

## Comparative Performance Testing

SEPTEMBER 2015

### Canon OEM Consumables versus China Eternal Compatible Consumables

#### Test Objective

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Buyers Laboratory LLC (BLI) conducted a comparative evaluation of the image quality, reliability and toner yield performance of original Canon consumables for the Canon imageRUNNER 2530 and third-party “compatible” drum and toner alternatives from China Eternal. Each test phase (as listed below) was run on the Canon iR 2530 for 140,000 impressions (the rated life of the drum) over a 20-working-day period. At the end of each test phase, a full PM call was carried out on the device.

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|---------------|---|
| Test Phase 1: | Canon drum and Canon toner cartridges                 |
| Test Phase 2: | China Eternal drum and China Eternal toner cartridges |
| Test Phase 3: | Canon drum and China Eternal toner cartridges         |

#### EXECUTIVE SUMMARY

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In BLI’s rigorous lab tests, Canon brand toner cartridges were evaluated for toner yield, reliability and image quality when run on a Canon imageRUNNER 2530 laser device in conjunction with a Canon drum. Third-party compatible toner cartridges from China Eternal were also tested—in one phase of the test with a Canon drum and in another phase of the test with a China Eternal drum.

The Canon genuine toner delivered a higher average yield with a 37.7% and 28.8% advantage versus the China Eternal toner tested in conjunction with its own brand drum and with a Canon

drum, respectively. This equated to an additional 5,498 pages per black cartridge, on average (when compared with the China Eternal toner/China Eternal drum test). In both of its tests, the China Eternal toner delivered page yields below the advertised cartridge yield of 14,600, while the Canon toner exceeded it by 37.5%. The China Eternal toner also produced a higher level of toner waste overall than the Canon toner, particularly when coupled with its native drum.

Neither the device, nor its components experienced any reliability issues or part failures during the entire test period. Similarly, no packaging or toner leakage problems were detected with Canon cartridges. While there were no packaging issues with the third-party brand, there was one premature cartridge failure with the China Eternal toner. This was due to the toner being heavily compacted in the cartridge—a particular characteristic of this third-party brand observed by BLI—so much so that twice during the test, the device displayed a message prompting the user to replace toner despite a new cartridge having just been inserted. Therefore, its cartridges required a much more vigorous shake prior to installation, which led to toner spilling from one cartridge while it was being handled.

Image quality advantages were mixed, but the Canon toner had the edge overall, with superior half-tone fills and less toner overspray exhibited in its output. The output produced by the China Eternal toner clearly had higher optical densities across the board than output produced by the Canon toner, but BLI observed some quality issues with China Eternal toner's solid reproduction, with banding and faded areas appearing from the start of the test up to the 50,000-impression mark. Notably, it also suffered from poor toner fusing—when the printed pages were handled, toner could be removed from the paper by rubbing or brushing it. Printed output with the Canon toner did not suffer this issue and toner fusing was rated good.

Overall, the Canon consumables enjoyed a clear advantage over compatible drum and cartridge consumables from China Eternal. In addition to delivering a fault-free reliability performance, its toner waste over the course of the test was significantly (64.5%) lower than that of the China Eternal toner. When the third-party compatible toner was used in conjunction with the Canon drum, the Canon drum did have some positive effect with less toner waste and higher average page yields delivered versus the China Eternal drum/China Eternal toner combination.

### Reliability, Part Life and Toner Yield Testing

No service calls were required throughout the evaluation; the Canon imageRUNNER 2530 did not experience any reliability issues, nor did any of its components. After the completion of each test phase, the Canon device was restored to optimal operating condition, with the relevant drum (from Canon or China Eternal), fuser, waste bottle and developer all being replaced with new parts by a Canon authorised service technician.

The Canon toner delivered a fault-free performance across all tested cartridges, with no issues reported, and no toner leakage or chip communication errors. The China Eternal toner had no packaging issues, nor was there any toner leakage inside the device. However, toner spillage can easily occur when removing empty China Eternal cartridges from the device, unless users know the correct method for doing so. The user must push the cartridge back in order to seal the cartridge. If this procedure is not followed, toner can spill out upon removing the cartridge—which did occur once during BLI's test—but this is likely be avoided by users who are familiar with handling China Eternal cartridges.



Toner spillage can occur if the user does not push the China Eternal cartridge back in (for sealing) before removing it from the device.

Another drawback of the China Eternal cartridges is that they required a thorough shake (much more so than with the Canon cartridges) prior to installation. This became apparent to BLI as, on two separate occasions, the device requested new toner despite a new cartridge having just been inserted. BLI determined that this was because of toner being so heavily compacted in China Eternal cartridges. One consequence of the user having to shake the cartridge more vigorously in order to loosen the toner powder is that handling errors can potentially arise; on one such occasion in BLI's tests, the cartridge lid fell off, causing toner spillage and a premature failure.



China Eternal failed cartridge

### Toner Yield Summary

Achieving the 140,000-impression volume of output for the test only required seven Canon toner cartridges when used with the Canon drum on the iR2530, whilst due to the lower yield of the China Eternal toner, nine cartridges of the third-party toner were required when used with the Canon drum. Nine China Eternal cartridges were also required when used with its own brand drum; however, one of the cartridges suffered a premature failure.

In terms of overall average toner yield, the Canon toner had the clear advantage: when run with the Canon drum and the Canon toner, the imageRUNNER 2530 produced an average of 20,069 impressions—37.7% more than that of the China Eternal drum/China Eternal toner combination (14,571 average impressions) and 28.8% higher than that of the Canon drum/China Eternal toner combination (15,586 average impressions).

When compared with the manufacturer’s rated yield of 14,600 (based on 6% coverage of A4), the Canon toner’s average page yield exceeded it by 37.5%. The China Eternal toner’s average page yield was slightly (0.2%) lower than the advertised 14,600 yield when tested with a China Eternal drum. However, when the China Eternal compatible cartridges were combined with a Canon drum, a more favourable and positive result was achieved, with an average page yield 6.8% higher than the rated yield of 14,600 pages.

### Toner Yield Data Summary: Test Phase 1: Canon Drum/Canon Toner

	A	B	C	D	E	F	G	Average
Start weight	852.4	853.4	853.5	852.5	851.7	851.9	851.1	852.3
Empty weight	157.2	157.2	156.5	157.0	156.8	156.6	210.7	164.5
Net weight	695.2	696.2	697.0	695.5	694.9	695.3	640.4	687.7
Start meter	0	14,223	34,888	56,339	77,682	99,190	120,735	
End meter	14,223	34,888	56,339	77,682	99,190	120,735	140,486	
Total impressions	14,223	20,665	21,451	21,343	21,508	21,545	19,751	20,069
Impressions per gram	20.46	29.68	30.78	30.69	30.95	30.99	30.84	29.198

### Toner Yield Data Summary: Test Phase 2: China Eternal Drum/China Eternal Toner

	A	B	C	D *	E	F	G	H	I	Average
Start weight	819.0	820.3	816.9	820.6	819.9	851.9	822.0	814.9	820.6	822.9
Empty weight	253.7	224.9	240.7	805.4	222.8	156.6	218.8	215.7	212.2	283.4
Net weight	565.3	595.4	576.2	15.2	597.1	695.3	603.2	599.2	608.4	539.4
Start meter	140,486	152,236	169,046	185,109	185,879	201,986	219,614	236,792	253,990	
End meter	152,236	169,046	185,109	185,879	201,986	219,614	236,792	253,990	271,626	
Total impressions	11,750	16,810	16,063	770	16,107	17,628	17,178	17,198	17,636	14,571
Impressions per gram	20.79	28.23	27.88	50.66	26.98	25.35	28.48	28.70	28.99	29.56

\* Early life failure due to toner spillage after shaking and tapping cartridge on floor, which led to the lid falling off. This accounts for the high impressions per gram figure.

**Toner Yield Data Summary: Test Phase 3: Canon Drum/China Eternal Toner**

	A	B	C	D	E	F	G	H	I	Average
<b>Start weight</b>	817.5	844.2	814.9	822.1	818.5	816.9	815.0	816.1	816.5	820.1
<b>Empty weight</b>	211.5	198.6	197.9	195.6	204.2	260.7	260.6	206.9	366.3	233.5
<b>Net weight</b>	606	645.6	617	626.5	614.3	556.2	554.4	609.2	450.2	586.6
<b>Start meter</b>	420,021	432,678	450,006	466,785	484,148	501,101	516,357	531,496	548,050	
<b>End meter</b>	432,678	450,006	466,785	484,148	501,101	516,357	531,496	548,050	560,298	
<b>Total impressions</b>	12,657	17,328	16,779	17,363	16,953	15,256	15,139	16,554	12,248	15,586
<b>Impressions per gram</b>	20.89	26.84	27.19	27.71	27.60	27.43	27.31	27.17	27.21	26.5

\* Early life failure due to toner spillage after shaking and tapping cartridge on floor, which led to the lid falling off. This accounts for the high impressions per gram figure.

**Waste Toner Bottle Yield Data Summary**

Test Phase	Drum	Toner	Start weight (g)	End weight (g)	Net weight (g)
1	Canon	Canon	172.0	391.8	219.8
2	China Eternal	China Eternal	166.6	786.3	619.7
3	Canon	China Eternal	174.5	600.4	425.9

BLI analysts noted that for each test phase, the waste bottle was not completely full at the end of the 140,000-impression target, and so none of the waste bottles required replacing. However, there were some significant differences observed between tests involving Canon consumables and third-party China Eternal consumables, with the third-party brand generating far higher levels of waste toner. In fact, 181.9% more waste was generated by the China Eternal toner (in conjunction with its own brand drum) than that produced by the Canon toner/Canon drum (619.7 grams versus 219.8 grams).

**Image Quality Summary**

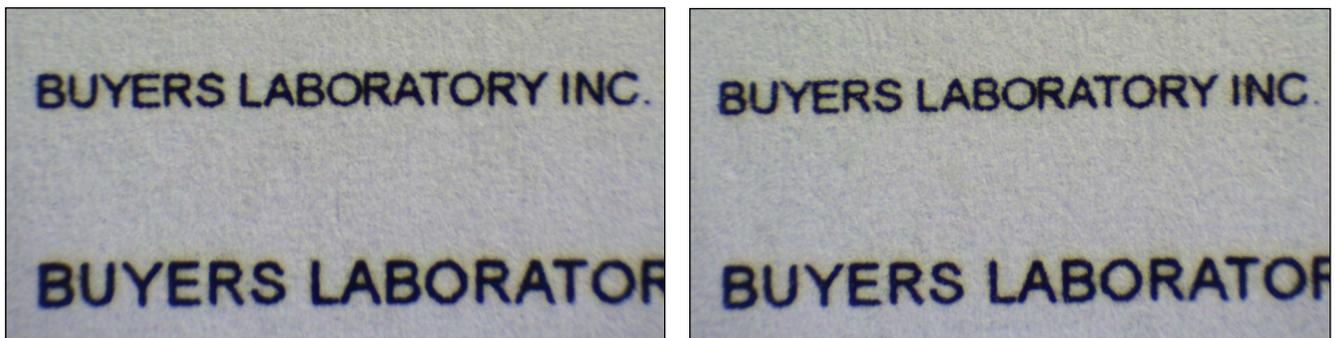
Advantage ✓	Canon Toner	China Eternal Toner
Text	=	=
Fine Lines	=	=
Halftone Range	=	=
Halftone Fill	✓	
Solid density	✓	

All image quality analysis was conducted on standard 80gsm media at 25,000-impression intervals throughout the test.

### Fine Line, Text and Halftone Reproduction

There was little to distinguish between the two toner brands when evaluating text and fine line reproduction quality; serif fonts were legible from the 4-pt. to 6-pt. level in output produced with the Canon toner, and down to the 6-pt.level with the China Eternal toner (in both of its tests), with some breakup evident in characters. Sans serif fonts showed clear character definition down to the smallest (3-pt.) level in the output produced using both of the toner brands.

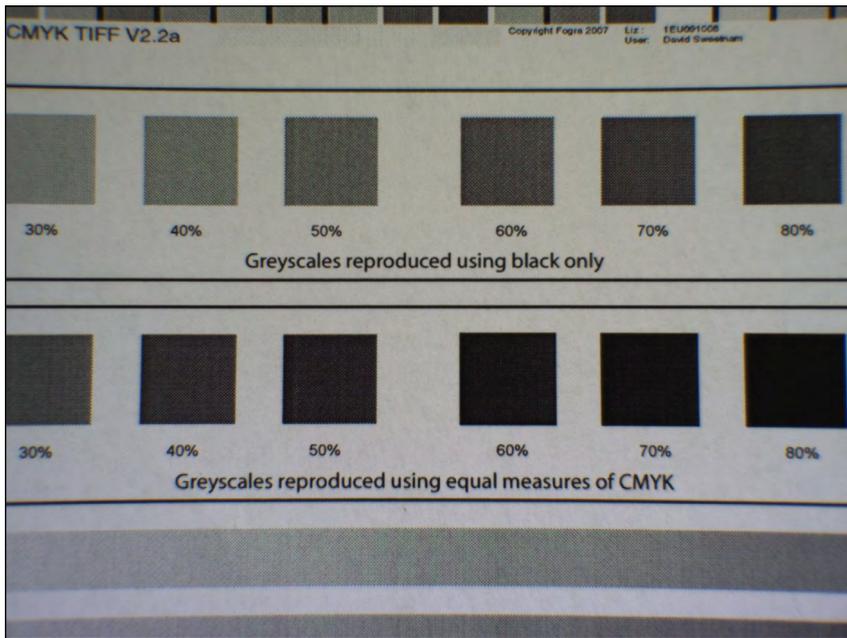
Black-on-white fine lines and circles remained distinct down to the 0.25-pt. level and were rated fair across the board for both brands. White-on-black fine lines were rated good and remained crisp and distinct down to the 0.1-pt. level consistently throughout the tests.



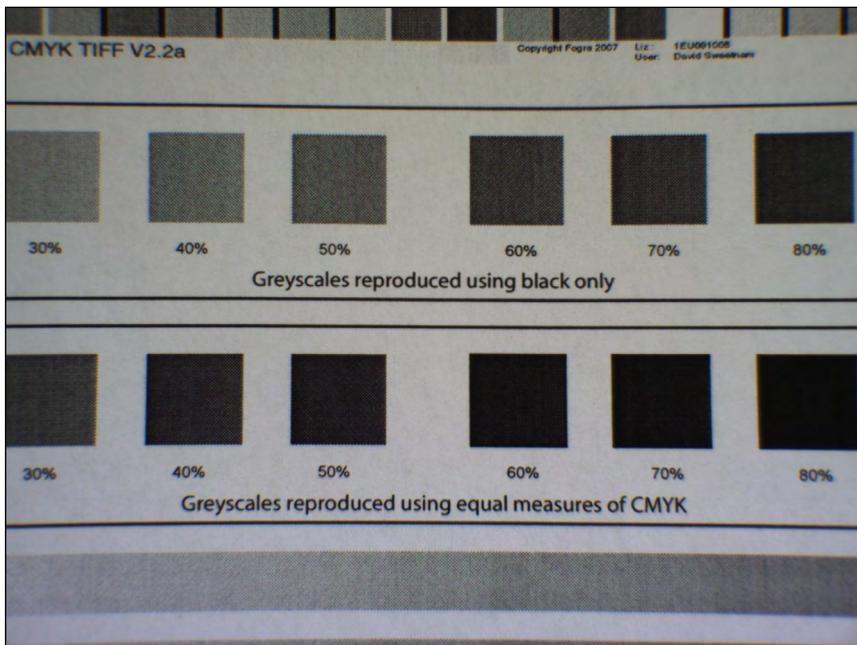
Enlarged photograph of 3-point Arial sans serif text at 75,000 impressions using Canon toner/Canon drum (left), and China Eternal toner/China Eternal drum (right).

Overall, a minimal amount of toner overspray was evident on output produced using Canon toner when viewed under magnification, the same being true for output in the China Eternal toner/China Eternal drum test. While an average amount of toner overspray was visible up to the 50,000-impression mark with China Eternal toner/Canon drum, there was some noticeable improvement in quality thereafter. BLI analysts attribute this improvement to the drum conditioning as usage increased during the course of the test.

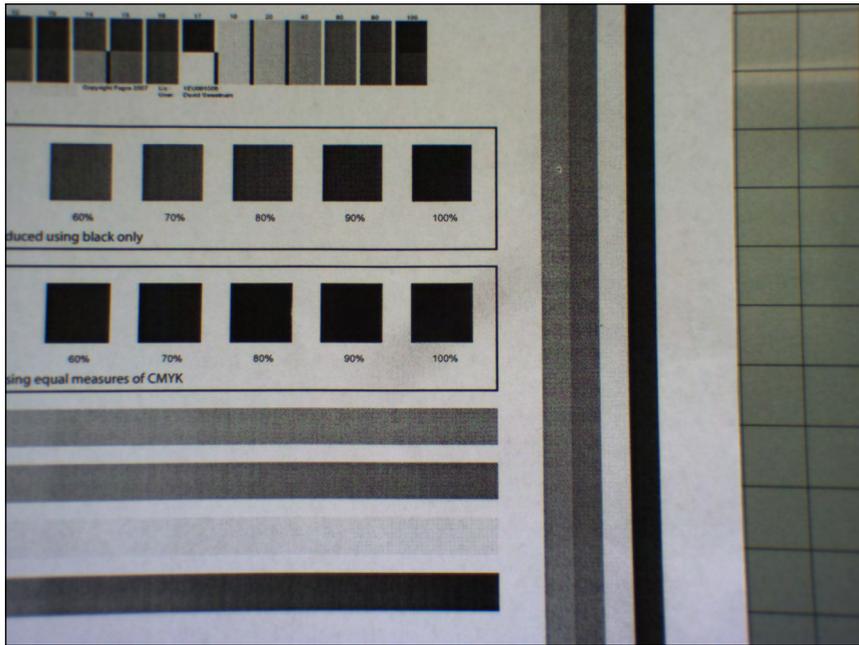
Halftone output was visible across the full range—from the 10% to 100% dot-fill levels, with distinct transitions between all levels. In halftone fills, however, there was a clear difference in output between the toner brands. The Canon toner produced good and consistent halftone fills, whilst the halftone fills produced with China Eternal toner/China Eternal drum were rated poor across the board, with banding and fading in some areas. Significantly, the China Eternal toner also demonstrated poor toner fusing (both when used in conjunction with a Canon drum and with its own native drum), resulting in toner set-off (or transfer) issues when a printed sheet was rubbed. No transfer issues occurred when pages printed with the Canon toner were rubbed or handled. BLI analysts noted that output using the China Eternal toner displayed excessive toner laydown, which may have contributed to the toner not fusing properly on the paper, as well as contributing to its higher density.



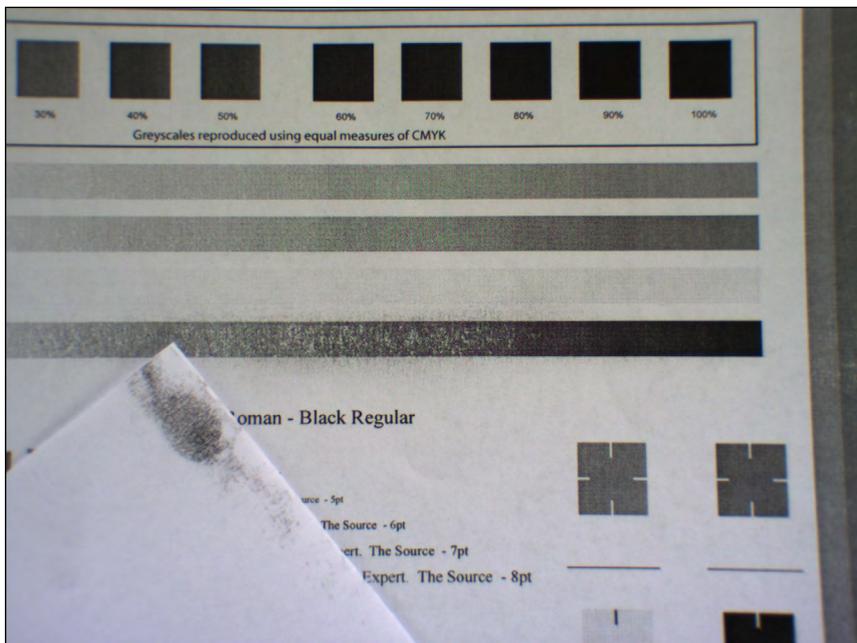
Enlarged photograph of halftone fills at 50,000 impressions using Canon toner/ Canon drum.



Enlarged photograph of halftone fills at 50,000 impressions using China Eternal toner/ China Eternal drum.



Banding shown on output (50,000) using China Eternal toner/China Eternal drum.



Poor toner fusing with the China Eternal toner/China Eternal drum.

### Optical density

Although the China Eternal toner delivered higher optical density results overall, there were some quality issues with its solid reproduction up to the 50,000-impression mark. The Canon toner’s average densities became steadily lower as testing progressed, whereas the China Eternal toner’s average densities showed less of a linear change and instead fluctuated between low and high readings throughout its test when combined with its native drum. When tested with a Canon drum, the China Eternal toner’s average densities tended to increase over time.

That said, the Canon toner maintained a lower optical density variance (0.18), compared with a variance of 0.22 for the China Eternal toner when used in conjunction with a China Eternal drum and 0.25 for the China Eternal toner when used in conjunction with the Canon drum, and this, combined with its better solid reproduction quality gives it the edge overall.

### Solid Fill Image Density Results

Canon Drum/Canon Toner					
	Reading 1	Reading 2	Reading 3	Reading 4	Average
<b>0</b>	1.15	1.15	1.22	1.23	1.19
<b>25,000</b>	1.16	1.13	1.13	1.14	1.14
<b>50,000</b>	1.15	1.16	1.11	1.12	1.14
<b>75,000</b>	1.07	1.06	1.07	1.07	1.07
<b>100,000</b>	1.06	1.09	1.12	1.18	1.11
<b>125,000</b>	1.05	1.07	1.08	1.11	1.08
<b>140,000</b>	1.10	1.12	1.12	1.10	1.11
<b>Highest Optical Density Recorded</b>					<b>1.23</b>
<b>Lowest Optical Density Recorded</b>					<b>1.05</b>

China Eternal Drum/China Eternal Toner					
	Reading 1	Reading 2	Reading 3	Reading 4	Average
<b>0</b>	1.24	1.13	1.25	1.22	1.21
<b>25,000</b>	1.23	1.20	1.30	1.28	1.25
<b>50,000</b>	1.33	1.29	1.13	1.16	1.23
<b>75,000</b>	1.18	1.11	1.19	1.21	1.17
<b>100,000</b>	1.24	1.19	1.19	1.22	1.21
<b>125,000</b>	1.16	1.15	1.22	1.19	1.18
<b>140,000</b>	1.11	1.13	1.15	1.16	1.14
<b>Highest Optical Density Recorded</b>					<b>1.33</b>
<b>Lowest Optical Density Recorded</b>					<b>1.11</b>

Canon Drum/China Eternal Toner					
	Reading 1	Reading 2	Reading 3	Reading 4	Average
<b>0</b>	1.02	1.08	1.02	1.02	1.04
<b>25,000</b>	1.11	1.14	1.18	1.19	1.16
<b>50,000</b>	1.19	1.21	1.10	1.13	1.16
<b>75,000</b>	1.25	1.26	1.18	1.13	1.21
<b>100,000</b>	1.24	1.26	1.13	1.15	1.20
<b>125,000</b>	1.27	1.26	1.06	1.07	1.17
<b>140,000</b>	1.20	1.21	1.04	1.04	1.12
<b>Highest Optical Density Recorded</b>					<b>1.27</b>
<b>Lowest Optical Density Recorded</b>					<b>1.02</b>

### Test Methodology

One new Canon iR2530 (or a unit restored to optimal operating condition) was run for testing. Each test phase involved the device being run for 140,000 impressions (the rated life of the drum) over a 20-working-day period. At the end of the 140,000-impression run, a full PM call was carried out before commencing testing of the next phase. With all three phases combined, the test was run for 60 business days, excluding downtime for PM service. All paper and consumables were acclimatized for a period of 12 hours inside the climate-controlled lab before testing commenced. The ISO 19752 test suite was used for all testing. Separate BLI image quality target files were submitted and BLI assessed the target sheets produced at every 25,000-impression interval over a selection of parameters, including optical density (measured using an X-Rite 508 densitometer), halftone reproduction, and font and fine line reproduction.

For Reliability, Part Life and Toner Yield testing, each cartridge was weighed at the start and end of testing to determine net weight. Each cartridge was run until significant “fade” became apparent on the printouts as determined by BLI, or when the cartridge ran until empty and/or the device prompted the operator that toner was empty (if equipped with a toner-out prompt). Waste toner bottle full weights and numbers consumed were also recorded in the same manner.

All files were submitted from a Dell Optiplex 390 3.30-GHz Intel i3 PC with 4 GB of RAM, running Windows 7 Professional with the current level of Acrobat Reader. Printing was conducted using the PCL driver with default settings.

Test environment: Testing conducted under ambient conditions of 22°C (+/-2.7°C) and 45% RH (+/-10%); monitored daily by Dickson Seven-Day Temperature/Humidity Chart Recorder, in Buyers Lab’s test facility at Unit 1 Station Industrial Estate, Wokingham, Berkshire RG41 2YQ).

## About Buyers Laboratory LLC

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Buyers Laboratory LLC (BLI) is the world's leading independent provider of analytical information and services to the digital imaging and document management industry. For more than 50 years, buyers have relied on BLI to help them differentiate products' strengths and weaknesses and make the best purchasing decisions, while industry sales, marketing and product professionals have turned to BLI for insightful competitive intelligence and valued guidance on product development, competitive positioning and sales channel and marketing support. Using BLI's web-based bliQ and Solutions Center services, 40,000 professionals worldwide create extensive side-by-side comparisons of hardware and software solutions for more than 15,000 products globally, including comprehensive specifications and the performance results and ratings from BLI's unparalleled Lab, Solutions and Environmental Test Reports, the result of months of hands-on evaluation in its US and UK labs. The services, also available via mobile devices, include a comprehensive library of BLI's test reports, an image gallery, hard to find manufacturers' literature and valuable tools for configuring products, calculating total cost of ownership (TCO) and annual power usage. BLI also offers consulting and private, for-hire testing services that help manufacturers develop and market better products and consumables.

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