### SPEC CPU®2017 Floating Point Speed Result

**Dell Inc.**

PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)

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**CPU2017 License:** 6573  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.

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<table>
<thead>
<tr>
<th>SpecMark</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_base</td>
<td>167</td>
</tr>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base (167)</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>24</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>24</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>24</td>
</tr>
<tr>
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<tr>
<td>638.imagick_s</td>
<td>24</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>24</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>24</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>24</td>
</tr>
</tbody>
</table>

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**Software**

- **OS:** Ubuntu 22.04.1 LTS 5.15.0-46-generic
- **Compiler:** C/C++/Fortran: Version 4.0.0 of AOCC
- **Parallel:** Yes
- **Firmware:** Version 1.1.0 released Nov-2022
- **File System:** tmpfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** Not Applicable
- **Other:** None
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage.

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**Hardware**

- **CPU Name:** AMD EPYC 9224
- **Max MHz:** 3700
- **Nominal:** 2500
- **Enabled:** 24 cores, 1 chip
- **Orderable:** 1 chip
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **L2:** 1 MB I+D on chip per core
- **L3:** 64 MB I+D on chip per core, 16 MB shared / 6 cores
- **Other:** None
- **Memory:** 768 GB (12 x 64 GB 2Rx4 PC5-4800B-R)
- **Storage:** 125 GB on tmpfs
- **Other:** None

---

**Test Date:** Dec-2022  
**Hardware Availability:** Dec-2022  
**Software Availability:** Nov-2022
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tbody>
<tr>
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<tr>
<td>638.imagick_s</td>
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<td>654.roms_s</td>
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<td>92.5</td>
<td>170</td>
<td>92.7</td>
<td>170</td>
<td></td>
<td></td>
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</table>

### Compiler Notes

The AMD64 AOCC Compiler Suite is available at http://developer.amd.com/amd-aocc/

### Submit Notes

The config file option 'submit' was used.

'numactl' was used to bind copies to the cores.

See the configuration file for details.

### Operating System Notes

'ulimit -s unlimited' was used to set environment stack size limit

'ulimit -l 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.

To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.

To free node-local memory and avoid remote memory usage, 'sysctl -w vm.zone_reclaim_mode=1' run as root.

To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.

To disable address space layout randomization (ASLR) to reduce run-to-run variability, 'sysctl -w kernel.randomize_va_space=0' run as root.
Dell Inc. PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)

CPU2017 License: 6573
CPU2017 License: Dell Inc.

Operating System Notes (Continued)

To enable Transparent Hugepages (THP) for all allocations, 'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and 'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

To always enable THP for peak runs of:
603.bwaves_s, 607.cactuBSSN_s, 619.lbm_s, 627.cam4_s, 628.pop2_s, 638.imagick_s, 644.nab_s, 649.fotonik3d_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

To disable THP for peak runs of 621.wrf_s:
'echo never > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

To enable THP only on request for peak runs of 654.roms_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo madvise > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-23"
LD_LIBRARY_PATH = 
"/mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b/amd_speed_aocc400_genoa_B_lib/lib:
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
MALLOCONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREADLIMIT = "24"

General Notes

Binaries were compiled on a system with 2x AMD EPYC 9174F CPU + 1.5TiB Memory using RHEL 8.6

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"
Dell Inc. PowerEdge R6615 (AMD EPYC 9224 24-Core Processor) SPEC#2017_fp_base = 167
SPEC#2017_fp_peak = Not Run

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: Dec-2022
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Platform Notes

BIOS settings:
- DRAM Refresh Delay: Performance
- DIMM Self Healing on
- Uncorrectable Memory Error: Disabled
- Logical Processor: Disabled
- Virtualization Technology: Disabled
- L3 Cache as NUMA Domain: Enabled

System Profile: Custom
- C-States: Disabled
- Memory Patrol Scrub: Disabled
- PCI ASPM L1 Link
- Power Management: Disabled
- Determinism Slider: Power Determinism
- Algorithm Performance
  - Boost Disable (ApbDis): Enabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on amd-sut Mon Dec 12 17:59:42 2022

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
- model name: AMD EPYC 9224 24-Core Processor
- 1 "physical id"s (chips)
- 24 "processors"

cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
- cpu cores: 24
- siblings: 24
- physical 0: cores 0 1 2 3 4 5 16 17 18 19 20 21 32 33 34 35 36 37 48 49 50 51 52 53

From lscpu from util-linux 2.37.2:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Address sizes: 52 bits physical, 57 bits virtual
- Byte Order: Little Endian
- CPU(s): 24
- On-line CPU(s) list: 0-23
- Vendor ID: AuthenticAMD
- Model name: AMD EPYC 9224 24-Core Processor
- CPU family: 25
- Model: 17

(Continued on next page)
Dell Inc.

PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)

SPECspeed®2017_fp_base = 167
SPECspeed®2017_fp_peak = Not Run

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Thread(s) per core: 1
Core(s) per socket: 24
Socket(s): 1
Stepping: 1
Frequency boost: enabled
CPU max MHz: 3707.0000
CPU min MHz: 400.0000
BogoMIPS: 5001.57

Virtualization: AMD-V
L1d cache: 768 KiB (24 instances)
L1i cache: 768 KiB (24 instances)
L2 cache: 24 MiB (24 instances)
L3 cache: 64 MiB (4 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-5
NUMA node1 CPU(s): 12-17
NUMA node2 CPU(s): 18-23
NUMA node3 CPU(s): 6-11

Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP disabled, RSB filling
Vulnerability Srbd: Not affected
Vulnerability Txs async abort: Not affected

(Continued on next page)
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Software Availability: Nov-2022

Platform Notes (Continued)

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 32K 768K 8 Data 1 64 1 64
L1i 32K 768K 8 Instruction 1 64 1 64
L2 1M 24M 8 Unified 2 2048 1 64
L3 16M 64M 16 Unified 3 16384 1 64

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 4 5
node 0 size: 193080 MB
node 0 free: 191591 MB
node 1 cpus: 12 13 14 15 16 17
node 1 size: 193534 MB
node 1 free: 193072 MB
node 2 cpus: 18 19 20 21 22 23
node 2 size: 193496 MB
node 2 free: 190995 MB
node 3 cpus: 6 7 8 9 10 11
node 3 size: 193498 MB
node 3 free: 192620 MB
node distances:
node 0 1 2 3
0: 10 11 11 11
1: 11 10 11 11
2: 11 11 10 11
3: 11 11 11 10

From /proc/meminfo
MemTotal: 792176524 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/sbin/tuned-adm active
Current active profile: latency-performance

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has performance

/usr/bin/lsb_release -d
Ubuntu 22.04.1 LTS

(Continued on next page)
Dell Inc.  
PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)  

**SPEC$speed®2017_fp_base = 167**  
**SPEC$speed®2017_fp_peak = Not Run**  

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**Platform Notes (Continued)**

From /etc/*release* /etc/*version*

debian_version: bookworm/sid  
os-release:
    PRETTY_NAME="Ubuntu 22.04.1 LTS"  
    NAME="Ubuntu"  
    VERSION_ID="22.04"  
    VERSION="22.04.1 LTS (Jammy Jellyfish)"  
    VERSION_CODENAME=jammy  
    ID=ubuntu  
    ID_LIKE=debian  
    HOME_URL="https://www.ubuntu.com/"

uname -a:  
Linux amd-sut 5.15.0-46-generic #49-Ubuntu SMP Thu Aug 4 18:03:25 UTC 2022 x86_64  
x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected  
CVE-2018-3620 (L1 Terminal Fault): Not affected  
Microarchitectural Data Sampling: Not affected  
CVE-2017-5754 (Meltdown): Not affected  
mmio_stale_data: Not affected  
retbleed: Not affected  
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp  
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swaps barriers and __user pointer sanitization  
CVE-2017-5715 (Spectre variant 2): Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling  
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected  
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Dec 12 17:09

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b  
Filesystem Type Size Used Avail Use% Mounted on  
tmpfs tmpfs 125G 3.4G 122G 3% /mnt/ramdisk

From /sys/devices/virtual/dmi/id  
Vendor: Dell Inc.  
Product: PowerEdge R6615  
Product Family: PowerEdge  
Serial: GLM4018

(Continued on next page)
Dell Inc. PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)

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Software Availability: Nov-2022

### Platform Notes (Continued)

Additional information from dmidecode 3.3 follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

**Memory:**
12x 802C0000802C MTC40F2046S1RC48BA1 64 GB 2 rank 4800

**BIOS:**
- **BIOS Vendor:** Dell Inc.
- **BIOS Version:** 1.1.0
- **BIOS Date:** 11/25/2022
- **BIOS Revision:** 1.1

(End of data from sysinfo program)

### Compiler Version Notes

```
Scientific C                | 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

```

```C++, C, Fortran | 607.cactuBSSN_s(base)```

```
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
(Continued on next page)```
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Compiler Version Notes (Continued)

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Fortran    | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base) 
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on 
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==============================================================================
Fortran, C  | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base) 
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on 
LLVM Mirror.Version.14.0.6)  
Target: x86_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang
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### Base Portability Flags

- 603.bwaves_s: -DSPEC_LP64  
- 607.cactuBSSN_s: -DSPEC_LP64  
- 619.hm_s: -DSPEC_LP64  
- 621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswap -DSPEC_LP64  
- 627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64  
- 628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswap -DSPEC_LP64  
- 638.imagick_s: -DSPEC_LP64  
- 644.nab_s: -DSPEC_LP64  
- 649.fotonik3d_s: -DSPEC_LP64  
- 654.roms_s: -DSPEC_LP64

### Base Optimization Flags

**C benchmarks:**

- `-m64`  
- `-W1,-mllvm -W1,-align-all-nofallthru-blocks=6`  
- `-W1,-mllvm -W1,-reduce-array-computations=3 -O3 -march=znver4`  
- `-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7`  
- `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`  
- `-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3`  
- `-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang`

**Fortran benchmarks:**

- `-m64`  
- `-W1,-mllvm -W1,-align-all-nofallthru-blocks=6`  
- `-W1,-mllvm -W1,-reduce-array-computations=3`  
- `-W1,-mllvm -W1,-enable-X86-prefetching -DSPEC_OPENMP -O3 -march=znver4`  
- `-fveclib=AMDLIBM -ffast-math -fopenmp -flto -Mrecursive`  
- `-funroll-loops -mlvm -lsep-in-nested-loop`  
- `-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp -lomp`  
- `-lamdlibm -lamdalloc -lflang`

**Benchmarks using both Fortran and C:**

- `-m64`  
- `-W1,-mllvm -W1,-align-all-nofallthru-blocks=6`  
- `-W1,-mllvm -W1,-reduce-array-computations=3`  
- `-W1,-mllvm -W1,-enable-X86-prefetching -O3 -march=znver4`  
- `-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7`  
- `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`  
- `-fremap-arrays -fstrip-mining -mlvm -reduce-array-computations=3`  
- `-DSPEC_OPENMP -zopt -Mrecursive -funroll-loops`  
- `-mlvm -lsep-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc`  
- `-lflang`

**Benchmarks using Fortran, C, and C++:**

- `-m64`  
- `-W1,-mllvm -W1,-align-all-nofallthru-blocks=6`

(Continued on next page)
### Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
- `-Wl,-mlllvm -Wl,-reduce-array-computations=3`
- `-Wl,-mlllvm -Wl,-x86-use-vzeroupper=false -O3 -march=znver4`
- `-ffast-math -fopenmp -flto -fstruct-layout=7`
- `-mlllvm -unroll-threshold=50 -mlllvm -inline-threshold=1000`
- `-fremap-arrays -fstrip-mining -mlllvm -reduce-array-computations=3`
- `-DSPEC_OPENMP -zopt -mlllvm -unroll-threshold=100 -finline-aggressive`
- `-mlllvm -loop-unschedule-threshold=200000 -Mrecursive -funroll-loops`
- `-mlllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang`

### Base Other Flags

C benchmarks:
- `-Wno-return-type` `-Wno-unused-command-line-argument`

Fortran benchmarks:
- `-Wno-unused-command-line-argument`

Benchmarks using both Fortran and C:
- `-Wno-return-type` `-Wno-unused-command-line-argument`

Benchmarks using Fortran, C, and C++:
- `-Wno-return-type` `-Wno-unused-command-line-argument`

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/aocc400-flags.html

You can also download the XML flags sources by saving the following links:

http://www.spec.org/cpu2017/flags/aocc400-flags.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-AMD-EPYC-v1.0.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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