**Huawei 2288 V5 (Intel Xeon Silver 4110)**

**SPECrate2017_fp_base = 84.6**

**SPECrate2017_fp_peak = 87.0**

| Test Date: | Aug-2018 |
| Hardware Availability: | Sep-2018 |
| Software Availability: | Jan-2018 |

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Name:</td>
<td>Intel Xeon Silver 4110</td>
</tr>
<tr>
<td>Max MHz.:</td>
<td>3000</td>
</tr>
<tr>
<td>Nominal:</td>
<td>2100</td>
</tr>
<tr>
<td>Enabled:</td>
<td>16 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td>Orderable:</td>
<td>1.2 chips</td>
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<tr>
<td>Cache L1:</td>
<td>32 KB I + 32 KB D on chip per core</td>
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<tr>
<td>L2:</td>
<td>1 MB I+D on chip per core</td>
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<tr>
<td>L3:</td>
<td>11 MB I+D on chip per chip</td>
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<tr>
<td>Other:</td>
<td>None</td>
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<tr>
<td>Memory:</td>
<td>384 GB (12 x 32 GB 2Rx4 PC4-2666V-R, running at 2400)</td>
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<tr>
<td>Storage:</td>
<td>1 x 2000 GB SATA, 7200 RPM</td>
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<tr>
<td>Other:</td>
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<tr>
<td>OS:</td>
<td>Red Hat Enterprise Linux Server release 7.4 (Maipo)</td>
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<tr>
<td>Compiler:</td>
<td>C/C++: Version 18.0.0.128 of Intel C/C++ Compiler for Linux; Fortran: Version 18.0.0.128 of Intel Fortran Compiler for Linux</td>
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<td>Parallel:</td>
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<td>Firmware:</td>
<td>Version 0.52 Released Jul-2018</td>
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<td>File System:</td>
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<td>System State:</td>
<td>Run level 3 (multi-user)</td>
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<td>Base Pointers:</td>
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<td>Peak Pointers:</td>
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<td>Other:</td>
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</table>
SPEC CPU2017 Floating Point Rate Result

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Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

SPECrate2017_fp_base = 84.6
SPECrate2017_fp_peak = 87.0

Results Table

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<tr>
<th>Benchmark</th>
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<th>Seconds</th>
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<td>503.bwaves_r</td>
<td>32</td>
<td>999</td>
<td>321</td>
<td>1000</td>
<td>321</td>
<td>1001</td>
<td>320</td>
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<tr>
<td>507.cactuBSSN_r</td>
<td>32</td>
<td>564</td>
<td>71.9</td>
<td>563</td>
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<td>508.namd_r</td>
<td>32</td>
<td>549</td>
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<tr>
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<td>91.7</td>
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<tr>
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<td>51.0</td>
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<td>995</td>
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</tr>
</tbody>
</table>

SPECrate2017_fp_base = 84.6
SPECrate2017_fp_peak = 87.0

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"

General Notes

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

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.4
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
sync; echo 3> /proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
Yes: 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)
Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)  

| SPECrate2017_fp_base = 84.6 |
| SPECrate2017_fp_peak = 87.0 |

CPU2017 License: 3175  
Test Sponsor: Huawei  
Tested by: Huawei  
Test Date: Aug-2018  
Hardware Availability: Sep-2018  
Software Availability: Jan-2018

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.

Platform Notes

BIOS configuration:
Power Policy Set to Performance
XPT Prefetch Set to Enabled
ADDDC Sparing Set to Disabled
Sysinfo program /spec2017/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f  
running on localhost.localdomain Fri Aug 17 19:02:08 2018

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) Silver 4110 CPU @ 2.10GHz
    2 "physical id"s (chips)
    32 "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 : 8
    siblings : 16
    physical 0: cores 0 1 2 3 4 5 6 7
    physical 1: cores 0 1 2 3 4 5 6 7

From lscpu:
  Architecture: x86_64
  CPU op-mode(s): 32-bit, 64-bit
  Byte Order: Little Endian
  CPU(s): 32
  On-line CPU(s) list: 0-31
  Thread(s) per core: 2
  Core(s) per socket: 8
  Socket(s): 2
  NUMA node(s): 2
  Vendor ID: GenuineIntel
  CPU family: 6
  Model: 85
  Model name: Intel(R) Xeon(R) Silver 4110 CPU @ 2.10GHz
  Stepping: 4
  CPU MHz: 2100.000

(Continued on next page)
Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

SPECrate2017_fp_base = 84.6
SPECrate2017_fp_peak = 87.0

CPU2017 License: 3175
Test Sponsor: Huawei
Tested by: Huawei

Test Date: Aug-2018
Hardware Availability: Sep-2018
Software Availability: Jan-2018

Platform Notes (Continued)

BogoMIPS: 4200.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 11264K
NUMA node0 CPU(s): 0-7,16-23
NUMA node1 CPU(s): 8-15,24-31
Flags: fpu vme de pse tsc msr pae mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
aperfmpref eagerfpu pni pclmulqdq dtes64 ds_cpl vmx smx est tm2 ssse3 fma cx16 xtr
pcdm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx
f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 invpcid_single intel_pt
spec_ctrl ibpb_support tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust
bm1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq rdseed adx
smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 cqm_llc
cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.
available: 2 nodes (0-1)
node 0 cpus: 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23
node 0 size: 194741 MB
node 0 free: 189262 MB
node 1 cpus: 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31
node 1 size: 196608 MB
node 1 free: 191214 MB
node distances:
node 0 1
0: 10 21
1: 21 10

From /proc/meminfo
MemTotal: 394174888 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
os-release:
NAME="Red Hat Enterprise Linux Server"
VERSION="7.4 (Maipo)"
ID="rhel"
ID_LIKE="fedora"

(Continued on next page)
Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

CPU2017 License: 3175
Test Sponsor: Huawei
Tested by: Huawei

SPECrate$_{2017\text{ fp}_\text{ peak}} = 87.0$
SPECrate$_{2017\text{ fp}_\text{ base}} = 84.6$

Test Date: Aug-2018
Hardware Availability: Sep-2018
Software Availability: Jan-2018

Platform Notes (Continued)

```plaintext
VARIANT="Server"
VARIANT_ID="server"
VERSION_ID="7.4"
PRETTY_NAME="Red Hat Enterprise Linux Server 7.4 (Maipo)"
redhat-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release-cpe: cpe:/o:redhat:enterprise_linux:7.4:ga:server
```

uname -a:
Linux localhost.localdomain 3.10.0-693.11.6.el7.x86_64 #1 SMP Thu Dec 28 14:23:39 EST 2017 x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Aug 17 08:04

SPEC is set to: /spec2017
```
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 2.0T 64G 2.0T 4% /
```

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.

BIOS INSYDE Corp. 0.52 07/18/2018
Memory:
4x NO DIMM NO DIMM
12x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

```
CC  519.lbm_r(base) 538.imagick_r(base, peak) 544.nab_r(base)
```

ICC (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

```
CC  519.lbm_r(peak) 544.nab_r(peak)
```

ICC (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

(Continued on next page)
Huawei

Huawei 2288 V5 (Intel Xeon Silver 4110)

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CPU2017 License: 3175
Test Sponsor: Huawei
Test Date: Aug-2018
Hardware Availability: Sep-2018
Tested by: Huawei
Software Availability: Jan-2018

Compiler Version Notes (Continued)

CXXC 508.namd_r(base) 510.parest_r(base)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------------

CXXC 508.namd_r(peak) 510.parest_r(peak)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------------

CC 511.povray_r(base) 526.blender_r(base)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------------

CC 511.povray_r(peak) 526.blender_r(peak)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------------

FC 507.cactuBSSN_r(base)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------------

FC 507.cactuBSSN_r(peak)
-----------------------------------------------------------------------------------
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

(Continued on next page)
SPEC CPU2017 Floating Point Rate Result

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Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

SPECrate2017_fp_base = 84.6
SPECrate2017_fp_peak = 87.0

CPU2017 License: 3175
Test Date: Aug-2018
Test Sponsor: Huawei
Hardware Availability: Sep-2018
Tested by: Huawei
Software Availability: Jan-2018

Compiler Version Notes (Continued)

icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

---
FC 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base)
---
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

---
FC 554.roms_r(peak)
---
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

---
CC 521.wrf_r(base) 527.cam4_r(base)
---
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

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CC 521.wrf_r(peak) 527.cam4_r(peak)
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Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

---
Base Compiler Invocation

C benchmarks:
iccc

C++ benchmarks:
icpc

(Continued on next page)
SPEC CPU2017 Floating Point Rate Result

Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

CPU2017 License: 3175
Test Sponsor: Huawei
Test Date: Aug-2018
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Hardware Availability: Sep-2018
Software Availability: Jan-2018

SPECrate2017_fp_base = 84.6
SPECrate2017_fp_peak = 87.0

Base Compiler Invocation (Continued)

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

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:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3

Fortran benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte

(Continued on next page)
Spec CPU2017 Floating Point Rate Result

Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

<table>
<thead>
<tr>
<th>SPECrate2017_fp_base</th>
<th>SPECrate2017_fp_peak</th>
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<td>84.6</td>
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CPU2017 License: 3175
Test Sponsor: Huawei
Test Date: Aug-2018
Hardware Availability: Sep-2018
Tested by: Huawei
Software Availability: Jan-2018

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C:
-xCORE-AVX2 
-ipo 
-03 
-no-prec-div 
-qopt-prefetch 
-ffinite-math-only 
-qopt-mem-layout-trans=3 
-nostandard-realloc-lhs 
-align array32byte

Benchmarks using both C and C++:
-xCORE-AVX2 
-ipo 
-03 
-no-prec-div 
-qopt-prefetch 
-ffinite-math-only 
-qopt-mem-layout-trans=3

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 
-ipo 
-03 
-no-prec-div 
-qopt-prefetch 
-ffinite-math-only 
-qopt-mem-layout-trans=3 
-nostandard-realloc-lhs 
-align array32byte

Base Other Flags

C benchmarks:
-m64 
-std=c11

C++ benchmarks:
-m64

Fortran benchmarks:
-m64

Benchmarks using both Fortran and C:
-m64 
-std=c11

Benchmarks using both C and C++:
-m64 
-std=c11

Benchmarks using Fortran, C, and C++:
-m64 
-std=c11

Peak Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

(Continued on next page)
Huawei
Huawei 2288 V5 (Intel Xeon Silver 4110)

| SPECrate2017_fp_base | 84.6 |
| SPECrate2017_fp_peak  | 87.0 |

**CPU2017 License:** 3175
**Test Sponsor:** Huawei
**Tested by:** Huawei

**Peak Compiler Invocation (Continued)**

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

**Peak Portability Flags**

Same as Base Portability Flags

**Peak Optimization Flags**

C benchmarks:
519.lbm_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3
538.imagick_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3
544.nab_r: Same as 519.lbm_r

C++ benchmarks:
-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3

Fortran benchmarks:
503.bwaves_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3
-nostandard-realloc-lhs -align array32byte
549.fotonik3d_r: Same as 503.bwaves_r

(Continued on next page)
Huawei 2288 V5 (Intel Xeon Silver 4110)  

<table>
<thead>
<tr>
<th>SPECrate2017_fp_base</th>
<th>84.6</th>
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</table>

**CPU2017 License:** 3175 
**Test Sponsor:** Huawei 
**Tested by:** Huawei 
**Test Date:** Aug-2018 
**Hardware Availability:** Sep-2018 
**Software Availability:** Jan-2018 

### Peak Optimization Flags (Continued)

```
554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs
-align array32byte
```

Benchmarks using both Fortran and C:
```
-no-prec-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte
```

Benchmarks using both C and C++:
```
-no-prec-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3
```

Benchmarks using Fortran, C, and C++:
```
507.cactuBSSN_r: basepeak = yes
```

### Peak Other Flags

**C benchmarks:**
```
-m64  -std=c11
```

**C++ benchmarks:**
```
-m64
```

**Fortran benchmarks:**
```
-m64
```

Benchmarks using both Fortran and C:
```
-m64  -std=c11
```

Benchmarks using both C and C++:
```
-m64  -std=c11
```

Benchmarks using Fortran, C, and C++:
```
-m64  -std=c11
```

The flags files that were used to format this result can be browsed at:
## SPEC CPU2017 Floating Point Rate Result

**Huawei**

**Huawei 2288 V5 (Intel Xeon Silver 4110)**

<table>
<thead>
<tr>
<th>SPECrate2017_fp_base</th>
<th>SPECrate2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>84.6</td>
<td>87.0</td>
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</tbody>
</table>

| CPU2017 License:      | 3175                 |
| Test Sponsor:         | Huawei               |
| Tested by:            | Huawei               |
| Test Date:            | Aug-2018             |
| Hardware Availability:| Sep-2018             |
| Software Availability:| Jan-2018             |

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

- [http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.xml](http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.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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