PASSMARK® SOFTWARE

OpenText Performance Testing of Antivirus and Backup Products

Performance Benchmarks

Windows 11

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Revision History

Rev	Revision History	Date
Edition 1	Initial version of report	13 October 2025
Edition 2	Amended Charts	16 October 2025

References

Ref #	Document	Author	Date
1	What Really Slows Windows Down (URL)	O. Warner, The PC Spy	2006

Executive Summary

PassMark Software® conducted independent performance benchmark testing antivirus products, including Webroot Total Protection and six leading competitors, on a Windows 11 platform.

AV Performance Results

The objective was to evaluate and compare their impact on system performance using 15 real-world metrics, including:

- Scan Time
- Scheduled Scan Time
- Installation Size
- Installation Time
- Registry Keys Added
- Boot Time
- User Interface Launch Time
- Chrome Launch Time
- Memory Usage during System Idle
- Memory Usage during Initial Scan
- Browse Time
- File Copy, Move and Delete
- File Format Conversion
- File Compression and Decompression
- File Write, Open and Close

VPN Comparison

For the VPN products, no benchmarking was conducted. Instead, PassMark prepared a comparison table outlining the key features common across all competing products. The table indicated whether each product included a given feature.

The products included in this comparison were all-in-one solutions that offered a VPN feature. The feature categories included in the comparison table were:

- Entry and exit countries
- Servers
- Bandwidth
- Quotas
- Kill switch
- Split tunnelling

All products tested were selected from each vendor's all-in-one consumer offerings to ensure a fair and consistent comparison aligned with Webroot Total Protection' positioning.

Each product was tested under controlled and repeatable conditions to maintain fairness and consistency. This report presents the complete test results, benchmarking methodology, and overall performance rankings.

Overall Score – AV Performance Results

Each antivirus product was assigned a performance score based on its ranking across all 15 benchmark metrics. A score of 100 represents a theoretical ideal — the highest possible performance in every category.

The table below summarizes the overall performance scores of all tested products:

Product Name	Overall Score
Webroot Total Protection	71
McAfee+ Ultimate	70
ESET HOME Security Ultimate	69
Avast One with Premium Security	56
Norton 360 Premium	56
Aura Individual	43
Bitdefender Ultimate Security +	34

Products are ranked from highest to lowest overall score, reflecting their relative performance across all test areas.

Products and Versions

All products were tested using the latest publicly available retail versions as of the time of testing. The table below outlines the product names, version numbers, and test dates:

Manufacturer	Product Name	Version	Test Date
Webroot Inc.	Webroot Total Protection	9.0.40.54	Sep 26, 2025
Norton	Norton 360 Premium	25.9.10453	Sep 24, 2025
McAfee	McAfee+ Ultimate	1.33.152.1	Sep 24, 2025
Bitdefender	Bitdefender Ultimate Security+	27.0.54.271	Sep 23, 2025
Aura	Aura Individual	7.5.1	Sep 22, 2025
ESET, spol. s r.o.	ESET HOME Security Ultimate	18.2.18.0	Sep 19, 2025
Avast	Avast One with Premium Security	25.9.10453a	Sep 20, 2025

All installations were performed on clean test environments to ensure fair comparison conditions.

Methodology Overview

The benchmark tests were designed to measure how antivirus products impact common system tasks performed by everyday users. We selected 15 performance metrics to provide a realistic and comprehensive view of overall system performance under each product.

These metrics cover a range of user activities, including scanning, software installation, system startup, memory usage, application responsiveness, and file handling.

All tests were conducted in a controlled environment and are fully repeatable using the test procedures outlined in Appendix 2 of this report.

Benchmark 1 – Scan Time

This metric measures how long each antivirus product takes to complete an on-demand scan of a clean file set.

The test used a 982 MB dataset consisting of typical end-user files, including media files, system files, and Microsoft Office documents. The goal is to assess the scanning performance under normal usage conditions, without malware present.

Benchmark 2 – Scheduled Scan Time

This metric measures the time taken to complete a scheduled scan initiated through the antivirus product's user interface. The scan was configured to run at a specified time using default scheduling options.

Benchmark 3 – Installation Size

As antivirus products evolve to include new features and capabilities, their installation size often grows. While modern storage devices offer increasing capacity, disk space remains a relevant consideration—especially for users managing limited storage or large volumes of personal media.

This benchmark measures the total disk space consumed by the antivirus product after installation. It accounts for all new and modified files added during the process, providing a clear picture of the product's overall storage footprint.

Benchmark 4 – Installation Time

This metric measures the time required for the antivirus product to complete installation and become fully functional. Faster installation times indicate a smoother setup experience and better first impression for the user.

Benchmark 5 – Registry Keys Added

This metric measures the number of registry keys and values added after a successful product installation and system reboot. A smaller number indicates less impact on system resources, particularly beneficial for older or resource-constrained machines.

Benchmark 6 – Boot Time

Measures the time it takes for the system to boot into Windows. Since antivirus software typically loads at startup, longer boot times can indicate a higher performance impact.

Benchmark 7 – User Interface Launch Time

Measures how quickly the antivirus product's main interface opens. Both initial and subsequent launches are tested to account for caching effects, and the final result is averaged.

Benchmark 8 – Chrome Launch Time

Evaluates how the antivirus software affects system responsiveness by measuring the launch time of the Google Chrome browser. Initial and subsequent launches are averaged for the final result.

Benchmark 9 – Memory Usage during System Idle

This metric measures the amount of RAM used by antivirus processes while the system is idle. Memory usage was calculated by identifying all associated processes and summing their memory consumption.

Lower idle memory usage indicates reduced long-term resource consumption, which is especially beneficial for maintaining overall system responsiveness.

Benchmark 10 – Memory Usage during Initial Scan

This metric measures RAM usage by the antivirus product during an active scan. Memory consumption was calculated by identifying all related processes and summing their usage while the scan was in progress.

Benchmark 11 – Browse Time

Measures how long it takes to load a series of popular websites from a local server, simulating real-world browsing. Longer times may reflect scanning delays introduced by the antivirus.

Benchmark 12 – File Copy, Move and Delete

This metric measures the time required to copy, move, and delete a sample file set containing a variety of common formats, including documents (e.g., Office, PDF, ZIP), media files (images, videos, music), and system files (executables, libraries). The test reflects typical file operations performed by everyday Windows users.

Benchmark 13 – File Format Conversion

Measures how long it takes to convert an MP3 file into both WAV and WMA formats, simulating common multimedia processing tasks.

Benchmark 14 – File Compression and Decompression

Times how long it takes to compress and extract a set of documents, images, and videos using standard zip tools.

Benchmark 15 – File Write, Open and Close

Derived from Oli Warner's File I/O test at http://www.thepcspy.com (please see ***Reference #1: What Really Slows Windows Down***), this benchmark measures how long it takes to write a file and repeatedly open and close it—simulating heavy file access behavior.

AV Performance Results

The following charts present the benchmark results for all tested antivirus products across the 15 performance metrics. For visual clarity:

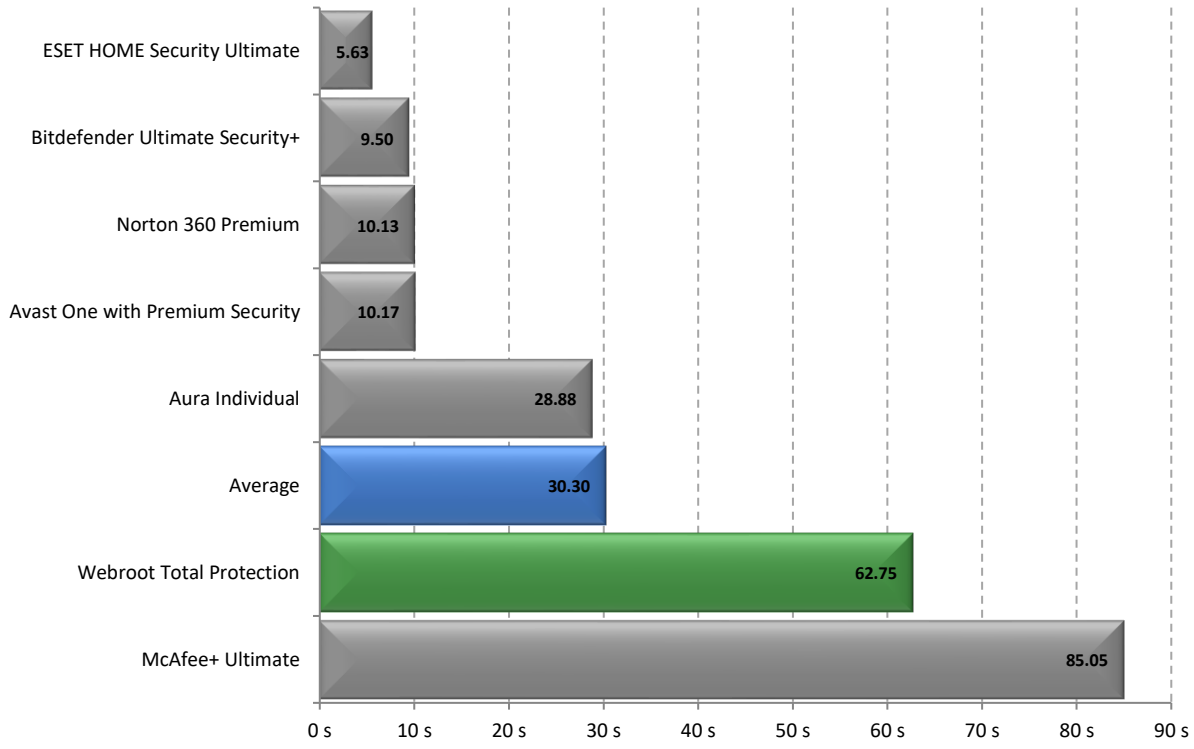
Webroot Total Protection results are highlighted in green
The average value across all products is shown in blue

Lower values typically indicate better performance for time- and resource-based metrics (e.g., scan time, memory usage).

Each benchmark result reflects the average of multiple test runs, conducted under consistent conditions with system reboots between rounds to minimize caching effects.

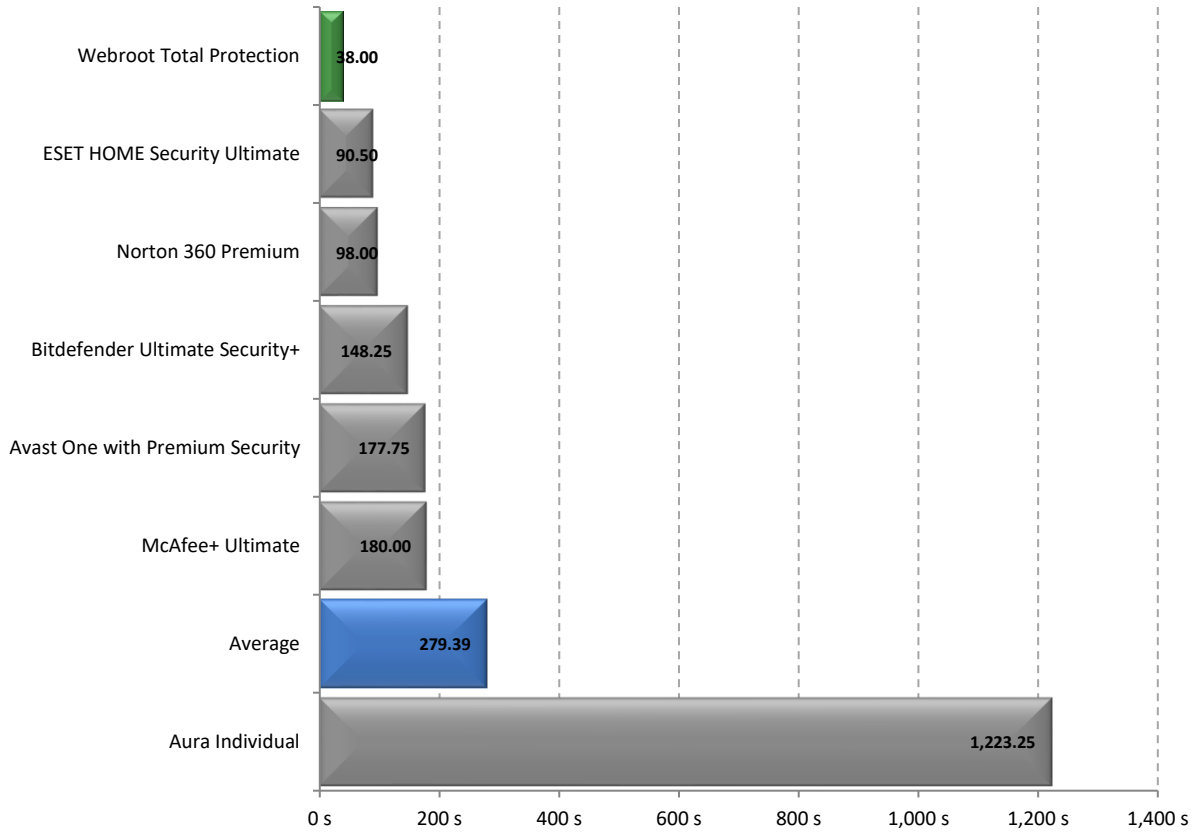
Benchmark 1 – Scan Time

This chart compares the average time taken to perform an on-demand scan of a 982 MB sample dataset. Products with lower scan times are considered to have better performance in this category.



Benchmark 2 – Scheduled Scan Time

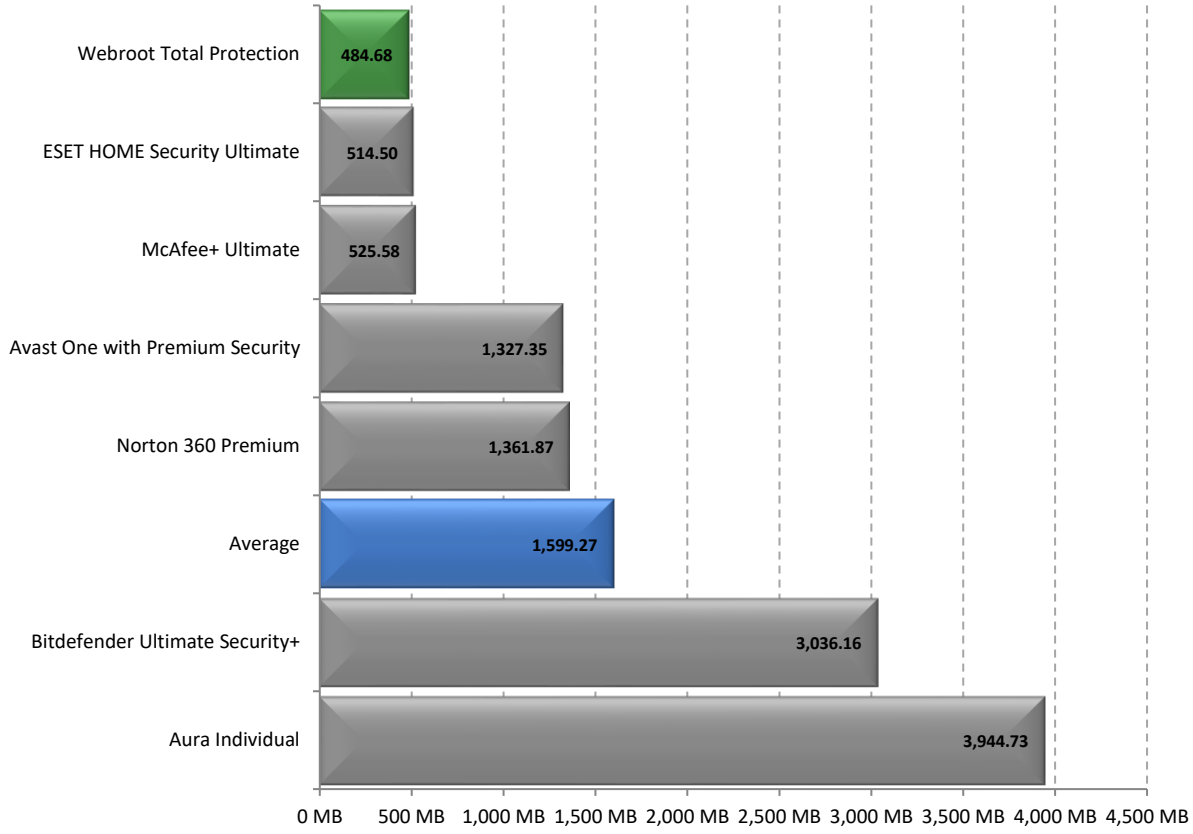
This chart shows the average time required to complete a scheduled scan. Products with shorter scan durations are considered more efficient. [1]



[1]Note: Microsoft Defender was excluded as it lacks scheduled scan functionality.

Benchmark 3 – Installation Size

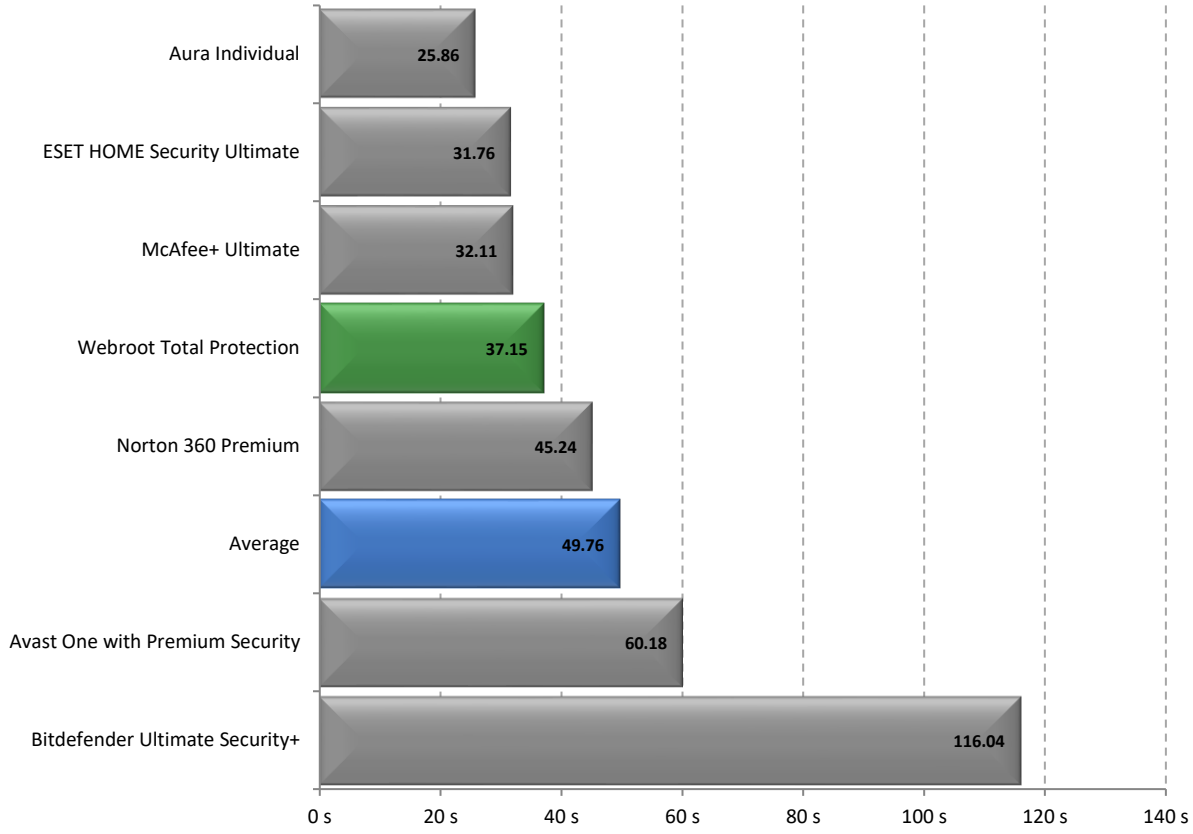
This chart compares the total disk space consumed by each product after installation. Products with a smaller installation footprint are considered better performing. [2]



[2] Note: Microsoft Defender was excluded as it is built into Windows.

Benchmark 4 – Installation Time

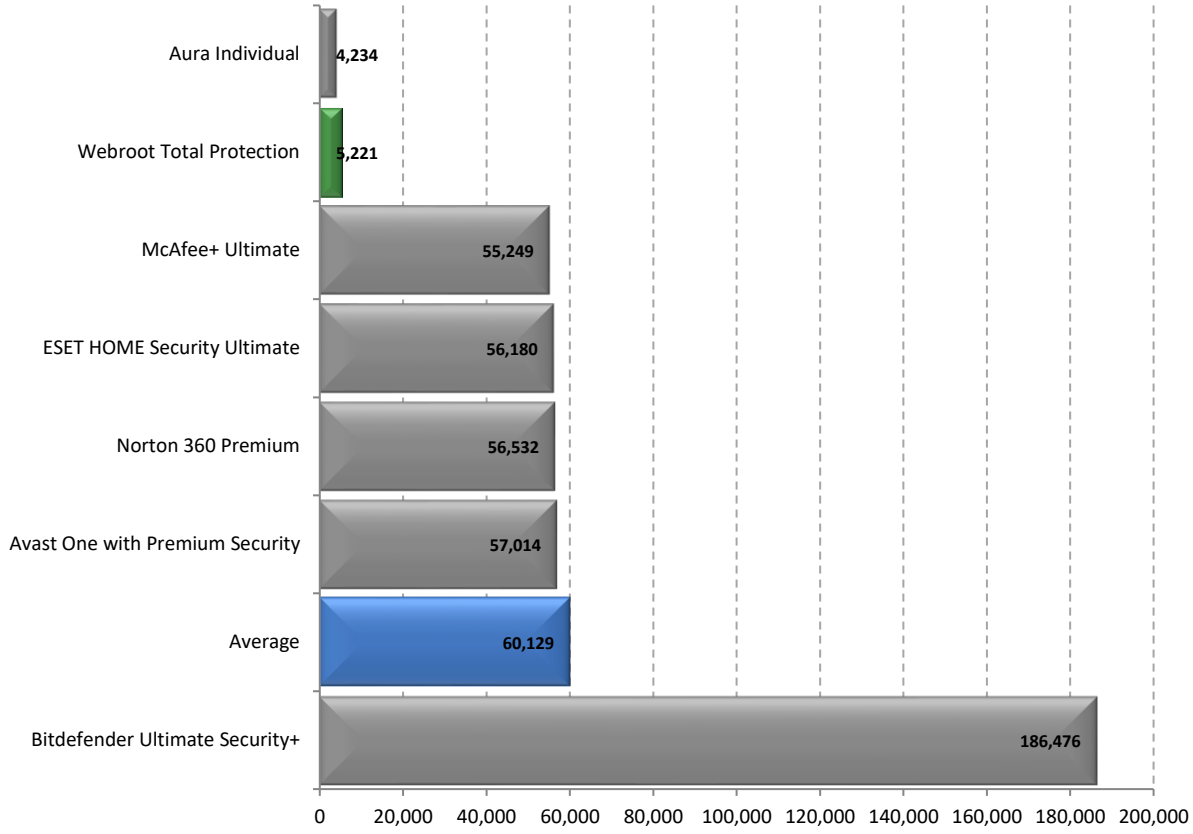
This chart reflects the time taken for each product to complete its installation and become fully functional. Products with lower installation times offer a faster setup experience. [3]



[3] Note: Microsoft Defender was excluded as it is pre-installed with Windows.

Benchmark 5 – Registry Keys Added

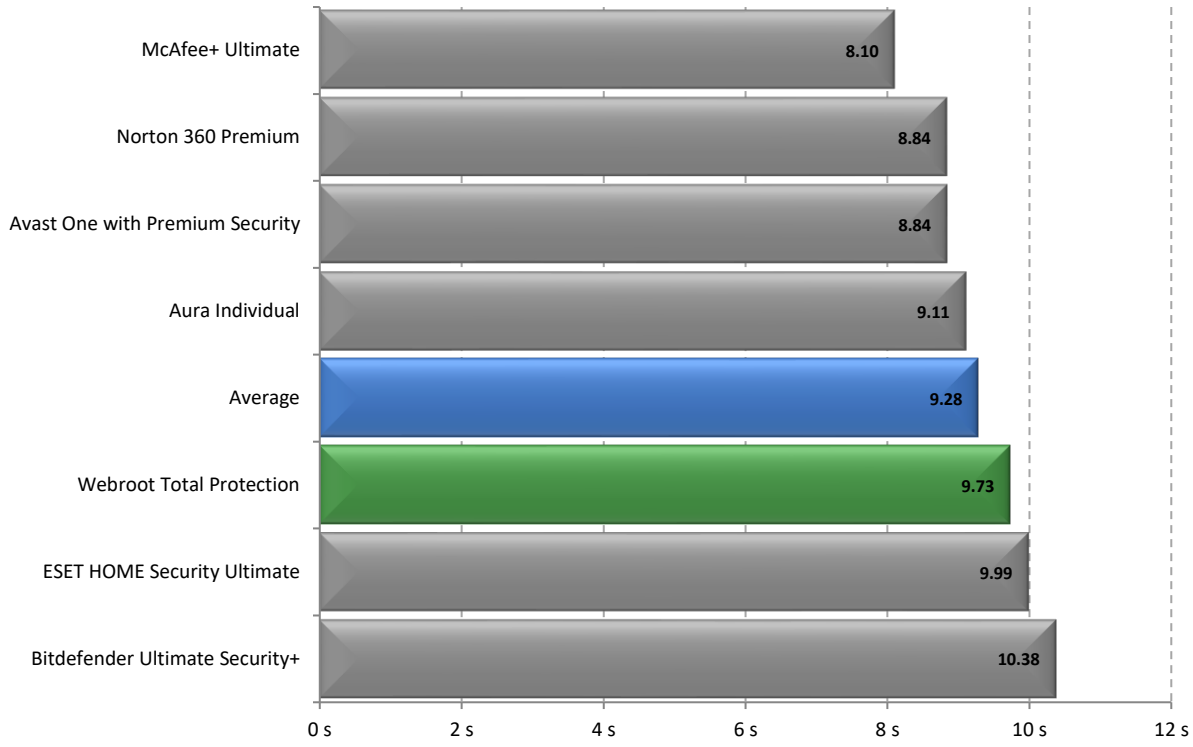
This chart shows the number of registry keys and values added during installation. Products with fewer additions are considered to have a lower system impact. [4]



[4] Note: Microsoft Defender was excluded from this test.

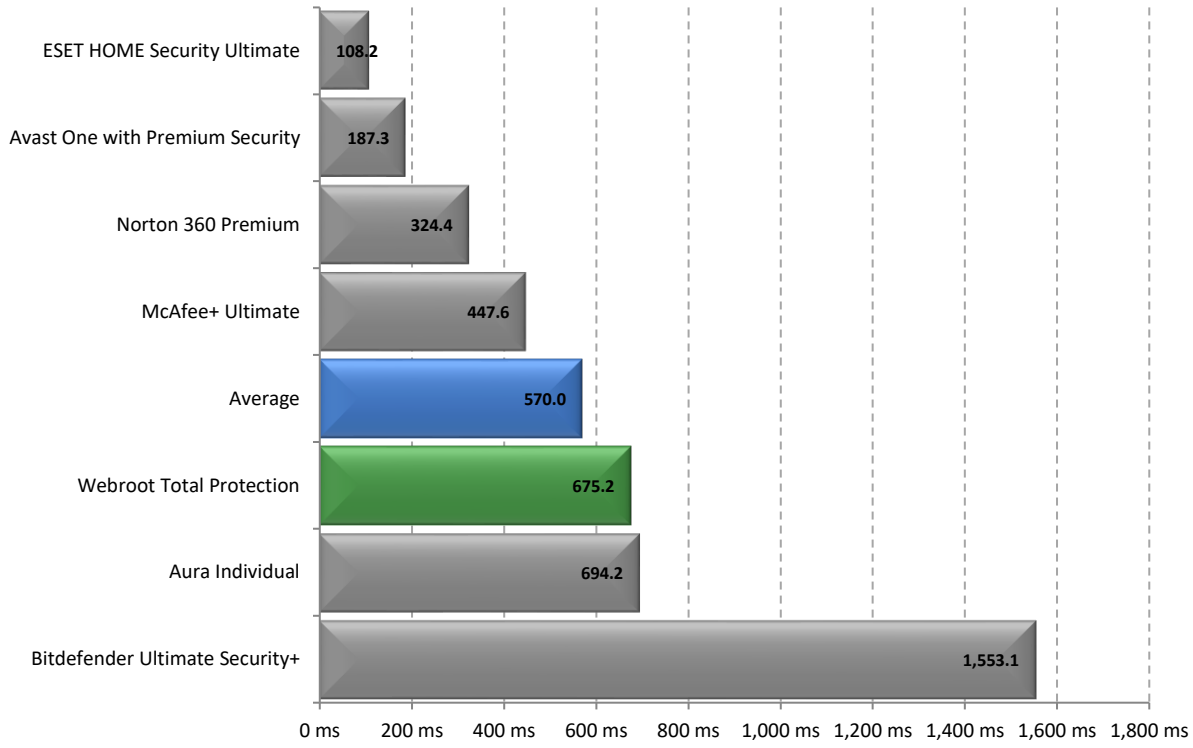
Benchmark 6 – Boot Time

The following chart compares the average time taken for the system to boot.



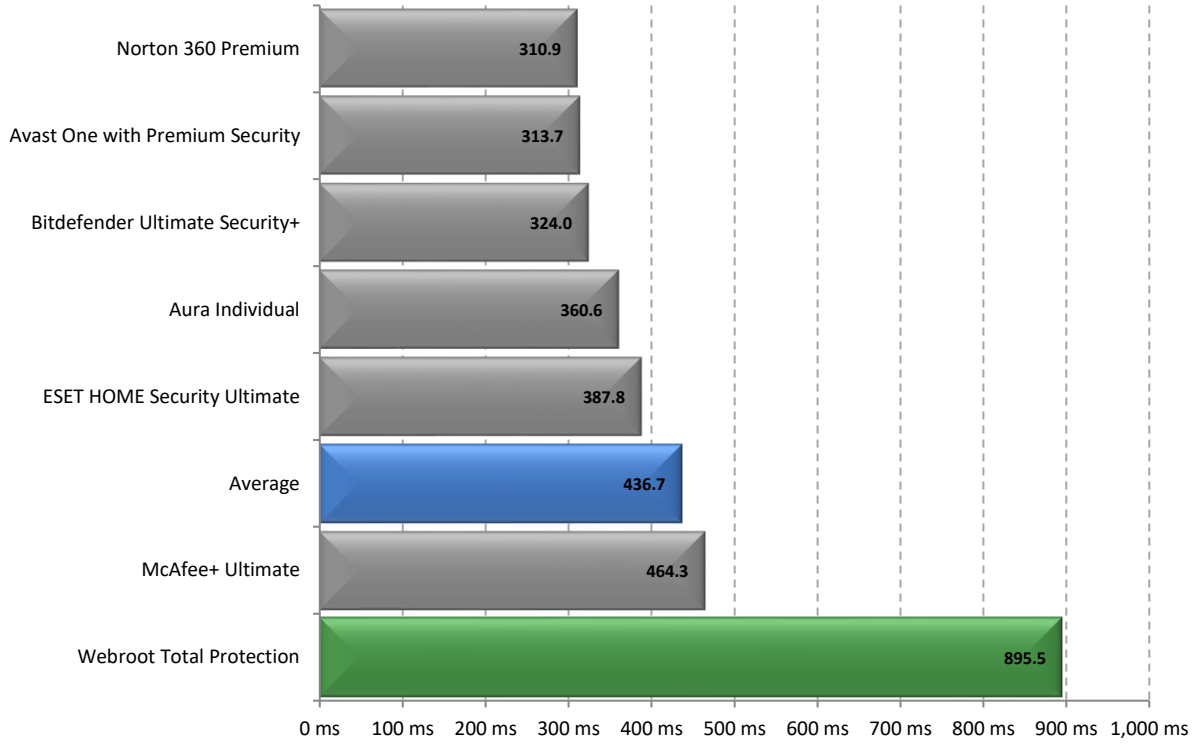
Benchmark 7 – User Interface Launch Time

This chart measures how long it takes to launch the antivirus product's user interface. Products with lower launch times provide a more responsive user experience.



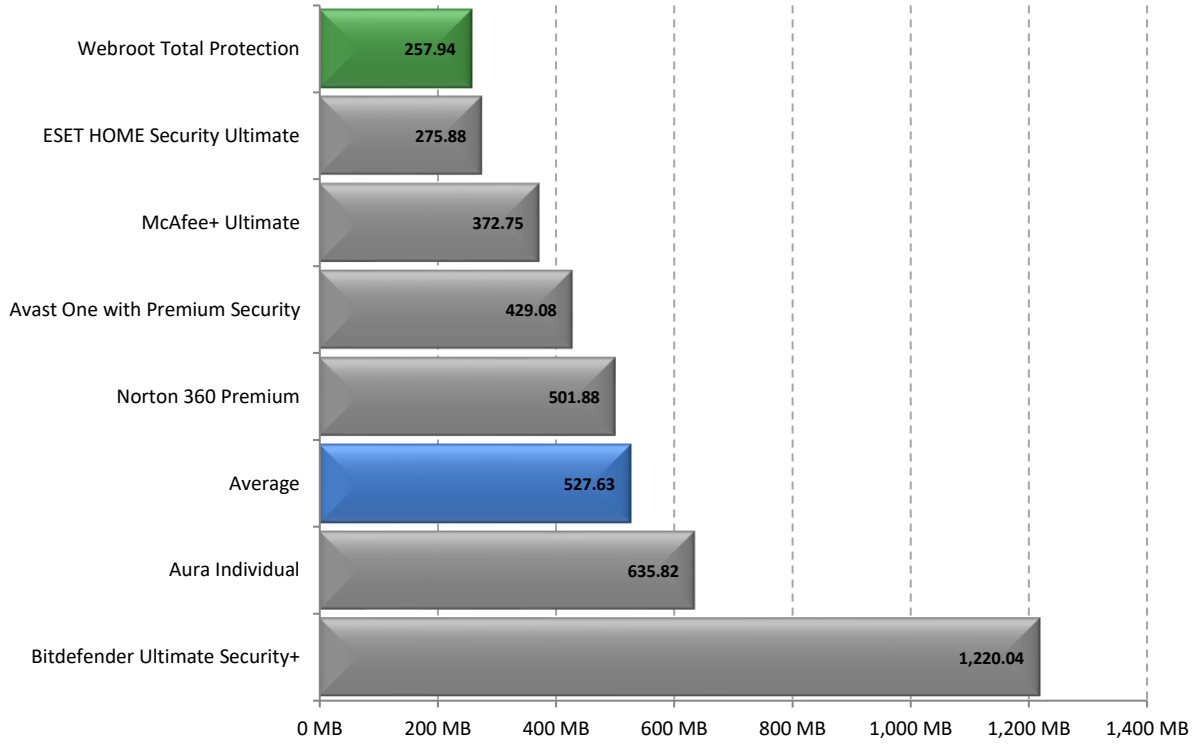
Benchmark 8 – Chrome Launch Time

This chart shows the time required to open Google Chrome after a system reboot. Lower times indicate less interference with everyday application performance.



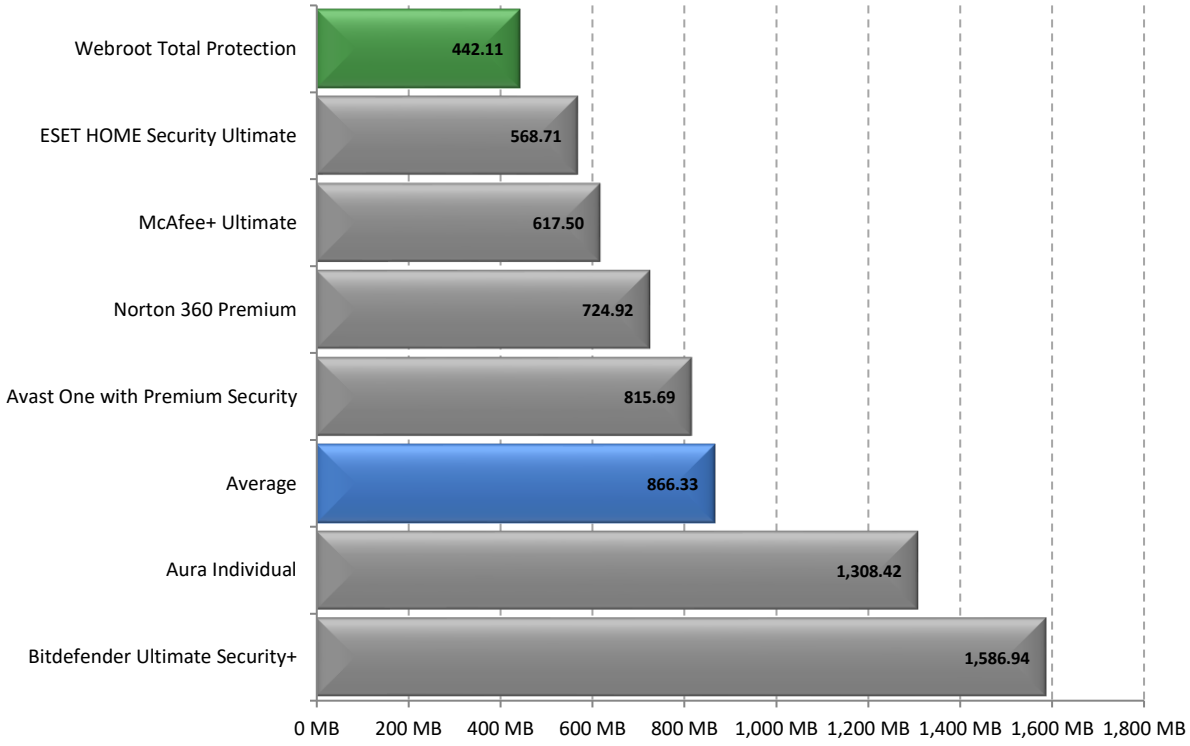
Benchmark 9 – Memory Usage during System Idle

This chart presents the average RAM usage by antivirus processes while the system is idle. Products with lower idle memory usage are more efficient and less likely to affect multitasking or background performance.



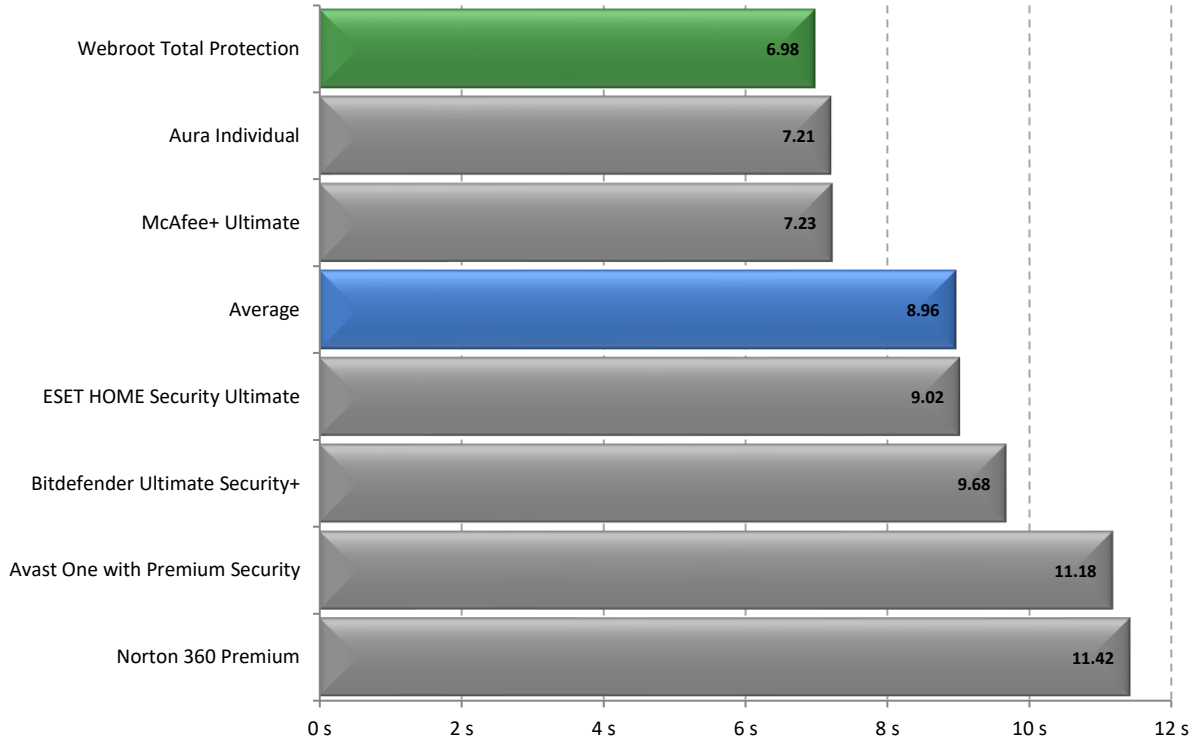
Benchmark 10 – Memory Usage during Initial Scan

This chart compares the average RAM usage by each product during a manual on-demand scan. Lower memory usage during scanning reflects more efficient resource management under active protection.



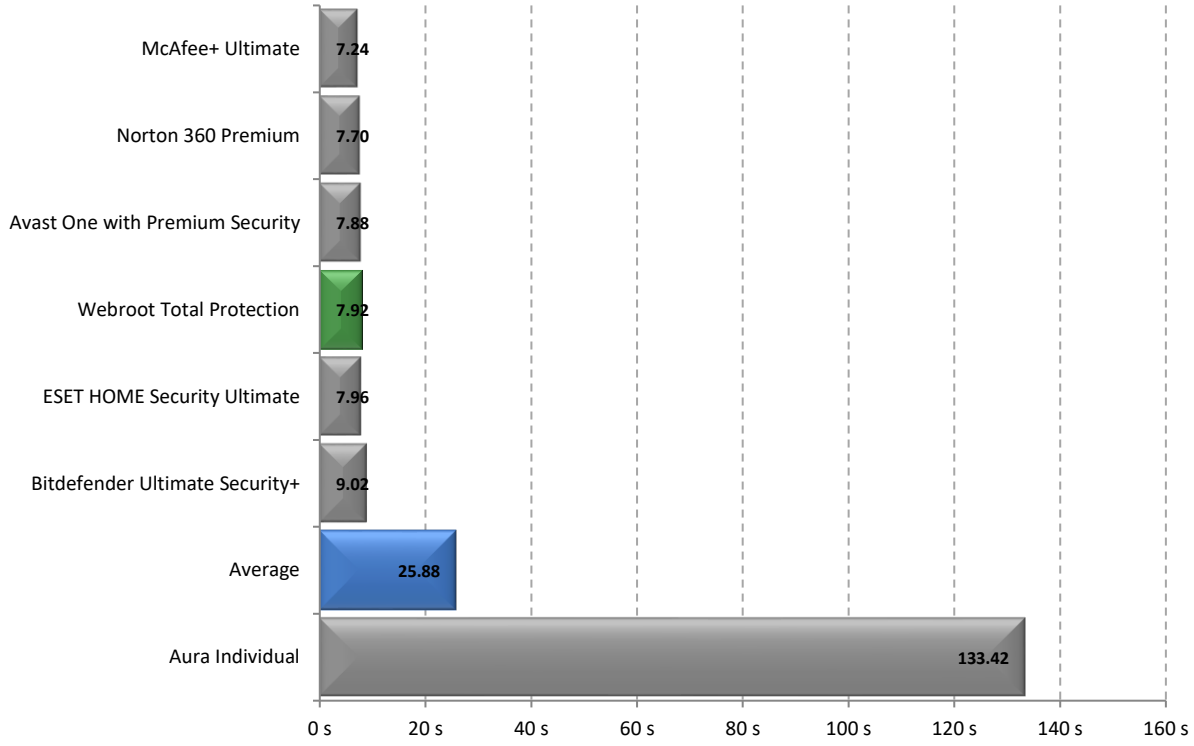
Benchmark 11 – Browse Time

This chart measures the time taken to load a series of popular websites from a local server using Google Chrome. Products with lower browse times are considered to have minimal impact on web browsing performance.



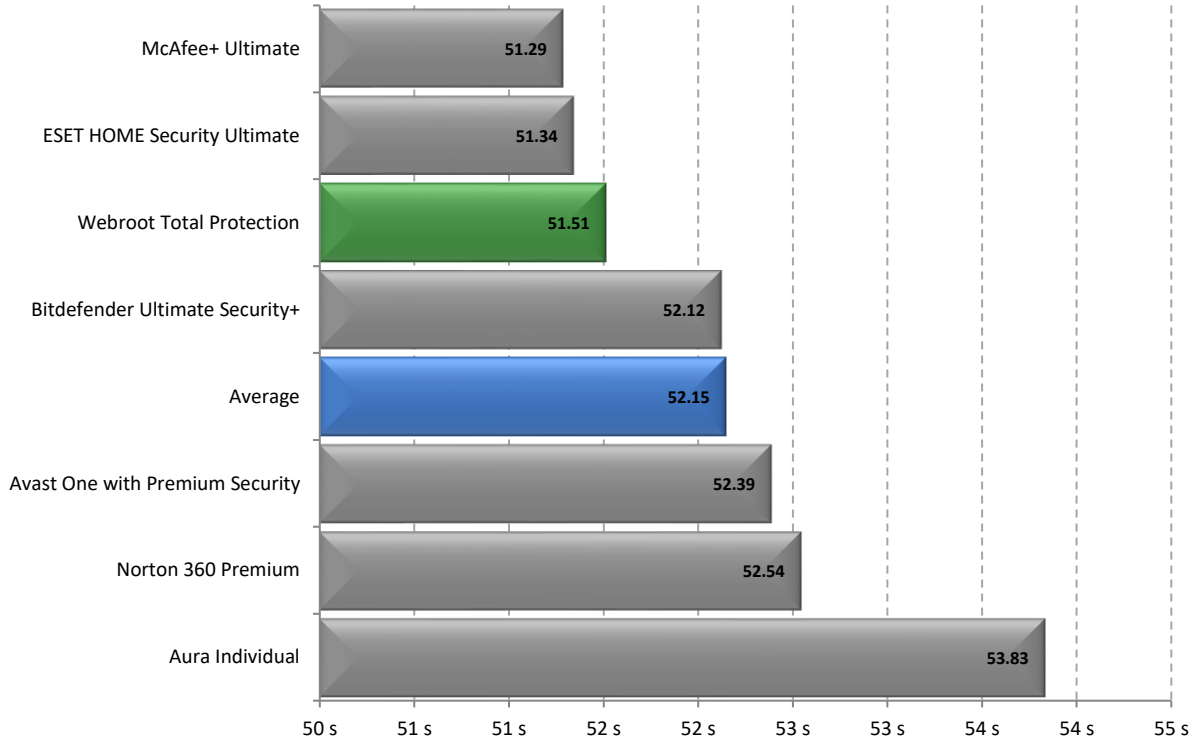
Benchmark 12 – File Copy, Move and Delete

This chart shows the time required to perform basic file operations—copying, moving, and deleting—on a mixed set of file types. Products with faster completion times demonstrate lower interference with file handling tasks.



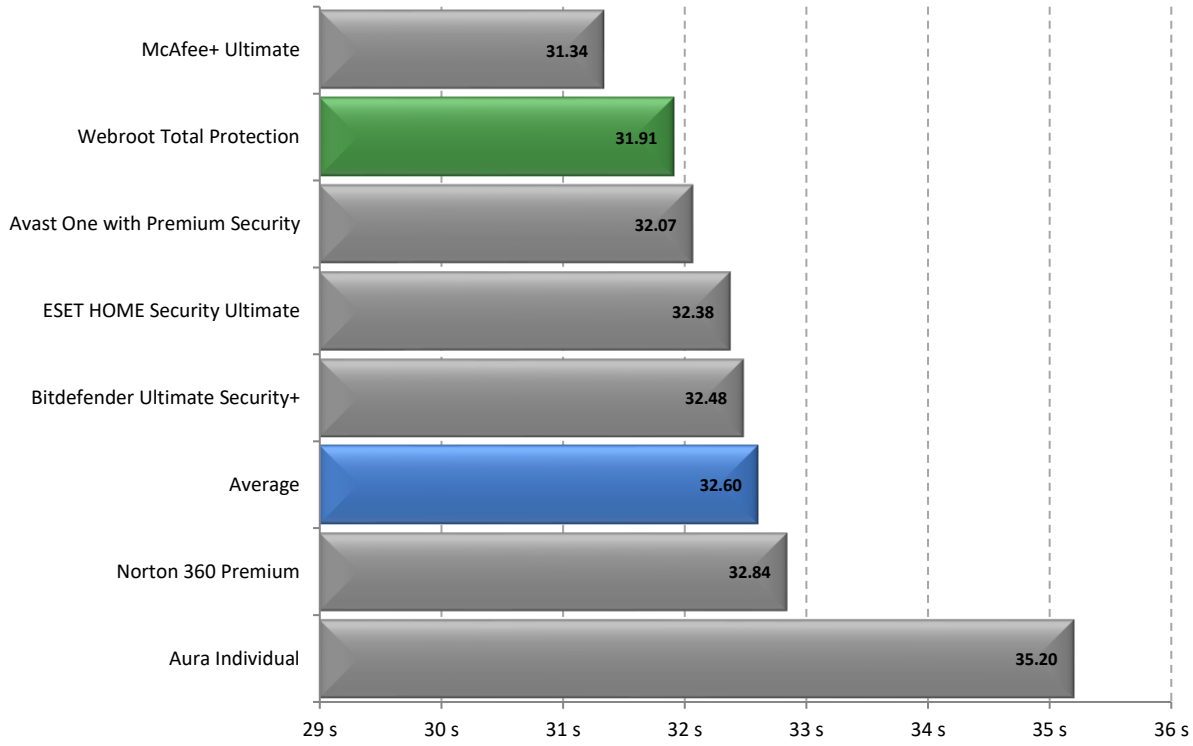
Benchmark 13 – File Format Conversion

This chart compares the time taken to convert MP3 files to WAV and WMA formats. Products with shorter conversion times show less impact on media processing workflows.



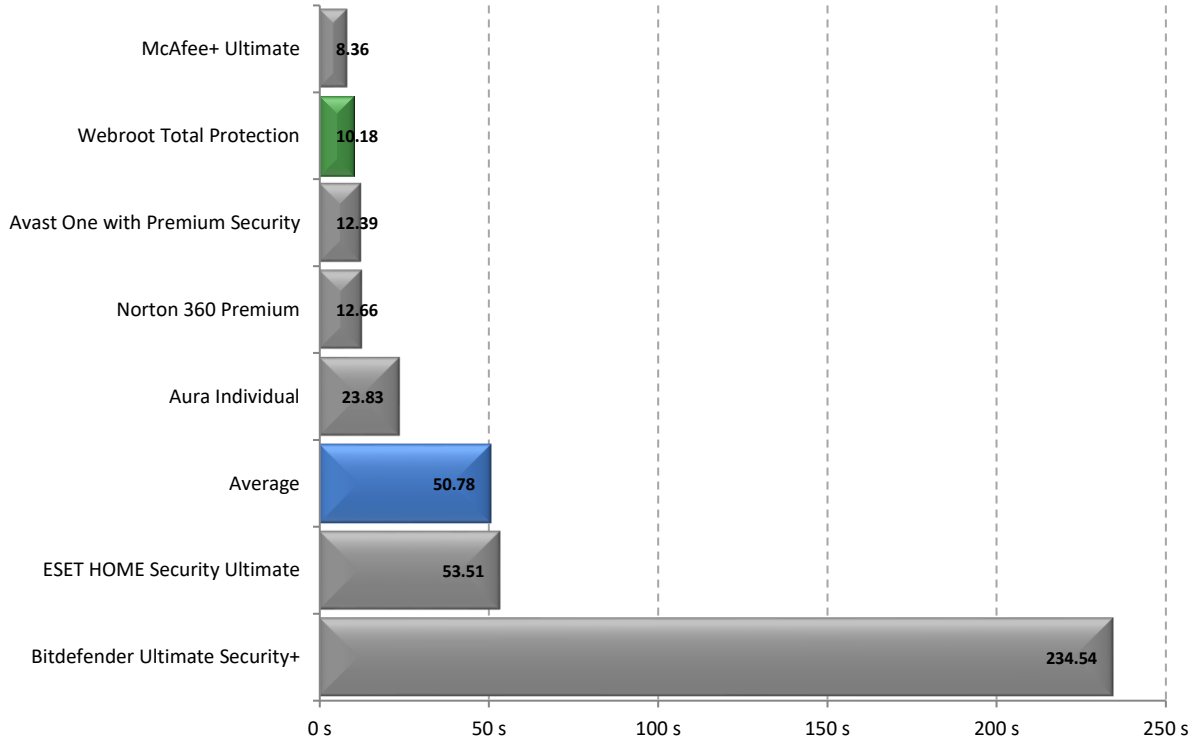
Benchmark 14 – File Compression and Decompression

This chart reflects how long it takes to compress and extract a set of files using standard compression tools. Products with lower times have less effect on common archiving tasks.



Benchmark 15 – File Write, Open and Close

This chart measures the time to repeatedly write, open, and close a file 180,000 times—simulating heavy file I/O operations. Lower times indicate better performance under sustained disk activity.



VPN Comparison

The table below presents a comparison of VPN features offered within several all-in-one security products. The comparison covers key attributes including available exit countries, server coverage, data transfer rate, usage limits, supported devices, and the inclusion of kill switch and split tunnelling capabilities.

	Exit Countries	Servers	Data Transfer Rate	Limit per Billing Period	Devices	Kill Switch	Split Tunnelling
Webroot Total Protection	80 locations in more than 65 countries	6500+ Servers	Not publicly disclosed.	Unlimited	5 devices	Yes	Yes
Norton 360 Premium	100 + Locations Norton FAQ: The Secure VPN in Norton 360 offers core privacy features but has fewer server locations than standalone Norton VPN plans, which provide broader city-level coverage and faster content access.	Not publicly disclosed.	Not publicly disclosed.	Not publicly disclosed.	Five PCs (Intel and ARM chips), Macs, smartphones or tablets	Yes	Yes
McAfee+ Ultimate	46 Counties	Not publicly disclosed.	Not publicly disclosed.	Unlimited	Unlimited Devices - Unlimited plans cover only household devices that you own for personal, non-commercial use, and is subject to our fair use policy.	Yes	Yes
Bitdefender Ultimate Security	110 Countries	More than 3,000 servers in 100+	Not publicly disclosed.	Unlimited	Five Devices	Yes	Yes, for Windows, Mac, iOS and Android
Aura Individual	100 virtual locations	Not publicly disclosed.	Not publicly disclosed.	Not publicly disclosed.	1 adult, 10 devices	Yes	Yes
ESET Home Security Ultimate	60 Countries	Not publicly disclosed.	Not publicly disclosed.	Unlimited	Five devices	Yes	Yes
Avast One with Premium Security	34 Countries	700 servers	Speeds of 450-600 Mbit/s	Not publicly disclosed.	Covers 1 Windows PC	Yes	Yes, for Windows, iOS and Android

Disclaimer and Disclosure

Disclaimer

This report is based on publicly available versions of each product at the time of testing. While every effort has been made to ensure the accuracy and completeness of the information provided, PassMark Software Pty Ltd accepts no responsibility for any errors, omissions, or outdated data. We shall not be held liable for any direct, indirect, incidental, or consequential damages resulting from the use or interpretation of this information.

Disclosure

This report was commissioned and funded by Webroot Inc. The list of products tested and the performance metrics evaluated were selected by Webroot. All testing and analysis were independently conducted by PassMark Software to ensure objective and repeatable results.

Trademarks

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Appendix 1 – Test Environment

All testing was conducted under controlled, repeatable conditions using consistent hardware and software configurations. The specifications for both the test machine and the local web server (used in the Browse Time benchmark) are provided below.

Test Machine Configuration

Component	Description
O/S:	Windows 11 Pro (64-bit)
Video card:	ASUS Dual Radeon RX 6600 XT OC
CPU:	Intel Core i3-12100 CPU @ 3.30 GHz
Motherboard:	ASUS PRIME Z690-A
RAM:	32GB DDR5 RAM
Main Drive:	Samsung 980 PRO NVMe M.2 SSD 500GB
2nd Drive	Samsung SSD 850 PRO 512GB
Network:	1 Gbps (connected via Gigabit Ethernet cable)

Back Up Benchmarking Configuration

Component	Description
O/S:	Windows 11 Pro (64-bit)
CPU:	Azure F16s vCore
RAM:	64GB
Network:	~8 – 12 Gbps

General Test Setup Notes

All tests were performed on clean Windows installations, with full system resets between antivirus product installs.
Startup applications and scheduled maintenance tasks (e.g., Windows Update) were disabled using Task Manager, Task Scheduler, and Group Policy where applicable.
Windows Defender was disabled when testing third-party antivirus products to avoid interference.
Each benchmark was run multiple times, with system reboots between rounds to reduce caching effects and improve result consistency.
All antivirus products were tested using default settings unless otherwise noted.

Appendix 2 – Detailed Test Procedures

Windows 11 Image Preparation

To ensure consistency and eliminate external OS factors, a streamlined Windows 11 Pro image was prepared and restored before each product test using Macrium Reflect. This baseline image minimized background noise and system variation.

Preparation Steps:

1. Install and activate Windows 11 Pro.
2. Remove the Windows login password.
3. Set User Account Control to “Never Notify”.
4. Disable SysMain to prevent background optimization.
5. Install essential test tools, including:
   - HTTP Watch (Browse Time test)
   - Windows Assessment and Deployment Kit (Boot Time test)
   - OSForensics (Installation Size test)
6. Apply the latest Windows updates.
7. Disable Windows Automatic Updates.
8. Create a system image using Macrium Reflect.

Benchmark 1 – Scan Time

This test measures how long each antivirus product takes to complete an on-demand scan of a fixed, clean sample dataset. The same file set was used for all products, consisting of 6,166 files totaling 982 MB, including a mix of system files, Microsoft Office documents, and other common file types.

A breakdown of file types and counts in the dataset is provided below:

File Format	Number	Total Size
DLL	2589	490 MB
EXE	694	101 MB
SYS	332	23.3 MB
GIF	302	567 KB
DOC	281	64.2 MB
WMF	185	1.78 MB
PNG	149	1.93 MB
HTM/HTML	126	946 KB
CAT	111	7.25 MB
NLS	80	6.63 MB
JPG	70	1.09 MB
INI	59	1.76 MB
ICO	58	58.2 KB
MOF	43	6.12 MB
AX	39	4.48 MB
XLS	38	3.62 MB
CFG	36	141 KB
POT	36	2.37 MB
IME	35	5 MB
DRV	31	1.19 MB
TXT	31	366 KB
CHM	30	6.28 MB
OCX	30	6.12 MB
CPL	29	4.42 MB
MFL	29	2.62 MB
INF	26	1.54 MB
TLB	25	2.17 MB
DOT	24	1.55 MB

File Format	Number	Total Size
FRA	3	880 KB
IQY	3	830 bytes
ISP	3	601 bytes
ITA	3	930 KB
MB	3	4.36 MB
MML	3	771 KB
MMW	3	946 KB
NLD	3	1.11 MB
RAR	3	1.91 MB
ROM	3	54.1 KB
SIG	3	19.8 KB
SVE	3	993 KB
TTF	3	580 KB
ACS	2	3.8 MB
C	2	28.5 KB
CMD	2	1.6 KB
LO_	2	128 KB
LXA	2	1.19 MB
MAP	2	3.72 KB
MDB	2	516 KB
MMF	2	1.92 KB
MSI	2	1.65 MB
NT	2	4.16 KB
OBE	2	13.9 KB
ODC	2	386 bytes
POL	2	488 bytes
RLL	2	112 KB
TAB	2	160 KB

HLP	22	3.44 MB
IMD	20	18 MB
PY	20	79.2 KB
[NO EXTENSION]	19	3.29 MB
MSC	18	752 KB
VBS	18	838 KB
XML	18	574 KB
RTF	16	62.1 MB
ECF	15	15.6 KB
INC	15	27.3 KB
COM	14	282 KB
DAT	14	1.83 MB
LOG	14	4.53 MB
TSP	14	1.22 MB
XSL	14	44.3 KB
H	12	56.5 KB
TBL	13	606 KB
AW	12	2.59 MB
FAE	12	1.02 MB
JS	12	429 KB
SCR	12	2.5 MB
VSD	12	1.67 MB
ZIP	11	25.2 MB
[HIDDEN FILES]	11	-
PNF	10	1 MB
ACM	9	836 KB
ICM	9	192 KB
LEX	9	10.3 MB
PPT	9	4.46 MB
MANIFEST	8	5.96 KB
UCE	8	240 KB
ACG	7	780 KB
OLB	7	1.34 MB
WAV	7	5.03 MB
WIZ	7	1.11 MB
BIN	6	25 MB
GPD	6	112 KB
CNT	5	4.15 KB
DUN	5	2.46 KB
MPP	5	1.83 MB
PIP	5	12.5 KB
SAM	5	305 KB
ADM	4	1.64 MB
BAT	4	22.4 KB
CPX	4	6.46 KB
FON	4	61.3 KB
SCP	4	8.53 KB
SEP	4	6.79 KB
CSS	3	11.4 KB
DEU	3	1.45 MB
DTD	3	22.6 KB
ENU	3	999 KB
ESN	3	815 KB

TSK	2	2.25 KB
XLA	2	79 KB
ACL	1	37 KB
BMP	1	234 KB
BTR	1	1.25 MB
BUD	1	93 KB
CHK	1	8 KB
CHS	1	1.65 KB
CHT	1	1.65 KB
CNV	1	52 KB
CPI	1	124 KB
DATA	1	5.99 MB
DB	1	17.5 KB
DBL	1	2.13 KB
DHS	1	138 bytes
DICT	1	18 KB
DIZ	1	428 bytes
DLS	1	3.28 MB
DPC	1	414 bytes
ENG	1	751 bytes
GRA	1	182 KB
HOL	1	269 KB
HTC	1	28 KB
HXX	1	6.55 KB
ICS	1	375 bytes
IMG	1	66.2 KB
JPN	1	2.01 KB
KOR	1	2 KB
LOCAL	1	0 bytes
MOD	1	2.03 KB
MST	1	3.99 MB
NVU	1	2.74 KB
OPS	1	2.26 KB
PAT	1	42 bytes
PRF	1	6.62 KB
PRO	1	20.7 KB
RAM	1	64 bytes
RAT	1	3.09 KB
RSP	1	4.19 KB
SCF	1	75 bytes
SDB	1	1.03 MB
SDF	1	888 bytes
SLL	1	471 KB
SPD	1	1.6 MB
SQL	1	748 KB
SVG	1	77.5 KB
THA	1	697 bytes
TPL	1	10.5 KB
TRM	1	4 KB
VXD	1	81 bytes
WMA	1	2.5 MB
WMV	1	649 KB
WSC	1	39.5 KB

			Total	**6166**	**982 MB**

The scan was initiated by right-clicking the folder and selecting "Scan Now" (or equivalent). Scan time was recorded using the antivirus product's built-in timer or reporting system. Where such tools were unavailable, time was measured manually with a stopwatch.

Each product was tested across five runs, with a full system reboot before each run to eliminate any caching effects from the operating system or the antivirus product itself. It is common for scan times to drop significantly after the first scan due to internal caching.

To account for this, the final scan time result was calculated as follows:

Initial Scan Time: First run
Subsequent Scan Average: Average of scans 2 through 5
Final Result: Average of the initial scan and subsequent scan average

This approach ensures a balanced representation of both first-time and typical scan performance.

Benchmark 2 – Scheduled Scan Time

This test measures how long the antivirus software takes to complete a scheduled system scan using its default configuration.

The scan was scheduled to run at the next available time through the product's built-in scheduler. When prompted to choose a scan target, the C:\ drive was selected. Each product was tested across three runs, with a system reboot before each to eliminate caching effects.

The final result was calculated as a weighted average:

50% weight assigned to the initial scan
50% weight assigned to the average of the two subsequent scans

If a product did not support scheduled scans or if the feature proved unreliable, it was excluded from the benchmark and assigned the lowest score for this metric.

Benchmark 3 – Installation Size

This test measures the total disk space consumed by each antivirus product after installation.

We used ***OSForensics*** to capture disk signatures both before and after product installation. These signatures recorded comprehensive file system data, including the number of files and folders, file names, sizes, checksums, and timestamps.

The initial disk signature was created immediately before installation.
The post-installation signature was captured after the system was rebooted and any product updates were completed.

The two signatures were then compared to determine the size of all new and modified files. The final result reflects the combined total size of these changes, providing a clear indication of the product's disk footprint.

Benchmark 4 – Installation Time

This benchmark measures the total time required for each antivirus product to become fully installed and operational from the user's perspective.

To reduce variability due to disk performance, each installer was copied to the local drive before starting the test. Installation time was manually recorded using a stopwatch and divided into three key phases:

Extraction and Setup Phase
Includes initial file unpacking, EULA acceptance, activation prompts, and any user-defined configuration steps.

File Copy Phase
Covers the main installation process, typically represented by a progress bar as files are written to disk.

Post-Installation Phase
Captures any remaining setup actions following file copy, including reboots, initial scans, or background initialization until the product reaches an idle state (e.g., visible in the system tray).

Where user input was required during the process, the stopwatch was paused, and the interaction was documented separately in the raw test data.

Additional notes:

If a pre- or post-installation scan could not be skipped, its duration was included in the total time.
Optional components (e.g., browser extensions) were installed if they were considered part of the product's core functionality.
If the installer downloaded additional components (such as updates or modules), the time taken for these downloads was included in the measurement and noted in the results.
Activation time was excluded to avoid inconsistencies from network-related delays or account setup requirements.

Benchmark 5 – Registry Keys Added

This test measures the number of Windows Registry keys and values added during antivirus product installation.

Using ***OSForensics***, registry snapshots were taken both before and after installation. The Signatures feature was used to compare the snapshots and identify new or modified entries.

The analysis focused on changes under the following registry hives:

HKEY_LOCAL_MACHINE
HKEY_USERS

The result reflects the total number of new keys and values added following a reboot after successful installation. A higher number may indicate deeper integration into the system and potentially greater long-term impact on performance.

Benchmark 6 – Boot Time

This benchmark measures how much the antivirus product affects Windows startup time.

The test was conducted using the ***Windows Performance Toolkit***, part of the Windows Assessment and Deployment Kit (ADK). Each antivirus product was evaluated individually using the Windows Assessment Console, with network connectivity disabled during testing to minimize variability.

The final result reflects the total time taken to boot into Windows, excluding the BIOS phase. This provides a consistent metric for assessing system startup impact caused by the installed antivirus software.

Benchmark 7 – User Interface Launch Time

This test measures how quickly the antivirus product's main user interface (UI) launches from the desktop environment.

We used ***AppTimer*** to automate UI launch measurements. For each product, 15 samples were collected, grouped into five sets of three launches. A system reboot was performed before each set to clear OS-level caching. The first launch in each set was recorded separately to distinguish initial (cold) launch performance from subsequent (warm) launches.

The final score was calculated as:

The average of the four subsequent launches
Combined with the initial launch time
Then averaged to give the final result

In cases where ***AppTimer*** failed to capture the full load time accurately (e.g., when the UI window appeared but remained unresponsive), the launch time was measured manually using a stopwatch.

Benchmark 8 – Chrome Launch Time

This test evaluates the impact of antivirus software on the launch time of a commonly used application — ***Google Chrome***.

The methodology was identical to the UI launch test:

15 launch samples were collected per product
Divided into five sets of three launches
A reboot was performed before each set to flush any caching effects

We used ***Google Chrome (version 137.0.7151.41)*** for consistency. The first launch in each set was separated from the subsequent two, allowing us to calculate:

The average subsequent launch time
Combined with the initial launch time
Then averaged to produce the final result

This benchmark helps assess whether the antivirus product affects the responsiveness of everyday applications.

Benchmark 9 – Memory Usage during System Idle

This test measures the memory (RAM) consumed by the antivirus software while the system is idle after startup.

We used the ***PerfLog++*** utility to record system-wide memory usage starting from boot, then once per minute for the next 15 minutes. A total of 15 samples were collected, with the first sample (at boot) discarded to avoid capturing transient startup behavior.

Since ***PerfLog++*** logs memory usage for all system processes, we used Process Explorer immediately after data collection to identify and isolate memory usage for only the antivirus-related processes. This allowed us to calculate the RAM footprint specifically attributable to each product while idle.

Benchmark 10 – Memory Usage during Initial Scan

This test measures memory consumption while an on-demand antivirus scan is in progress.

We used ***PerfLog++*** to monitor RAM usage at 5-second intervals over a 60-second period during a manual scan of the C:\ drive. As with Benchmark 9, Process Explorer was used to isolate antivirus processes from other system activity.

To ensure accuracy, we took precautions to prevent the antivirus product from scanning the C:\ drive before the test, as some products cache scan paths and may reduce memory usage in repeated scans. The scan and memory logging were initiated simultaneously to ensure synchronized sampling.

Benchmark 11 – Browse Time

This test measures how antivirus software may impact web browsing performance by recording the time taken to load a sequence of popular websites.

We used ***Google Chrome*** to load 108 high-traffic websites (e.g., shopping, social media, news, finance, and reference sites) hosted on a local server to eliminate internet latency.

Each page in the dataset was modified with a few lines of JavaScript that automatically triggered the loading of the next page. This allowed us to measure the total time taken to sequentially load all sites. Start and end times were recorded to calculate the result.

The test was repeated five times, with the final score calculated as the average of the five runs.

Benchmark 12 – File Copy, Move and Delete

This benchmark measures the time required to perform basic file operations—copying, moving, and deleting—on a diverse set of file types commonly found on end-user systems.

The sample dataset included a mix of documents, media files, system files, and other standard formats. A breakdown of file types and counts is provided below:

File Format	Number	Total Size
DOC	24	91.6 MB
DOCX	12	48.8 MB
PPT	9	126 MB
PPTX	9	74.4 MB
XLS	12	51.5 MB
XLSX	12	14.6 MB
PDF	219	323 MB

File Format	Number	Total Size
ZIP	8	84.5 MB
7Z	2	1.66 MB
JPG	1045	135 MB
GIF	27	82.4 MB
PNG	5	483 KB
MOV	7	54.7 MB
RM	1	5.39 MB
AVI	24	130 MB
WMV	5	43.9 MB
MP3	84	356 MB
EXE	138	87.12 MB
DLL	625	213.6 MB
AX	2	36 KB
CPL	4	4.02 MB
CPX	4	8.56 KB
DRV	20	302 KB
ICO	2	210 KB
MSC	2	81.2 KB
NT	2	3.28 KB
ROM	4	71.4 KB
SRC	4	4.28 MB
SYS	4	88.12 KB
TLB	6	264 KB
TSK	2	2.24 KB
UCE	2	44.8 KB
Total	**2329**	**1.89 GB**

The test was repeated five times, with a full system reboot between each run to eliminate caching effects and ensure consistency. The final result reflects the average time taken to complete each operation across all five runs.

Benchmark 13 – File Format Conversion

This benchmark measures the time required to convert audio files between formats, simulating a common media processing task.

A set of 7 MP3 files (total size: 31.9 MB) was used. Each file was:

Converted to WAV
Then converted to WMA

The conversions were performed using the ***ffmpeg*** command-line tool, and the process was timed using ***CommandTimer***.

The test was repeated five times, with the system rebooted between each run to eliminate caching effects. The final result reflects the average time taken to complete both format conversions across all test runs.

Benchmark 14 – File Compression and Decompression

This test measures the time required to compress and then decompress a representative set of files using standard archiving tools.

The sample set contained 1,316 files totaling 1.15 GB, covering a variety of file types. A detailed breakdown of file formats, counts, and sizes is provided in the table below:

File Type	Number	Total Size
Document Files	78	97.9 MB
Image Files	1073	113 MB
Video Files	65	568 MB
Music Files	100	395 MB
Total	**1316**	**1.15 GB**

Compression and decompression were performed using ***7-Zip***, and the duration was recorded with ***CommandTimer***. Files were first archived into a .zip file, then extracted back to their original state.

The test was run five times, with a system reboot between each run to eliminate caching effects. Final results reflect the average time for both compression and decompression operations.

Benchmark 15 – File Write, Open and Close

This benchmark measures the system's performance under repeated file I/O operations and is based on Oli Warner's File I/O test from The PC Spy (see ***Reference #1: What Really Slows Windows Down***).

For this test, we developed a custom tool called ***OpenClose.exe***, which repeatedly writes, opens, and closes a small file in a tight loop. A total of 180,000 operations were executed per run. The execution time was recorded using ***CommandTimer***.

The test was repeated five times, with a reboot between each run to eliminate any caching effects. The final result reflects the average duration across all five samples.