



December 18, 2013

Hewlett Packard Company
Mr. Paul Emerson
18110 SE 34th St.
Vancouver, WA 98683-9497

Dear Mr. Emerson:

Thank you for choosing UL Environment and its ISO 17025 accredited testing laboratories for your analytical needs. Attached is the final report, which presents the test protocols and resulting data.

We appreciate this opportunity to assist you. If you have any questions or wish to discuss your results, please feel free to contact us at (888) 485-4733.

Sincerely,

A handwritten signature in black ink that reads "W. Elliott Horner".

W. Elliott Horner, PhD, LEED® AP
Lead Scientist

Attachment: Report: 17870-01



CLEAN ROOM EVALUATION

for

HEWLETT-PACKARD

Category: Office Equipment

Test Product Description: HP OfficeJet Ent Color MFP X585c

EXECUTIVE SUMMARY

Project Description

UL Environment is pleased to present the results of its clean room evaluation for the “HP OfficeJet Ent Color MFP X585c”. Testing of the unit was conducted in a 32 m³ dynamic environmental chamber operated according to the guidelines of ASTM D 6670. Purified air was supplied to the chamber at standard conditions of 23°C, 50% relative humidity, and 1 air change per hour. The printer was placed in the center of the chamber on a stand and particle samples were collected at breathing height in close proximity to the printer. The cleanliness of the chamber environment was classified according to ISO 14644-1:1999, “Cleanrooms and associated controlled environments - Classification of air cleanliness” prior to testing, with product powered on but not printing (ready phase), and during and after a 10 page print (printing phase).

Although this standard does not apply to equipment or supplies for use within clean rooms, it does allow for establishment of clean room status of a particular environment with a product in use.

Methodology

The chamber was purged and monitored for particles to establish the background level prior to loading of the unit. Particle concentrations (number of particles/m³) were determined for particles in the size ranges of 0.1 µm, 0.2 µm, 0.3 µm, and 0.5 µm in diameter.

Particle monitoring utilized a MetOne A2100 Laser Particle Counter. Thirty particle measurements were made at 2 minute intervals in the empty chamber. The particle concentrations in the empty chamber are summarized in Table 1.

Table 1. Particle Counts and Cleanroom Classification for Empty Chamber

Description	Particle Size			
	0.1 µm	0.2 µm	0.3 µm	0.5 µm
Particle Count (#/ m ³) - Avg	2,532	1,167	630	198
ISO Class - Avg	3.4	3.7	3.8	3.8
Particle Count (#/ m ³) - Max	3,320	1,642	1,024	530
ISO Class - Max	3.5	3.8	4.0	4.2

According to ISO 14644-1:1999, this established the chamber as Class 3.8 based on the average particle concentrations and Class 4.2 based on the maximum particle concentrations.

The unit was placed in the chamber with dynamic operating conditions as presented in Table 1. Following a 24 hour equilibration period with the unit in the chamber, 30 particle measurements were made at 2 minute intervals while the printer was powered up, but prior to printing (Ready Phase). Following the powered-up background, a single 10 page print job was sent to the printer using the Blue Angel color X pattern. Particle samples were collected during printing and after printing for a total of 122 particle measurements at 2 minute intervals (Printing Phase).

Results

Data for the Ready Phase sample are summarized in Table 2.

Table 2. Particle Counts and Cleanroom Classification for Ready Phase

Description	Particle Size			
	0.1 µm	0.2 µm	0.3 µm	0.5 µm
Particle Count (#/ m ³) - Avg	2,298	1,154	630	154
ISO Class - Avg	3.4	3.7	3.8	3.6
Particle Count (#/ m ³) - Max	2,949	1,377	848	300
ISO Class - Max	3.5	3.8	3.9	3.9

According to ISO 14644-1:1999, this established the chamber as Class 3.8 based on the average particle concentrations and Class 3.9 based on the maximum particle concentrations.

Data for the Printing Phase sample are summarized in Table 3.

Table 3. Particle Counts and Cleanroom Classification for Printing Phase

Description	Particle Size			
	0.1 µm	0.2 µm	0.3 µm	0.5 µm
Particle Count (#/ m ³) - Avg	12,669	5,663	2,175	619
ISO Class - Avg	4.1	4.4	4.3	4.2
Particle Count (#/ m ³) - Max	18,770	8,034	2,931	1,112
ISO Class - Max	4.3	4.5	4.5	4.5

According to ISO 14644-1:1999, this established the chamber as Class 4.4 based on the average particle concentrations and Class 4.5 based on the maximum particle concentration.

Based on average particle count measurements the product is qualified for use in clean rooms established as Class 4.5 or below.

ISO Class 4.5; *Operational Occupancy State*

Considered Sizes: 0.1 µm (31,600 particles/m³ maximum average allowed)
 0.2 µm (7,480 particles/m³ maximum average allowed)
 0.3 µm (3,220 particles/m³ maximum average allowed)
 0.5 µm (1,110 particles/m³ maximum average allowed)

TABLE 1

ENVIRONMENTAL CHAMBER TEST PARAMETERS FOR CLEAN ROOM TESTING

PREPARED FOR: HEWLETT-PACKARD

Product Description:	OFFICE EQUIPMENT; HP OfficeJet Ent Color MFP X585c
Sample Identification:	17870-010AA
Product Loading:	One printer
Test Conditions:	1.00 ± 0.05 ACH 50% RH ± 5% RH 23°C ± 2°C
Test Period:	10/03/13
Pollutant Emissions Evaluated:	Particles (0.1 µm, 0.2 µm, 0.3 µm, and 0.5 µm in diameter)

Environmental chamber test following ASTM D 6670 in a 28.5 ± 3.0 m³ chamber.

PHOTOGRAPH

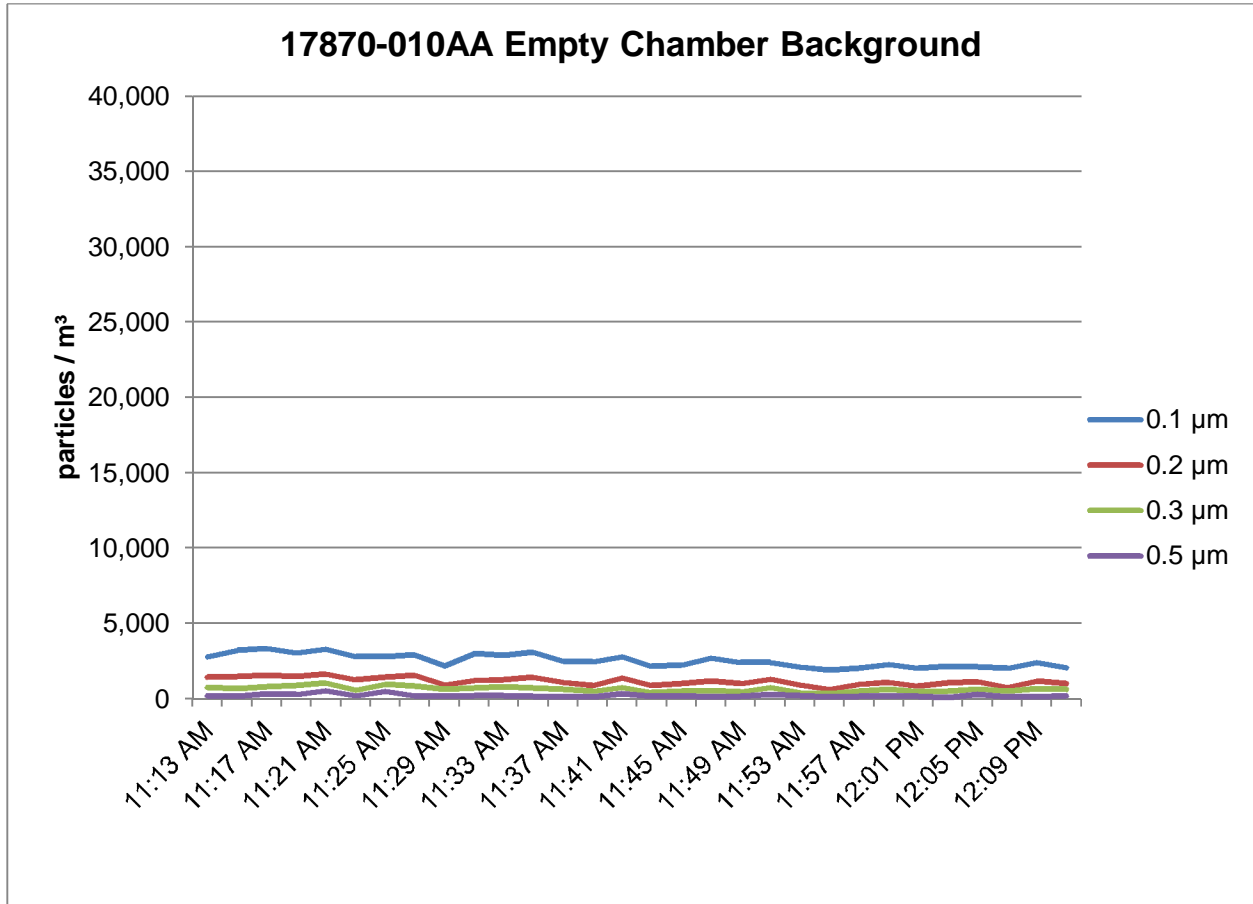
**PREPARED FOR: HEWLETT-PACKARD
PRODUCT: 17870-010AA; HP OFFICEJET ENT COLOR MFP X585C**



PARTICLE COUNTS

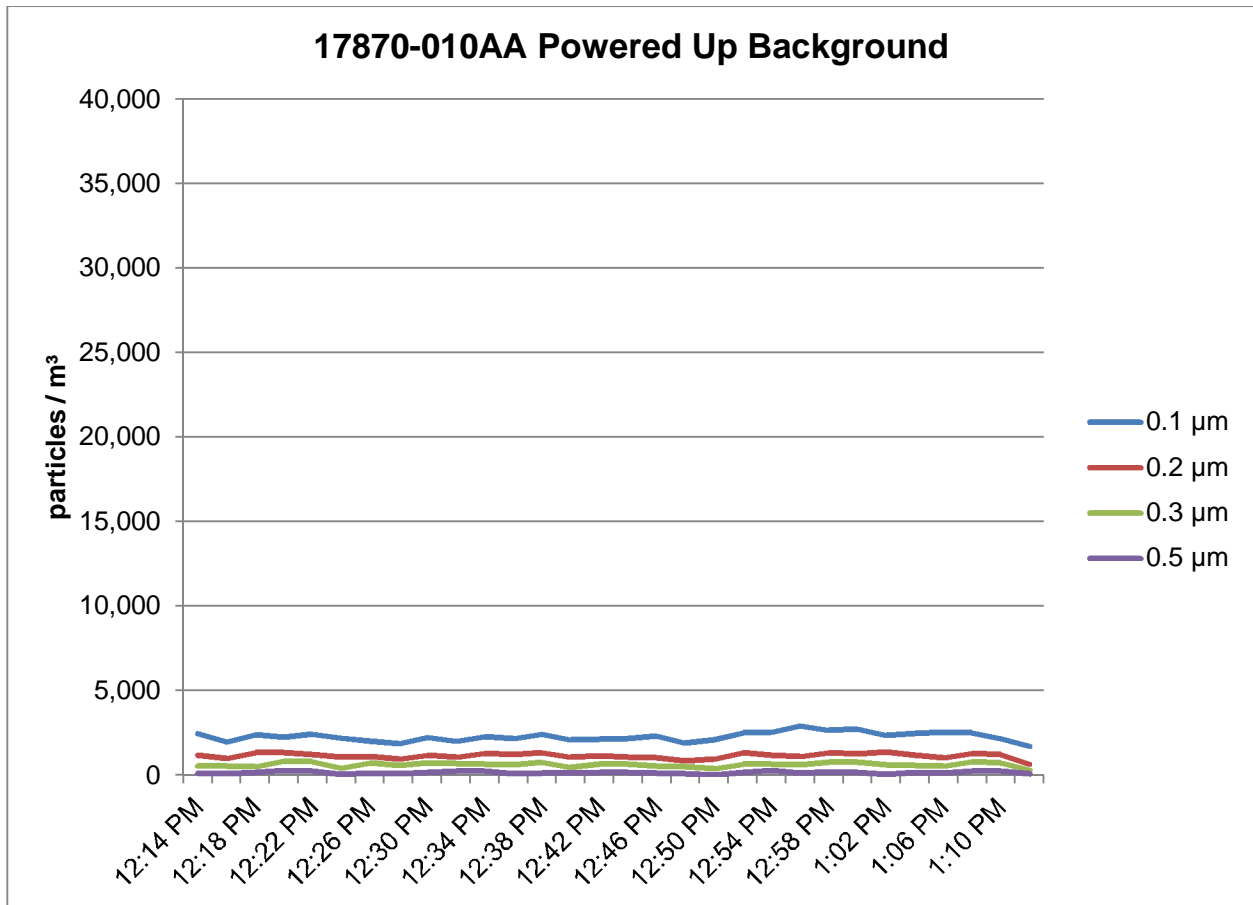
PREPARED FOR: HEWLETT-PACKARD PRODUCT: 17870-010AA; HP OFFICEJET ENT COLOR MFP X585C

Particle count results for the empty environmental chamber prior to loading the printer (0.1 μm , 0.2 μm , 0.3 μm and 0.5 μm diameter particle size classes – note scale height 10x relative to test)



PREPARED FOR: HEWLETT-PACKARD
PRODUCT: 17870-010AA; HP OFFICEJET ENT COLOR MFP X585C

Particle count results for the environmental chamber after loading the printer, with power on, but before printing (0.1 μm , 0.2 μm , 0.3 μm and 0.5 μm diameter particle size classes – note scale height 10x relative to test)



PREPARED FOR: HEWLETT-PACKARD
PRODUCT: 17870-010AA; HP OFFICEJET ENT COLOR MFP X585C

Particle count results for the environmental chamber during and after printing (0.1 μm , 0.2 μm , 0.3 μm and 0.5 μm diameter particle size classes)

