

# **Apple Computer Inc.**

**EDVT**

(Engineering Design Verification Test)

## **ETHERNET ADAPTER CARD**

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## **1.0 OBJECTIVES :**

The objective of the EDVT (Engineering Design Verification Tests) is to;

- 1) Identify any design weaknesses of the unit
- 2) Verify the Specification for the unit
- 3) Determine the margin to Specification.
- 4) Establish base line performance data

## **2.0 SCOPE:**

**2.1** This test plan outlines the methods to be used to meet the above objectives.

**2.2** The following documents will be required:

- 1) Engineering Specifications
- 2) OEM Specification (Manuals)
- 3) Software Documentation
- 4) Test Equipment Manuals.

**2.3** The following list consists of the extraordinary items of test equipment that will be required. It does not include such items as oscilloscopes, meters .... etc.

- 1). 5 COMPUTERS Configured to exercise the ETHERNET CARD.  
(with cables, terminations, etc.)
- 2) Environmental chamber.
- 3) Shock table.
- 4) Vibration table.

### 3.0 GENERAL TEST DESCRIPTION

- 1) Initial Functional.
- 2) Voltage Margins.
- 3) Environmental.
- 4) Corrosive Atmosphere Testing
- 5) Shock/Vibration
- 6) Solderability Testing
- 7) Power.
- 8) Electro Static Discharge.
- 9) Electromagnetic Compatibility
- 10) Life Test

Section 8.0 gives a detailed description of the above tests.

#### 4.0 TEST DURATION:

The following is an estimate of the time required to complete each series of tests. The numbers are based on normal conditions and continuous operation.

1) Functional	2 days
2) Voltage Margins	3 days
3) Environmental	6 days
4) Corrosive Atmosphere Testing	8 days
5) Shock/Vibration Non-Operating	5 days
6) Solderability Testing	5 days
7) Power	5 days
8) Electro Static Discharge	1 day
9) Electromagnetic Compatibility	5 days min
10) Life	Continuous (6wk min)

## 5.0 SAMPLE SIZE

Functional test (total sample)	24 units
Voltage Margins	3 units
Environmental	3 units
Corrosive Atmosphere Testing	3 units
Shock/Vibration	3 units
Solderability Testing	2 units
Power	3 units
Electro Static Discharge	3 units
Electromagnetic Compatibility	3 units
Life Test	24 units

Note: There is some duplication of the same units in more than one section to allow parallel testing.

## **6.0 DATA COLLECTION:**

**6.1** A summary log shall be kept on each individual unit. Each entry shall be dated and signed by the person actually making the entry. The data shall include the following;

- 1) unit S/N, Date, and the time of the test.
- 2) Date, Time, and the elapsed time to a failure.
- 3) Summary of conditions at the time of a failure (temp, power, or any other instrumentation).
- 4) Test Failure mode and symptoms (see section 7.0).
- 5) Adjustments and/or parts exchanges made.
- 6) Date and time of re-entry to EDVT.

**6.2** Each device will be identified by number and a test status log attached to it.

**6.3** Engineering shall be responsible for the logging of a complete analysis of any failure.

**6.4** Engineering shall be responsible for any corrective action reporting and follow-up.

## 7.0 FAILURE DEFINITIONS:

All units under EDVT will be tested to their specification, and non-conformance will be considered a failure. Each failure must undergo Failure Analysis and be completely documented. The different failure modes are listed below.

- 1) Failure to meet specification due to unit design, assembly or component failure is cause for rejection and corrective action is required.
- 2) Failures that can be corrected/prevented by design changes may not be subject to rejection but corrective action is required.
- 3) Failures caused by an error in assembly may not be cause for rejection but corrective action is required.
- 4) Secondary failures caused by the primary failure, defective replacement parts, or by incorrect rework procedures do not require corrective action.
- 5) Externally induced failures caused by adverse operating conditions or operating the unit in an out-of-spec condition do not require corrective action.
- 6) Software failures that are not unit caused are non-relevant, however internal corrective action may be required.
- 7) Unexplained failures that fix themselves and are not repeatable do not require corrective action. Special attention should be placed on these type of failures to observe any re-occurrences.

## 8.0 DETAILED TEST DESCRIPTIONS:

Each of the tests described below are designed to meet the objectives as listed in Section 1.0. Each tested unit shall meet or exceed the specification.

### 8.1 INITIAL FUNCTIONAL TESTS:

The unit shall be mounted in its normal mounting configuration. The unit shall perform software controlled operations that exercise all of the boards functions. The cards shall perform this test without error.

### 8.2 VOLTAGE MARGINS:

This test is designed to test the operation of the unit over the range of voltage extremes. With proper instrumentation it may be combined to meet the temperature and power section requirements as well. The humidity shall be controlled only to the extent of not allowing any condensation.

**NOTE:** The above test will only be performed when and if the host computer unit is tested for voltage margins. The test parameters for the card shall not exceed the specifications of the host computer.

**8.2.1** As an alternate test the practical voltage margin shall be tested by performing the functional test on the ethernet card with all slots of the host computer filled with cards that draw typical to max current.

### 8.3 ENVIRONMENTAL:

This section describes a thermal test cycle designed to verify the units ability to meet the operational performance specifications at the extremes of temperature.

Note: The extremes of humidity will not be tested in this series, however, it should be closely controlled to eliminate the possibility of condensation during any changes in environment. The requirements of this section may be satisfied within the voltage margin series as described in section 8.3. If the voltage/temperature matrix as described in that section is completed, the remainder of this section may be skipped.

### **8.3.1 ENVIRONMENT (NON-OPERATING)**

The units are to be first tested functionally. Then they should be placed in the oven at 70° C, 80% humidity (non-condensing), for 72 hours. They are to be then retested for faultfree operation and visually examined for defects. Maximum wet bulb temperature to be 26.7° C

This test is to be repeated at the other extreme conditions of temperature and humidity specified, i.e. -40° C and 20% RH.

### **8.3.2 TEMPERATURE (OPERATING)**

Temperatures at the PCB electronics will be monitored.

1) This test will be conducted by installing the Ethernet Card test sample in the host computer and placing the system in the environmental test chamber. The test system will be configured with test software that will continually exercise the card and record any errors.

2) The environmental test chamber will be configured to cycle the temperature from 10 deg C to 40 deg C and back to 10 deg C with a one hour soak at each 10 deg C increment. This cycling will continue for 72 hours.

Note: Overstress thermal tests may be run at the completion of the EDVT to determine the units thermal margin to spec. They should not be run at this time due to the high potential of permanent damage to the unit

## **8.4 CORROSIVE ATMOSPHERE TESTING**

1) HYDROGEN SULFIDE TESTING: This test is conducted by placing test samples in a special test chamber and exposing them to an atmosphere of hydrogen sulfide gas for 200 hours at a concentration of 25 PPM with an ambient temperature of 25 to 28 deg C @ 90% +/- 5% RH noncondensing. After 200 hours of exposure, the humidity is reduced to 50% RH for an additional 50 hours.

After 100 hours of exposure, the samples are visually inspected every 24 hours for visual signs of corrosion or degradation.

2) OZONE TESTING: This test is conducted by placing test samples in a special test chamber and exposing them to an atmosphere of ozone gas for 200 hours at a concentration of 2.5 PMM with an ambient temperature of 25 to 28 deg C @ 90% +/- 5% RH non-condensing. After 200 hours of exposure the humidity is reduced to 50% +/- 5% RH for an additional 50 hours.

After 100 hours of exposure, the samples are visually inspected every 24 hours for visual signs of corrosion or degradation.

#### **8.4 SHOCK AND VIBRATION**

This series of tests will be conducted in accordance with the procedures outlined in specifications #062-0086 and #062-0087.

#### **8.5 SOLDERABILITY**

Using a band saw with a suitable blade and cutting speed, the test sample is segmented and a PCB/solder joint sample is obtained with the PCB intact. These samples are potted within a suitable casting resin and then cross-sectioned using a low-speed jewelers saw. Polishing and microscopic inspection is completed per techniques outlined in the Interconnections Packaging Assembly - Joining Handbook (IPC) # 8.1.4. Procedures 1.0 through 7.0.

#### **8.6 POWER:**

The DC power requirements of the card will be monitored at its input to determine concurrence with the Technical Specification of the card.

#### **8.7 ELECTROSTATIC DISCHARGE**

Test the ability of the unit to withstand a high voltage electrical surge such as that obtained in extremely low humidities due to Static Discharge as specified in spec#062-0302-A.

#### **8.8 ELECTROMAGNETIC COMPATIBILITY**

These tests will be conducted as outlined in spec. #062-0088-B

#### **8.9 SHIPPING CONTAINER TESTS**

Perform mechanical shock and vibration tests of the unit in its factory shipping container to insure that the unit can tolerate shipment by Air or Surface carriers.

#### **8.10 SAFETY TESTS**

These tests are to be performed as per Apple spec # 062-0093-C.

#### **8.11 LIFE TESTING**

The purpose of this testing is to establish an MTBF of 15,000 hours.