## NEC Corporation

### SPEC CPU®2017 Floating Point Rate Result

**NEC Corporation**  
**Express5800/R120i-2M (Intel Xeon Gold 5320)**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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<tr>
<td>503.bwaves_r</td>
<td>104</td>
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<td>507.cactuBSSN_r</td>
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<tr>
<td>508.namd_r</td>
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<tr>
<td>554.roms_r</td>
<td>104</td>
<td>142</td>
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</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 5320  
  - Max MHz: 3400  
  - Nominal: 2200  
  - Enabled: 52 cores, 2 chips, 2 threads/core  
  - Orderable: 1,2 chips  
  - Cache L1: 32 KB I + 48 KB D on chip per core  
  - L2: 1.25 MB I+D on chip per core  
  - L3: 39 MB I+D on chip per core  
  - Other: None  
- **Memory:** 2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R, running at 2933)  
- **Storage:** 1 x 800 GB SAS SSD, RAID 0  
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux release 8.3 (Ootpa)  
  - 4.18.0-240.el8.x86_64  
- **Compiler:** C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;  
- **Parallel:** No  
- **Firmware:** NEC BIOS Version U46 v1.40 04/28/2021 released Jul-2021  
- **File System:** ext4  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage.
### Results Table

<table>
<thead>
<tr>
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<th>Ratio</th>
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</table>

SPECrate\textsuperscript{2017\_fp\_base} = 353

SPECrate\textsuperscript{2017\_fp\_peak} = 369

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

### Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor.

For details, please see the config file.

### Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"

### Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD\_LIBRARY\_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"

MALLOC\_CONF = "retain:true"

### General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

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

(Continued on next page)
**SPEC CPU®2017 Floating Point Rate Result**

**NEC Corporation**

**Express5800/R120i-2M (Intel Xeon Gold 5320)**

<table>
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<th>SPECrate®2017_fp_peak</th>
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<tbody>
<tr>
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</table>

**CPU2017 License:** 9006  
**Test Sponsor:** NEC Corporation  
**Tested by:** NEC Corporation  
**Test Date:** Jul-2021  
**Hardware Availability:** Jul-2021  
**Software Availability:** Dec-2020

---

**General Notes (Continued)**

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.

This benchmark result is intended to provide perspective on past performance using the historical software and/or firmware described on this result page.

The system as described on this result page was formerly generally available. At the time of this publication, it may not be shipping, and/or may not be supported, and/or may fail to meet other tests of General Availability described in the SPEC OSG Policy document, http://www.spec.org/osg/policy.html

This measured result may not be representative of the result that would be measured were this benchmark run with software and firmware available as of the publication date.

Transparent Huge Pages enabled by default  
Prior to runcpu invocation  
Filesystem page cache synced and cleared with:  
```bash  
sync; echo 3 > /proc/sys/vm/drop_caches  
runcpu command invoked through numactl i.e.:  
numactl --interleave=all runcpu <etc>  
jemalloc, a general purpose malloc implementation  
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5  
```

---

**Platform Notes**

**BIOS Settings:**  
Thermal Configuration: Maximum Cooling  
Workload Profile: General Throughput Compute  
Advanced Memory Protection: Advanced ECC Support  
Memory Patrol Scrubbing: Disabled  
Minimum Processor Idle Power Core C-State: C6 State  
LLC Dead Line Allocation: Disabled  
LLC Prefetch: Enabled  
Enhanced Processor Performance: Enabled  
XPT Prefetcher: Enabled  
Workload Profile: Custom  
DCU Stream Prefetcher: Disabled  
Energy/Performance Bias: Balanced Performance

Sysinfo program /home/cpu2017/bin/sysinfo  
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d

(Continued on next page)
## Platform Notes (Continued)

running on r120i2m Mon Jul 19 20:17:42 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

From `/proc/cpuinfo`

```
model name : Intel(R) Xeon(R) Gold 5320 CPU @ 2.20GHz
  2 "physical id"s (chips)
  104 "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 : 26
siblings : 52
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
```

From `lscpu` from `util-linux 2.32.1`:

```
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 104
On-line CPU(s) list: 0-103
Thread(s) per core: 2
Core(s) per socket: 26
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 5320 CPU @ 2.20GHz
Stepping: 6
CPU MHz: 2963.068
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 39936K
NUMA node0 CPU(s): 0-12,52-64
NUMA node1 CPU(s): 13-25,65-77
NUMA node2 CPU(s): 26-38,78-90
NUMA node3 CPU(s): 39-51,91-103
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
```

(Continued on next page)
NEC Corporation

Express5800/R120i-2M (Intel Xeon Gold 5320)

SPEC CPU®2017 Floating Point Rate Result

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Copyright 2017-2023 Standard Performance Evaluation Corporation

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NEC Corporation

Express5800/R120i-2M (Intel Xeon Gold 5320)

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SPECrate®2017_fp_peak = 369

CPU2017 License: 9006
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Software Availability: Dec-2020

Platform Notes (Continued)

lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xptr pdcmt cpuid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_13 invpcid_single ssbd mba ibps ibp ibrs_enhanced tpr_shadow vmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmis hle avx2 smep bmi2 erms invpcid crd rt a avx512f avx512dq rdseed adx smap avx512ifma ciflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsavesopt xsavet xsavex xgetbv1 xsaves crmu crm ocup pll crm mbm_total crm mbm local split lock detect wbnoinvd dtherm ida arat pln pts avx512v bmi umip pku ospke avx512_v bmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntd q la57 rdpid md_clear pconfig flush_lld arch_capabilities

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 6 7 8 9 10 11 12 52 53 54 55 56 57 58 59 60 61 62 63 64
  node 0 size: 504036 MB
  node 0 free: 515077 MB
  node 1 cpus: 13 14 15 16 17 18 19 20 21 22 23 24 25 65 66 67 68 69 70 71 72 73 74 75 76 77
  node 1 size: 504349 MB
  node 1 free: 515592 MB
  node 2 cpus: 26 27 28 29 30 31 32 33 34 35 36 37 38 78 79 80 81 82 83 84 85 86 87 88 89 90
  node 2 size: 504189 MB
  node 2 free: 515851 MB
  node 3 cpus: 39 40 41 42 43 44 45 46 47 48 49 50 51 91 92 93 94 95 96 97 98 99 100 101 102 103
  node 3 size: 504781 MB
  node 3 free: 515605 MB
  node distances:
    node 0 1 2 3
    0: 10 20 30 30
    1: 20 10 30 30
    2: 30 30 10 20
    3: 30 30 20 10

From /proc/meminfo
  MemTotal: 2113478176 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

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

(Continued on next page)
### Platform Notes (Continued)

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

```bash
os-release:
  NAME="Red Hat Enterprise Linux"
  VERSION="8.3 (Ootpa)"
  ID="rhel"
  ID_LIKE="fedora"
  VERSION_ID="8.3"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
  ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga
```

```bash
uname -a:
Linux r120i2m 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020 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
- **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: Enhanced IBRS, IBPB: conditional, RSB filling
- **CVE-2020-0543 (Special Register Buffer Data Sampling):** Not affected
- **CVE-2019-11135 (TSX Asynchronous Abort):** Not affected

**run-level 3 Jul 19 20:14**

**SPEC is set to:** `/home/cpu2017`

<table>
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<th>Type</th>
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<th>Avail</th>
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<td>96G</td>
<td>591G</td>
<td>14%</td>
<td>/</td>
</tr>
</tbody>
</table>

From `/sys/devices/virtual/dmi/id`

**Vendor:** NEC

**Product:** Express5800/R120i-2M

**Product Family:** Express5800

**Serial:** CN705114NH

(Continued on next page)
## Platform Notes (Continued)

Additional information from dmidecode 3.2 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:**

32x Hynix HMAA8GR7AJR4N-XN 64 GB 2 rank 3200, configured at 2933

**BIOS:**

- BIOS Vendor: NEC
- BIOS Version: U46
- BIOS Date: 04/28/2021
- BIOS Revision: 1.40
- Firmware Revision: 2.44

(End of data from sysinfo program)

### Compiler Version Notes

```plaintext
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<th>Component</th>
<th>Version Details</th>
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<tr>
<td>C</td>
<td>519.lbm_r (base, peak) 538.imagick_r (base, peak) 544.nab_r (base, peak)</td>
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</tbody>
</table>

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

| C++, C               | 511.povray_r (peak)                                                            |

Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
```

(Continued on next page)
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**Test Sponsor:** NEC Corporation  
**Tested by:** NEC Corporation  
**Test Date:** Jul-2021  
**Hardware Availability:** Jul-2021  
**Software Availability:** Dec-2020

---

## Compiler Version Notes (Continued)

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

Intel (R) oneAPI DPC++/C++ Compiler for applications running on Intel (R) 64,  
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```
C++, C | 511.povray_r(peak)
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```
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
```

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(Continued on next page)
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Test Date: Jul-2021
Tested by: NEC Corporation
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Compiler Version Notes (Continued)

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

Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
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==============================================================================
| Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak) |
| 544.fotonik3d_r(base, peak) |
==============================================================================

Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifort
## NEC Corporation

**NEC Corporation**

**Express5800/R120i-2M (Intel Xeon Gold 5320)**

<table>
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<th>CPU2017 License</th>
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**SPECrate®2017_fp_peak = 369**

**SPECrate®2017_fp_base = 353**

**Test Date:** Jul-2021  
**Hardware Availability:** Jul-2021  
**Software Availability:** Dec-2020

### 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_LP64 -DSPEC_CASE_FLAG -convert big_endian
- 526. blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char
- 527. cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
- 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:**

```bash
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**C++ benchmarks:**

```bash
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto  
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**Fortran benchmarks:**

```bash
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div  
-qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**Benchmarks using both Fortran and C:**

```bash
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib
```

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

Benchmarks using both C and C++:
- `-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
- `-mbranches-within-32B-boundaries -ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using Fortran, C, and C++:
- `-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3`
- `-no-prec-div -qopt-prefetch -ffinite-math-only`
- `-qopt-multiple-gather-scatter-by-shuffles`
- `-mbranches-within-32B-boundaries -nostandard-realloc-lhs`
- `-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

**Peak Compiler Invocation**

C benchmarks:
- `icx`

C++ benchmarks:
- `icpx`

Fortran benchmarks:
- `ifort`

Benchmarks using both Fortran and C:
- `ifort icx`

Benchmarks using both C and C++:
- `511.povray_r: icpc icc`
- `526.blender_r: icpx icx`

Benchmarks using Fortran, C, and C++:
- `icpx icx ifort`

**Peak Portability Flags**

Same as Base Portability Flags
NEC Corporation
Express5800/R120i-2M (Intel Xeon Gold 5320)

SPECrate®2017_fp_base = 353
SPECrate®2017_fp_peak = 369

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Jul-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Peak Optimization Flags

C benchmarks:

519.lbm_r: basepeak = yes

538.imagick_r: basepeak = yes

544.nab_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto
-Ofast -qopt-mem-layout-trans=4
-fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:

508.namd_r: basepeak = yes

510.parest_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:

503.bwaves_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs
-align array32byte -auto -mbranches-within-32B-boundaries
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

549.fotonik3d_r: basepeak = yes

554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:

521.wrf_r: basepeak = yes

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries

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NEC Corporation

Express5800/R120i-2M (Intel Xeon Gold 5320)

SPECrate®2017_fp_base = 353
SPECrate®2017_fp_peak = 369

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Jul-2021
Hardware Availability: Jul-2021
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Peak Optimization Flags (Continued)

511.povray_r (continued):
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120i-RevE.xml

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120i-RevE.html

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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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