applicable
			Table 3-2	Buried Vias >2 Layers	0.000787" Avg [Class 2]; 0.000984" Avg [Class 3]		Not Applicable
<input checked="" type="checkbox"/> SAMPLE MEETS THE APPLICABLE REQUIREMENTS OF IPC-6012B, CLASS 2.							
Comments:							

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Date Code:
Defects: None Found
Structural Integrity
Vertical Microsection @ 50X

Date Code:
Defects: None Found
Structural Integrity
Vertical Microsection @ 100X

Sample Identification:

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CERTIFICATE OF CONFORMANCE

[] certifies that the test equipment used complies with the calibration requirements of ANSI/NCSL Z540-1, IPC-QL-653, and ISO/IEC-17025 and that the data contained in this report is accurate within the tolerance limitation of this equipment.

The materials and/or devices furnished on this order have been tested/analyzed/and inspected in accordance with all designated instructions and specifications. Physical reports and other data pertinent to applicable specifications are on file and available for inspection at this plant.

All test procedures detailed are complete. If any additional information or clarification of this report is required, please contact us.

Thank you for selecting [] for your testing requirements.

Report Prepared By:

Report Reviewed By: