XYZ Corporation

Power Supply Test Outline

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Revision History:

Version	Date	Comments	Contributors
1.0		Initial Release, for reference only	

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1.0 Introduction

Overview

This test report outline covers the power supply specification verification test requirements and methods for the ~product, hereafter known as the Equipment Under Test (EUT), to the requirements as stated in the references.

Qualifications

The EUT supplied by ~manufacturer was representative of product produced in their volume manufacturing process.

Statement Concerning Measurement Uncertainty

The data and results referenced in this document are true and accurate. Where possible, the measurement uncertainty has been calculated or attained from the testing laboratory and included in this report.

Client

XYZ Corporation

Company Restricted Information

2.0 Power Supply Test Summary

The following are functions typically tested when qualifying a switching power supply.

Functional Tests

2.1 Hold on adjust/set output voltage:

The first test step is to adjust the output voltage to within a specified range. This is done first to ensure further specifications are met. Normally the AC line voltage is set to nominal and the DC output current is set to a nominal or maximum load current in the HOLD-ON adjust procedure. The electronic load measures the power supply's output voltage, and adjusts the potentiometer until the voltage reading is within the required limit.

2.2 Load Regulation & Cross-Regulation:

Load regulation is a static performance measurement, which defines the ability of a power supply to remain within specified output limits for a predetermined load change. For multiple output CV power supplies, cross load effect is determined. This is an extension of the load effect test and determines the ability of all outputs of a CV power supply to remain within their specified voltage rating for a load current change on one output. Conversely, the ability of one output to withstand the effect of changes on all other outputs can be specified.

$$\% \text{ Load Regulation} = V_{out(max)} - V_{out(min)} / V_{out(normal)} \times 100$$

2.3 Line Regulation:

Line regulation measures the change in DC output voltage or current resulting from a change in AC input voltage over a specified range. Normally specified as the + or – change from the nominal DC output voltage.

$$\% \text{ Line Regulation} = V_{out(max)} - V_{out(min)} / V_{out(normal)} \times 100$$

2.4 Load Transient Recovery Time:

Constant Voltage load transient recovery time is a dynamic measurement of the time required for the output voltage of a CV power supply to settle within a predefined settling band following a load current induced transient. The response is typically measured in microseconds or milliseconds. This test can reveal critical manufacturing flaws that can cause instability, such as defective output filter capacitor or loose capacitor connections. Loads are generally dynamic, therefore dynamic loads can emulate the worst case real world load for testing a power supply, because the supply's feedback loop has finite bandwidth which limits the ability of the supply to respond to a change in load current.

2.5 Periodic and Random Deviation (Output Ripple and noise):

This test measures the periodic and random deviation of the DC output voltage from its average value. PARD is measured in either rms or peak-to-peak values, over a specified bandwidth, usually 20Hz to 20Mhz. Pard measurements are made at the lowest and highest specified value of AC input to the power supply. Any deviation below 20Hz is included in the specification called output drift.

2.6 Efficiency and Power Factor:

To measure the efficiency of the power supply which is the ratio of its total output power to its total input power. This test serves as a good overall correct operation of supply under test. If the measured efficiency is outside the specified range for the topology of the power supply, it is probable that a design flaw or a manufacturing problem exists. The Power Factor (PF) which is the ratio of true input power to apparent power in AC circuits.

$$\text{True Power} = V_{rms} \times I_{rms} \times \text{Power Factor}$$

2.7 In-Rush Current:

To measure the peak instantaneous input current drawn by a power supply at turn-on. In-rush current specifications are normally given with power supplies. The In-rush current will be measured at minimum, nominal and maximum specified AC input.

2.8 Start-Up Delay:

The start up delay is the amount of time between the application of AC input and the time at which the DC outputs are within their regulation specification. This time period is critical for proper sequencing of output voltage at turn-on. Undesirable events can occur at turn-on, causing current spikes, which can destroy the switching transistors and voltage latch-up.

2.9 Line Voltage Dropout/ Hold-up Time:

The Power supply should recover and operate within regulated specification after a line voltage dropout. The hold-up time test is a measure of the time during which a power supply's output voltage remains within specification following the loss of input power at a specified load setting.

2.10 Voltage and Frequency Ranges:

To determine that the power supply operates to the specified limits at each of the voltage and frequencies listed in the table below.

Volts (VAC)	90		100		120		132		180		220		240		264	
Frequency (Hz)	47	63	47	63	47	63	47	63	47	63	47	63	47	63	47	63

2.11 Brownout & Recovery:

To determine the brownout and recovery limits of the power supply.

Test Procedure:

- Brownout Start Voltage(s): 85V/47Hz, 120V/60Hz, & 264V/ 440Hz
- Brownout Period: 10-minute ramp down to 0V
- Recovery Start Voltage: 0V
- Test Recovery Period: 10-minute ramp up to 85V/47Hz, 20V/60Hz & 264V/ 440 Hz

2.12 Surge

Objective: To validate the performance of the product when exposed to power line surge.

Test Procedure:

- Start Voltage(s): 132V & 240V
- Surge Voltage(s): 147V & 264V
- Surge Period: 500ms

Number of Tests: Minimum of 5 each power supply

3.0 Protection Tests: Over voltage protection (OVP), Over current protection (OCP), Short circuit protection

3.1 Over voltage Protection/Shutdown:

The over voltage protection feature is very important for sensitive loads such as CPU's, memory, etc. The over voltage protection test demonstrates the ability of the power supply to crowbar or clamp the output when its voltage exceeds a preset level.

3.2 Over Current Protection or Current Limit Characterization:

Current limit measurements demonstrate the degree to which a constant voltage power supply limits its maximum output current to a preset value. There are three types of current limiting design implementations. The test will increase load current to a predetermined current until the output voltage drops to a programmed threshold limit.

3.3 Short Circuit Protection:

This test measures the steady-state current of the power supply under test after the output terminals have been shorted which demonstrates the ability of the power supply to correctly respond to any short circuit conditions.

4.0 Additional Tests

4.1 Drift: long term output monitoring

This test involves the measurement of the periodic and random deviation of a power supply's output current or voltage (typically over 8hrs.), typically covering a bandwidth from DC to 20Hz.

4.2 Programming Response Time:

This test measure the maximum time required for the programmed output voltage or current of a power supply to change from a specified initial value to a value within a specified tolerance band of a newly programmed value, following the onset of a step change in an analog programming signal, or the gating of a digital signal.

5.0 Complex Switching Power Supply Evaluation Tests

Requires Agilent 4395A Network/spectrum/impedance analyzer

- Loop Gain Measurement – the analyzer can evaluate the stability of the control system by measuring two parameters – Phase margin and Gain margin. Stable systems are typically at a Gain Margin > 6dB, and Phase margin > 30 deg.
- Output Impedance Measurement – The output impedance of a power supply is the frequency response of the output voltage to a small signal current source perturbation at the power supply output. Typically the output impedance should be small to obtain good performance.

- Component Measurement – The impedance analyzer is useful in measuring the impedance characteristics of the individual components in the power supply, i.e. capacitors, inductors, transformer, etc.
- EMC Measurement – The power supply must meet all EMC requirements.

Test Equipment:

- Extech 380801 Power analyzer
- California Instruments 801RP Programmable AC Power Supply
- Agilent AT-N3300A DC electronic load mainframe
- Agilent AT-N3303A 250W DC electronic load module (x2)
- LeCroy 9354AL Oscilloscope
- LeCroy AP015 Current Probe or
- Agilent 6811B Power source/power analyzer
- Optional - Agilent 4395A Network/spectrum/impedance analyzer
- Precision current shunt