



SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2021 Standard Performance Evaluation Corporation

GIGA-BYTE TECHNOLOGY CO., LTD.

SPECrate®2017_fp_base = 213

R272-P30-00 (Ampere Altra Q80-33 3.0GHz)

SPECrate®2017_fp_peak = 219

CPU2017 License: 9082

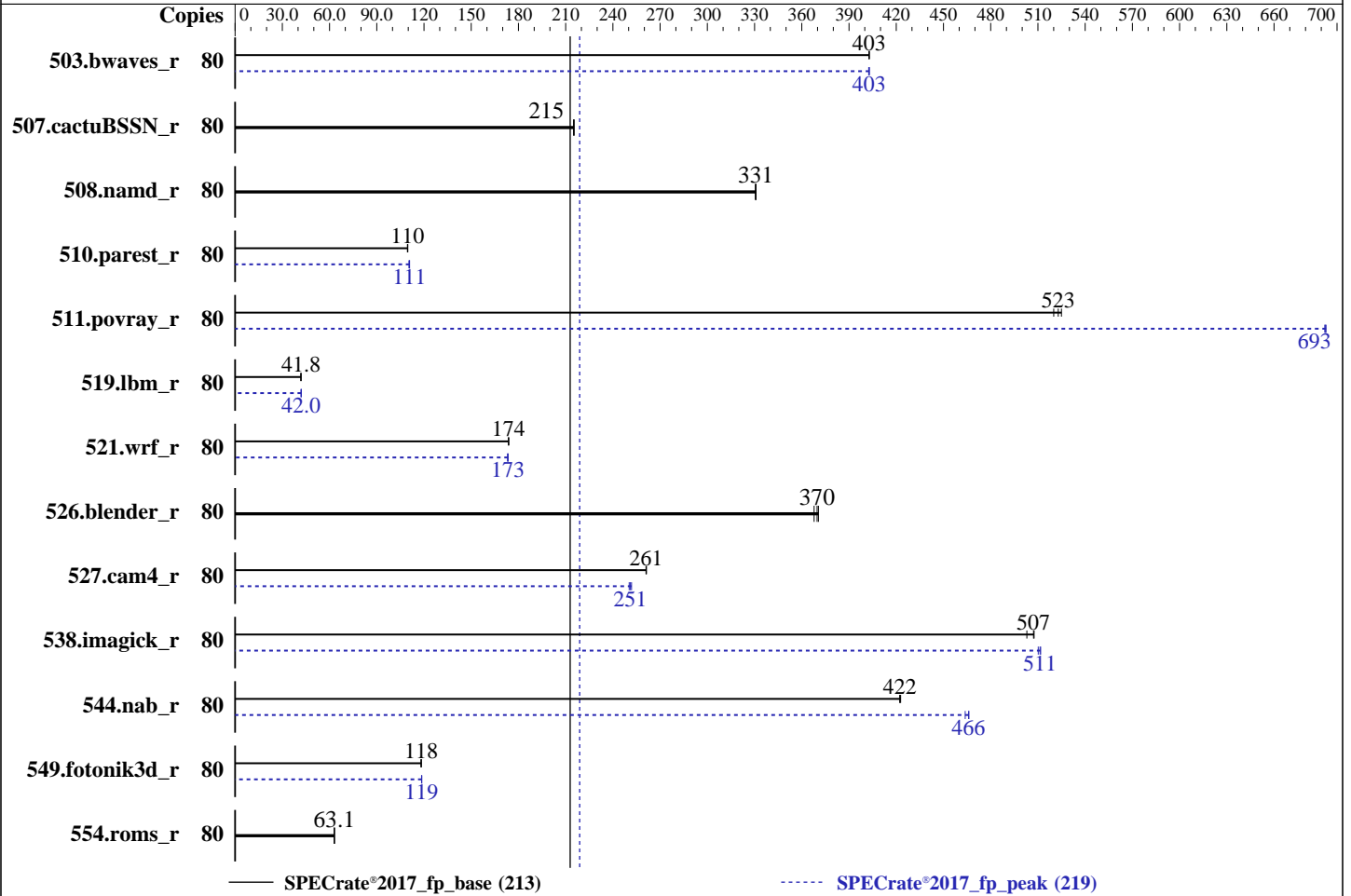
Test Date: Jul-2021

Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.

Hardware Availability: Jun-2021

Tested by: GIGA-BYTE TECHNOLOGY CO., LTD.

Software Availability: Jun-2021



Hardware

CPU Name: Ampere Altra Q80-33
 Max MHz: 3300
 Nominal: 3000
 Enabled: 80 cores, 1 chip
 Orderable: 1 chips
 Cache L1: 64 KB I + 64 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 32 MB I+D on chip per chip
 Other: None
 Memory: 256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)
 Storage: 819 GB, NVME, M.2, PCIe Gen 3
 Other: None

Software

OS: CentOS Linux release 8.4.2105
 4.18.0-305.7.1.el8_4.aarch64
 Compiler: C/C++/Fortran: Version 10.2.1 of Ampere GCC
 Parallel: No
 Firmware: Version F16e released Jun-2021
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 64-bit
 Other: Jemalloc memory allocator library v5.2.1
 Power Management: OS set to prefer performance at the cost of additional power usage



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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	80	1992	403	1992	403	1991	403	80	1993	403	1991	403	1992	403
507.cactuBSSN_r	80	470	215	471	215	471	215	80	470	215	471	215	471	215
508.namd_r	80	230	331	230	331	230	330	80	230	331	230	331	230	330
510.parest_r	80	1911	109	1907	110	1910	110	80	1895	110	1889	111	1888	111
511.povray_r	80	356	525	357	523	359	520	80	270	692	270	693	270	693
519.lbm_r	80	2013	41.9	2017	41.8	2016	41.8	80	2007	42.0	2008	42.0	2009	42.0
521.wrf_r	80	1032	174	1031	174	1031	174	80	1034	173	1035	173	1034	173
526.blender_r	80	329	371	330	370	331	368	80	329	371	330	370	331	368
527.cam4_r	80	536	261	535	261	536	261	80	557	251	559	250	556	252
538.imagick_r	80	392	508	396	503	392	507	80	389	511	389	512	390	510
544.nab_r	80	318	423	319	422	319	422	80	290	464	289	466	289	466
549.fotonik3d_r	80	2636	118	2639	118	2637	118	80	2632	118	2629	119	2630	119
554.roms_r	80	2016	63.1	2018	63.0	2015	63.1	80	2016	63.1	2018	63.0	2015	63.1

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Compiler Notes

Binaries were compiled on a system with 2x Ampere Altra Q80-33 CPU chips + 256 GB Memory using CentOS 8.4

Ampere GCC 10.2.1 is available via <https://github.com/AmpereComputing/ampere-gcc/release>

Submit Notes

The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.

Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
Set dirty_ratio=8 to limit dirty cache to 8% of memory
i.e. echo 8 | sudo tee /proc/sys/vm/dirty_ratio
Set swappiness=1 to swap only if necessary
i.e. echo 1 | sudo tee /proc/sys/vm/swappiness
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
i.e. echo 1 | sudo tee /proc/sys/vm/zone_reclaim_mode
Set drop_caches=3 to reset caches before invoking runcpu
i.e. echo 3 | sudo tee /proc/sys/vm/drop_caches
Set numa_balancing=0 to disable automatic numa balancing

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Operating System Notes (Continued)

```
i.e. echo 0 | sudo tee /proc/sys/kernel/numa_balancing
Switch off all ktune and tuned settings
i.e. sudo tuned-adm off
Transparent huge pages set to 'never'
i.e. sudo bash -c "echo never > /sys/kernel/mm/transparent_hugepage/enabled"

runcpu command invoked through numactl i.e.
numactl --interleave=0-3 runcpu
```

Environment Variables Notes

Environment variables set by runcpu before the start of the run:

```
LD_LIBRARY_PATH =
"/home/ampctest/ampere_spec2017/jemalloc/install/lib:/home/ampctest/ampere_spec2017/gcc/install/lib64:/home/ampctest/ampere_spec2017/gcc/install/lib:/home/ampere_spec2017/gcc/install/lib64:/home/ampere_spec2017/jemalloc/install/lib:"
```

General Notes

Jemalloc v5.2.1 is available via <https://github.com/jemalloc/jemalloc/releases/download/5.2.1/jemalloc-5.2.1.tar.bz2>
It was built on CentOS 8.3 using Version 10.2.1 of Ampere GCC with configure options `--prefix=/home/ampctest/jemalloc/install --with-lg-quantum=3`

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

Platform Notes

BIOS settings:
Chipset > ANC Mode > Quadrant

```
Sysinfo program /home/ampere_spec2017/spec2017/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on localhost.localdomain Mon Jul 5 21:44:19 2021
```

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>

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Platform Notes (Continued)

From /proc/cpuinfo

```

*
* Did not identify cpu model.  If you would
* like to write your own sysinfo program, see
* www.spec.org/cpu2017/config.html#sysinfo
*
*
* 0 "physical id" tags found.  Perhaps this is an older system,
* or a virtualized system.  Not attempting to guess how to
* count chips/cores for this system.
*
    80 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)

```

From lscpu:

```

Architecture:      aarch64
Byte Order:        Little Endian
CPU(s):            80
On-line CPU(s) list: 0-79
Thread(s) per core: 1
Core(s) per socket: 80
Socket(s):         1
NUMA node(s):     4
Vendor ID:         ARM
BIOS Vendor ID:   Ampere(R)
Model:             1
Model name:        Neoverse-N1
BIOS Model name:   Ampere(R) Altra(R) Processor
Stepping:          r3p1
CPU max MHz:      3300.0000
CPU min MHz:      1000.0000
BogoMIPS:          50.00
L1d cache:        64K
L1i cache:        64K
L2 cache:         1024K
NUMA node0 CPU(s): 0-19
NUMA node1 CPU(s): 20-39
NUMA node2 CPU(s): 40-59
NUMA node3 CPU(s): 60-79
Flags:             fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp
cpuid asimdrdm lrcpc dcpop asimddp ssbs

```

```

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.
available: 4 nodes (0-3)

```

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Platform Notes (Continued)

```

node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
node 0 size: 64522 MB
node 0 free: 63628 MB
node 1 cpus: 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
node 1 size: 65420 MB
node 1 free: 64691 MB
node 2 cpus: 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59
node 2 size: 65459 MB
node 2 free: 64886 MB
node 3 cpus: 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79
node 3 size: 65426 MB
node 3 free: 64315 MB
node distances:
node  0  1  2  3
  0:  10  11  11  12
  1:  11  10  12  11
  2:  11  12  10  11
  3:  12  11  11  10

```

From /proc/meminfo

```

MemTotal:      267088448 kB
HugePages_Total:      0
Hugepagesize:    524288 kB

```

```

/sbin/tuned-adm active
  No current active profile.

```

```

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

```

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

```

centos-release: CentOS Linux release 8.4.2105
centos-release-upstream: Derived from Red Hat Enterprise Linux 8.4
os-release:
  NAME="CentOS Linux"
  VERSION="8"
  ID="centos"
  ID_LIKE="rhel fedora"
  VERSION_ID="8"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="CentOS Linux 8"
  ANSI_COLOR="0;31"
redhat-release: CentOS Linux release 8.4.2105
system-release: CentOS Linux release 8.4.2105
system-release-cpe: cpe:/o:centos:centos:8

```

uname -a:

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Platform Notes (Continued)

Linux localhost.localdomain 4.18.0-305.7.1.el8_4.aarch64 #1 SMP Tue Jun 29 21:32:00 UTC 2021 aarch64 aarch64 aarch64 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
CVE-2018-3639 (Speculative Store Bypass):	Mitigation: Speculative Store Bypass disabled via prctl
CVE-2017-5753 (Spectre variant 1):	Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2):	Not affected
CVE-2020-0543 (Special Register Buffer Data Sampling):	Not affected
CVE-2019-11135 (TSX Asynchronous Abort):	Not affected

run-level 3 Jul 6 05:21

SPEC is set to: /home/ampere_spec2017/spec2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/mapper/cl-home	xfs	819G	75G	744G	10%	/home

From /sys/devices/virtual/dmi/id

```
Vendor:      GIGABYTE
Product:     R272-P30-JG
Product Family: Server
Serial:      01234567890123456789AB
```

Additional information from dmidecode 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:

8x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200

BIOS:

```
BIOS Vendor:      GIGABYTE
BIOS Version:     F16e (SCP: 1.06.20210615)
BIOS Date:        06/30/2021
BIOS Revision:    5.15
Firmware Revision: 1.6
```

(End of data from sysinfo program)



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Compiler Version Notes

```
=====
C          | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
          | 544.nab_r(base, peak)
-----
```

```
gcc (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
-----
```

```
=====
C++       | 508.namd_r(base, peak) 510.parest_r(base, peak)
-----
```

```
g++ (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
-----
```

```
=====
C++, C   | 511.povray_r(base, peak) 526.blender_r(base, peak)
-----
```

```
g++ (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
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gcc (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
-----
```

```
=====
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
-----
```

```
g++ (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
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gcc (Ampere Computing Build 11923 20201215) 10.2.1 20201216
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GNU Fortran (Ampere Computing Build 11923 20201215) 10.2.1 20201216
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-----
```

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Compiler Version Notes (Continued)

```

=====
Fortran          | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                  | 554.roms_r(base, peak)
=====

```

```

GNU Fortran (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
=====

```

```

=====
Fortran, C       | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
=====

```

```

GNU Fortran (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
gcc (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
=====

```

Base Compiler Invocation

C benchmarks:

gcc

C++ benchmarks:

g++

Fortran benchmarks:

gfortran

Benchmarks using both Fortran and C:

gfortran gcc

Benchmarks using both C and C++:

g++ gcc

Benchmarks using Fortran, C, and C++:

g++ gcc gfortran



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Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
526.blender_r: -funsigned-char -DSPEC_LINUX -DSPEC_LP64
527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:

```
-mabi=lp64 -std=c99 -L/home/ampctest/ampere_spec2017/gcc/install/lib64  
-L/home/ampctest/ampere_spec2017/gcc/install/lib  
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -fno-strict-aliasing -ljemalloc
```

C++ benchmarks:

```
-mabi=lp64 -std=c++03 -L/home/ampctest/ampere_spec2017/gcc/install/lib64  
-L/home/ampctest/ampere_spec2017/gcc/install/lib  
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -ljemalloc
```

Fortran benchmarks:

```
-mabi=lp64 -L/home/ampctest/ampere_spec2017/gcc/install/lib64  
-L/home/ampctest/ampere_spec2017/gcc/install/lib  
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -fno-stack-arrays -ljemalloc
```

Benchmarks using both Fortran and C:

```
-mabi=lp64 -std=c99 -L/home/ampctest/ampere_spec2017/gcc/install/lib64  
-L/home/ampctest/ampere_spec2017/gcc/install/lib  
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -fno-stack-arrays -fno-strict-aliasing  
-ljemalloc
```

Benchmarks using both C and C++:

```
-mabi=lp64 -std=c++03 -std=c99  
-L/home/ampctest/ampere_spec2017/gcc/install/lib64
```

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Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):

```
-L/home/ampptest/ampere_spec2017/gcc/install/lib  
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -fno-strict-aliasing -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-mabi=lp64 -std=c++03 -std=c99  
-L/home/ampptest/ampere_spec2017/gcc/install/lib64  
-L/home/ampptest/ampere_spec2017/gcc/install/lib  
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib -g -Ofast  
-mcpu=neoverse-n1 -flto -fno-stack-arrays -fno-strict-aliasing  
-ljemalloc
```

Base Other Flags

C benchmarks:

```
-Wl, -Map, mapfile
```

C++ benchmarks:

```
-Wl, -Map, mapfile
```

Fortran benchmarks:

```
-fallow-argument-mismatch -Wl, -Map, mapfile
```

Benchmarks using both Fortran and C:

```
-fallow-argument-mismatch -Wl, -Map, mapfile
```

Benchmarks using both C and C++:

```
-Wl, -Map, mapfile
```

Benchmarks using Fortran, C, and C++:

```
-fallow-argument-mismatch -Wl, -Map, mapfile
```

Peak Compiler Invocation

C benchmarks:

```
gcc
```

C++ benchmarks:

```
g++
```

(Continued on next page)



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Peak Compiler Invocation (Continued)

Fortran benchmarks:

gfortran

Benchmarks using both Fortran and C:

gfortran gcc

Benchmarks using both C and C++:

g++ gcc

Benchmarks using Fortran, C, and C++:

g++ gcc gfortran

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

```
-mabi=lp64 -std=c99 -L/home/ampctest/ampere_spec2017/gcc/install/lib64
-L/home/ampctest/ampere_spec2017/gcc/install/lib
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib -fprofile-generate
-fprofile-use -g -Ofast -mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96 --param max-inline-insns-auto=64
--param inline-unit-growth=96 -ljemalloc
```

C++ benchmarks:

508.namd_r: basepeak = yes

510.parest_r: -mabi=lp64 -std=c++03

```
-L/home/ampctest/ampere_spec2017/gcc/install/lib64
-L/home/ampctest/ampere_spec2017/gcc/install/lib
-L/home/ampctest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=256
--param max-inline-insns-auto=128
--param inline-unit-growth=256 -ffinite-loops -ljemalloc
```

Fortran benchmarks:

(Continued on next page)



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Peak Optimization Flags (Continued)

```
503.bwaves_r: -mabi=lp64
-L/home/ampptest/ampere_spec2017/gcc/install/lib64
-L/home/ampptest/ampere_spec2017/gcc/install/lib
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
-fno-stack-arrays -ljemalloc
```

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: basepeak = yes

Benchmarks using both Fortran and C:

```
521.wrf_r: -mabi=lp64 -std=c99
-L/home/ampptest/ampere_spec2017/gcc/install/lib64
-L/home/ampptest/ampere_spec2017/gcc/install/lib
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -fno-stack-arrays -ljemalloc
```

```
527.cam4_r: -mabi=lp64 -std=c99
-L/home/ampptest/ampere_spec2017/gcc/install/lib64
-L/home/ampptest/ampere_spec2017/gcc/install/lib
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -fno-stack-arrays
-fno-strict-aliasing -ljemalloc
```

Benchmarks using both C and C++:

```
511.povray_r: -mabi=lp64 -std=c++03 -std=c99
-L/home/ampptest/ampere_spec2017/gcc/install/lib64
-L/home/ampptest/ampere_spec2017/gcc/install/lib
-L/home/ampptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96
```

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Peak Optimization Flags (Continued)

511.povray_r (continued):

```
--param early-inlining-insns=256  
--param max-inline-insns-auto=128  
--param inline-unit-growth=256 -ffinite-loops  
-fno-strict-aliasing -ljemalloc
```

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

Peak Other Flags

C benchmarks:

```
-w -Wl,-Map,mapfile
```

C++ benchmarks:

```
-Wl,-Map,mapfile
```

Fortran benchmarks (except as noted below):

```
-Wl,-Map,mapfile
```

554.roms_r: -fallow-argument-mismatch -Wl,-Map,mapfile

Benchmarks using both Fortran and C:

521.wrf_r: -w -fallow-argument-mismatch -Wl,-Map,mapfile

527.cam4_r: -fallow-argument-mismatch -Wl,-Map,mapfile

Benchmarks using both C and C++:

```
-Wl,-Map,mapfile
```

Benchmarks using Fortran, C, and C++:

```
-fallow-argument-mismatch -Wl,-Map,mapfile
```

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

<http://www.spec.org/cpu2017/flags/gcc.2021-07-21.html>

<http://www.spec.org/cpu2017/flags/GIGA-BYTE-platform-settings-Altra-rev.2.html>



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

<http://www.spec.org/cpu2017/flags/gcc.2021-07-21.xml>

<http://www.spec.org/cpu2017/flags/GIGA-BYTE-platform-settings-Altra-rev.2.xml>

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