Originator's Report Number: 95000993.01

July 14, 1995

Test Report
for
American Power Conversion
on the
Smart Slot and Probe
AP9512T, AP9512TH, AP9612, AP9612T
AP9612TH

Tests Performed by

Dash, Straus & Goodhue, Inc.
593 Massachusetts Avenue
Boxborough, MA 01719

Tests Authorized by

American Power Conversion
Nine Executive Park Drive
Billerica, MA 01862

Test Initiated		June 15, 1995
Test Completed		June 15, 1995
Test Engineer		Michael F. Murphy
Supervisor		7/14/95 Robert Martin

MFM/Dal

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Inchcape Testing Services
Dash, Straus & Goodhue

Dash, Straus & Goodhue, Inc.
593 Massachusetts Avenue
Boxborough, MA 01719
Telephone (508) 263-2662
Fax (508) 263-7086

July 14, 1995

Mr. Joe Pomata
American Power Conversion
Nine Executive Park Drive
Billerica, MA 01862

Dear Mr. Pomata:

Enclosed you will find our test report covering testing on the Smart Slot and Probe. Testing was performed on June 15, 1995.

If you have any questions on the content of the report or the performance of the test, please feel free to contact me at (508) 264-0102.

Sincerely,

Robert F. Martin, N.C.E., P.E.
Chief Engineer

RFM/Dal
Enclosure

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Scope

This report covers testing performed on June 15, 1995 on the Smart Slot and Probe manufactured by American Power Conversion.

1.2 Purpose

Testing was performed to evaluate the Smart Slot and Probe for susceptibility to ESD, line-conducted burst interference and radiated RFI in accordance with EN50082-1.

1.3 Summary

The Smart Slot and Probe was found to be immune to ESD and line-conducted burst interference in accordance with EN50082-1 without modification. The EUT was however susceptible to radiated RFI. Table 1.3-1 presents a summary of test results.

1.4 Testing Requirements

Testing was performed using procedures and criteria contained in IEC 801-2, 801-3, 801-4 and EN50082-1. Table 1.4-1 contains specifics pertaining to testing parameters.

Table 1.3-1 Results Summary/Modifications

IEC 801-2	
Results	**Modifications**
Passes at 15 kV	None

IEC 801-3	
Results	**Modifications**
Fails 10 V/m from 27 to 500 MHz	None

IEC 801-4	
Results	**Modifications**
Passes Levels 1, 2, 3 and 4	None

Table 1.4-1 Test Parameters/Compliance Criteria

IEC 801-2, ESD Susceptibility
+15 kV air discharge
Category B Compliance per EN50082-1:1992

IEC 801-3, Radiated Electromagnetic Field Susceptibility
10 V/m, 27 MHz to 500 MHz
Category A Compliance per EN50082-1:1992

IEC 801-4, Conducted Susceptibility to Line Transients
±2.0 kV on signal lines, ±4.0 kV on power lines
Category B Compliance per EN50082-1:1992

2.0 Test Environment

2.1 Test Sample Description

The Equipment Under Test (EUT) consisted of a Smart Slot and Probe, manufactured by American Power Conversion. The unit was received on June 15, 1995 in good condition and tested on June 15, 1995 with the client present during testing.

The device is an accessory for APC Uninterruptible Power Supplies. It monitors temperature and humidity.

A result which is considered unacceptable would be if the temperature and humidity readings drift as a result of ESD, RFI or transients.

2.2 Test Facility

The test facility, Dash, Straus & Goodhue, Inc., is located at 1145 Massachusetts Avenue, Boxborough, Massachusetts. The test site is located on the ground floor and consists of an anechoic shielded room (16' x 24' x 10') and a shielded room (12' x 24' x 10') with a test bench to hold the test sample. Ambient temperature is maintained between 65° and 75°F, with an approximate relative humidity of 45%.

2.3 Test Equipment

Table 2.3-1 contains a list of the test equipment used during the testing.

Table 2.3-1 Test Equipment

801-2
CDI ESD1000 Charge Reservoir ESD Simulator

801-3		
Model No.	**Serial No.**	**Description**
AR10W1000	8328	Amplifier
6071A	3215002	Signal Generator
B100	207	Biconical Antenna
B200	205	Biconical Antenna
B300	206	Biconical Antenna
FM2000	14937	Isotropic Field Monitor
FP2000	14904	Isotropic Field Probe
888	12161	Levelling Preamplifier

801-4		
Model No.	**Serial No.**	**Description**
CDI EFT/B-100	3080	Burst Generator

3.0 Test Results

3.1 IEC 801-2, Electrostatic Discharge Susceptibility

3.1.1 Test Description

IEC Publication 801-2:1984, Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 2: Electrostatic Discharge Requirements, was the guiding document for this test. This test evaluates the test sample's response to electrostatic discharge events that occur to the body of the test sample at + 15 kV discharged through air.

3.1.2 Test Configuration

Figure 3.1-1 shows the testing configuration used.

3.1.3 Test Procedure

The ESD test level is set and discharges are applied to the conductive surface under the test sample, and along all seams and control surfaces on the test sample. If a discharge occurs and an error is caused, the type of error, discharge level and location is recorded.

3.1.4 Test Results

The system was found to be immune to Electrostatic Discharges of 2kV, 4kV, 6kV, 8kV, 10 kV, 12 kV and 15 kV both near field and direct discharges without modification.

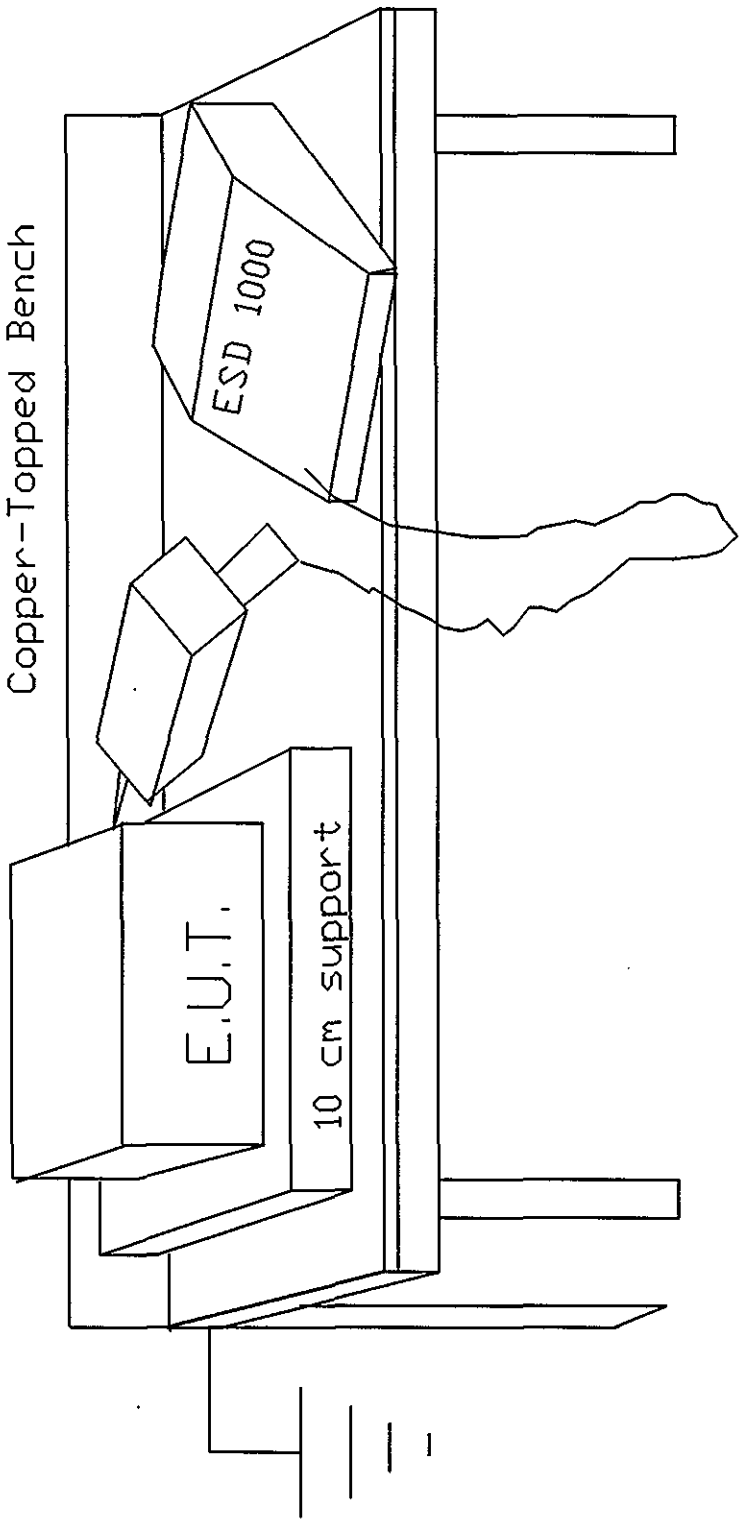


Figure 3.1-1 ESD Test Configuration

3.2 IEC 801-3, Radiated Susceptibility-Electric Field

3.2.1 Test Description

IEC Publication 801-3:1984, Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3: Radiated Electromagnetic Field Requirements, was the guiding document for this test. This test evaluates the test sample's response to radiated electric fields and was performed from 27 to 500 MHz at a level of 10 V/m.

3.2.2 Test Configuration

Figure 3.2-1 shows the testing configurations.

3.2.3 Test Procedures

The test sample is set into operation and was monitored for variations in performance. The test signal is set for frequency and field strength. While maintaining the necessary field strength, the frequency is changed until the range appropriate for the current test configuration has been covered. If an error is detected, the field strength is reduced until the error corrects, then increased until the error begins to occur. This threshold level, the frequency and the error created are noted before continuing. The procedure is then repeated in the opposite antenna polarization.

3.2.4 Test Results

The test sample was found to be susceptible to RFI at 10 V/m from 27 to 500 MHz, in both antenna polarizations. Shielding modifications were not effective in fixing the problem. Additional test and modifications are necessary.

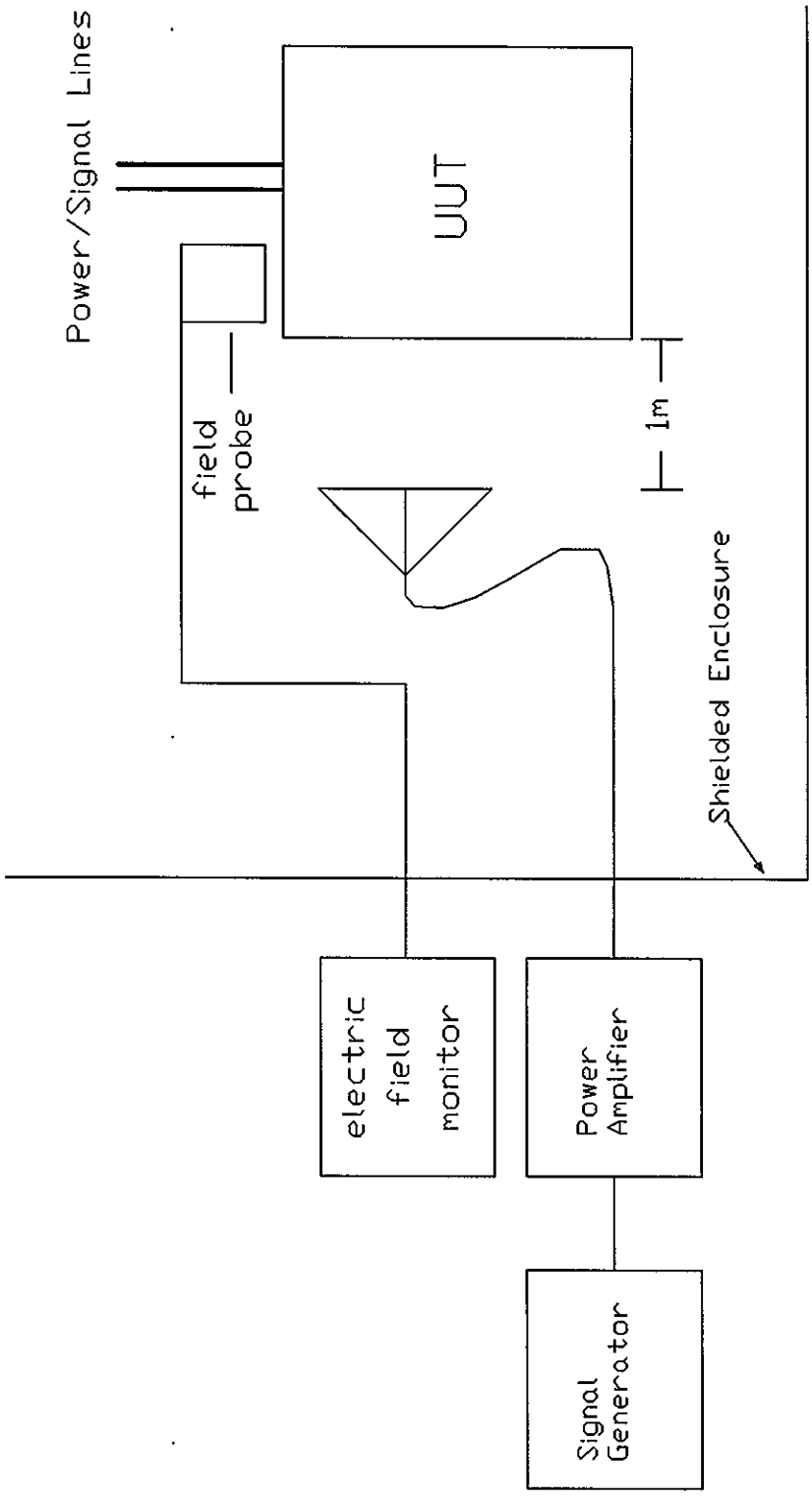


Figure 3.2-1 Biconical Antenna Testing Configuration

3.3 IEC 801-4, Conducted Transients Susceptibility

3.3.1 Test Description

IEC Publication 801-4:1988, Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 4: Conducted Burst Interference was the guiding document for this test. This test evaluates the test sample's response to burst interference transients conducted on the supply. A test signal of ±4 kV was applied to both sides of the line and ground and a test signal of ±2 kV was applied to all signal and I/O lines.

3.3.2 Testing Configuration

Figure 3.3-1 shows the testing configuration used. Figure 3.3-2 shows the transient waveform.

3.3.3 Test Procedure

The test sample was connected to the test equipment, as shown in Figure 3.3-1, and monitored for performance. The test level was set and the test signal was applied for the required time to one side of the line (L1). When an error occurs, the test level is reduced until the error recovers and then increased until the threshold level is reached. This threshold and the error conditions were noted. This procedure was then repeated while injecting into line 2(L2),ground and then to L1 and L2 together.

Using a capacitive coupling plate as called out in IEC 801-4, the procedure was then repeated on signal and I/O lines.

3.3.4 Test Results

The EUT was found to be immune to conducted transients of up to ±4 kV on power lines and ±2 kV on signal and I/O lines without modification.

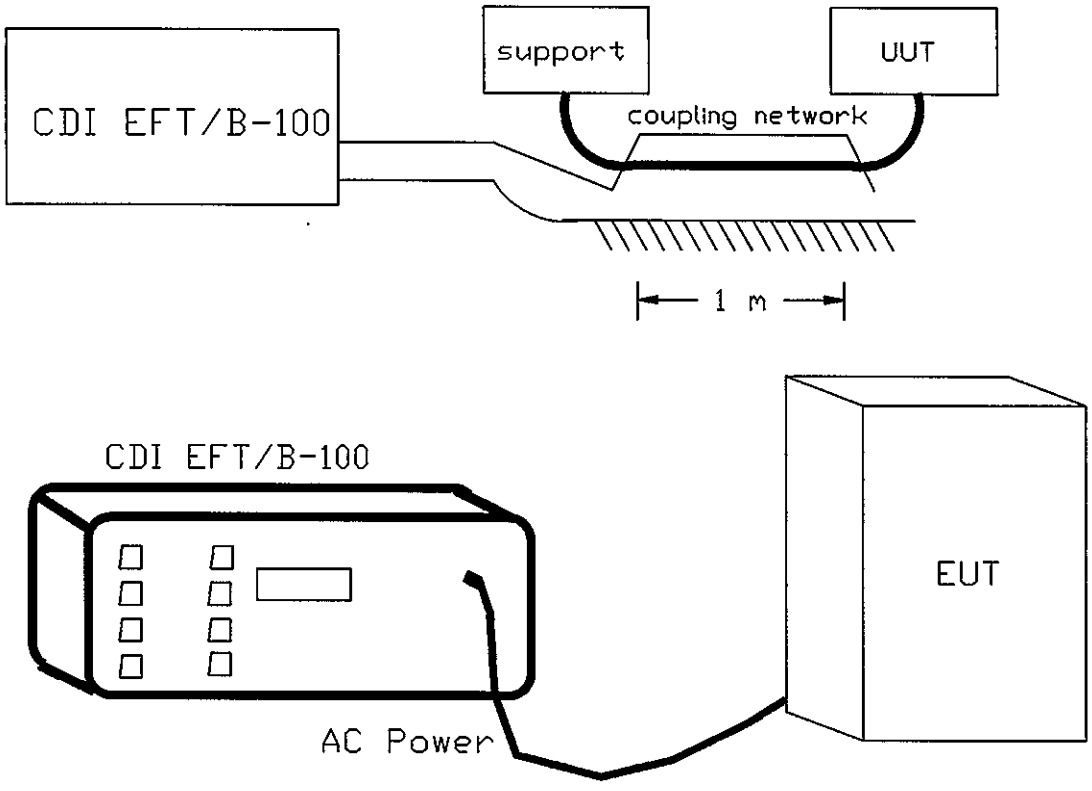
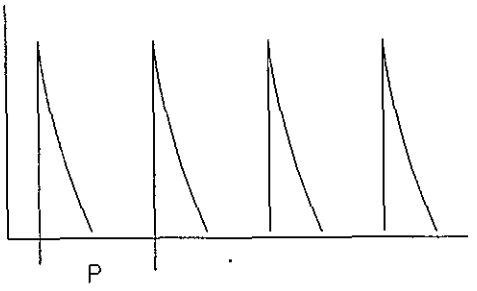
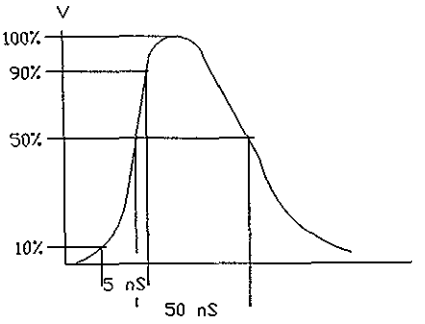


Figure 3.3-1 Conducted Susceptibility Test Configuration



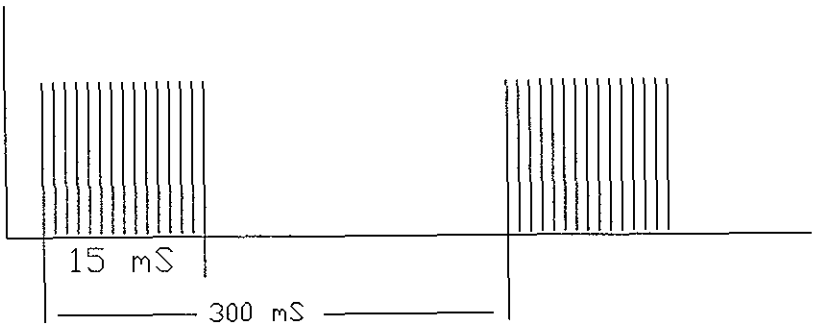
Repetition Period

(Dependant on Test Voltage Level)



Waveshape of Single Pulse

Into 50 ohms



General Graph of Fast Transient/Burst

Figure 3.3-2 Burst Transient Waveform

4.0 Conclusions

4.1 IEC 801-2, ESD Susceptibility

The Smart Slot and Probe, manufactured by American Power Conversion, was found to be immune to ESD up to 15 kV discharged using the through air method without modification.

4.2 IEC 801-3, Radiated Susceptibility - Electric Field

The Smart Slot and Probe, manufactured by American Power Conversion, was found to be susceptible to RFI at 10 V/m from 27 to 500 MHz in either antenna polarization, without modification. Additional testing is needed.

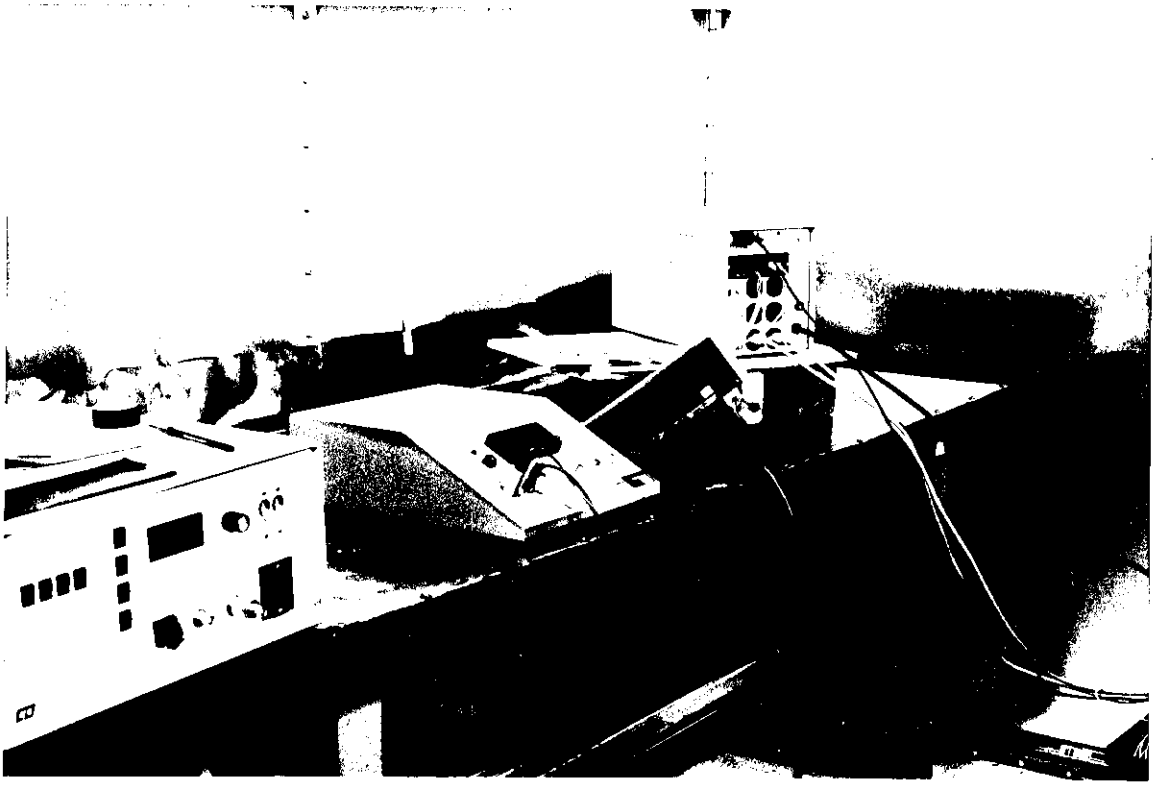
4.3 IEC 801-4, Conducted Susceptibility - Burst Interference Transients

The Smart Slot and Probe, manufactured by American Power Conversion, was found to be immune to ±4 kV transients on power lines and ±2 kV transients on signal lines without modification.

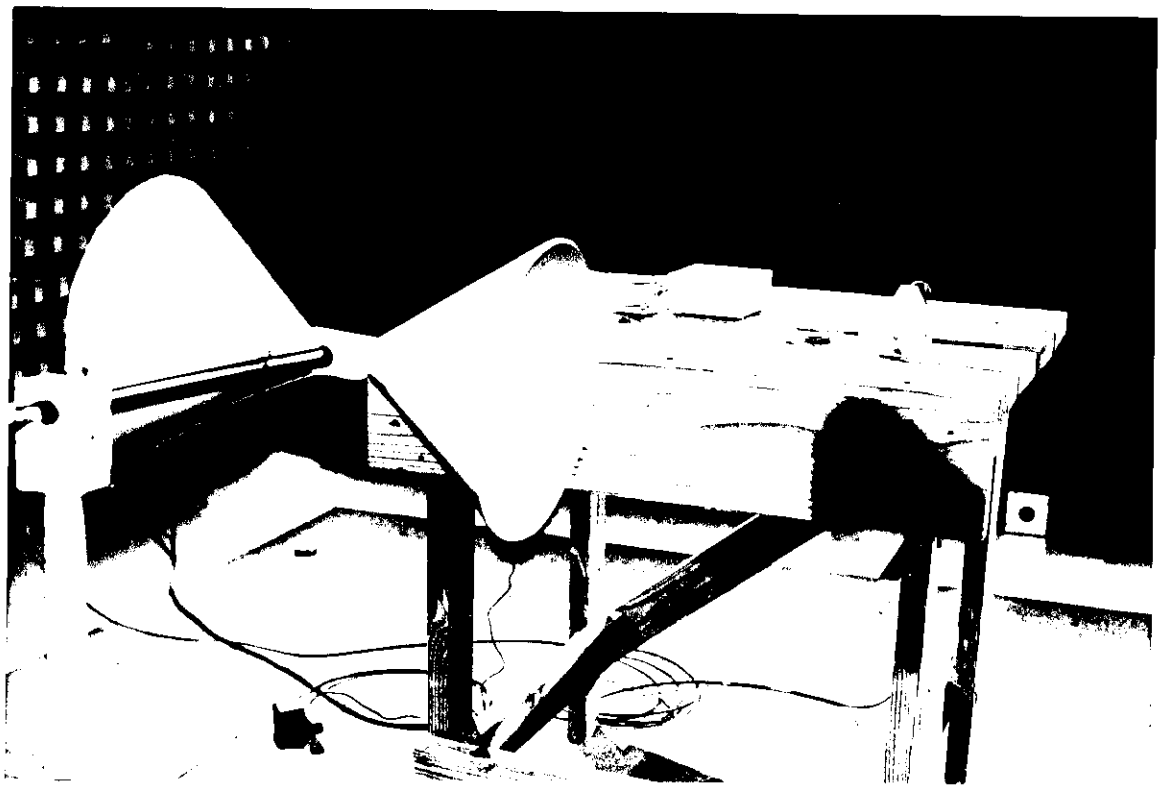
4.4 EN50082-1 Generic Immunity - European Requirements

The Smart Slot and Probe, manufactured by American Power Conversion, fails to comply with the requirements of EN50082-1:1992 without modification. Additional testing and modifications are needed and precludes verification.

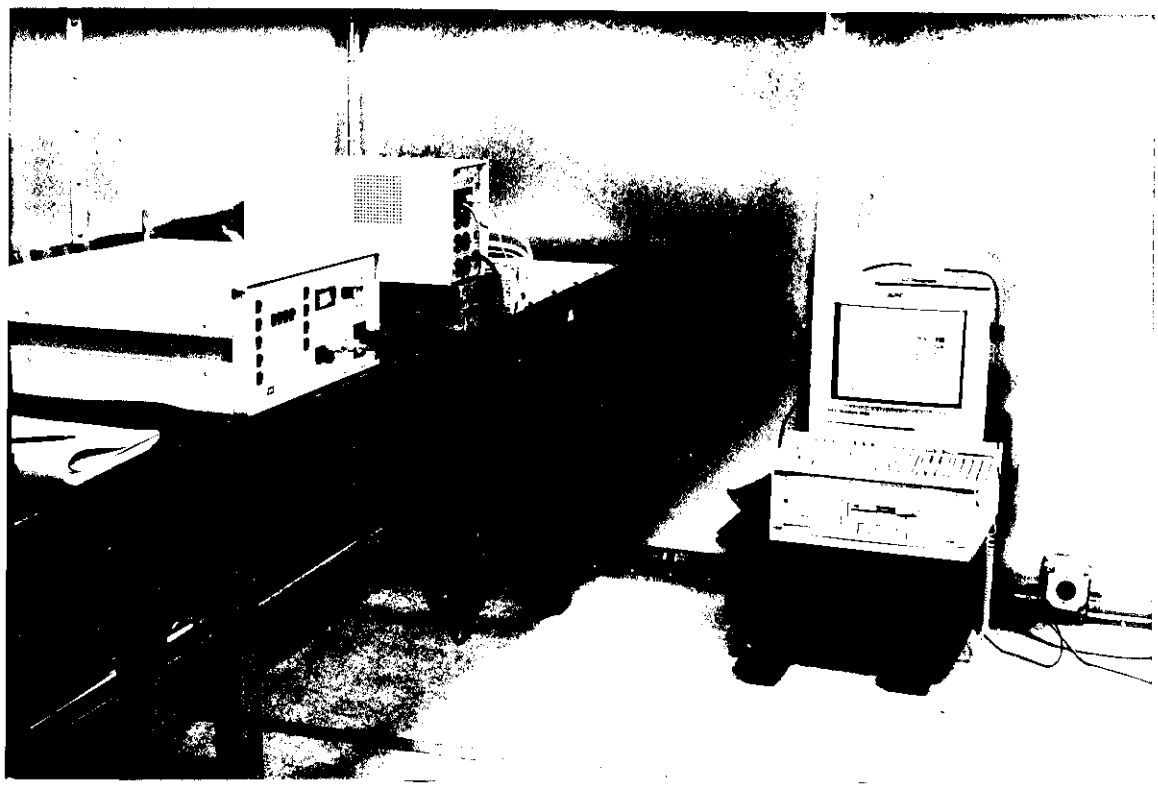
Configuration Photographs

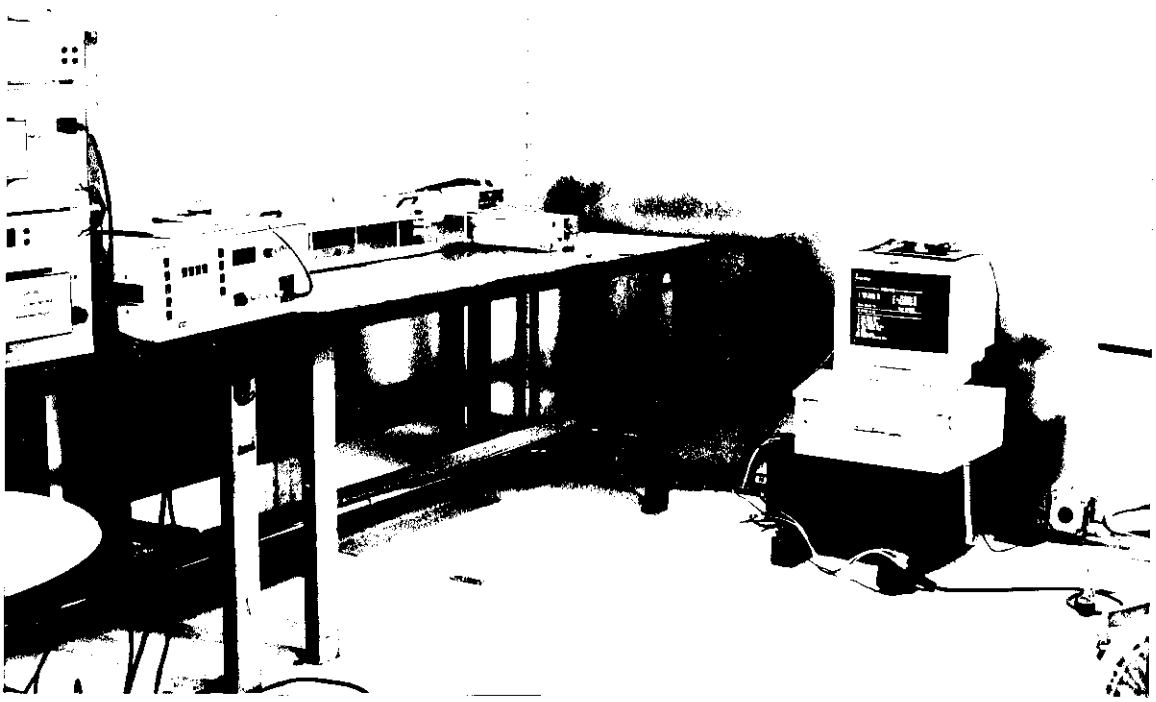


Configuration Photographs



Configuration Photographs





DASH, STRAUS & GOODHUE, INC.

Terms and Conditions

Article 1 - Services, LABORATORY will:

.1 Act for CLIENT in a professional manner, using the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.

.2 Provide only those services that lie within the technical and professional areas of expertise of LABORATORY and which LABORATORY is adequately staffed and equipped to perform.

.3 Perform all technical services in substantial accordance with the generally accepted laboratory testing principles and practices.

.4 Promptly submit formal reports of technical services performed indicating, where applicable, compliance with specification or other contract documents. Such reports shall be complete and factual, citing where appropriate the technical services performed, methods employed, and values obtained.

.5 Employ instrumentation which has been calibrated within a period not exceeding twelve (12) months from the time of use by devices of accuracy traceable to the National Institute of Standards and Technology of the United States Department of Commerce.

.6 Consider all reports to be the confidential property of client, and distribute reports only to those persons, organizations or agencies designated by CLIENT or his authorized representative.

.7 Retain all pertinent records relating to the services performed for a period of three (3) years following submission of the report or the suspension of manufacturing of product subject to follow-up services, whichever is later, during which period the records will be made available to CLIENT upon reasonable request.

Article 2 - Client's Responsibilities, CLIENT or his authorized representative will:

2.1 Provide LABORATORY with all plans, schematics, specifications, addenda, change orders, drawings and other information for the proper performance of technical services.

2.2 Designate a person to act as CLIENT's representative with respect to LABORATORY's services to be performed under this Agreement; such person or firm to have complete authority to transmit instructions, receive information and data, interpret and define CLIENT's policies and decisions with respect to the project and to order, at CLIENT's expense, such technical services as may be required.

2.3 Designate a person who is authorized to receive copies of LABORATORY's test reports.

2.4 To undertake the following:

(a) Secure and deliver to LABORATORY, without cost to LABORATORY, preliminary representative samples of that equipment proposed to require technical analysis, together with any relevant data.

(b) Furnish such labor and equipment needed by LABORATORY to handle samples at the LABORATORY and to facilitate the specified technical analysis.

Article 3 - General Conditions

3.1 LABORATORY, by the performance of services covered hereunder, does not in any way assume any of those duties or responsibilities customarily vested in the CLIENT's employees, or any other party, agency or authority.

3.2 LABORATORY shall not be responsible for acts or omissions of any other party or parties involved in the design, manufacture or maintenance of the equipment or the failure of any employee, contractor or subcontractor to undertake any aspect of equipment's design, manufacture or maintenance.

3.3 LABORATORY is not authorized to revoke, alter, relax, enlarge or release any requirement of the equipment's design, manufacture or maintenance unless specifically authorized by CLIENT or his authorized representative.

3.4 This Agreement may be terminated by either party on ten (10) days written notice or by mutual agreement. If this Agreement is terminated by either party, LABORATORY shall be paid in full for all services performed through the termination date, and the CLIENT shall be provided with a complete report of the results of technical analysis conducted prior to termination.

3.5 Neither CLIENT nor LABORATORY may delegate, assign, sublet or transfer his duties or interest in this Agreement without the written consent of the other party.

3.6 ***The only warranty made by LABORATORY in connection with its service performed hereunder is that it will use that degree of care and skill as set forth in Article 1.1 and 1.3 above. No other warranty, expressed or implied, is made or intended for services provided hereunder.***

3.7 Where the LABORATORY indicates that additional testing is advisable to obtain more valid or useful data, and where such testing has not been authorized in writing, CLIENT agrees to view such test reports as inconclusive and preliminary.

3.8 The LABORATORY shall supply technical service and prepare a report based solely on the sample submitted to the LABORATORY by the CLIENT. The CLIENT understands that application of the data to other devices is highly speculative and should be applied with extreme caution.

3.9 The LABORATORY agrees to exercise ordinary care in receiving, preserving and shipping (F.O.B. Boxborough, Mass.) any sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise or are alleged to arise from loss, damage or destruction of the samples due to the act of examination, modification or testing, or technical analysis, or circumstances beyond LABORATORY's control.

3.10 The LABORATORY will hold samples for thirty (30) days after tests are completed, or until the CLIENT's outstanding debts to the LABORATORY are satisfied, whichever is later.

3.11 The client recognizes that samples of products subject to LABORATORY's review and test procedures may be damaged or destroyed.

3.12 The CLIENT recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.

3.13 It is agreed between LABORATORY and CLIENT that no distribution of any test, reports or analysis shall be made to any third party without the prior written consent of both parties. The content of all reports, analysis and tests is strictly confidential and shall not be released to any third party without the written consent of the other party.

3.14 The CLIENT acknowledges that all employees of LABORATORY operate under employment contracts with the LABORATORY, and CLIENT agrees not to solicit employment of such employees, or solicit information related to other clients from said employees.

Article 4 - Follow-Up Services (for listed products only)

4.1 If the product is found to be in compliance with the review and test requirements, it is agreed that CLIENT will abide by the Follow-Up Service Procedure.

4.2 It is understood and agreed by the CLIENT that the LABORATORY name or listing mark will not be applied or utilized until authorized representatives of LABORATORY have concluded the procedure set forth in Article 4.1.

4.3 All costs associated with the Follow-Up Service Procedure will be the responsibility of CLIENT. CLIENT's failure to pay these charges will result in the revocation of authorization to use the LABORATORY listing mark.

Article 5 - Insurance

5.1 LABORATORY shall secure and maintain throughout the full period of this Agreement sufficient insurance to protect it adequately from claims under applicable Workmen's Compensation Acts and from claims for bodily injury, death or property damage as may arise from the performance of services under this Agreement.

5.2 The CLIENT hereby warrants that it has sufficient insurance to protect its employees adequately under applicable Workmen's Compensation Acts and for bodily injury, death or property damage as may arise from the acts of its employees pursuant to the Agreement.

5.3 No insurance, of whatever kind or type, which may be carried by LABORATORY is to be considered as in any way limiting any other party's responsibility for damages resulting from their operations or for furnishing work and materials related to the project.

Article 6 - Payment

6.1 CLIENT will pay LABORATORY for services and expenses. LABORATORY's invoices will be presented at the completion of its work or monthly and will be paid within thirty (30) days of receipt by CLIENT or his authorized representative.

6.2 LABORATORY shall be paid in full as described in Article 6.1 and, in addition, shall be paid in full for any services authorized orally or in writing by an employee or agent of the CLIENT pursuant to Article 2.2.

Article 7 - Extent of Agreement

The Agreement, including these Terms and Conditions and the Schedules attached hereto, represent the entire agreement between CLIENT and LABORATORY and supersedes all prior negotiations, representations or agreements, written or oral. The Agreement may be amended only in accordance with this Agreement or by written instrument signed by CLIENT and LABORATORY.

Article 8 - Collection

8.1 CLIENT shall pay LABORATORY interest in the amount of one and one half percent (1.5%) per month on amounts invoiced which are overdue. Invoices which are overdue are defined as those which remain unpaid more than thirty (30) days after presentation.

8.2 CLIENT agrees to pay LABORATORY all amounts incurred by LABORATORY in collecting on invoices which are overdue. Such amounts shall include, but shall not be limited to, reasonable attorneys' fees and court costs.