

TABLET DURABILITY, BARCODE READING, AND PERFORMANCE COMPARISON: PANASONIC TOUGHPAD FZ-G1 VS. APPLE IPAD AIR

Get the job done with the Panasonic Toughpad® FZ-G1



Visibility

It was easier to read the screen in direct sunlight.



Temperature

The Toughpad still functioned at extreme temperatures.



Barcodes

The built-in scanner let the Toughpad scan in low light.

vs. Apple® iPad Air™

Outdoor service workers increasingly rely on tablet devices as they go about their workday. These workers have needs that differ from those of typical office workers. They and their devices are exposed to a range of climate conditions, including extremely high and low temperatures and bright sunlight that can make it difficult to read electronic screens. In addition to word processing, spreadsheet, and presentation tasks using Microsoft Office productivity tools, many workers also need to read barcodes as part of their daily routine.

Companies are wise to invest in a tablet that functions even when it's very hot or very cold, has a screen that is easily readable on the sunniest day, and helps workers perform their jobs quickly and efficiently.

In the Principled Technologies labs, we put two tablets to the test, the Panasonic Toughpad FZ-G1 and the Apple iPad Air. We subjected the two devices to extreme heat and cold, scanned dozens of barcodes under different lighting conditions, opened a set of Microsoft Office files in different ways, and conducted a series of industry-standard performance benchmark tests. We even had test subjects read from the two screens in bright sunlight. The Panasonic Toughpad FZ-G1 outdid the Apple iPad Air on all of our tests and offered more complete functionality for Microsoft® Office 365™ tasks, making it a very attractive option for outdoor field workers.



A PRINCIPLED TECHNOLOGIES TEST REPORT

Commissioned by Panasonic

OCTOBER 2014

PANASONIC TOUGHPAD FZ-G1—POWERFUL PROCESSOR, WINDOWS 8.1 PRO, INTEGRATED BARCODE READER

As its name suggests, Panasonic designed the Toughpad FZ-G1 to be an extremely rugged tablet. It uses the latest, fourth-generation Intel® Core™ i5 vPro™ processor and runs the Microsoft Windows® 8.1 Pro 64-bit operating system. Unlike many other tablets, the Toughpad FZ-G1 is available with an integrated barcode reader.

To learn more about how well the Panasonic Toughpad FZ-G1 performed, we conducted a series of tests on it and another tablet, the Apple iPad Air.

We found that across the board, the Panasonic Toughpad FZ-G1 outdid the Apple iPad Air. For detailed system configuration, see [Appendix A](#). For details on how we conducted our testing, see [Appendix B](#).

HOW WELL DID THE TABLET OPERATE AT EXTREME TEMPERATURES?

Workers in the field—and their electronic devices—must deal with the elements every day. In the summer, closed vehicles can reach extremely high temperatures, and in the winter, temperatures can drop to well below zero. For example, temperatures can drop to -30°C in colder regions such as the Nordic countries, Eastern Europe, and Russia.

To simulate the effect these extreme weather conditions can have on a tablet, PT used a climate-controlled test chamber. We began by setting the chamber to 23.9°C (75°F). We then powered on each of the devices, and placed them in the chamber. Next, we lowered the chamber to -12°C (10.4°F). Once the chamber reached this temperature, we left the devices inside for 15 minutes. We then removed the devices and inspected them to see whether the touch screen functioned and noted any other issues. We shut the devices down and allowed them to sit at room temperature for 2 hours. We then repeated the process with progressively lower temperatures. Figure 1 summarizes our findings. “Pass” means that the device functioned normally after spending 15 minutes in the extremely cold chamber. “Fail” means the device stopped working due to the cold, and would not allow us to turn it back on.

Temperature	Panasonic Toughpad FZ-G1	Apple iPad Air
-12°C (10.4°F)	Pass	Pass
-17.8°C (0°F)	Pass	Pass
-25°C (-13°F)	Pass	Fail
-30°C (-22°F)	Pass	Fail

Figure 1: The effect of extremely cold temperatures on the devices.

As Figure 1 shows, the Panasonic Toughpad FZ-G1 functioned normally after spending 15 minutes at all test temperatures, whereas the iPad Air failed at -25°C. These findings mean that workers could use the Toughpad in considerably colder conditions than they could use the iPad Air.

To simulate extremely warm conditions, we again used the climate-controlled chamber and followed an approach similar to the cooling tests. Figure 2 summarizes our findings. “Pass” means that the device functioned normally after spending 15 minutes in the extremely warm chamber. “Fail” means the device stopped due to the heat, and would not allow us to turn it back on.

Temperature	Panasonic Toughpad FZ-G1	Apple iPad Air
45°C (113°F)	Pass	Pass
50°C (122°F)	Pass	Pass
55°C (131°F)	Pass	Fail
60°C (140°F)	Pass	Fail
65°C (149°F)	Pass	Fail

Figure 2: The effect of extremely warm temperatures on the devices.

As Figure 2 shows, the Panasonic Toughpad FZ-G1 remained functional at all of the test temperatures—up to 65°C or 149°F. The iPad Air failed at 55°C (131°F). As with the cooling results, these findings mean that a Toughpad left inside a closed vehicle on a very hot day would have a much better chance of continuing to function correctly than an iPad Air would.

HOW EASY WAS IT TO READ THE SCREEN OUTDOORS ON A SUNNY DAY?

Field workers must often use their electronic devices in full sunlight, which can make viewing the screen difficult. To learn how well the screens of the two tablets in our study fared under very sunny conditions, PT recruited five test subjects. The test proctor asked each subject to stand in a parking lot in direct sun. He told them that he would be handing them a tablet on which a PDF document was displayed and instructed them to begin reading the text aloud once they received the tablet. The proctor used a stopwatch to measure the time that elapsed before the test subject began to read aloud. He then repeated the test with the other tablet.

Each device was fully charged and set using its default brightness settings. Some test subjects received the Panasonic Toughpad FZ-G1 first and others received the Apple first. The devices each had different text to avoid “priming” test subjects by familiarizing them with the text.

Figure 3 summarizes the test results. As it shows, every test subject took less time to begin reading the text on the Panasonic Toughpad FZ-G1 screen than on the Apple screen, 25.2 percent less time on average. Four out of five test subjects commented that the Panasonic Toughpad FZ-G1 was easier to read; the fifth test subject had no preference.

Test subject	Time to begin reading a passage of text aloud (seconds)		Comments
	Panasonic Toughpad FZ-G1	Apple iPad Air	
Test subject 1	2.41	3.63	Subject found the Toughpad easier to read.
Test subject 2	3.26	4.37	Subject found the Toughpad easier to read. "Without adjusting [the iPad], there is no way I could read that."
Test subject 3	3.77	4.40	Subject found the Toughpad easier to read. "Lots of glare on [the iPad]."
Test subject 4	1.71	2.49	Subject found the Toughpad easier to read. "The [Toughpad Matte] screen made it easier to read and made things brighter."
Test subject 5	1.67	2.26	Subject had no preference between the two screens.
Average	2.56	3.43	The test subjects began reading the text on the Panasonic Toughpad FZ-G1 was 25.2 percent faster than on the Apple.

Figure 3: The amount of time in seconds that elapsed before five test subjects began reading text on the two systems' screens.

HOW WELL DID THE TABLETS READ BARCODES?

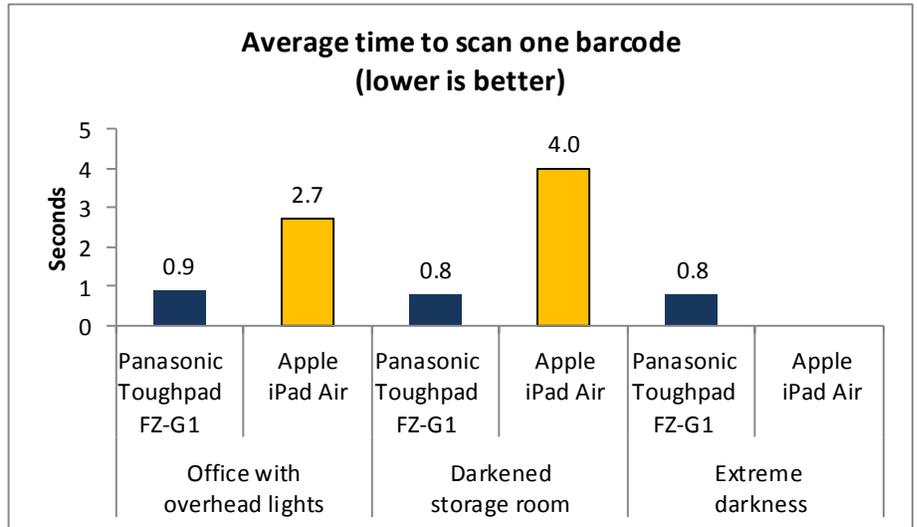
Those whose jobs include scanning barcodes—in the field, in warehouses—know that the lighting conditions can be far from ideal. When you need to scan a large number of items quickly, a reliable and speedy scanner can be the difference between executing a job with ease and having productivity break down completely.

We printed 53 sample barcodes and selected nine real-world items containing barcodes. We used our two test devices to scan each. For the Panasonic Toughpad FZ-G1, we used its built-in barcode reader. For the Apple iPad Air, we used the Barcode Scanner app from Manatee Works Inc. We tested all 61 barcodes in three lighting situations:

- Office setting with overhead fluorescent lighting
- Storage room setting with dim light
- Extremely limited light as in a crawl space under a house or in a basement

As Figure 4 shows, regardless of the lighting conditions, the Panasonic Toughpad FZ-G1 with its integrated barcode reader took about the same amount of time to read a barcode—0.8 or 0.9 seconds. In contrast, the Apple iPad Air took three times as long to read a barcode under typical office lighting conditions and took more than four times as long to read a barcode in a darkened storage room. In extreme darkness, the Apple iPad Air could not read the bar code at all. (Note: We present detailed results of our barcode testing in [Appendix C](#).)

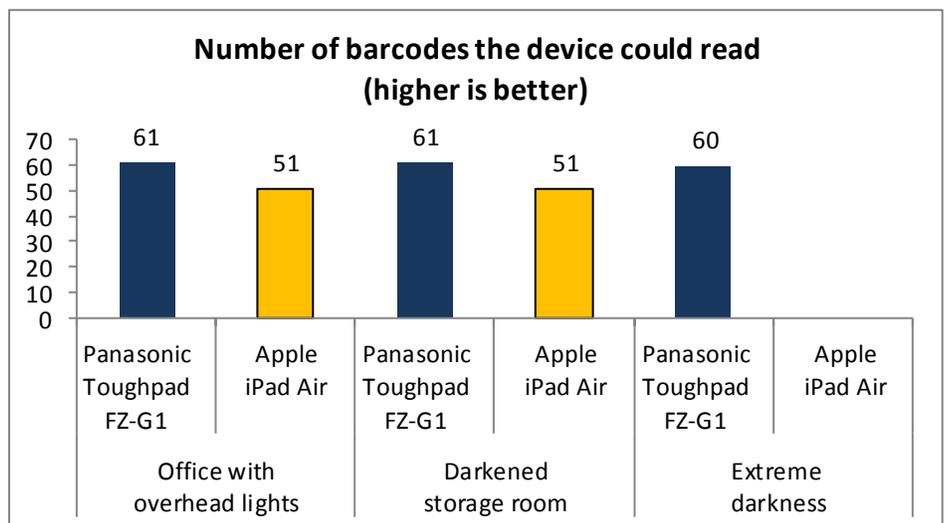
Figure 4: Scanning barcodes with the Panasonic Toughpad FZ-G1 took a fraction of the time it took to perform the same task on the Apple iPad Air. Note: The Apple iPad Air could not scan a single barcode under extremely dark conditions.



For workers who need to scan many bar-coded items over the course of their jobs, these time differences can become very dramatic. For example, a worker scanning in an office with the Toughpad FZ-G1 would be able to scan 250 barcodes in 3 minutes 45 seconds. This same worker would need 11 minutes 15 seconds to scan the same number of barcodes with the Apple iPad Air. If this worker were performing this task in a darkened storage room, performing this task on the iPad Air would take more than 16 minutes.

In addition to scanning the barcodes more quickly, the Panasonic Toughpad FZ-G1 with its integrated barcode reader was also more reliably able to read the codes. Of the 61 barcodes we scanned, the Toughpad could read all of them under normal office lighting conditions and in a darkened storage room, whereas the Apple iPad Air could read only 51 of them (83.6 percent). Under extremely dark conditions, the Apple iPad Air using the Barcode Scanner app could not scan any barcodes while the Panasonic Toughpad FZ-G1 was able to read all but one. (See Figure 5.)

Figure 5: The Panasonic Toughpad FZ-G1 had a much higher success rate for scanning barcodes than the Apple iPad Air, which could not scan a single barcode under extremely dark conditions.



HOW QUICKLY COULD WE TRANSFER LARGE AMOUNTS OF DATA USING THE USB PORT?

Field workers often rely on large repositories of technical diagrams or schematics to do their jobs. While in the past, they might have travelled with volumes of hard-copy versions of these diagrams, today they are likely stored digitally on a USB flash drive. Such a solution is less expensive and more environmentally friendly—saving paper and space in the workers’ vehicles—and allows for easier updates as schematics change.

Because the Panasonic Toughpad FZ-G1 is equipped with a USB port, copying files from a USB flash drive onto the tablet involves one quick step. As Figure X shows, copying a 500MB data file to the Toughpad took less than 26 seconds. The iPad lacks a USB port, however, so the process of getting a diagram off the USB drive is much more complex and requires a notebook system with a USB port. In our scenario, the steps are as follows:

1. Copy the file from the USB flash drive to the notebook’s hard drive.
2. Upload the file from the notebook’s hard drive to a cloud-based location using a tool such as Dropbox.
3. Download the file from Dropbox to the iPad Air.

We measured the time it took the two devices to download a 500MB technical diagram. As Figure 6 shows, thanks to the USB port, performing this task on the Panasonic Toughpad FZ-G1 took a fraction of the time it did on the Apple iPad Air, which means our worker could get to work than much faster.

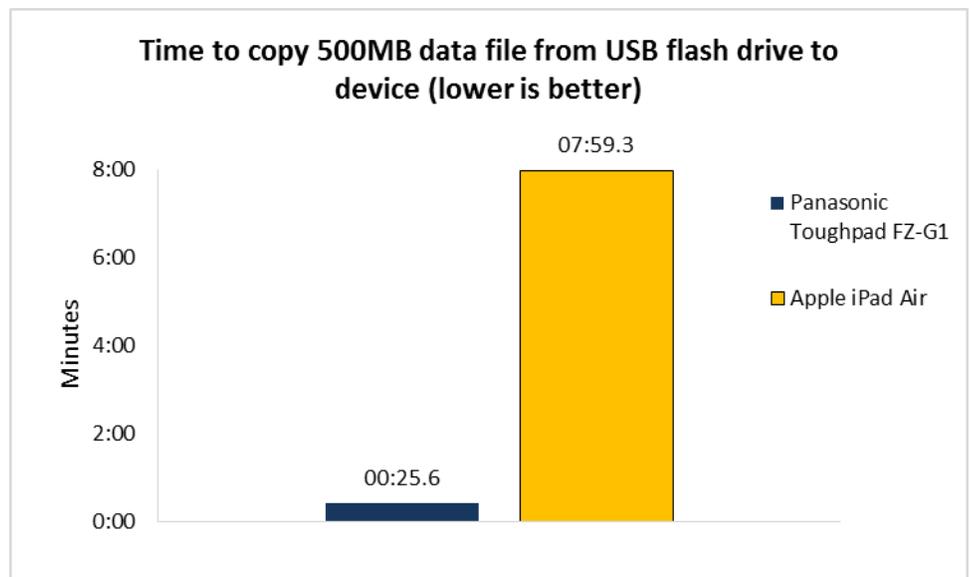


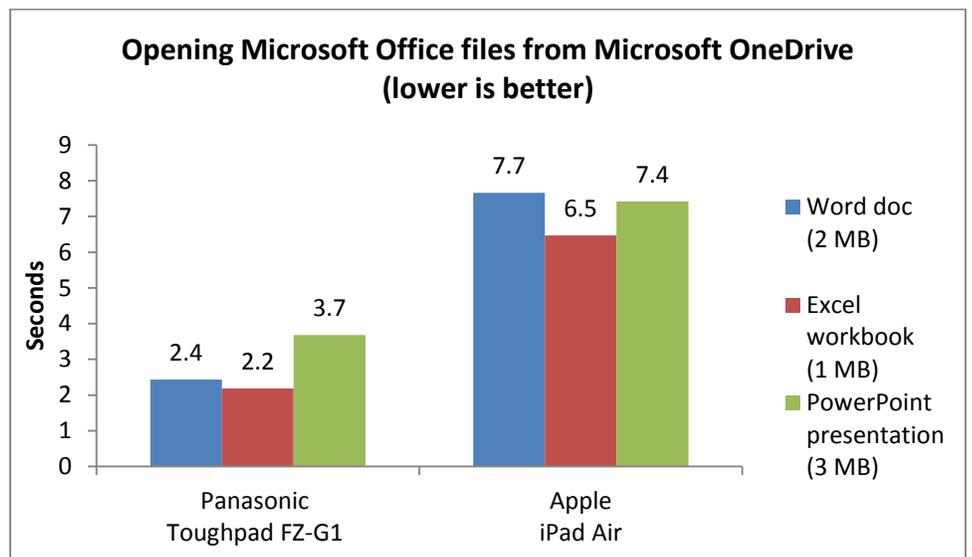
Figure 6: Copying the large data file took more than 18 times as long on the Apple iPad Air than it did on the Panasonic Toughpad FZ-G1.

HOW QUICKLY DID THE TABLETS OPEN MICROSOFT OFFICE FILES AND HOW MUCH COULD THEY DO WITHIN THOSE APPLICATIONS?

No one likes to wait for files to open. We measured the time it took our two test devices to open Word, Excel®, and PowerPoint® files –first from Microsoft OneDrive for Business, a cloud-based file storage space, and then when the files were attached to email messages.

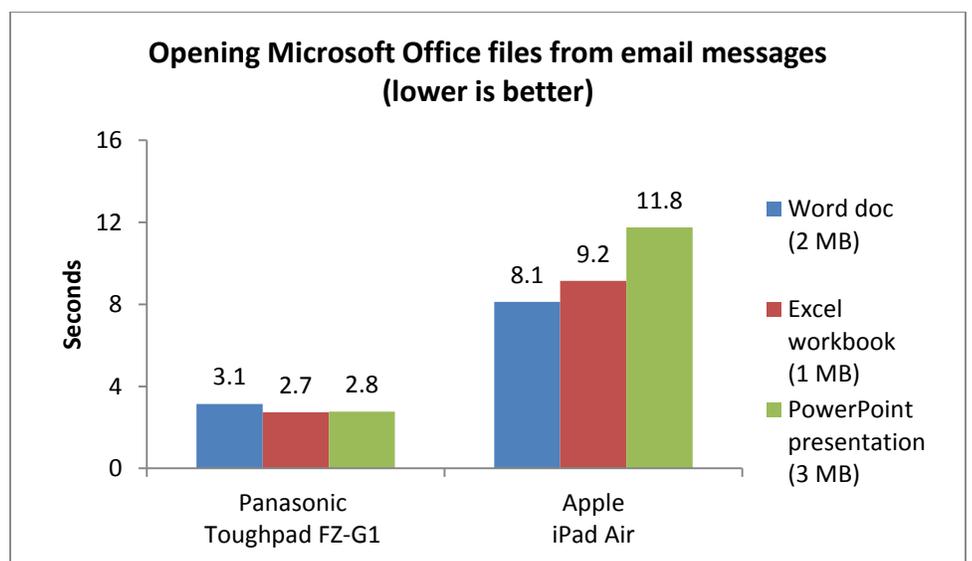
As Figure 7 shows, the Panasonic Toughpad FZ-G1 took considerably less time to open all three file types than the Apple iPad Air—as much as 68 percent less time.

Figure 7: Opening Office files for editing from Microsoft OneDrive was much faster on the Panasonic Toughpad FZ-G1 than on the Apple iPad Air.



As Figure 8 shows, the Panasonic Toughpad FZ-G1 took considerably less time to open all three file types than the Apple iPad Air did—from 5 seconds to 9 seconds faster.

Figure 8: Opening Office files for editing directly from email messages was much faster on the Panasonic Toughpad FZ-G1 than on the Apple iPad Air.



Workers need reliable tablets that can allow them to access data and applications quickly, help foster communication with the office if they're out in the field, and complete all Office tasks they require from anywhere.

Figure 9 shows how the tablets fared when completing a number of tasks. The Panasonic Toughpad FZ-G1 was the better multitasker, while the Apple iPad Air encountered several problems completing the tasks.

Task	Panasonic Toughpad FZ-G1	Apple iPad Air	Notes
Accessing Office documents in OneDrive for Business			iPad Air could only access previously opened documents.
Encrypting Office documents with full support for document protection options			iPad Air could not encrypt and didn't support other protection options.
Viewing multiple Office apps and documents at a time			iPad Air could only view one Office app at a time, and could only present one doc at a time.
Saving Excel spreadsheets in CSV format			iPad Air couldn't save in CSV format.
Fully visible scroll bars with custom zoom level settings in Office documents			iPad Air lacked full scroll bars in Word and could only pinch to zoom.
Checking grammar in Word documents and spelling in PowerPoint presentations and adding comments in Excel sheets and PowerPoint			iPad Air could complete none of these Office tasks.
Using custom fonts and page margins in Word documents			iPad Air could not display custom fonts or margins.
Creating and running macros and using external data connections in Excel spreadsheets			iPad Air could not run macros or use external connections.
Viewing a Skype video conference call while editing a Word document side by side using Snap View			iPad Air couldn't have Skype and Word open side by side.

Figure 9: Microsoft Office application functionality comparison.

HOW DID THE TABLETS FARE ON INDUSTRY-STANDARD PERFORMANCE BENCHMARKS?

In addition to the comparisons we have presented so far, we also looked at the performance of the two tablets. Benchmarks measure performance in different ways—some focus on processors or operating systems while others cover a wide range of factors, including graphics. We chose three performance-measuring benchmarks for our testing.

WebXPRT 2013

WebXPRT 2013 measures Web-browsing performance by simulating everyday usage scenarios. The benchmark uses four workloads to produce an overall score. We tested a variety of browser-tablet combinations and present the results for the browser that performed best on each of the tablets—Google Chrome on Panasonic Toughpad FZ-G1 and Safari® on Apple iPad Air.

As Figure 10 shows, the Panasonic Toughpad FZ-G1 achieved an overall score of 581, 6 percent greater than the Apple iPad Air, which achieved an overall score of 546. On the subscores, where lower numbers are better, the Panasonic Toughpad FZ-G1 delivered better (faster) performance on both Photo Effects and Face Detection.

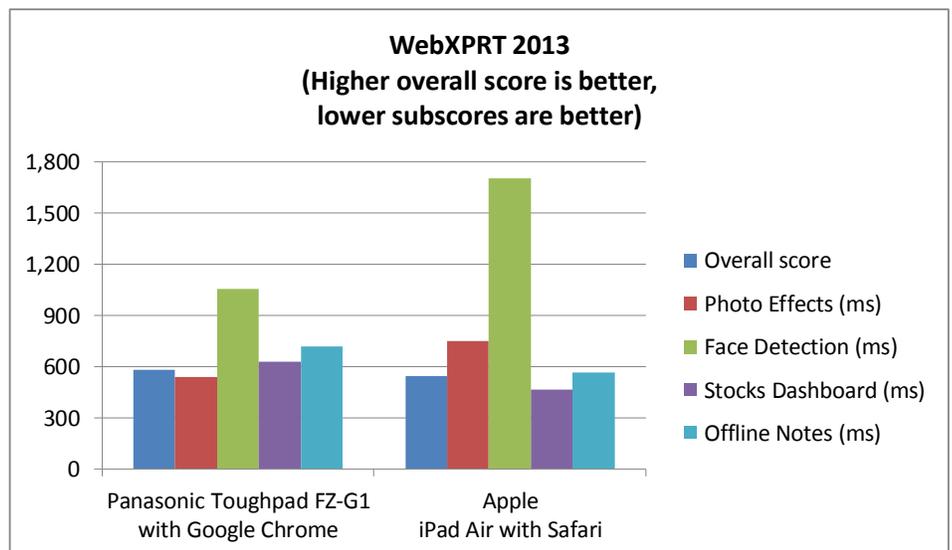


Figure 10: WebXPRT 2013 scores for the two devices.

Futuremark 3DMark

Viewing graphic-heavy apps or large images can greatly slow down a tablet. The 3DMark benchmark rates a system's graphics performance; a higher score translates to faster performance. Figure 11 shows the 3DMark overall scores, graphics scores, and physics scores for the two devices. The Panasonic Toughpad FZ-G1 outperformed the Apple iPad Air by as much as 63 percent.

Figure 11: 3DMark scores for the Panasonic Toughpad FZ-G1 were better than those for the Apple iPad Air were.

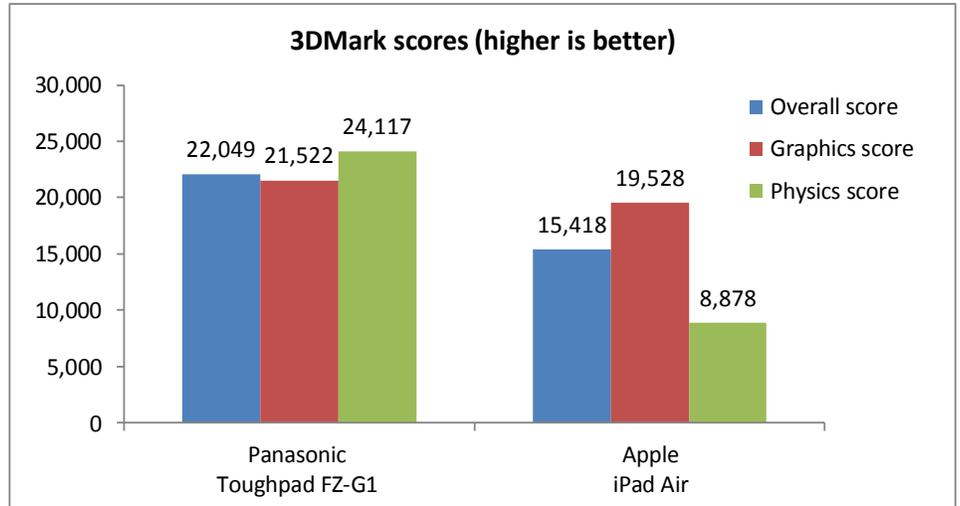
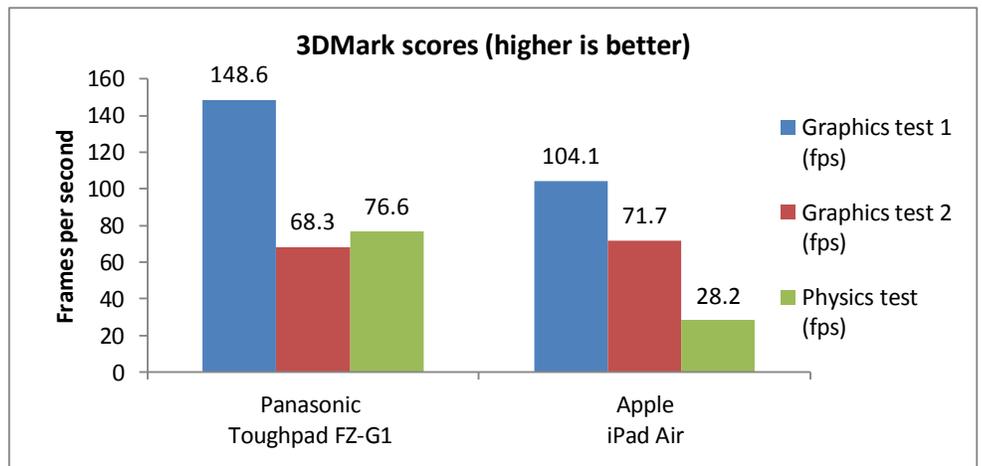


Figure 12 shows the 3DMark scores in frames per second for the two devices on two graphics tests and a physics test. The Panasonic Toughpad FZ-G1 outperformed the Apple iPad Air on two of three tests—by as much as 63 percent—and performed about the same as the Apple iPad Air on the second graphics test.

Figure 12: 3DMark frames-per-second scores for the Panasonic Toughpad FZ-G1 were better than those for the Apple iPad Air were.

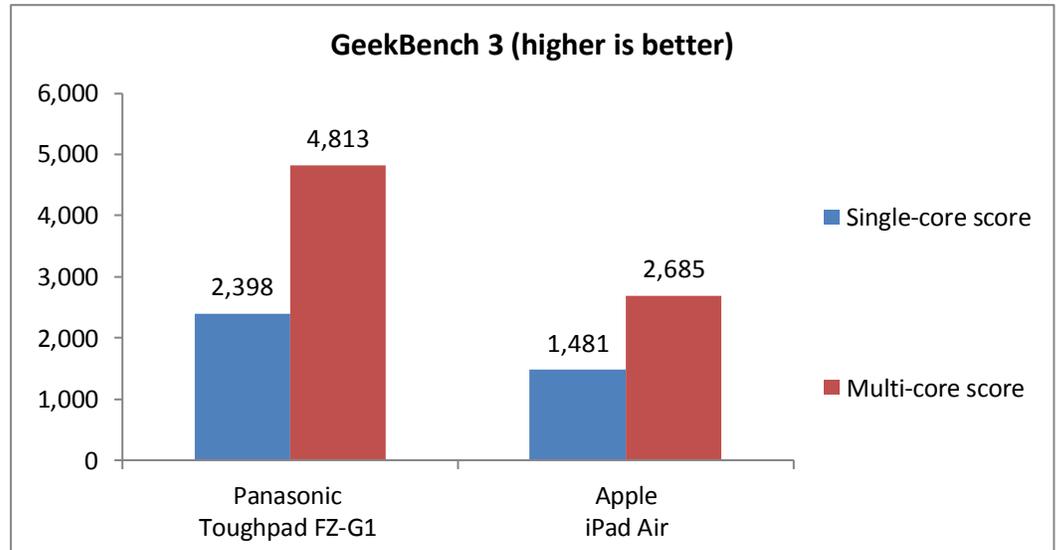


GeekBench 3

The GeekBench 3 benchmark measures processor performance and has single-core and multi-core tests. Its workloads derive from real-world scenarios. The single-core test stresses only one core to produce a result, whereas the multi-core test stresses multiple cores to produce a result.

As Figure 13 shows, the Panasonic Toughpad FZ-G1 outperformed the Apple iPad Air on both single-core and multi-core tests, with wins of 38 percent and 44 percent respectively.

Figure 13: GeekBench 3 scores for the Panasonic Toughpad FZ-G1 were better than those for the Apple iPad Air were.



CONCLUSION

The tablets on today's market vary enormously. When selecting a model for field workers who subject their devices to extreme temperatures, who must read their screens in bright sunlight, and who require reliable and efficient barcode reading, Office productivity, and strong performance, not just any tablet will do.

The Panasonic Toughpad FZ-G1 functioned in a much broader range of temperatures than the iPad Air did and its screen was easier to read in the sunlight. Its USB port greatly shortened the time needed to copy diagrams from a USB flash drive.

With its integrated barcode reader, the Panasonic Toughpad FZ-G1 delivered dramatically speedier and more reliable scanning performance than the Apple iPad Air with the Barcode Scanner app. It also opened Microsoft Office files more quickly and fared better in Web-browsing, graphics, and processor performance benchmarks.

If your field workers need a fast, responsive, reliable tablet for performing barcode reading and office productivity tasks outdoors, consider the Panasonic Toughpad FZ-G1.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 14 provides detailed configuration information for the test systems.

	Panasonic Toughpad FZ-G1	Apple iPad Air
Screen size	10.1" (257.17mm)	9.7" (246.63mm)
Display resolution	1,920 x 1,200	2,048 x 1,536
PPI	224	264
Dimensions	11.02" x 7.81" x 2.21" 279.96mm x 198.50mm x 56.31mm	10.26" x 7.62" x 2.16" 260.64mm x 193.54mm x 54.98mm
Weight	2.78 lbs. (1260.9 g)	2.50 lb. (1133.9 g)
CPU	Intel Core i5 3437U @ 1.90 GHz	Apple A7
Storage	128 GB	128 GB
OS	Windows 8.1 Professional	iOS 7.1.2
RAM	4 GB	1 GB
Retail price as of 07-14	\$2,919.00	\$799.00

Figure 14: Configuration information for the two devices.

Note: We based the Toughpad price on what we could find on the Internet for a similar model of the FZ-G1.

APPENDIX B – HOW WE TESTED

OPERATING AT A LOW TEMPERATURE

1. With the climate-controlled chamber roughly 23.9°C (75°F), place the device, powered on to its home screen, in the climate-controlled chamber.
2. Cool the device to -12°C (10°F). Once the chamber reaches -12°C, continue to cool the device for an additional 15 minutes.
3. After 15 minutes, open the climate-controlled chamber and inspect device. Note any issues. Does the touch screen still function as it should?
4. Shut down the device and allow it to sit for 2 hours at room temperature.
5. Perform steps 1 through 4, with increasingly lower temperatures. Note any issues.

OPERATING AT A HIGH TEMPERATURE

1. With the climate-controlled chamber roughly 23.9°C (75°F), place the device, powered on to its home screen, in the climate-controlled chamber.
2. Heat the device to 45°C (113°F). Once the chamber reaches 45°C, continue to heat the device for an additional 15 minutes.
3. After 15 minutes, open the climate-controlled chamber and inspect device. Note any issues. Does the touch screen still function as it should?
4. Shut down the device and allow it to sit for 2 hours at room temperature.
5. Perform steps 1 through 4 with increasingly higher temperatures. Note any issues.

OUTDOOR SCREEN VIEWING

Setting up the test

1. It is necessary to perform this test on a bright, sunny day at 12 o'clock noon.
2. Copy a Word document onto each device.

Running the test

1. Go outside on a bright, sunny day.
2. Open the Word document.
3. Determine whether you can read the document.
4. If unable to view the document, adjust the brightness settings to a point at which you either can read the document, or at which you are able to state that the manual is unreadable at any setting.

TRANSFERRING LARGE AMOUNTS OF DATA USING THE USB PORT

Setting up the test

1. Copy the 500 MB of technical schematic files onto a USB flash drive.
2. Set up an additional notebook PC with Dropbox installed in order to upload the 500 MB to Dropbox.

3. Set up a Dropbox account on the iPad device.

Running the test

Panasonic Toughpad FZ-G1

1. Insert the USB flash drive into the USB port.
2. Right-click on the 500 MB directory and select Copy.
3. Simultaneously start the timer and click Paste to copy the 500 MB directory to the desktop.
4. Stop the timer when the 500 MB directory has been copied to the desktop.
5. Delete the 500 MB directory and perform steps 1 through 5 two more times.
6. Report the median of the three runs.

Apple iPad Air

1. Insert the USB flash drive into the USB port of the additional notebook PC.
2. Open up the Dropbox desktop application found on the notebook PC.
3. Right-click on the 500 MB directory found on the USB drive and select Copy.
4. Simultaneously start the timer and click Paste to copy the 500 MB directory to the Dropbox application.
5. Stop the timer when the 500 MB directory has been uploaded to Dropbox.
6. Power on the iPad.
7. Simultaneously start the timer and open the Dropbox iPad application.
8. Stop the timer when the 500 MB directory has finished syncing to the iPad.
9. Delete the 500 MB directory and perform steps 1 through 9 two more times.
10. Report the median of the three runs.

BARCODE TESTING

We printed 53 sample barcodes from intermec.custhelp.com/app/answers/detail/a_id/12650/~/sample-barcodes-that-can-be-used-for-testing-and-comparing-scanners as well as nine real-world items and scanned each one with each tablet to determine how well each performed the task. We scanned 61 barcodes in all. The barcodes varied in size and shape; most were unblemished while others had various degrees of damage (worn or taped over). We tested the Panasonic Toughpad FZ-G1 using its built in barcode reader. We tested the Apple iPad Air using the Barcode Scanner app from Manatee Works Inc.

For each barcode sample, we observed whether the scanner could read the sample. If the scanner could read it, we measured how long it took. We tested all 61 barcodes in three lighting situations:

- Office setting with overhead fluorescent lighting
- Storage room setting with dim light
- Extremely limited light as in a crawl space under a house or in a basement

Running the test

1. Simultaneously start the timer and scan the barcode.
2. Stop the timer once the barcode has been scanned.
3. Was it able to read the barcode (Pass/Fail). Note the time as well as any issues that were encountered.

PERFORMING MICROSOFT OFFICE TASKS

Opening Office documents for editing from Microsoft OneDrive for Business

For timing how long it took to open Office documents for editing, we followed the steps outlined for each device:

Time to open Word documents for editing on the Toughpad

1. Open the Word desktop app from the taskbar in desktop mode.
2. Tap Open Other Documents.
3. Tap OneDrive for Business, and tap the Documents folder.
4. Tap the test Word document.
5. Simultaneously start the timer and tap Open to open the Word document.
6. When the Word document is fully displayed, stop the timer, and record the result.
7. Close the Word document.
8. Close the Word desktop app.
9. Perform steps 1 to 8 two more times.

Time to open Word documents for editing on the iPad Air

1. Open the Word for iPad app from the home screen.
2. Tap OneDrive for Business, and tap the Documents folder.
3. Simultaneously start the timer and tap the file name to open the test Word document.
4. Tap Edit.
5. When the Word document is fully displayed, stop the timer, and record the result.
6. Close the Word document.
7. Close the Word for iPad app.
8. Perform steps 1 to 7 two more times.

Time to open Excel spreadsheets for editing on the Toughpad

1. Open the Excel desktop app from the taskbar in desktop mode.
2. Tap Open Other Spreadsheets.
3. Tap OneDrive for Business, and tap the Spreadsheets folder.
4. Tap the test Excel spreadsheet.
5. Simultaneously start the timer and tap Open to open the Excel spreadsheet.
6. When the Excel spreadsheet is fully displayed, stop the timer, and record the result.
7. Close the Excel spreadsheet.
8. Close the Excel desktop app.
9. Perform steps 1 to 8 two more times.

Time to open Excel spreadsheets for editing on the iPad Air

1. Open the Excel for iPad app from the home screen.
2. Tap OneDrive for Business, and tap the Spreadsheets folder.
3. Simultaneously start the timer and tap the file name to open the test Excel spreadsheet.
4. Tap Edit.

5. When the Excel spreadsheet is fully displayed, stop the timer, and record the result.
6. Close the Excel spreadsheet.
7. Close the Excel for iPad app.
8. Perform steps 1 to 7 two more times.

Time to open PowerPoint presentations for editing on the Toughpad

1. Open the PowerPoint desktop app from the taskbar in desktop mode.
2. Tap Open Other Presentations.
3. Tap OneDrive for Business, and tap the Presentations folder.
4. Tap the test PowerPoint presentation.
5. Simultaneously start the timer and tap Open to open the PowerPoint presentation.
6. When the PowerPoint presentation is fully displayed, stop the timer, and record the result.
7. Close the PowerPoint presentation.
8. Close the PowerPoint desktop app.
9. Perform steps 1 to 8 two more times.

Time to open PowerPoint presentations for editing on the iPad Air

1. Open the PowerPoint for iPad app from the home screen.
2. Tap OneDrive for Business, and tap the Presentations folder.
3. Simultaneously start the timer and tap the file name to open the test PowerPoint presentation.
4. Tap Edit.
5. When the PowerPoint presentation is fully displayed, stop the timer, and record the result.
6. Close the PowerPoint presentation.
7. Close the PowerPoint for iPad app.
8. Perform steps 1 to 7 two more times.

Opening Office documents directly from email messages

For timing how long it took to open Office documents directly from email on the Toughpad and iPad Air, we followed the steps outlined for each device:

Time to open Word documents from Outlook on the Toughpad

1. Open the Outlook desktop app from the taskbar in desktop mode.
2. Tap the new email message.
3. Simultaneously start the timer and double tap the attachment to open the Word document.
4. When the Word document is fully displayed, stop the timer, and record the result.
5. Close the Word document.
6. Close the Word desktop app.
7. Close the Outlook desktop app.
8. Perform steps 1 to 7 two more times.

Time to open Word documents from the Mail app on the iPad Air

1. Open the Mail app from the home screen.
2. Tap the new email message.

3. Simultaneously start the timer and tap the attachment to download the Word document.
4. When the Word document has downloaded, long press on the attachment.
5. Tap to open the Word document in Word for iPad.
6. When the Word document is fully displayed, stop the timer, and record the result.
7. Close the Word document.
8. Close the Word for iPad app.
9. Close the Mail app.
10. Perform steps 1 to 9 two more times.

Time to open Excel spreadsheets from Outlook on the Toughpad

1. Open the Outlook desktop app from the taskbar in desktop mode.
2. Tap the new email message.
3. Simultaneously start the timer and double tap the attachment to open the Excel spreadsheet.
4. When the Excel spreadsheet is fully displayed, stop the timer, and record the result.
5. Close the Excel spreadsheet.
6. Close the Excel desktop app.
7. Close the Outlook desktop app.
8. Perform steps 1 to 7 two more times.

Time to open Excel spreadsheets from the Mail app on the iPad Air

1. Open the Mail app from the home screen.
2. Tap the new email message.
3. Simultaneously start the timer and tap the attachment to download the Excel spreadsheet.
4. When the Excel spreadsheet has downloaded, long press on the attachment.
5. Tap to open the Excel spreadsheet in Excel for iPad.
6. When the Excel spreadsheet is fully displayed, stop the timer, and record the result.
7. Close the Excel spreadsheet.
8. Close the Excel for iPad app.
9. Close the Mail app.
10. Perform steps 1 to 9 two more times.

Time to open PowerPoint presentations from Outlook on the Toughpad

1. Open the Outlook desktop app from the taskbar in desktop mode.
2. Tap the new email message.
3. Simultaneously start the timer and double tap the attachment to open the PowerPoint presentation.
4. When the PowerPoint presentation is fully displayed, stop the timer, and record the result.
5. Close the PowerPoint presentation.
6. Close the PowerPoint desktop app.
7. Close the Outlook desktop app.
8. Perform steps 1 to 7 two more times.

Time to open PowerPoint presentations from the Mail app on the iPad Air

1. Open the Mail app from the home screen.
2. Tap the new email message.
3. Simultaneously start the timer and tap the attachment to download the PowerPoint presentation.
4. When the PowerPoint presentation has downloaded, long press on the attachment.
5. Tap to open the PowerPoint presentation in PowerPoint for iPad.
6. When the PowerPoint presentation is fully displayed, stop the timer, and record the result.
7. Close the PowerPoint presentation.
8. Close the PowerPoint for iPad app.
9. Close the Mail app.
10. Perform steps 1 to 9 two more times.

INDUSTRY-STANDARD BENCHMARK TESTING

WebXPRT 2013

Running the test

1. Open the Web browser under test, and go to www.principledtechnologies.com/benchmarkxpert/webxpert/.
2. Click Run WebXPRT 2013.
3. At the Ready to test your browser screen, click Continue.
4. Click Start.
5. When the test completes, record the results.
6. Perform steps 1 through 5 two more times.
7. Report the median of the three runs.

3DMark

Setting up the test

1. Install 3DMark.
 - a. Download 3DMark from www.futuremark.com/benchmarks/3dmark.
 - b. To begin the installation, click Install.
 - c. After the installation is complete, click Open.
 - d. Press OK, Let's go.
 - e. Press Install to install the Ice Storm benchmark.
 - f. Close 3DMark. Setup is complete.

Running the test

1. Click/press the 3DMark icon to launch 3DMark.
2. Press the drop-down arrow to display the different benchmark options.
3. Press Ice Storm Unlimited to start the benchmark.
4. When the test completes, record the results.
5. Perform steps 1 through 4 two more times.
6. Report the median of the three runs.

GeekBench 3

Setting up the test

1. Install GeekBench 3.
 - a. Download GeekBench 3 from www.primatelabs.com/geekbench/download/.
 - b. To begin the installation, click Install.
 - c. Setup is complete.

Running the test

1. Launch GeekBench 3 by clicking/pressing the GeekBench 3 icon.
2. Press Run Benchmarks.
3. When the test completes, record the results.
4. Perform steps 1 through 3 two more times.
5. Report the median of the three runs.

APPENDIX C – DETAILED BAR CODE SCANNER TEST RESULTS

Note: We tested the Panasonic Toughpad FZ-G1 with its built in barcode reader. We tested the Apple iPad Air with the Barcode Scanner app from Manatee Works Inc.	Normal office with overhead lights		Darkened storage room		Extreme darkness (little to no light)	
	Panasonic Toughpad FZ-G1	Apple iPad Air	Panasonic Toughpad FZ-G1	Apple iPad Air	Panasonic Toughpad FZ-G1	Apple iPad Air
Code 39 QR code 0.32mm	1.5	3.4	0.9	4.8	1.0	
Code 39 QR code 0.36mm	1.6	3.0	0.7	2.8	0.8	
Code 39 QR code 0.40mm	1.5	2.8	0.8	2.9	0.8	
Code 39 QR code 0.44mm	1.2	2.7	0.8	2.6	0.8	
Code 39 QR code 0.49mm	1.1	2.6	0.8	2.3	0.8	
Code 39 QR code 0.53mm	1.0	2.7	0.8	2.7	0.8	
Code 39 X Dimension 0.23mm	1.0	2.8	1.4	4.8	0.9	
Code 39 X Dimension 0.27mm	1.1	2.7	0.8	4.4	0.8	
Code 39 X Dimension 0.32mm	0.8	2.8	1.5	4.1	1.2	
Code 128 QR code 0.57mm	0.8	2.6	0.8	2.6	0.8	
Code 128 QR code 0.61mm	0.8	2.6	0.8	2.4	0.7	
Code 128 QR code 0.66mm	0.8	2.7	0.8	2.4	0.8	
Code 128 QR code 0.70mm	0.8	2.6	0.7	2.6	0.8	
Code 128 QR code 0.74mm	0.9	2.6	0.7	2.2	0.8	
Code 128 QR code 0.78mm	0.8	2.6	0.8	2.1	0.8	
Code 128 QR code 0.83mm	0.8	2.4	0.8	2.3	0.8	
Code 128 QR code 0.87mm	0.8	2.5	0.8	2.4	0.8	
Code 128 X Dimension 0.23mm	1.3	2.7	0.8	2.9	0.9	
Code 128 X Dimension 0.27mm	0.9	2.7	0.8	2.6	0.8	
Code 128 X Dimension 0.32mm	0.8	2.7	0.8	3.0	0.8	
2D Dot Matrix QR code 0.91mm	0.8	2.6	0.8	2.4	0.8	
2D Dot Matrix QR code 0.95mm	0.8	2.5	0.7	2.2	0.8	
2D Dot Matrix QR code 1.00mm	0.8	2.6	0.8	2.3	0.8	
2D Dot Matrix QR code 1.04mm	0.7	2.0	0.8	2.4	0.9	
2D Dot Matrix QR code 1.08mm	0.8	2.2	0.8	2.2	0.8	
GS1-128	0.8	2.6	0.7	2.6	0.7	
Codabar	0.8	2.6	0.7	2.9	0.7	
Interleaved 2 of 5	0.9	2.7	0.7	2.4	0.8	
GS1 Databar Stacked	1.7	3.4	0.9	3.9		
GS1 Databar limited	0.8	2.8	0.8	3.8	1.6	
GS1 Databar Expanded Stacked	0.8	2.8	0.8	4.2	0.8	
GS1 Databar Extended	1.4	2.7	1.0	58.7	1.0	
GS1 Databar Stacked Omni Directional	1.3	2.7	0.8	3.2	1.0	
GS1 Databar Omni Directional	0.8	2.7	0.7	2.7	0.7	
PDF417	1.1	2.7	0.8	2.7	0.8	
Codablock F	1.5	2.6	0.7	2.6	0.8	
UPC-A	0.7	2.6	0.8	2.9	1.0	

Note: We tested the Panasonic Toughpad FZ-G1 with its built in barcode reader. We tested the Apple iPad Air with the Barcode Scanner app from Manatee Works Inc.	Normal office with overhead lights		Darkened storage room		Extreme darkness (little to no light)	
	Panasonic Toughpad FZ-G1	Apple iPad Air	Panasonic Toughpad FZ-G1	Apple iPad Air	Panasonic Toughpad FZ-G1	Apple iPad Air
UPC-E	0.7	2.7	0.7	2.5	0.7	
EAN-8	0.8	2.7	0.7	2.6	0.7	
EAN-13	0.8	2.5	0.7	2.8	0.7	
Rectangular Datamatrix QR	0.8	2.3	0.8	2.3	0.7	
Square Datamatrix QR	0.8	2.2	0.8	2.6	0.7	
QR Code Model 2	0.9	2.5	0.8	2.7	0.8	
X Dimension 0.010: 10 mm	0.7	N/A	0.7	N/A	0.9	
X Dimension 0.015" 15 mm	0.8	N/A	0.7	N/A	0.7	
X Dimension 0.020" 20 mm	0.8	N/A	0.7	N/A	0.8	
X Dimension 0.030" 30 mm	0.7	N/A	0.7	N/A	0.8	
X Dimension 0.040" 40 mm	0.7	N/A	0.7	N/A	0.8	
X Dimension 0.050" 50 mm	0.7	N/A	0.7	N/A	0.8	
X Dimension 0.060" 60 mm	0.8	N/A	0.7	N/A	0.8	
X Dimension 0.070" 70 mm	0.8	N/A	0.7	N/A	0.7	
X Dimension 0.080" 80 mm	0.8	N/A	0.8	N/A	0.7	
X Dimension 0.100" 100 mm	0.8	N/A	0.8	N/A	0.8	
Pistachio bag	1.3	2.8	0.7	2.6	0.8	
BCAA supplement bottle (curved shape)	0.8	5.0	0.8	2.8	0.9	
UPS label torn and taped back together	0.8	2.7	0.9	2.9	0.8	
Acer Iconia UPC box label	1.0	3.2	1.3	3.6	0.9	
Microsoft Home and Business 2010 sku	0.8	2.6	1.3	2.7	1.5	
Allen Tate realtor QR code from ad brochure	1.4	2.6	0.8	2.6	0.8	
Samsung MZ-5PA1280/OD1 128GB SSD QR code on label	0.9	2.6	0.9	2.8	1.0	
Gossen Mavolux 5032C (worn blue label box serial number)	1.1	2.8	3.1	N/A	0.8	
Average time to scan	0.9	2.7	0.8	4.0	0.8	
Total sum of barcode reading averages (Lower is better)	56.9	2:17.8	51.2	3:18.6	50.0	
Number of barcodes the device failed to read (Lower is better)	0	10	0	10	1	61

Figure 11: Barcode scanning results. Lower numbers are better.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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