## Huawei

### Huawei 2288H V5 (Intel Xeon Silver 4214)

<table>
<thead>
<tr>
<th><strong>CPU2017 License:</strong></th>
<th>3175</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Date:</strong></td>
<td>Apr-2019</td>
</tr>
<tr>
<td><strong>Test Sponsor:</strong></td>
<td>Huawei</td>
</tr>
<tr>
<td><strong>Tested by:</strong></td>
<td>Huawei</td>
</tr>
<tr>
<td><strong>Hardware Availability:</strong></td>
<td>Apr-2019</td>
</tr>
<tr>
<td><strong>Software Availability:</strong></td>
<td>Dec-2018</td>
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</tbody>
</table>

### Threads

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>SPECspeed2017_fp_base</th>
<th>SPECspeed2017_fp_peak</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>24</td>
<td>88.9</td>
<td>94.4</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>24</td>
<td>104</td>
<td>104</td>
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<tr>
<td>619.ibm_s</td>
<td>24</td>
<td>75.6</td>
<td>75.6</td>
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<tr>
<td>621.wrf_s</td>
<td>24</td>
<td>93.4</td>
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<tr>
<td>627.cam4_s</td>
<td>24</td>
<td>57.2</td>
<td>57.2</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>24</td>
<td>59.0</td>
<td>59.0</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>24</td>
<td>71.4</td>
<td>71.4</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>24</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>24</td>
<td>71.1</td>
<td>71.1</td>
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<td>654.roms_s</td>
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<td>90.3</td>
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### Software

<table>
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<tr>
<th><strong>CPU Name:</strong></th>
<th>Intel Xeon Silver 4214</th>
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<tbody>
<tr>
<td><strong>Max MHz.:</strong></td>
<td>3200</td>
</tr>
<tr>
<td><strong>Nominal:</strong></td>
<td>2200</td>
</tr>
<tr>
<td><strong>Enabled:</strong></td>
<td>24 cores, 2 chips</td>
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<tr>
<td><strong>Orderable:</strong></td>
<td>1.2 chips</td>
</tr>
<tr>
<td><strong>Cache L1:</strong></td>
<td>32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td><strong>L2:</strong></td>
<td>1 MB I+D on chip per core</td>
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<tr>
<td><strong>L3:</strong></td>
<td>16.5 MB I+D on chip per chip</td>
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<tr>
<td><strong>Other:</strong></td>
<td>None</td>
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<tr>
<td><strong>Memory:</strong></td>
<td>384 GB (24 x 16 GB 2Rx8 PC4-2933Y-R, running at 2400)</td>
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<tr>
<td><strong>Storage:</strong></td>
<td>1 x 1200 GB SAS, 10000 RPM</td>
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<tr>
<td><strong>Other:</strong></td>
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<table>
<thead>
<tr>
<th><strong>OS:</strong></th>
<th>SUSE Linux Enterprise Server 12 SP4 (x86_64)</th>
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<tbody>
<tr>
<td><strong>Compiler:</strong></td>
<td>C/C++: Version 19.0.1.144 of Intel C/C++</td>
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<tr>
<td></td>
<td>Compiler Build 20181018 for Linux;</td>
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<td></td>
<td>Fortran: Version 19.0.1.144 of Intel Fortran</td>
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<td><strong>Parallel:</strong></td>
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<td><strong>Firmware:</strong></td>
<td>Version 6.52 Released Mar-2019</td>
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<td><strong>File System:</strong></td>
<td>xfs</td>
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<tr>
<td><strong>System State:</strong></td>
<td>Run level 3 (multi-user)</td>
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<td><strong>Base Pointers:</strong></td>
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<td><strong>Peak Pointers:</strong></td>
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Results Table

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<tr>
<th>Benchmark</th>
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<th>Ratio</th>
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<th>Ratio</th>
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<th>Ratio</th>
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<td>174</td>
<td>90.3</td>
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</tbody>
</table>

SPECspeed2017_fp_base = 93.7
SPECspeed2017_fp_peak = 94.4

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

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:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/spec/lib/ia32:/spec/lib/intel64"
OMP_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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
Yes: 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.

Platform Notes

BIOS configuration:
Power Policy Set to Load Balance
Hyper-Threading Set to Disable

(Continued on next page)
Huawei

Huawei 2288H V5 (Intel Xeon Silver 4214)

<table>
<thead>
<tr>
<th>SPECspeed2017_fp_peak = 94.4</th>
<th>SPECspeed2017_fp_base = 93.7</th>
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<td>CPU2017 License: 3175</td>
<td>Test Date: Apr-2019</td>
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<td>Hardware Availability: Apr-2019</td>
</tr>
<tr>
<td>Tested by: Huawei</td>
<td>Software Availability: Dec-2018</td>
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</tbody>
</table>

Platform Notes (Continued)

XPT Prefetch Set to Enabled
Sysinfo program /spec/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcede8f2999c33d61f64985e45859ea9
running on linux-7ejo Tue Apr 16 20:33:46 2019

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 4214 CPU @ 2.20GHz
  2 "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 : 12
siblings : 12
physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13
physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 13

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 24
On-line CPU(s) list: 0-23
Thread(s) per core: 1
Core(s) per socket: 12
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Silver 4214 CPU @ 2.20GHz
Stepping: 6
CPU MHz: 2200.000
CPU max MHz: 3200.0000
CPU min MHz: 1000.0000
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 16896K
NUMA node0 CPU(s): 0-11
NUMA node1 CPU(s): 12-23
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
(Continued on next page)
Huawei

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Platform Notes (Continued)

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 cpuid
aperfmpref pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtrn pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invvd_single ssbd mba ibrs ibpb stibp tpr_shadow vnmi flexpriority ept vpid
fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cmp mxrt a axv512f
avx512dq rdseed adx clflushopt clwb intel_pt avx512cd avx512bv avx512vl
xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbml_total cqm_mbml_local
dtherm ida arat pln pts pku ospke avx512_vnni flush_l1d arch_capabilities

/proc/cpuinfo cache data
  cache size : 16896 KB

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 8 9 10 11
  node 0 size: 191905 MB
  node 0 free: 185297 MB
  node 1 cpus: 12 13 14 15 16 17 18 19 20 21 22 23
  node 1 size: 193280 MB
  node 1 free: 186260 MB
  node distances:
  node  0   1
  0: 10 21
  1: 21 10

From /proc/meminfo
  MemTotal:       394430608 kB
  HugePages_Total:       0
  Hugepagesize:       2048 kB

From /etc/*release* /etc/*version*
  SUSE-release:
    SUSE Linux Enterprise Server 12 (x86_64)
    VERSION = 12
    PATCHLEVEL = 4
    # This file is deprecated and will be removed in a future service pack or release.
    # Please check /etc/os-release for details about this release.
  os-release:
    NAME="SLES"
    VERSION="12-SP4"
    VERSION_ID="12.4"
    PRETTY_NAME="SUSE Linux Enterprise Server 12 SP4"
    ID="sles"
    ANSI_COLOR="0,32"

(Continued on next page)
Huawei

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Platform Notes (Continued)

uname -a:
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2017-5754 (Meltdown): Not affected
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Indirect Branch Restricted Speculation, IBPB, IBRS_FW

run-level 3 Apr 16 14:57

SPEC is set to: /spec
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/sda3 xfs 734G 104G 631G 15% /

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. 6.52 03/16/2019
    Memory:
        24x Samsung M393A2K43CB2-CVF 16 GB 2 rank 2933, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
  CC  619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(base, peak)
  Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.1.144 Build 20181018
  Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================

==============================================================================
  FC  607.cactuBSSN_s(base, peak)
  Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.1.144 Build 20181018
  Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
  Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
(Continued on next page)
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Compiler Version Notes (Continued)

Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
Intel (R) Fortran Intel (R) 64 Compiler for applications running on Intel (R)
64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
FC 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base, peak)
==============================================================================
Intel (R) Fortran Intel (R) 64 Compiler for applications running on Intel (R)
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FC 603.bwaves_s(peak) 649.fotonik3d_s(peak)
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==============================================================================
CC 621.wrf_s(base) 627.cam4_s(base, peak) 628.pop2_s(base)
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Intel (R) C Intel (R) 64 Compiler for applications running on Intel (R) 64,
Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
CC 621.wrf_s(peak) 628.pop2_s(peak)
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Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
Intel (R) C Intel (R) 64 Compiler for applications running on Intel (R) 64,
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Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
## SPEC CPU2017 Floating Point Speed Result

### Huawei

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<tr>
<th>Huawei 2288H V5 (Intel Xeon Silver 4214)</th>
<th>SPECspeed2017_fp_base = 93.7</th>
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</tbody>
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---

### Base Compiler Invocation

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

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

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

- **Benchmarks using Fortran, C, and C++**:
  - `icpc -m64 icc -m64 -std=c11 ifort -m64`

---

### Base Portability Flags

- `603.bwaves_s`: `-DSPEC_LP64`
- `607.cactuBSSN_s`: `-DSPEC_LP64`
- `619.lbm_s`: `-DSPEC_LP64`
- `621.wrf_s`: `-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian`
- `627.cam4_s`: `-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian -assume byterecl`
- `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**:
  - `-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP`

- **Fortran benchmarks**:
  - `-DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs`

- **Benchmarks using both Fortran and C**:
  - `-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs`

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

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<table>
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<tr>
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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs

Peak Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

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

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

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
619.lbm_s: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP

638.imagick_s: basepeak = yes

644.nab_s: Same as 619.lbm_s

Fortran benchmarks:
603.bwaves_s: -prof-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -O2 -xCORE-AVX512 -qopt-prefetch -ipo -O3
-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=4

(Continued on next page)
## Huawei 2288H V5 (Intel Xeon Silver 4214)

<table>
<thead>
<tr>
<th>SPECspeed2017_fp_base</th>
<th>SPECspeed2017_fp_peak</th>
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<td>93.7</td>
<td>94.4</td>
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<th>Test Sponsor:</th>
<th>Huawei</th>
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<tbody>
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<td>Tested by:</td>
<td>Huawei</td>
</tr>
</tbody>
</table>

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### Peak Optimization Flags (Continued)

- **603.bwaves_s**: 
  - `qopenmp -nostandard-realloc-lhs`

- **649.fotonik3d_s**: Same as 603.bwaves_s

- **654.roms_s**: 
  - `-DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs`

Benchmarks using both Fortran and C:

- **621.wrf_s**: 
  - `-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512 -qopt-prefetch -ffinite-math-only -no-prec-div -qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs`

- **627.cam4_s**: 
  - `-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs`

- **628.pop2_s**: Same as 621.wrf_s

Benchmarks using Fortran, C, and C++:

- `-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs`

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


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


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Tested with SPEC CPU2017 v1.0.5 on 2019-04-16 08:33:45-0400.
