

decode

**Hardware prototype and
reference platform running
the DECODE OS**



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Project no. 732546

DECODE

DEcentralised Citizens Owned Data Ecosystem

D4.8 Hardware prototype and reference platform running the DECODE OS

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Lead beneficiary: Arduino

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RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Approved by: Francesca Bria (Chief Technology and Digital Innovation Officer, Barcelona City Hall)

Date: 30/04/2018

This report is currently awaiting approval from the EC and cannot be considered to be a final version.

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1 Executive Summary

This document is part of the work done by Arduino in collaboration with the other technical partners in the DECODE project in the search for an optimal hardware platform ready to perform well enough to run the software created by the other partners in the consortium. While previous studies, made in D4.5, focused in a pure performance analysis of the boards chosen by the different partners, D4.8 builds on top of those results, includes the observations made by partners, makes a further analysis of other boards, and makes a final suggestion of an architecture that should be ready to fulfil the needs of the project. The next step, after this deliverable, will be to proceed with the design of the hardware on time to bring it in to some of the pilots and compare in real life its performance hand in hand with boards by other manufacturers. The analysis hereby presented is strongly oriented towards the production of an exploitable result by the end of the DECODE project.

2 State of the research

Up until now, in previous deliverables, we have set a standard way of measuring performance and performed a series of tests on existing commercial boards chosen by the partners (D4.5). The results of these activities showed, as expected, that a processor with a higher amount of cores and higher processor speed, given a similar operating system and identical conditions to handle data transfers to a physical storage, will always perform better except for some rare exceptions, like the case where the Raspberry Pi3 board performed better than all of the other devices under test to the analysis of MD5 strings (in our tests, the RPi3 board performed the worst in all tests except for that one).

However, given the special use needs from the software development team within DECODE, it was not the best performer that was chosen to be the board of reference to continue to develop software for the project. Dyne, partner who is main responsible for the software development for e.g. the project's wallet, came to the conclusion that the best board, should be the Olimex A20 board. The reasons for this were not so much the processor speed, where the tests demonstrated that it is scoring between the second and third place, neither the disk writing speed, where other boards scored better even if they only had a USB3 interface for the access to the external drive used in the tests (the Olimex board has SATA access, which in theory should have been faster), nor the network speed, since the processor on the Olimex board doesn't reach Gb speeds since it lacks an internal peripheral allowing it to operate at that speed. The software team voted for this board for two factors: first is the access to a drive via SATA even if it is not necessarily an advantage in terms of speed, but it is clearly better to have that as an internal peripheral to the processor and not having data to flow through a USB hub chipset attached to the main processor. Second, the lack of a firmware from the vendor on the chip, what ensures the maximum performance since there is nothing in the bottom of the process using computing cycles. At the same time, the lack of that firmware means that there is no chance to external monitoring of the processor as it has been documented with some other boards. This aspect – the lack of a firmware – plays a bigger role that goes beyond the possibility of external monitoring of the boards, since it facilitates the application of software patches on top of a mainline version of the Linux Kernel.

Given the circumstances, we (ARD) decided to incorporate the feedback from the software team in an attempt to please as many as possible of their conditions, while trying to keep in mind the need of making a choice for a technology that is up-to-date and that will have a long live expectancy. This text documents our analysis of three different processors, running on development boards from silicon vendors, the cost analysis of making a board that should be running the Devuan / DECODE OS (and / or Debian derivatives). Since this is a study made to help making the best choice of technology for developing these boards for real, we have included an analysis of the cost, but also looked into potential risks having to do with obsolescence, availability of documentation, and other aspects have to make the manufacturing as easy as possible.

3 Further analysis of boards

Throughout conversations with the software development team it seems to be clear that the following list of requirements has emerged as relevant while developing software for the project:

- The need of a reliable input / output to either internal storage of sufficient capacity or access to external storage, namely SSD drives, using SATA directly from the processor (eventually both would be ideal)
- ARM technology, preferably 64b CPU
- The need of accessing a wired network with Gb ethernet on chip and not through an external controller
- Availability of open source drivers for the peripherals in the processor
- A strong requirement is not to have any firmware in the processor “under the hood”
- Small form factor (while this is always relative, it should be big enough to host ethernet, USB, HDMI, SATA, and power connectors)
- If possible, wireless connectivity, namely WiFi and / or Bluetooth

On top of those requirements, from Arduino we had to add some other factors to the study. Based on our experience in the development of hardware products, we need to bring into the equation a series of aspects that should ease the manufacturing, certification, and maintenance of the design:

- Which is the cost of the BOM (Bill Of Materials, or components on the board)
- How good is the documentation about the main parts of the board: processor, and schematic
- Are the components used in other designs? Have they been certified? (this will give us an idea of how easy or hard it would be to bring a design with certain components to the market)
- Availability of open source design files
- Amount of IO pins on the board once the main communication aspects have been covered
- Availability of extra hardware peripherals on chip (like ADC, I2C, SPI, extra on-chip processor, etc)
- Programmed obsolescence of the processors
- Computing power available, namely a GPU to have a competitive product (industrial PC in this case)

Since we had already performed test on the main boards chosen by the software team in D4.5, we decided to further explore the field of existing boards while enlarging the types of processors to be tested as a way to put some other technologies under test. The choice of technologies was not casual, the main feature is that all of the boards run on ARM processors, Cortex A53 or better, and at 64b. On top of that, all of them have GPUs.

3.1 Khadas Vim2

Khadas Vim is a family of boards manufactured by the Khadas company, a Chinese based hardware design and manufacturing company. We looked at the Khadas Vim2 which main features follow (list taken from their website):

- SoC: Amlogic S912 or S905D
- CPU: 64Bit Octa (S912) or Quad(S905D) Core ARM Cortex-A53

- Up to 3GB DDR4
- Up to 64GB eMMC
- 2MB SPI Flash
- 100Mb or Gb LAN (depending on the processor)
- USB-C with 2.0 OTG
- 2X2 MIMO Wi-Fi AP6359SA, 802.11b/g/n/ac
- Bluetooth 4.2
- HDMI video out
- 40 Pins 2.54mm Pitch / USB, I2C, I2S, SPDIF, UART, PWM, ADC, ISO7816, IOs
- Open Source
- Linux Mainline
- Android Nougat and later

It is worth mentioning that Arduino has made an analysis of all of the components of the board and it should be possible to quickly start developing a board based on this design, though the delivery time for processors might be an issue. At first sight, the board could fulfil the needs of the project, only lacking the SATA connector. This is available at the hardware level, or so it seems, because one of the main issues is that the processor of the board, which is made by AMLOGIC. The Khadas board exists in two different flavours, based on the kind of processor it comes with: the S905 model and the S912 one. While the second one performs better in terms of processing speed, it doesn't have Gb LAN interface, what the other processor has. However, the family of processors is a strong candidate since it has strong support for different flavours of the Linux operating system, what should make the work of porting Devuan / DECODE OS to it fairly simple.

3.1.1 Performance test

We have performed the same battery of tests with the Khadas board as we did with the previous boards under study. Here are the main results for the board. In the overall score it ended up in position 2, after the Odroid board. It is worth mentioning that some of the for Khadas were made under different conditions (since it was not using the same kind of storage as the others) what presumably will make it score slightly worse. However, because the Odroid has more cores, it is also reasonable to think that it is going to score better, but at the price of more power dissipation and making it need a fan. See appendix A for the full list of test results for all boards, includes all of the tests performed up till the time of writing.

Also, since both boards were scoring really close to one another, we decided to make a performance-based point estimation for the boards, instead of the previous table of results where all of them were graded 1 to 4. In the following table, the best score gets 100 points and the worst gets 0 points for a certain test. A negative one (-1) means a penalty because that board couldn't perform a certain test. All of the values will be between -1 and 100 and will be assigned proportionally.

Test / Board	BPi	Khadas Vim2	Odroid-Xu4	Olimex	RPi3
pts/compress-gzip	77.12	0.00	100.00	76.87	35.63
pts/sqlite	88.00	42.49	77.06	100.00	0.00
pts/apache	5.49	27.49	100.00	0.00	9.86
pts/pgbench	-1.00	100.00	-1.00	0.00	-1.00
pts/compilebench	14.07	100.00	17.71	36.07	0.00

Test / Board	BPi	Khadas Vim2	Odroid-Xu4	Olimex	RPi3
pts/iozone	10.63	77.58	100.00	98.14	0.00
pts/dbench	-1.00	100.00	17.03	98.11	0.00
pts/fs-mark	60.66	12.15	44.23	100.00	0.00
pts/fio	-1.00	-1.00	-1.00	-1.00	-1.00
pts/tiobench	15.49	49.58	100.00	13.40	0.00
pts/postmark	40.00	100.00	13.43	37.71	0.00
pts/aio-stress	22.59	100.00	13.33	20.33	0.00
pts/unpack-linux	62.40	100.00	88.76	59.97	0.00
pts/network-loopback	21.39	60.13	100.00	0.00	47.16
pts/botan	-1.00	-1.00	-1.00	-1.00	-1.00
pts/gnupg	68.82	0.00	-1.00	100.00	-1.00
pts/openssl	4.19	34.00	100.00	4.19	0.00
pts/gcrypt	0.00	-1.00	-1.00	100.00	-1.00
pts/john-the-ripper Blowfish	8.82	47.00	100.00	9.00	0.00
pts/john-the-ripper DEC	81.85	0.18	0.00	82.95	100.00
pts/john-the-ripper MD5	10.22	64.74	100.00	8.16	0.00
pts/memory (RAMspeed)	-1.00	100.00	90.92	0.00	52.35
pts/t-test1	14.42	100.00	41.44	0.00	69.24
pts/cachebench read	12.39	0.00	100.00	-1.00	5.46
pts/cachebench write	0.00	8.99	100.00	-1.00	8.57
	24.54	48.85	55.96	37.64	12.93

It is worth reminding the reader that all of the tests on the Khadas Vim2, except for the ones that required writing to a HDD (namely the pts/fio test) were executed directly on the processor's internal storage and embedded board's memory, which is a huge difference in comparison to all of the tests made until this time that required an SD card to run the operating system. This is an aspect that reduces the possibility of getting a corrupted storage, something that we documented as it happened with the BPi tests from D4.5 as well as with some of the RPi3 tests from the same deliverable. Also, it is important to note that computing the results using averages transforms the perception we had of the BPi board that jumps from being considered the best of the cheap alternatives (letting Odroid the label of "expensive alternative"), to score worse than the Olimex A20, what comes to reinforce the decisions made by DECODE's software development team up to this moment in regards to the hardware chosen for most of the tests for the time being.

3.1.2 Cost analysis

In appendix B you can see the full BOM analysis for this board, the final cost is of approximately 137,231 Euros. In the cost analysis we have considered the prices for making 1 board at once and looked at the price of each component of the board. The most challenging factor has been obtaining the price for the processor, as it is not available anywhere, the device is always sold against a quote produced specifically for each case. By making a cost analysis of just one board, the prices of a final product are much higher

than the board that could be purchased now from the manufacturer. However, in order to have a proper measure of the prices of the parts, we have estimated the price of manufacturing a single Olimex A20 board. This will also help the rest of the partners understand which the proportional difference between the prices of the different boards is. The Olimex A20 could be produced for 124,750 Euros.

3.1.3 Openness analysis

One aspect we have realized when making the analysis is that the Khadas board has been the one that was the best documented from all, even better than the Olimex one. This is actually very important from the perspective of openness of the product. If the parts are documented and listed, it becomes very easy to figure out how to replicate the design, but this has not always been the case. While the schematics for the boards were available, there were always some components that were really hard to trace and that seemed to be left out of the schematic design almost intentionally, and this was especially dramatic in the case of the Olimex A20 design.

3.1.4 Risks

The main risk with following the path set by this design is not meeting the conditions of maximizing LAN speed and processing capabilities. The processor, which was designed for the creation of TV boxes, doesn't have the need of very fast ethernet connection and therefore the S912 family of processors, while being faster, has worse connectivity than the older S905 family of chips. While the old ones reach Gb ethernet, the new ones are limited to 100Mbps.

At the same time, the technology behind these chips is already old-ish, as the processors are over 4 years old (the S905) and it is not clear – because they don't publish it and it hasn't been possible for us to obtain – their sales numbers, what could determine the termination of the product to happen any time soon.

3.2 Dragonboard 410C

Dragonboard is a family of boards manufactured by Arrow. It has the Snapdragon 410 processor (from Qualcomm) on board and while it doesn't comply with the possibility of having ethernet (this board completely lacks that), it does come with WiFi and Bluetooth. It is worth mentioning that the Snapdragon 410 processor is typically used in the creation of mobile devices. While it doesn't have ethernet connectivity, it also lacks support for a SATA drive, in exchange for that the processor has USB-2.0 capability.

The processor itself is LTE ready, which means that it can also be used on mobile networks, and while it has not been possible for us to figure out this extent, it seems like it should be possible to get it to work on narrow band IoT (a special part of the LTE network dedicated to IoT devices) which potentially be very interesting for remote DECODE OS enabled sensor boards. This is the main reason why we decided to go for analysing this board, since this is something none of the others count on.

The following list depicts the main specifications of the board:

- Supported Device: Snapdragon 410
- Supported Device Technology: Application Processor and SOC
- RAM Size: 1GB
- Program Memory Size: 8GB
- Program Memory Type: eMMC Flash
- USB ports: 4

- I2C ports: 4
- SPI ports: 1
- UART ports: 1
- GPIO: 12 pins
- Display Interface: HDMI
- Display Type: LCD
- Operating Systems: Android 5.1|Linux Based on Debian|Win 10 IoT Core
- PC Card Interface: micro SD
- Audio Interfaces: Yes
- Bluetooth: On Board
- Wi-Fi: On Board
- Main Program Memory Type: Flash
- Android: Android 5.1
- Linux Based on Debian

While some of the features of the Dragonboard don't seem to be competitor to the Khadas one, at the same time this board is meant to be mobile, which means it should be possible to implement e.g. a hardware wallet for the DECODE project, a portable sensor device (to run on a vehicle as part of a float), etc.

3.2.1 Performance test

We have not been able of performing any tests from the predefined test suite we created for DECODE with the Dragonboard as we did with the previous boards under study. The main reason for this is that the board only has two versions of its OS that are Linux based: Linaro (based on Debian) and Ubuntu code (a UI-less version of Ubuntu). While testing on the later (Ubuntu core) makes no sense since we would be not able of having a fair comparison to the other processors as we would not be using any graphical capabilities as we did in the other tests; the Linaro OS crashed every time we tried to install a test from the standard Phoronix Test Suite we have been using until this point. It is unclear why this happens and we assume it has to do with the specifics of how the board is set up when using Linaro. We tried in multiple ways to run tests on the board by testing different versions of the OS image, trying to install some community maintained images, but nothing worked. Since – from the beginning – we had other technical reasons to discard this architecture, we decided to do so after a week of making different tests. We include the following video to show how the board will stop to function once we tried to install a test on the external HDD: <https://youtu.be/LLU-3ns41D4>. The video is a screen-capture session where we boot a Dragonboard where the full installation of the extra packages needed for testing has been done, and we try to run the Phoronix Test Suite to perform some tests. At the time of installing any of the tests, the board crashes and reboots.

3.2.2 Cost analysis

In appendix B you can see the full BOM analysis for this board, the final cost is of approximately 115,379 Euros. Again, this calculation is for buying components just to build one board and we did it as a way to get an overview of the difference in prices between the boards.

3.2.3 Risks

The main risk has to do with the fact that this board is too far from the expected design brief extracted from the previous deliverables. While it offers great performance and connectivity possibilities, it is not

optimal in many other ways, like it would need an external chip to handle the ethernet, or the SATA connectivity, what will be an inconvenient for many of the expected usage scenarios for the board. While the failure to install the test suite could be considered a risk, it basically means that we should invest more time patching the OS as a way to make it work, and this is the actual risk, that the time to patch the system is uncertain and the parts are old enough not to be considered for future designs.

3.3 NXP iMX solution

While the previous boards were very well defined, the possibility of developing using an NXP iMX solution is not as developed. This family of processors by NXP features a Quad-core Cortex A53 on board, like all of the other options here presented, but there is at least one other MCU that could be used to perform other things at a lower level. In other words, these chips have inside enough hardware to run a Linux machine with an Arduino board connected to it at all times. The only aspect to research is in which way can pins from the processor be made available as GPIOs.

3.3.1 Performance test

For this board we have not made a performance test, since it is not as easily available in the market (it wasn't at the time when we purchased the materials to start testing, but the tests will be performed regardless, and this deliverable will be updated with the corresponding data).

3.3.2 Cost analysis

Once more, we don't have made a cost analysis for this board as we haven't been able of purchasing it, yet.

3.3.3 Risks

The main risk with this approach is that, at the time of writing, we only have the word from NXP representatives that this approach is feasible, since we haven't been able of acquiring one of these boards to put it under test.

4 High level conversations with silicon vendors

Unlike in previous phases of the project we at Arduino focused only in making tests of available boards, directly after finishing the previous deliverable we moved into making a cost analysis of boards that would better suit the project while still being a possible Arduino product. We have been making, as Arduino, this kind of analysis in the past and it requires having an executive level conversation with hardware vendors to figure out on the one hand which are the best conditions we could get in economic terms for making a product, but also how much are these companies willing to help out in the process of making these products.

One of the aspects that these conversations can really influence is the price of the boards. While the passive components (resistors, capacitors, connectors) have relatively low prices, the memory and the processors are the ones that set the final price of a product. A proper negotiation at a high level can really influence the price of a hardware product. As an example, the RPi family of boards has subsidized components on them, which means the price of the final product can be made much more competitive as the board vendor doesn't have to include the cost of some of the components in the BOM.

Top executives from Arduino maintained conversations with representatives from different part vendors to obtain relevant information about product roadmaps, availability of processors, estimated delivery times, etc. When crossing the information coming from those meetings with the facts obtained from the analysis at technical level, it is possible to make an informed decision on how to proceed with the project.

In our case, despite the fact of not having actual data from testing the processor, it seems like the iMX family of processors from NXP is one of the best options for the project. Not only do those processors include all the features requested having the same core as the others, but the promised end of life expectancy of the processors (as in for how long they will be selling those) excesses our expectations. This means that our recommendation is to go for this manufacturer due to their availability over time.

5 Conclusions

Designing a board requires making analysis at different levels: features, price, and planned obsolescence seem to be facts we should not avoid when thinking about the creation of a new piece of hardware. At the same time, making a one-board computer is a highly complex task that requires a level of expertise that is partly missing at Arduino. This means that we will require the help of a partner willing to collaborate with us. It is this mix of hard facts and soft values that guide the decision making when creating a new product. These are then the factors that influence the creation of a new platform like the DECODE Hardware and this deliverable has been explaining those as an attempt to clarify the design choices made for this project. As the reader can appreciate, sometimes getting a longer processor life expectancy is much more important than technical features. Even if we couldn't try the Cortex A53 processor from NXP until now, we are in the process of acquiring one of the existing development boards through our contacts. Once they are made available to us we will proceed to test them in the same way we have tested all of the other boards. While the end functionality and basic computation performance is not going to differ much from the other ones running on the same kind of Quad Core processors, we expect the added features to really make a big difference in terms of making a competitive device that will fulfil the needs of the project.

Appendix A: full performance tests

These performance tests include the Khadas Vim2 board to the list of previously performed tests.



www.phoronix-test-suite.com

dts

Unknown testing with a Raspberry Pi 3 Model B Rev 1.2 and BCM2708 on Devuan jessie via the Phoronix Test Suite.

Test Systems:

bpi-0001

Processor: ARMv7 rev 4 @ 0.96GHz (2 Cores), Motherboard: Allwinner sun7i (A20) Family LeMaker Banana Pi, Memory: 1024MB, Disk: 120GB SHFS37A120G + 4GB SS04G, Graphics: simple

OS: Devuan 1.0, Kernel: 4.11.2 (armv7l), Desktop: LXDE 0.7.2, Display Server: X Server 1.16.4, Display Driver: modesetting 0.9.0, OpenGL: 2.1 Mesa 10.3.2, Compiler: GCC 4.9.2, File-System: ext4, Screen Resolution: 1920x1080

khadas-0001

Processor: Unknown @ 1.51GHz (8 Cores), Motherboard: Amlogic, Memory: 3072MB, Disk: 500GB SSD 850 EVO 500G + 63GB CJNB4R + 16GB SL16G, Graphics: LLVMPipe

OS: Ubuntu 16.04, Kernel: 4.9.40 (aarch64), Desktop: MATE 1.12.1, Display Server: X Server 1.18.4, Display Driver: modesetting 1.18.4, OpenGL: 3.3 Mesa 17.0.7 Gallium 0.4 (LLVM 4.0 128 bits), Compiler: GCC 5.4.0 20160609, File-System: ext4, Screen Resolution: 1920x1080

khadas-0001b

Processor: Unknown @ 1.51GHz (8 Cores), Motherboard: Amlogic, Memory: 3072MB, Disk: 500GB SSD 850 EVO 500G + 63GB CJNB4R + 16GB SL16G, Graphics: LLVMPipe

OS: Ubuntu 16.04, Kernel: 4.9.40 (aarch64), Desktop: MATE 1.12.1, Display Server: X Server 1.18.4, Display Driver: modesetting 1.18.4, OpenGL: 3.3 Mesa 17.0.7 Gallium 0.4 (LLVM 4.0 128 bits), Compiler: GCC 5.4.0 20160609, File-System: ext4, Screen Resolution: 1920x1080

odroid-0001

Processor: ARMv7 rev 3 @ 1.40GHz (8 Cores), Motherboard: ODROID-XU4 Hardkernel Odroid XU4, Memory: 2048MB, Disk: 240GB 40G2G0A-00JH30 + 16GB SL16G, Graphics: LLVMPipe, Monitor: W2243

OS: Ubuntu 16.04, Kernel: 4.14.0-83 (armv7l), Display Server: X Server 1.18.4, OpenGL: 3.3 Mesa 17.0.7 Gallium 0.4 (LLVM 4.0 128 bits), Compiler: GCC 5.4.0 20160609, File-System: fuseblk, Screen Resolution: 1920x1080

odrois-0001

Processor: ARMv7 rev 3 @ 1.40GHz (8 Cores), Motherboard: ODROID-XU4 Hardkernel Odroid XU4, Memory: 2048MB, Disk: 240GB 40G2G0A-00JH30 + 16GB SL16G, Graphics: LLVMPipe, Monitor: W2243

OS: Ubuntu 16.04, Kernel: 4.14.0-83 (armv7l), Display Server: X Server 1.18.4, OpenGL: 3.3 Mesa 17.0.7 Gallium 0.4 (LLVM 4.0 128 bits), Compiler: GCC 5.4.0 20160609, File-System: fuseblk, Screen Resolution: 1920x1080

olimex-0002

Processor: ARMv7 rev 4 @ 0.96GHz (2 Cores), Motherboard: Allwinner sun7i (A20) Family Olimex A20-OLinuXino-LIME2, Memory: 1024MB, Disk: 120GB KINGSTON SHFS37A + 16GB SL16G, Graphics: simple

OS: Devuan 1.0, Kernel: 4.14.11 (armv7l), Desktop: LXDE 0.7.2, Display Server: X Server 1.16.4, Display Driver: modesetting 0.9.0, OpenGL: 2.1 Mesa 10.3.2, Compiler: GCC 4.9.2, File-System: ext4, Screen Resolution: 1920x1080

olimex-0003

Processor: ARMv7 rev 4 @ 0.96GHz (2 Cores), Motherboard: Allwinner sun7i (A20) Family Olimex A20-OLinuXino-LIME2, Memory: 1024MB, Disk: 120GB KINGSTON SHFS37A + 16GB SL16G, Graphics: simple

OS: Devuan 1.0, Kernel: 4.14.11 (armv7l), Desktop: LXDE 0.7.2, Display Server: X Server 1.16.4, Display Driver: modesetting 0.9.0, OpenGL: 2.1 Mesa 10.3.2, Compiler: GCC 4.9.2, File-System: ext4, Screen Resolution: 1920x1080

olimex-0004

Processor: ARMv7 rev 4 @ 0.96GHz (2 Cores), Motherboard: Allwinner sun7i (A20) Family Olimex A20-OLinuXino-LIME2, Memory: 1024MB, Disk: 120GB KINGSTON SHFS37A + 16GB SL16G, Graphics: simple

OS: Devuan 1.0, Kernel: 4.14.11 (armv7l), Desktop: LXDE 0.7.2, Display Server: X Server 1.16.4, Display Driver: modesetting 0.9.0, OpenGL: 2.1 Mesa 10.3.2, Compiler: GCC 4.9.2, File-System: ext4, Screen Resolution: 1920x1080

rpi3-0001

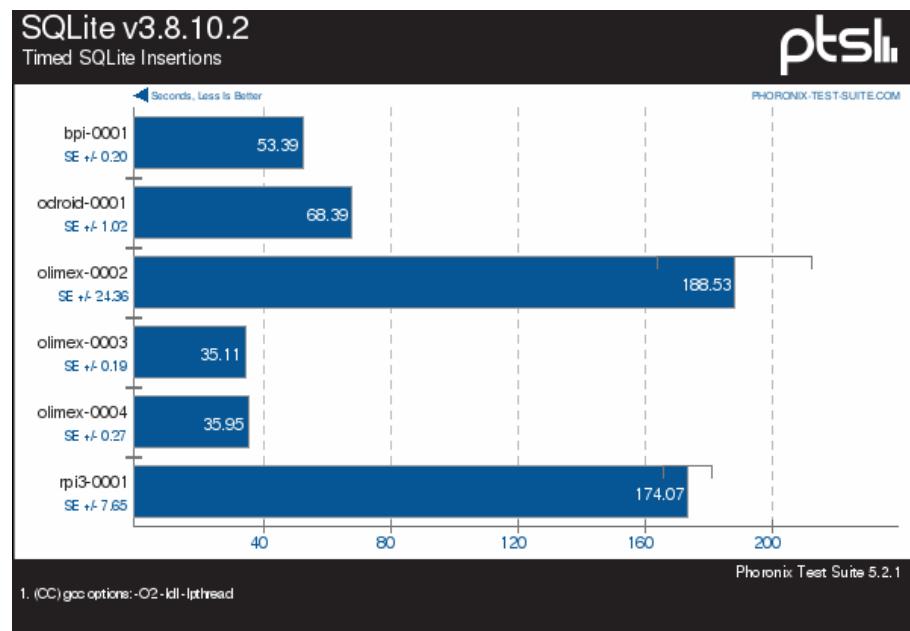
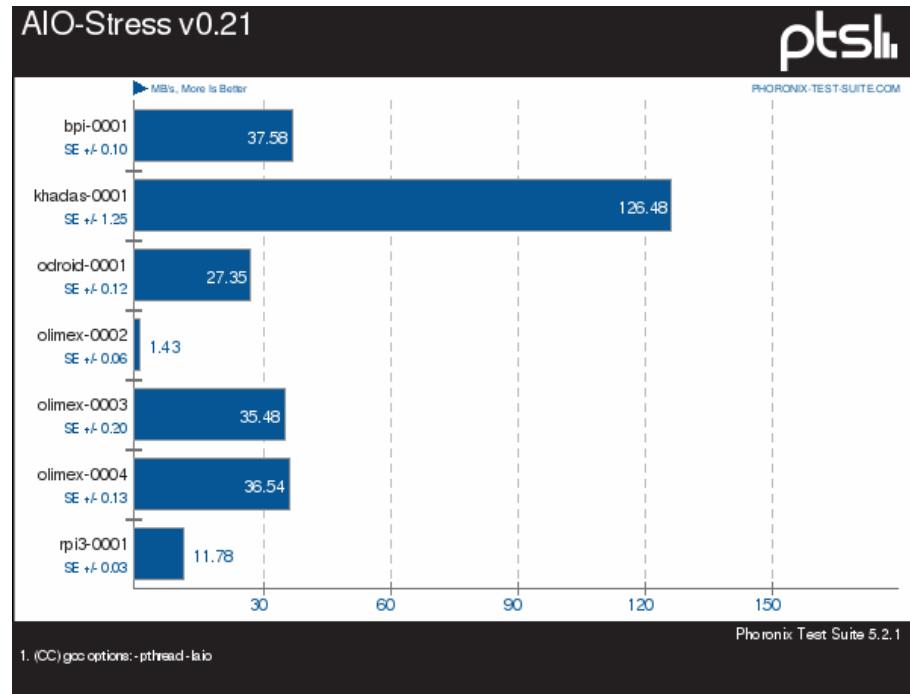
Processor: Unknown @ 1.20GHz (1 Core), Motherboard: Raspberry Pi 3 Model B Rev 1.2, Memory: 931MB, Disk: 500GB SSD 850 EVO 500G + 16GB SL16G, Graphics: BCM2708

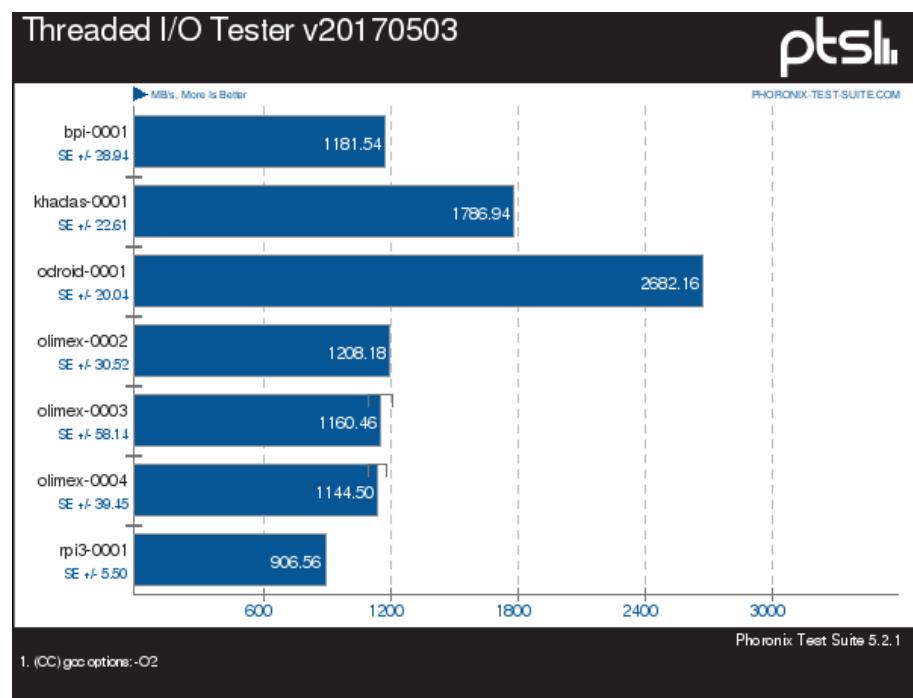
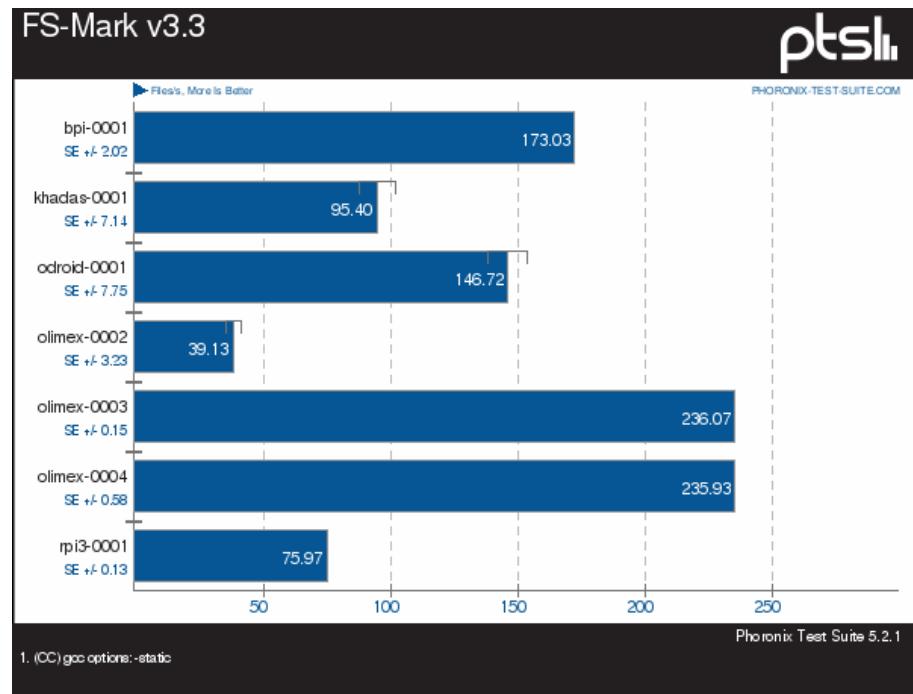
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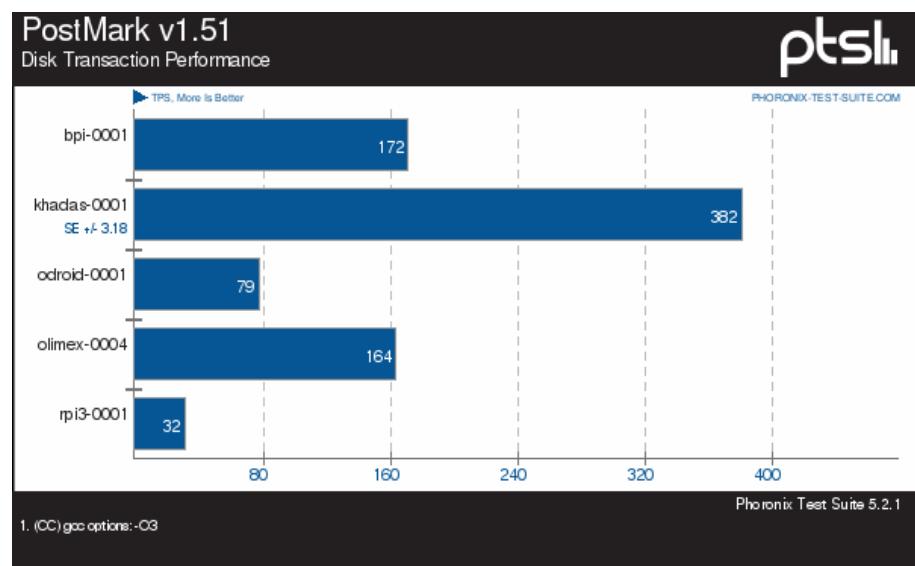
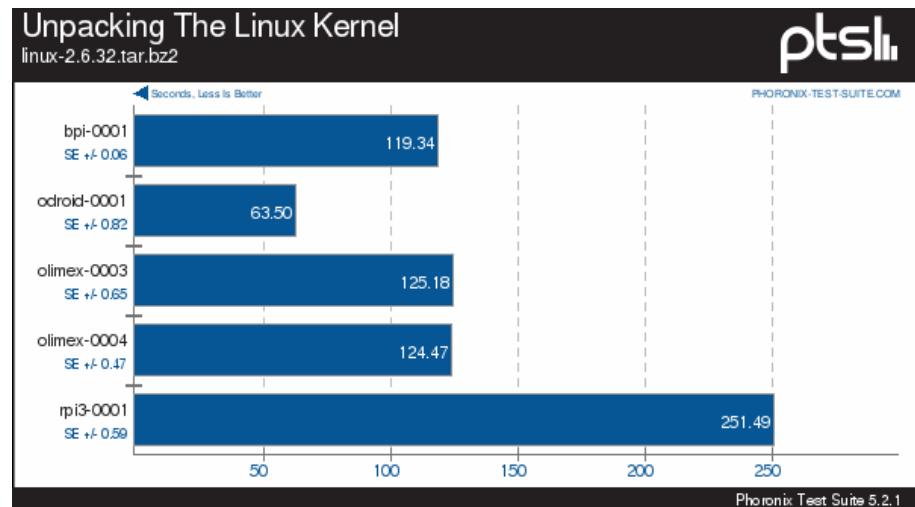
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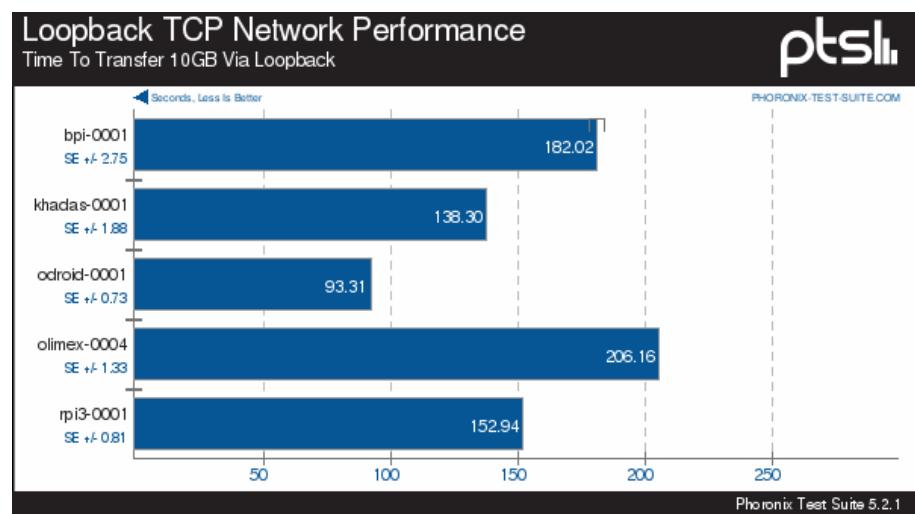
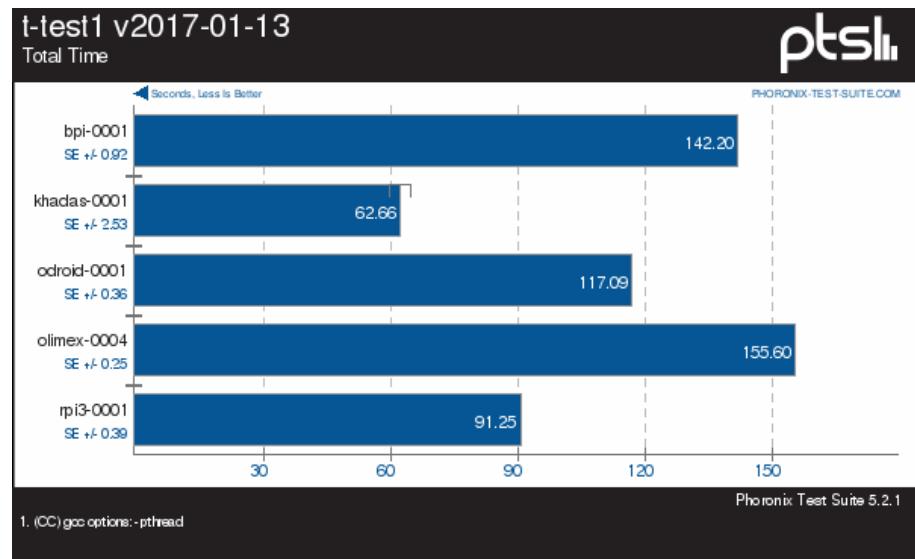
Processor: Unknown @ 1.20GHz (1 Core), Motherboard: Raspberry Pi 3 Model B Rev 1.2, Memory: 931MB, Disk: 500GB SSD 850 EVO 500G + 16GB SL16G, Graphics: BCM2708

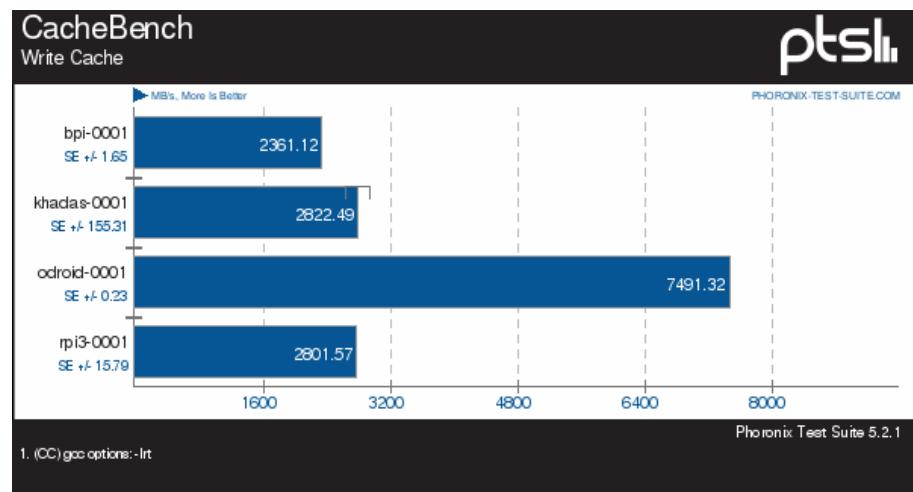
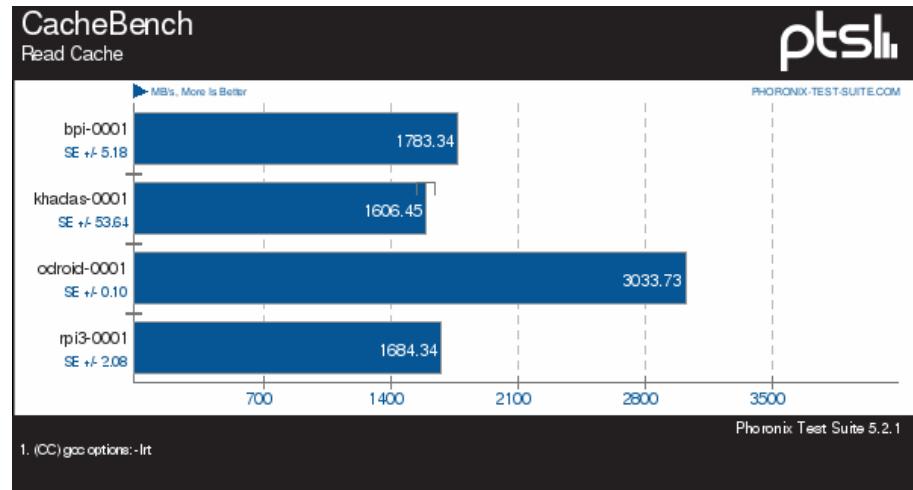
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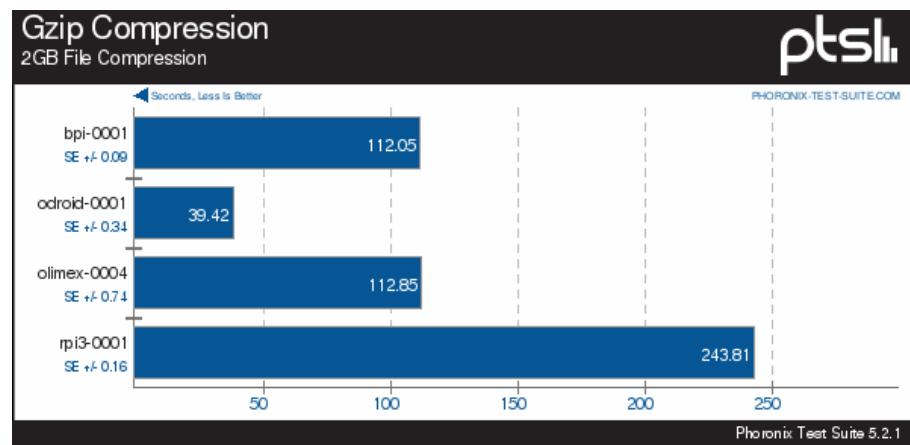
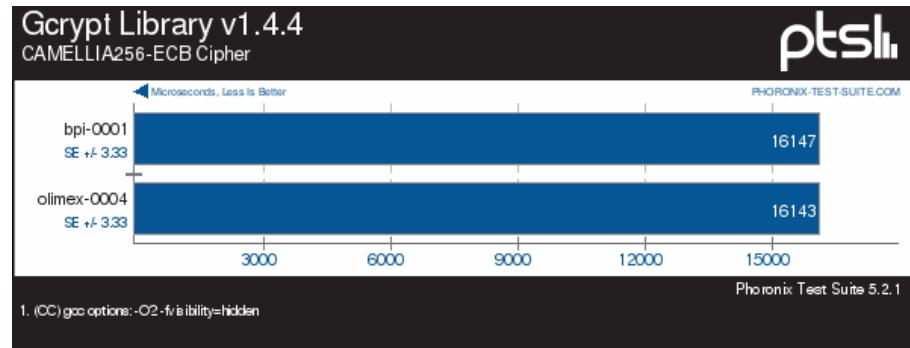


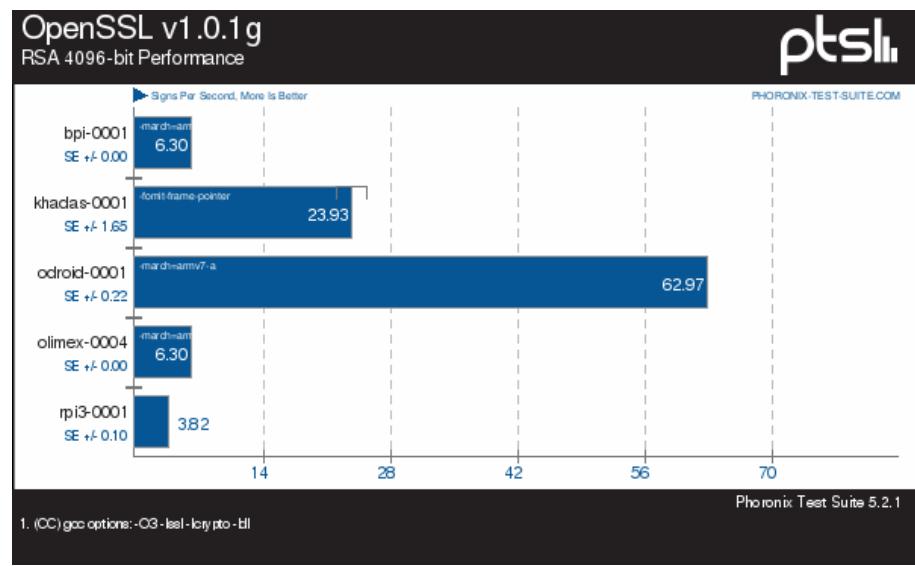
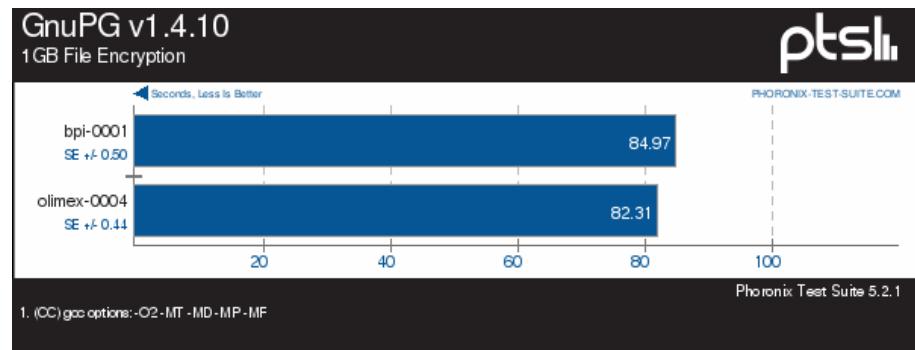


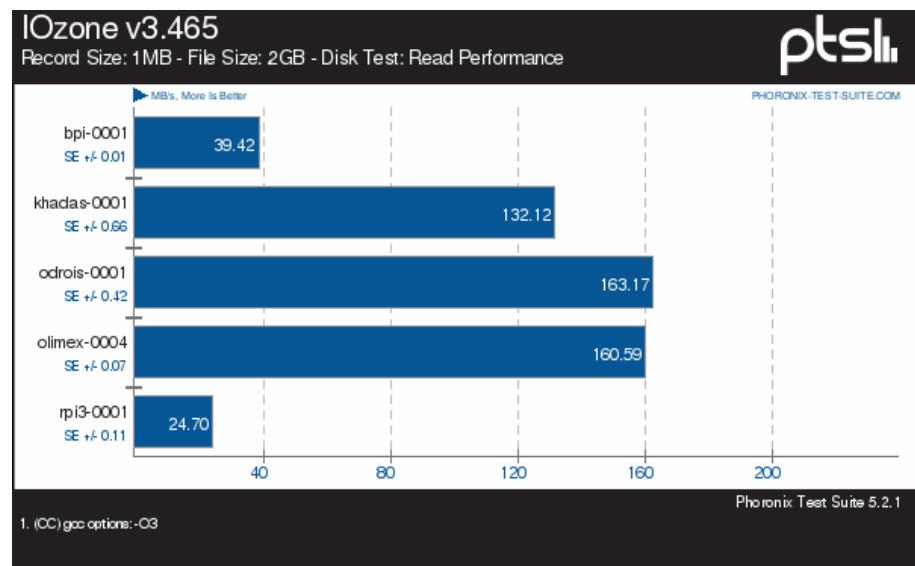
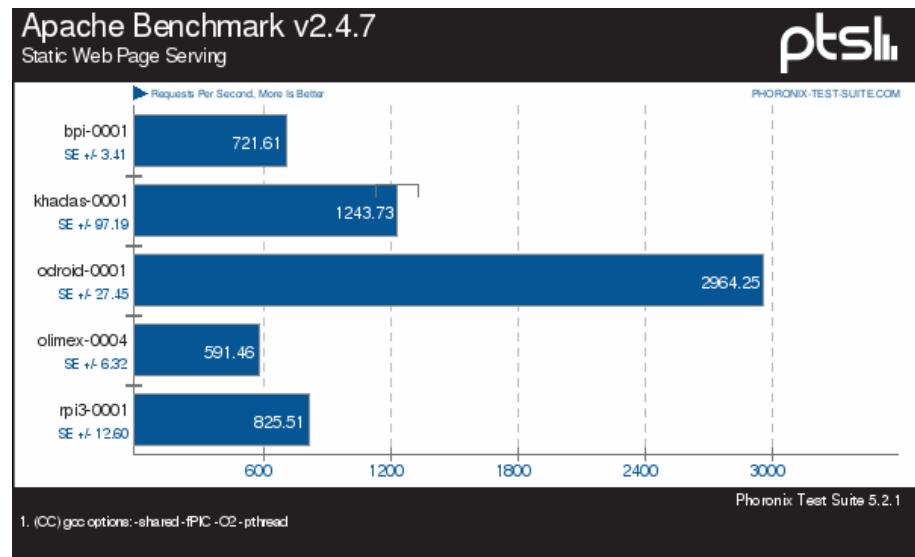


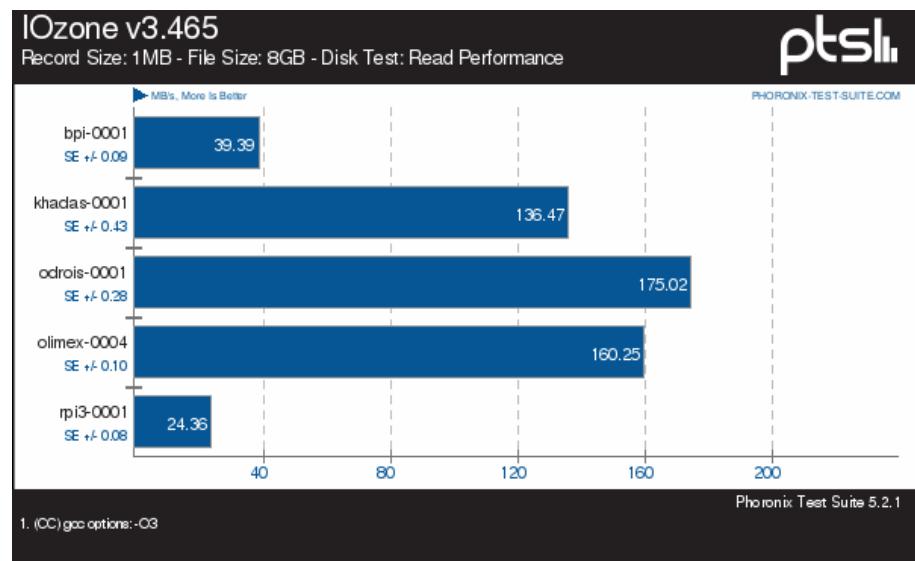
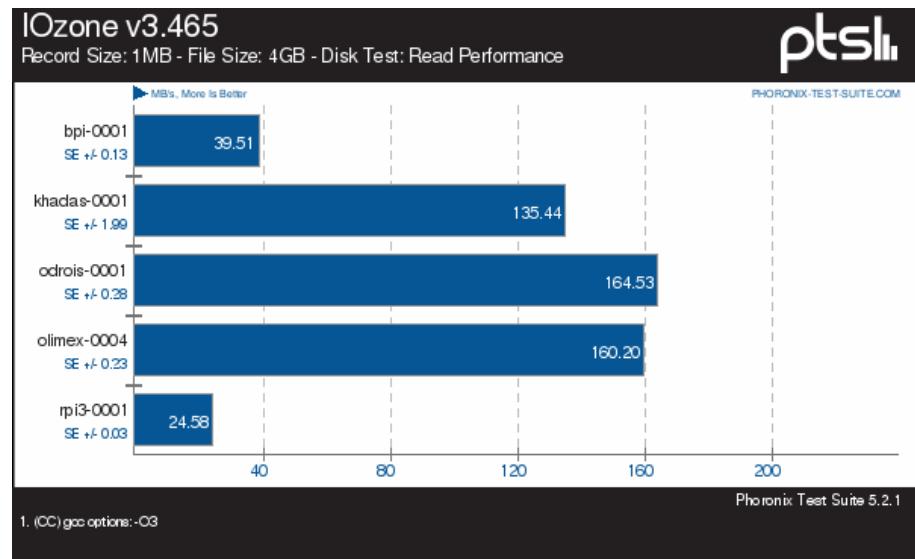


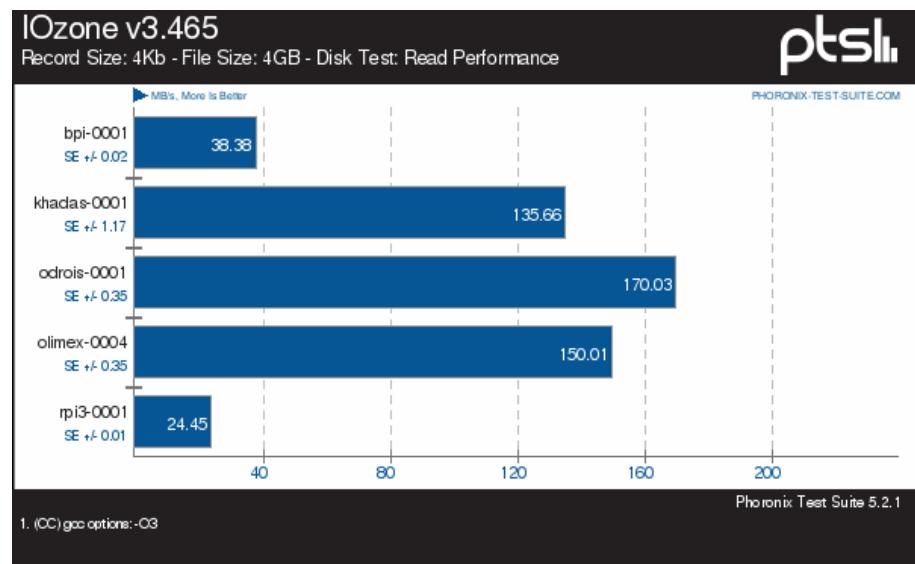
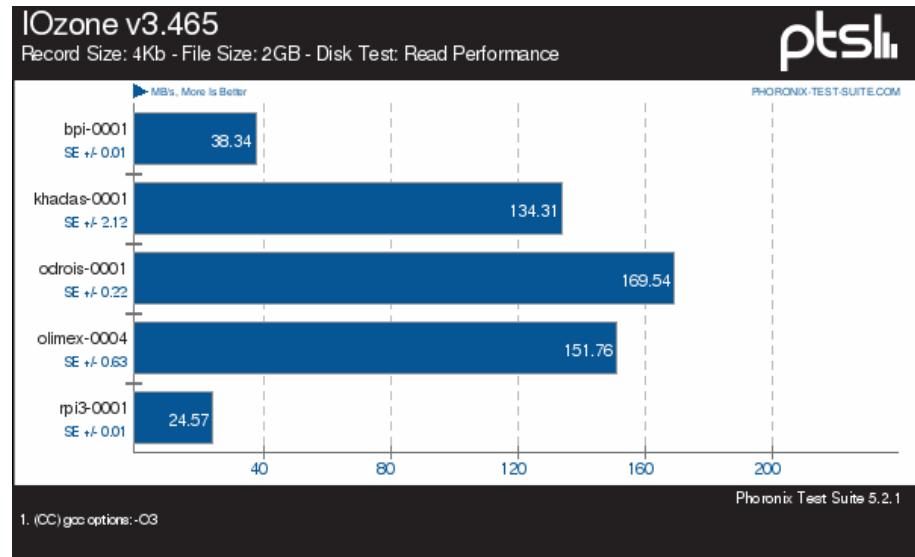


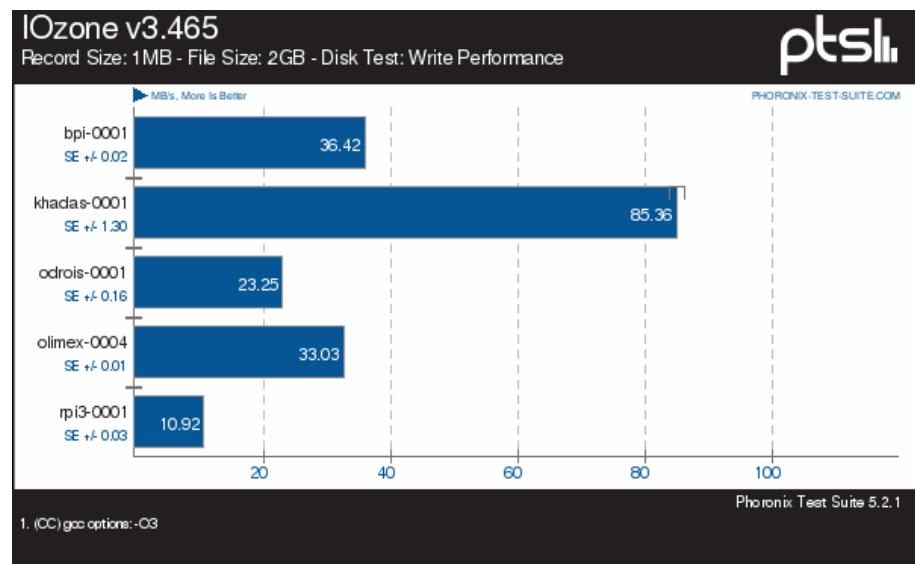
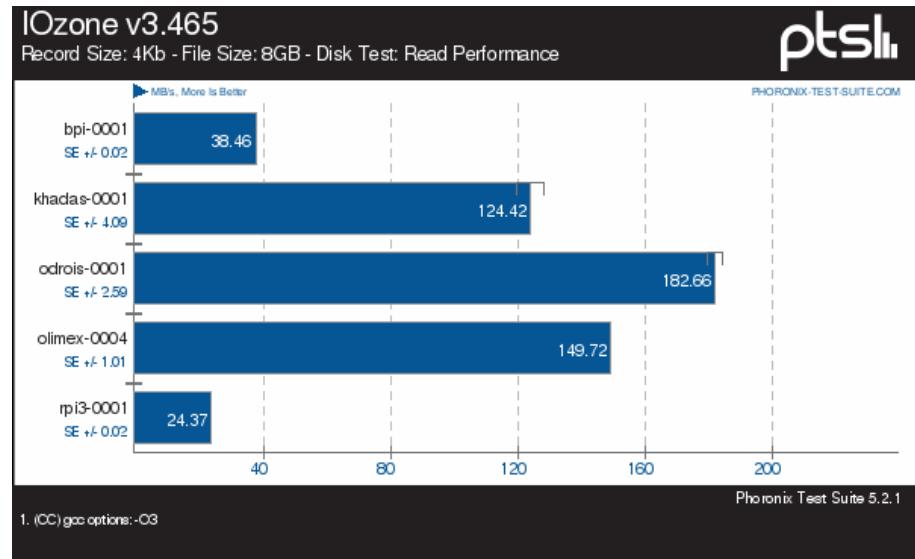


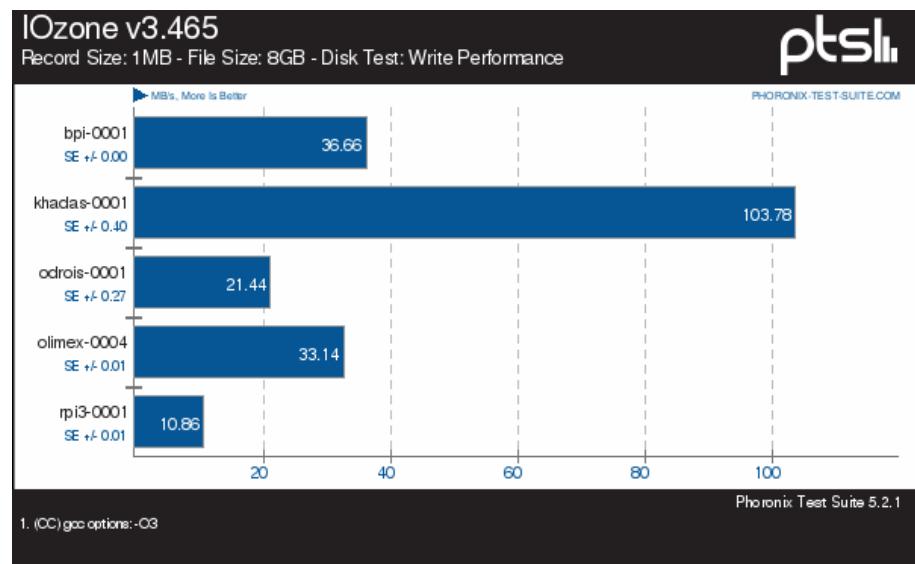
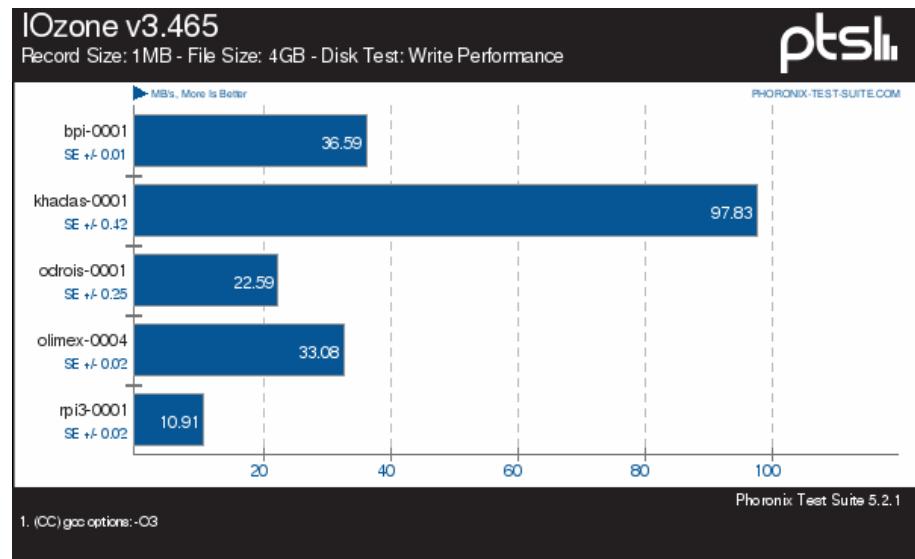


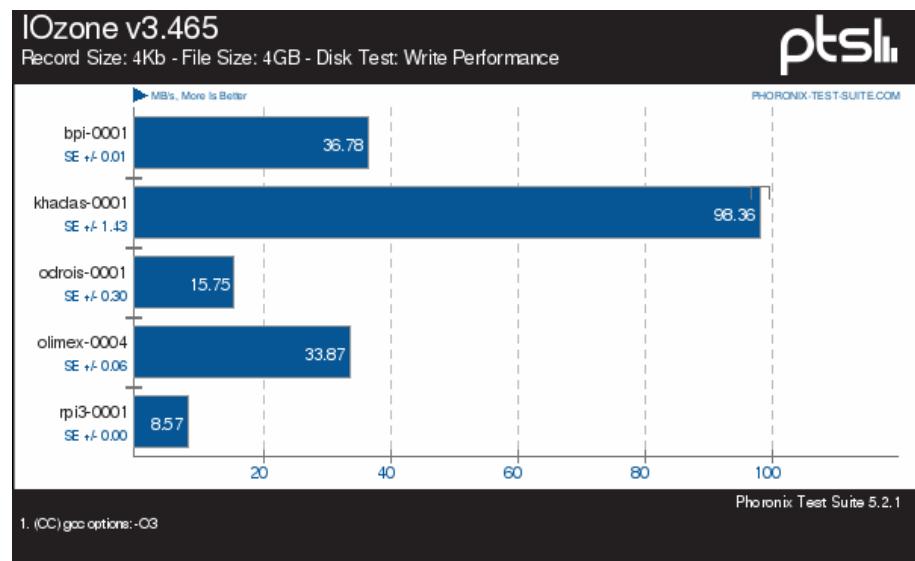
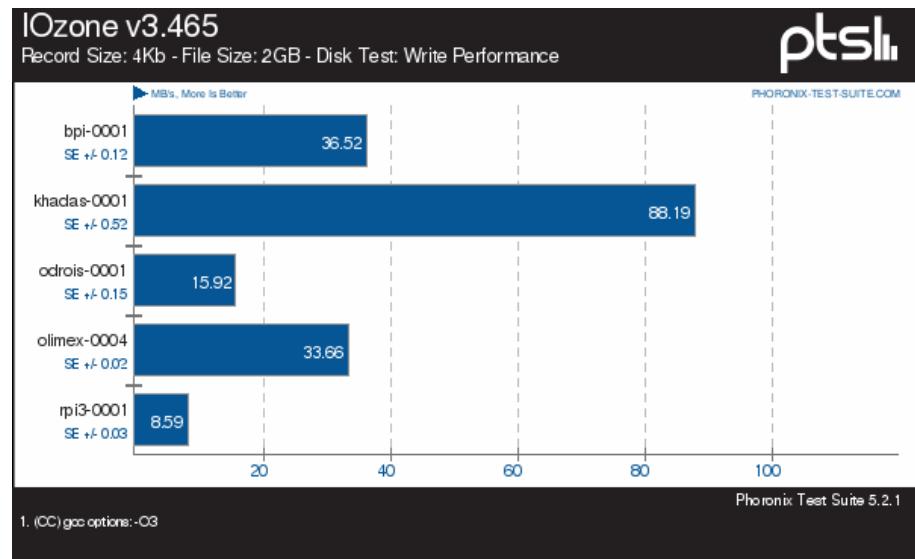


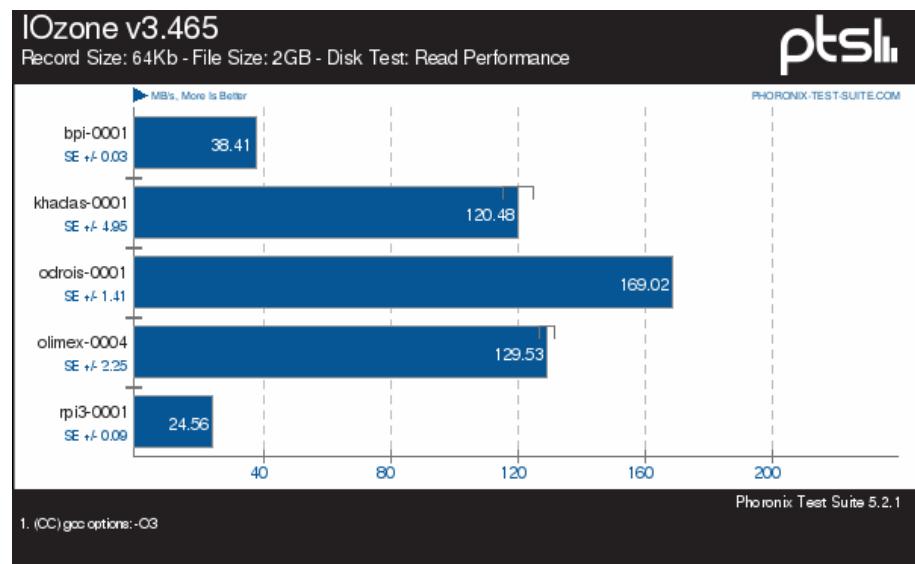
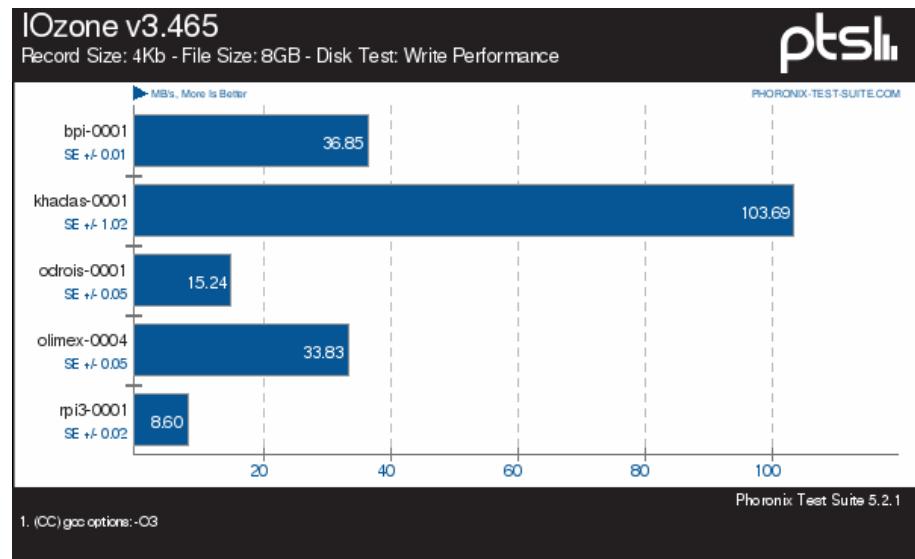


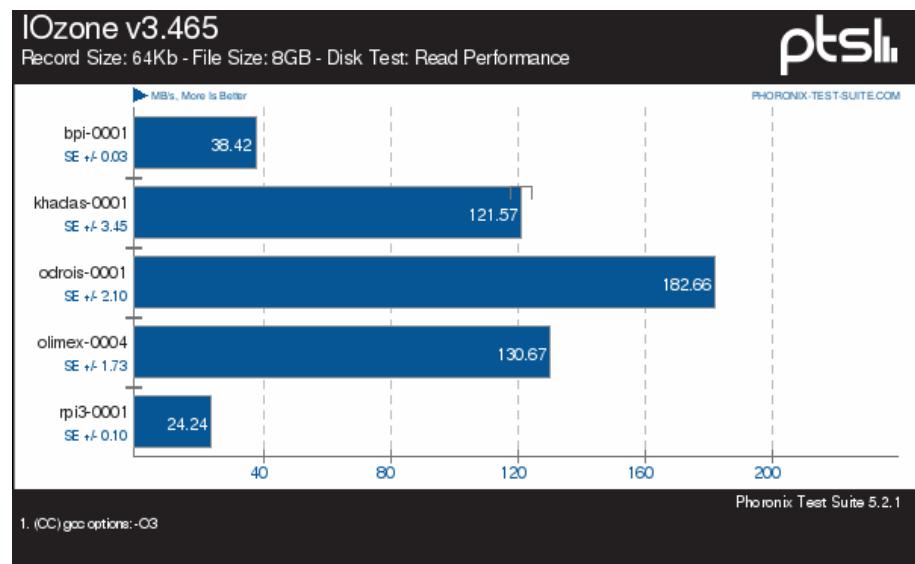
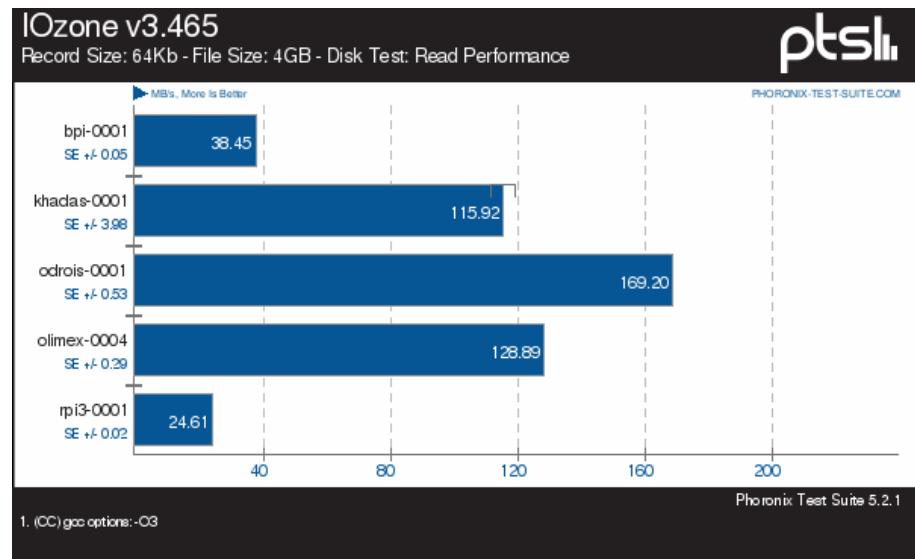


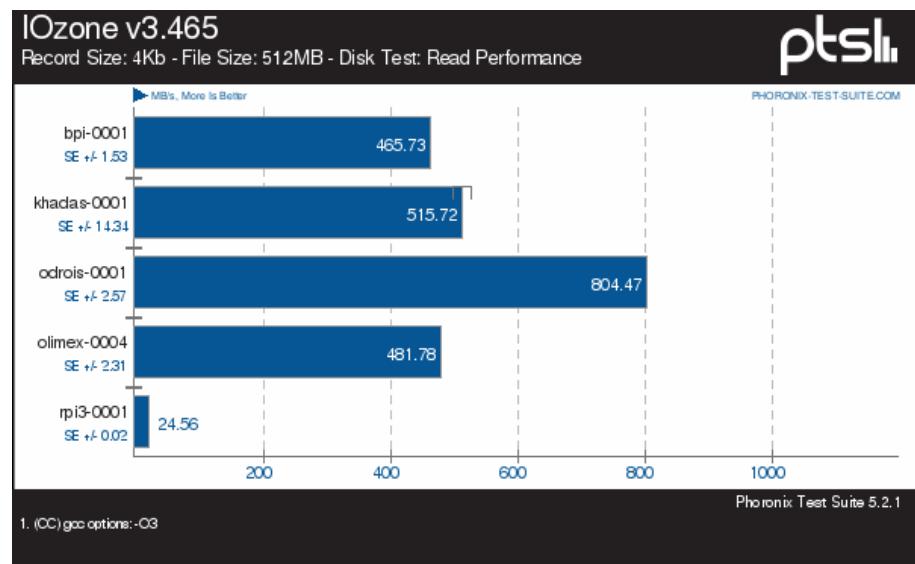
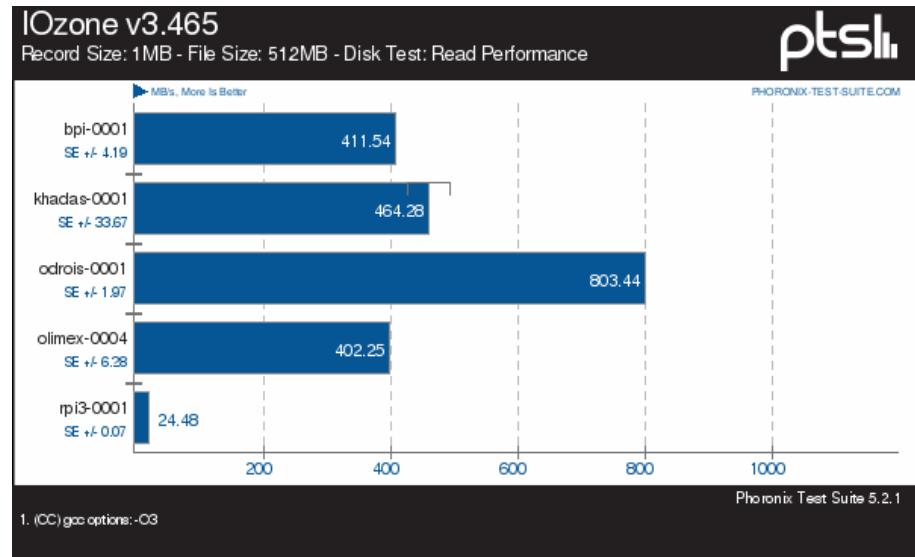


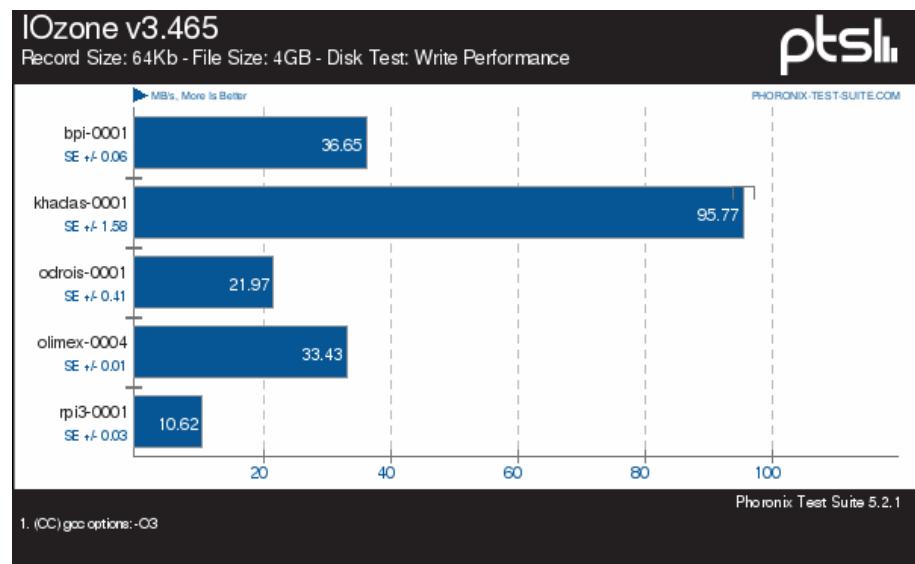
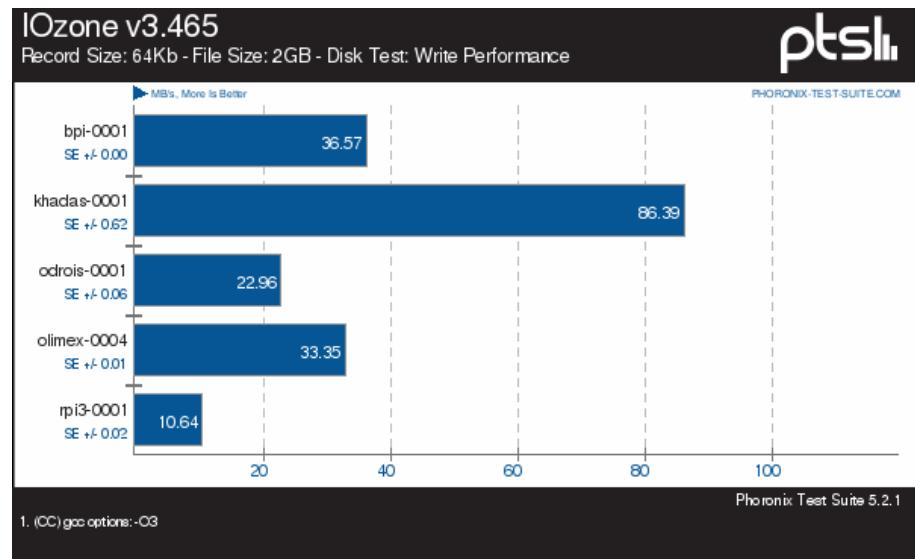


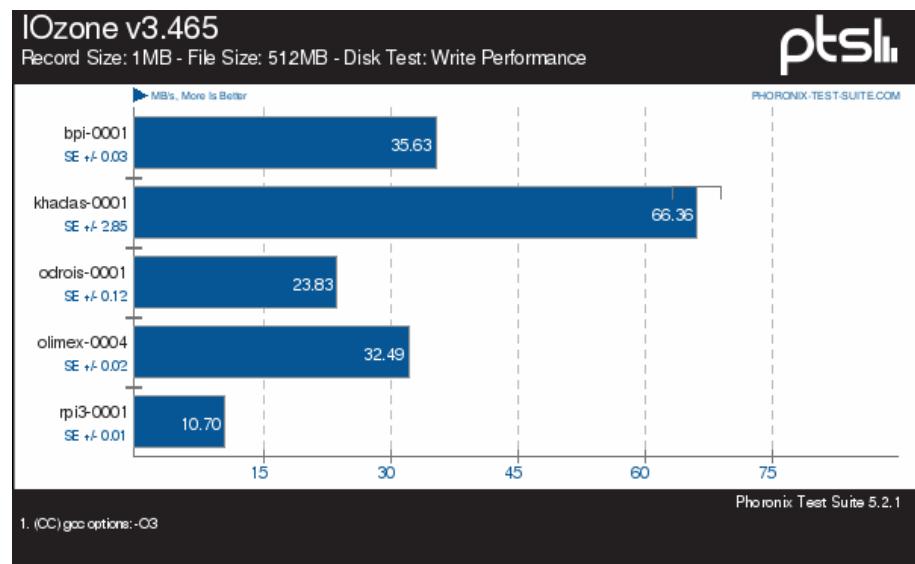
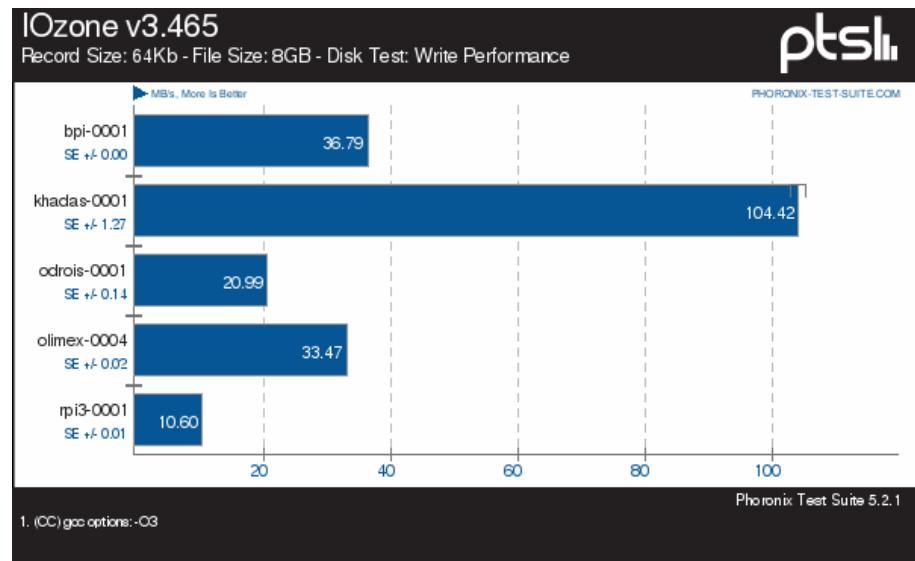


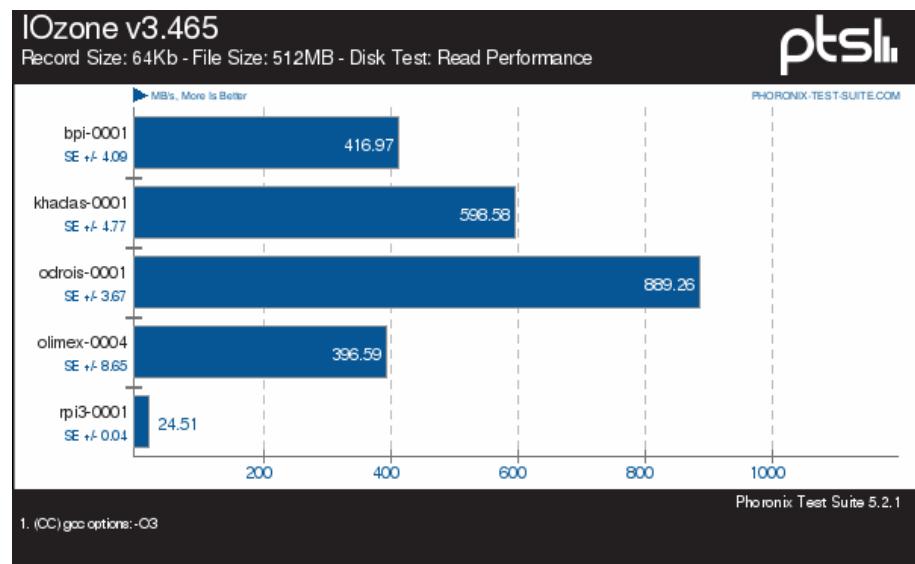
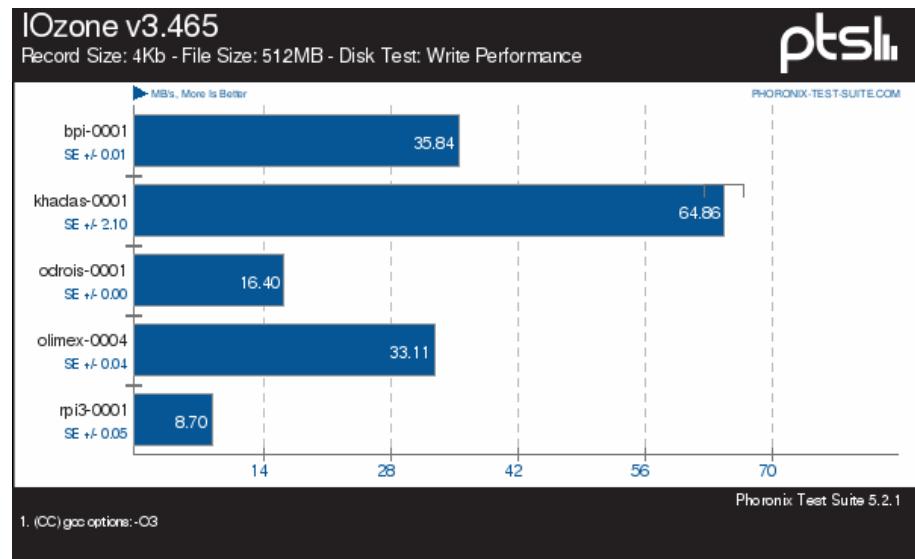


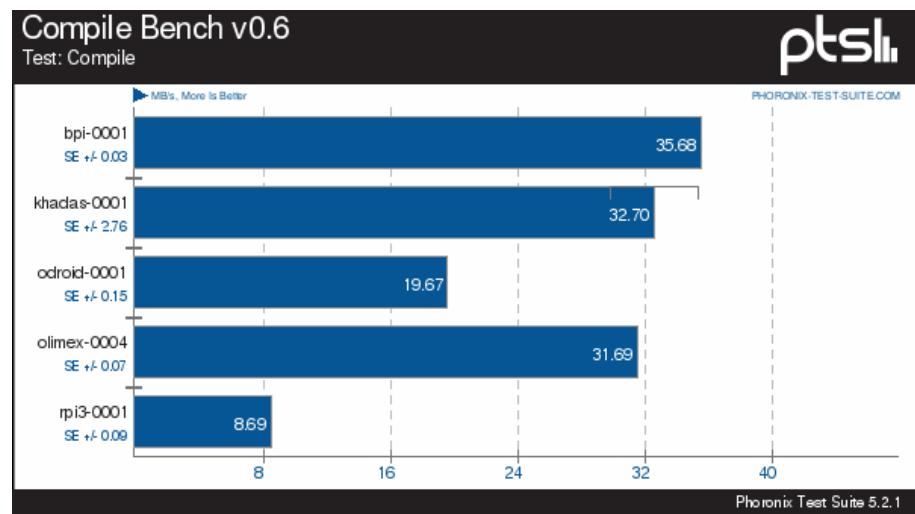
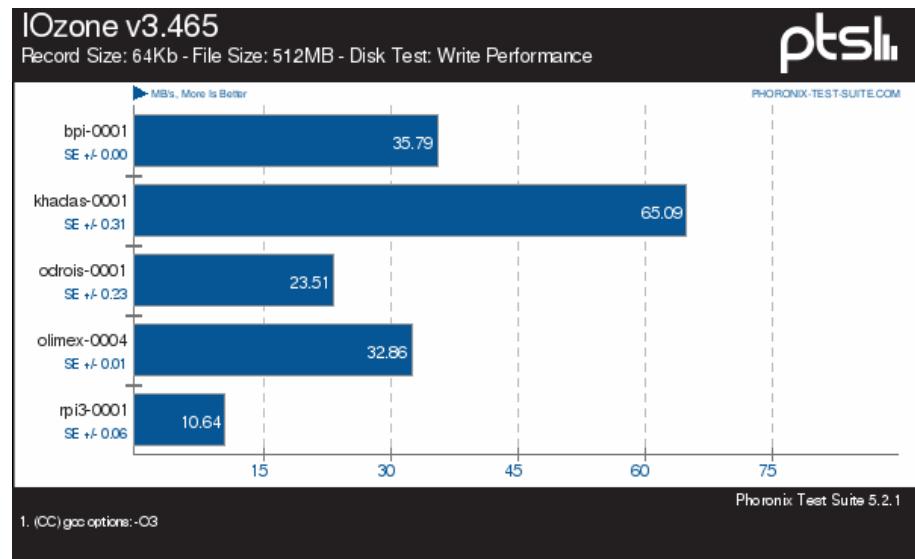


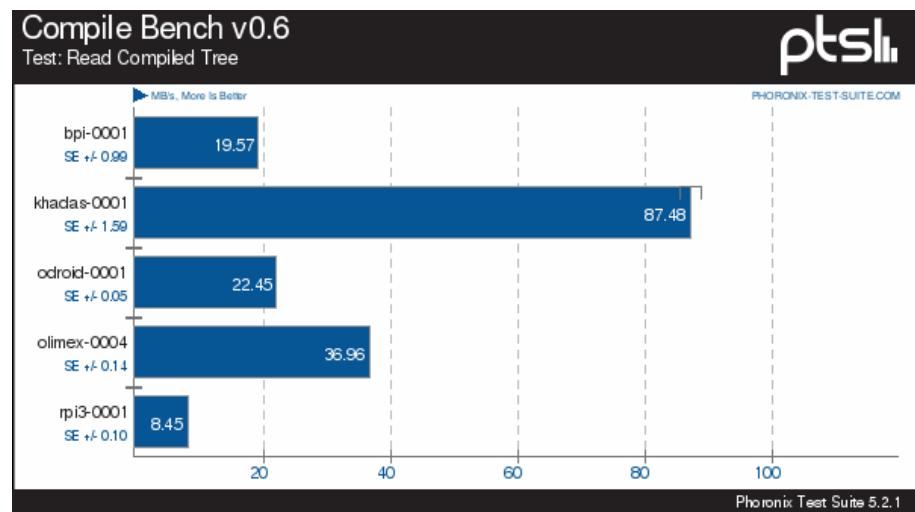
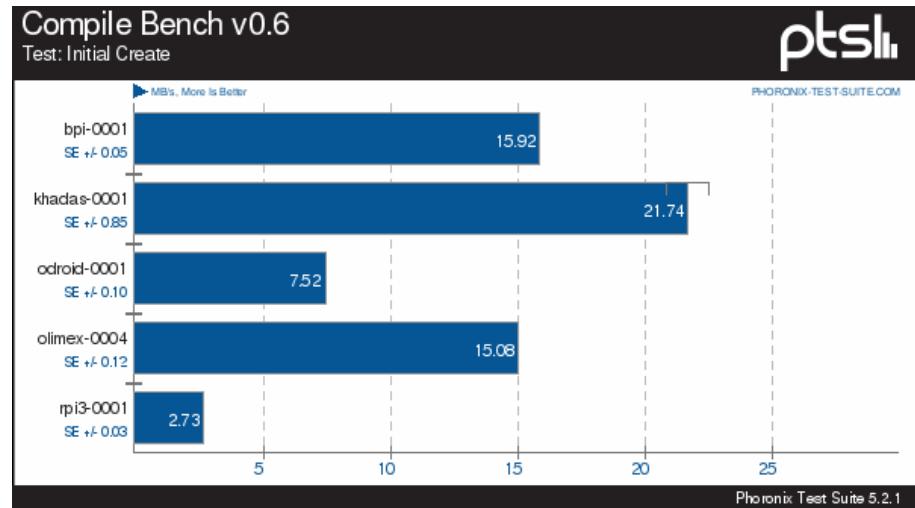


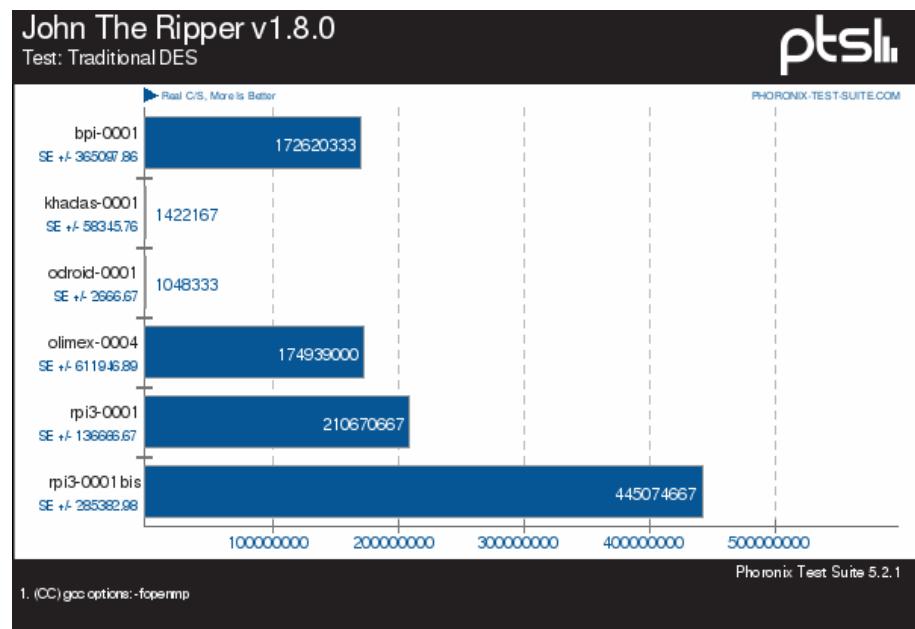
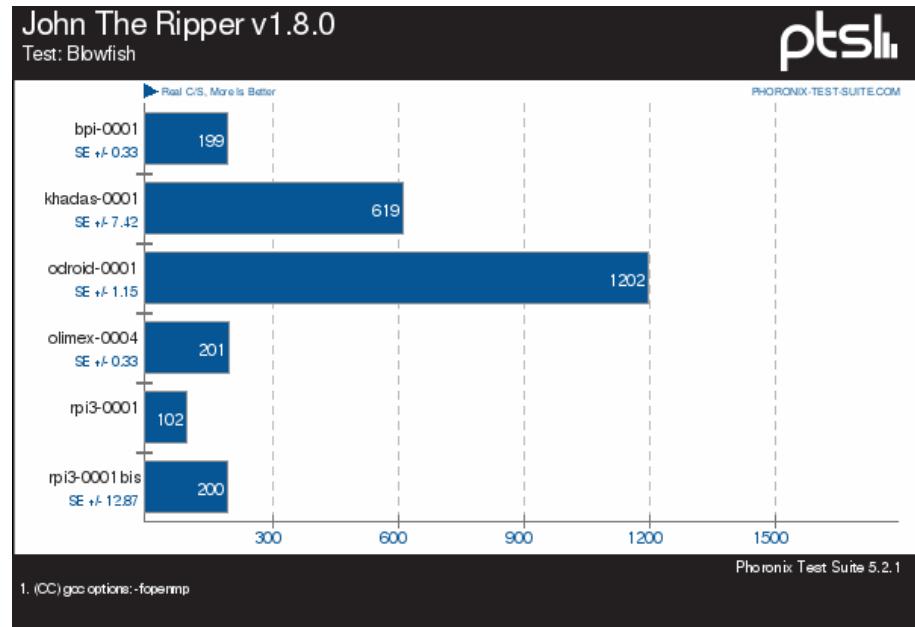


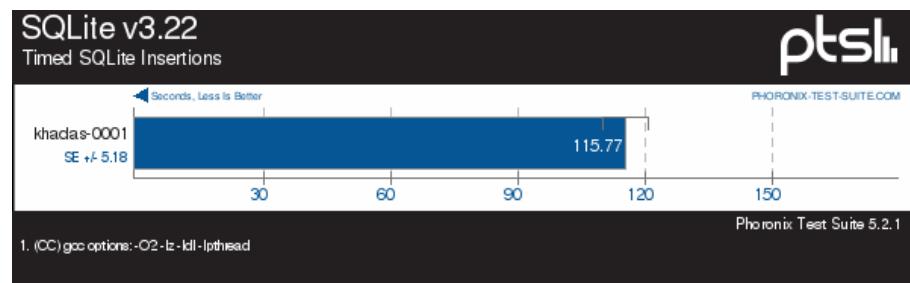
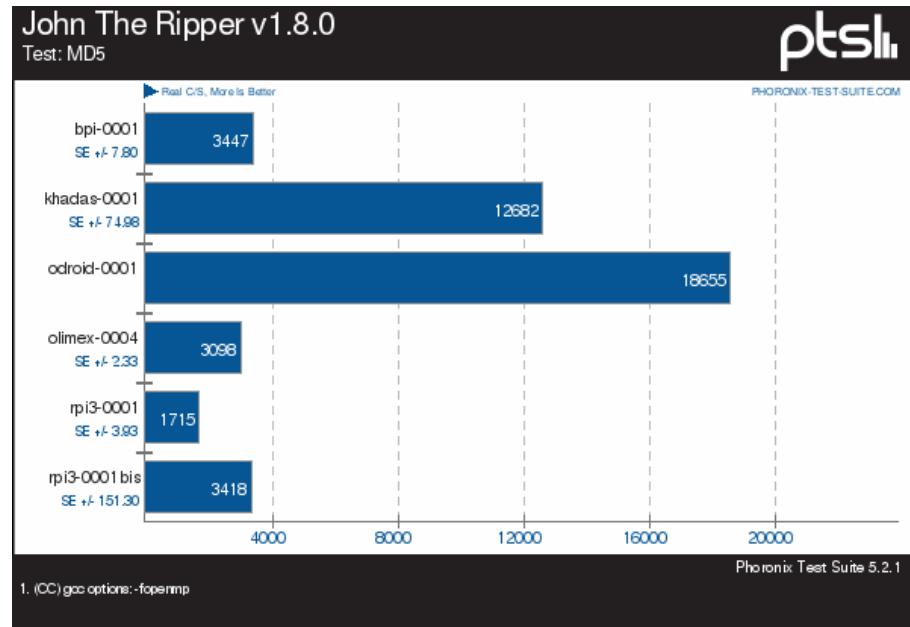


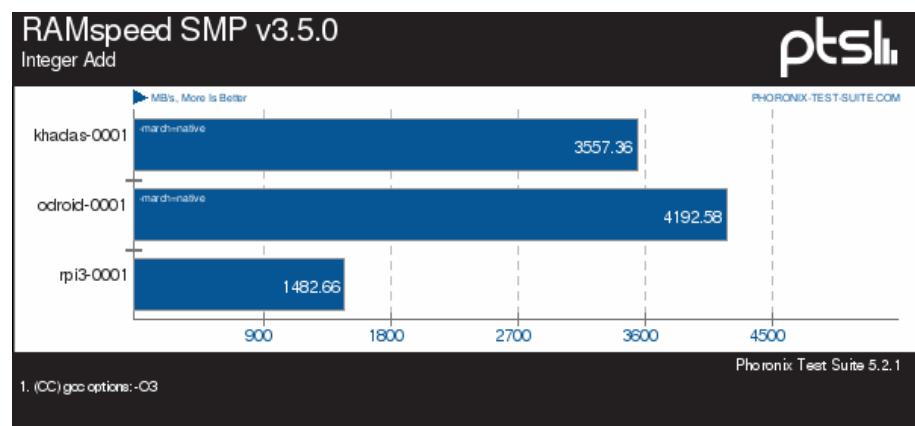
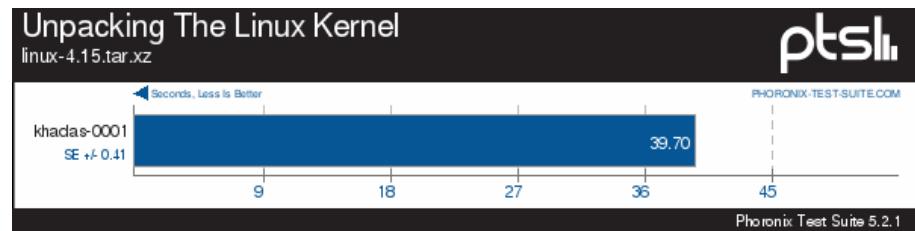


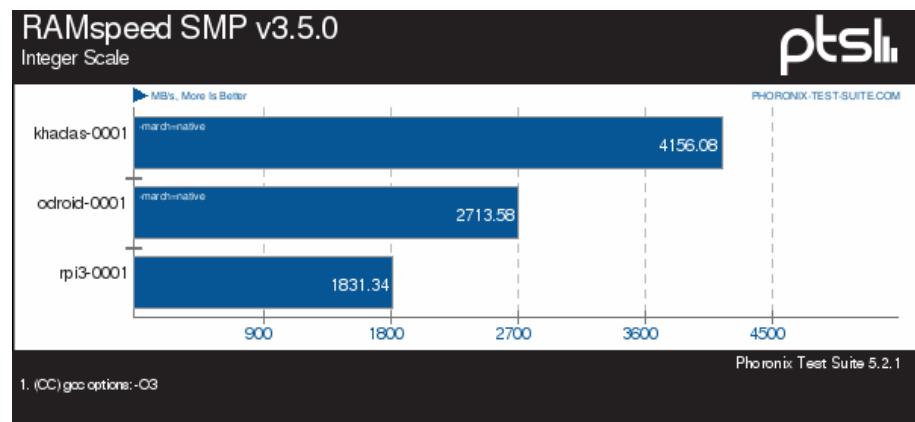
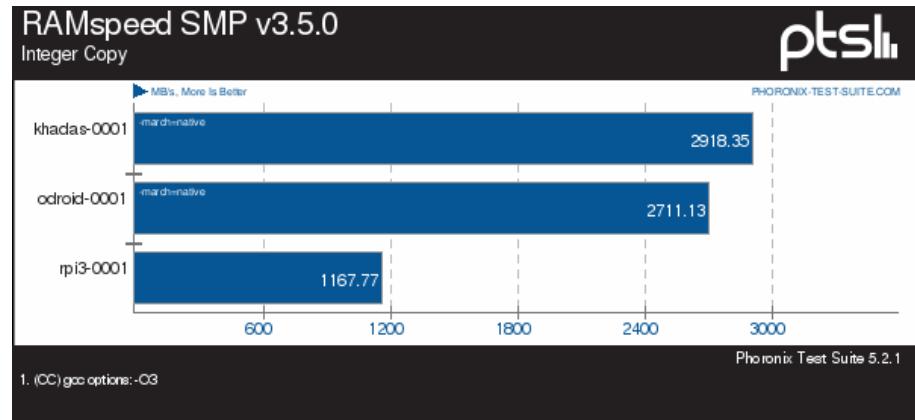


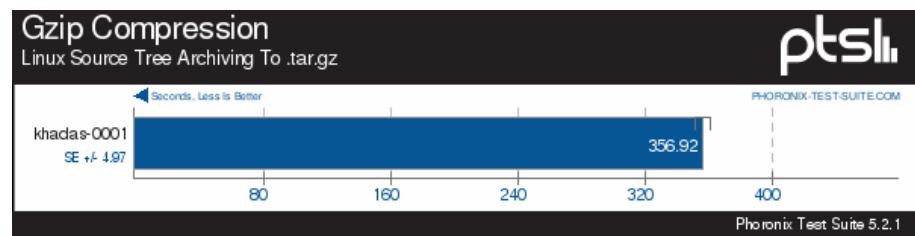
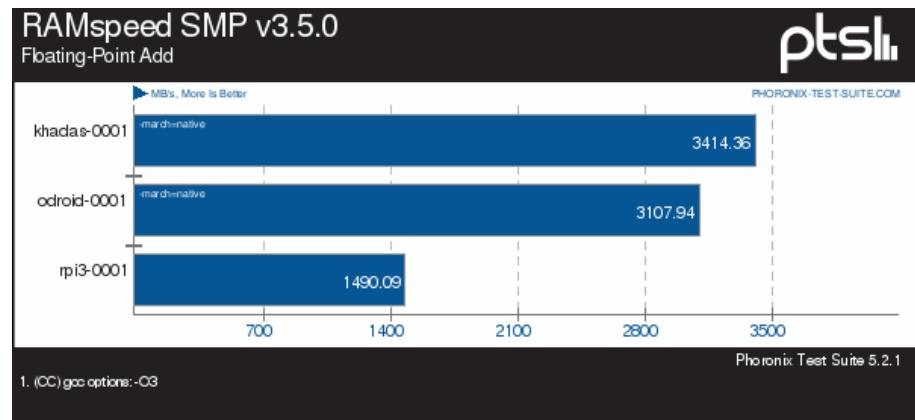


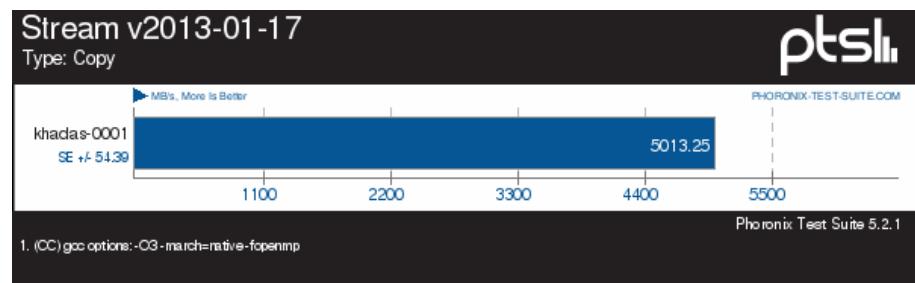
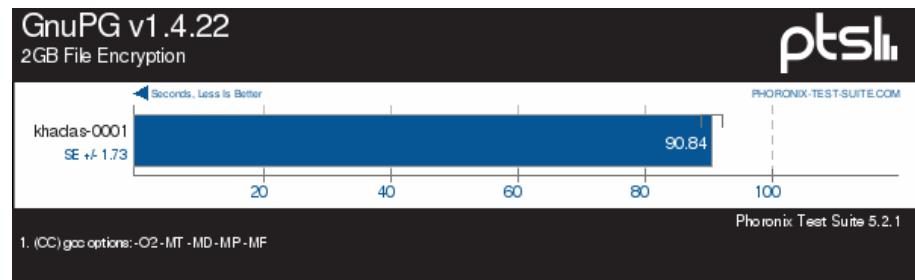


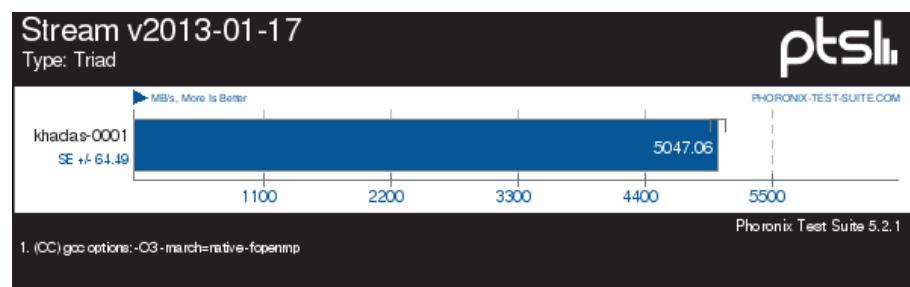
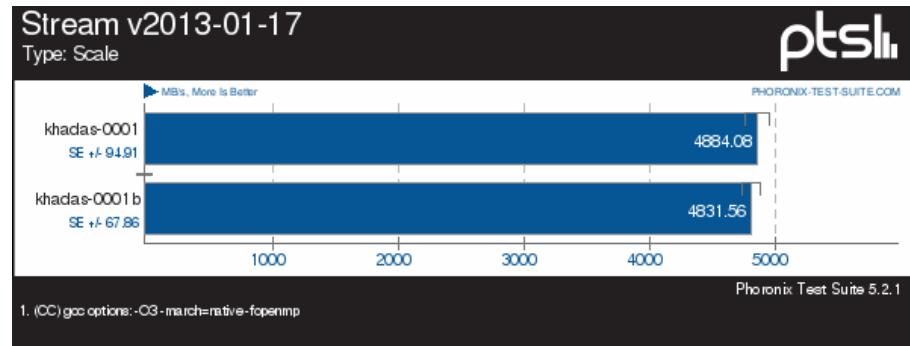


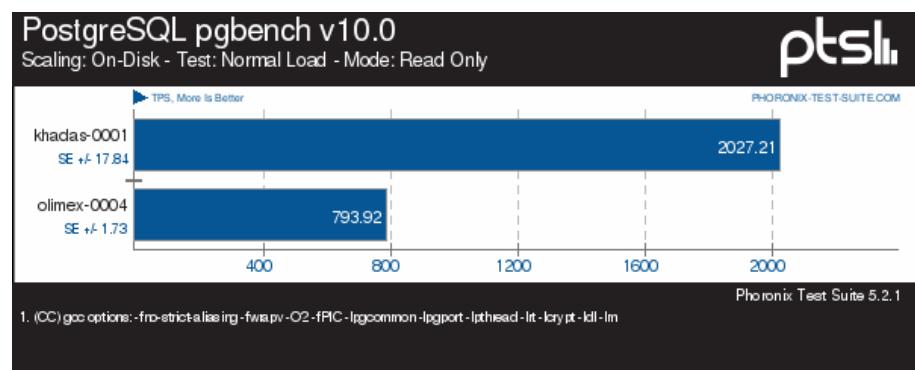
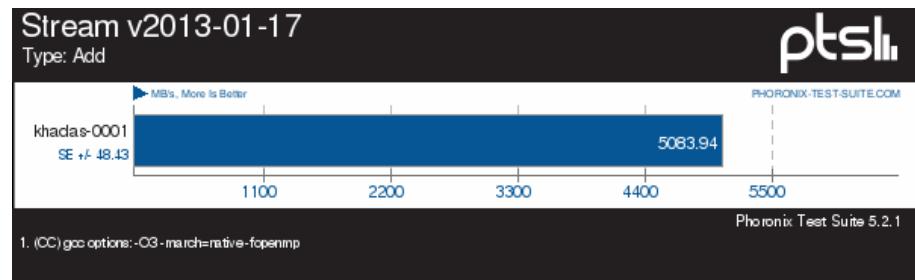


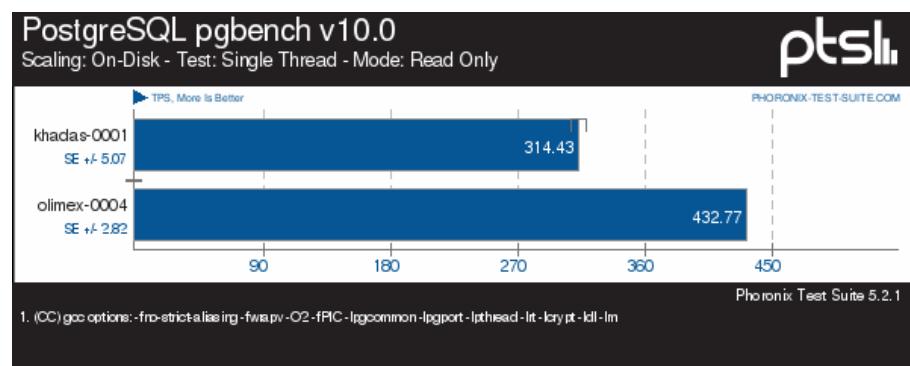
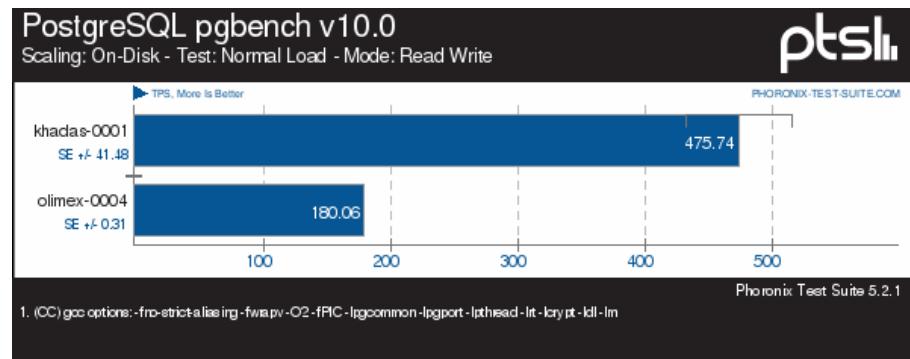


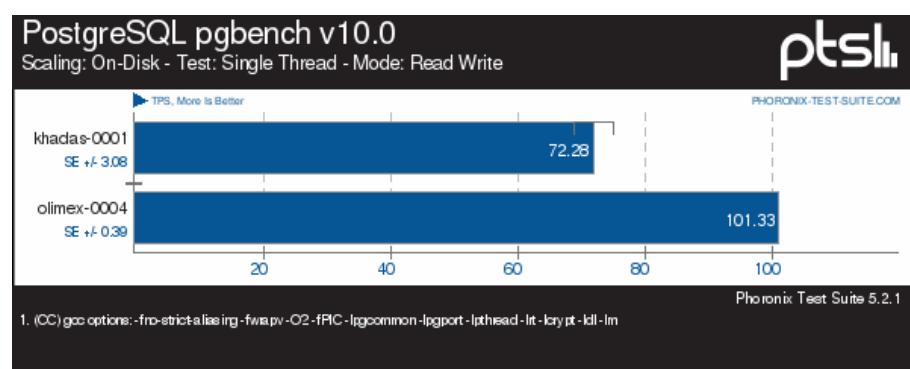
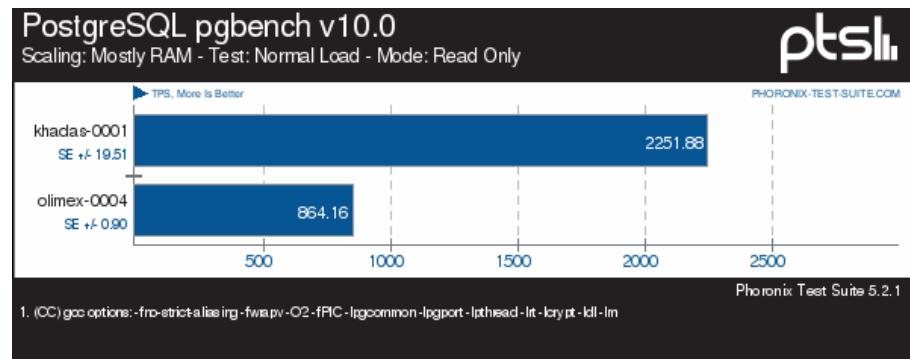


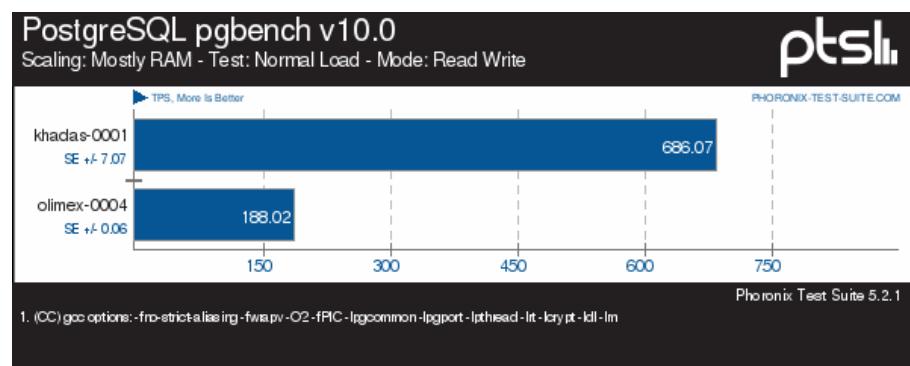
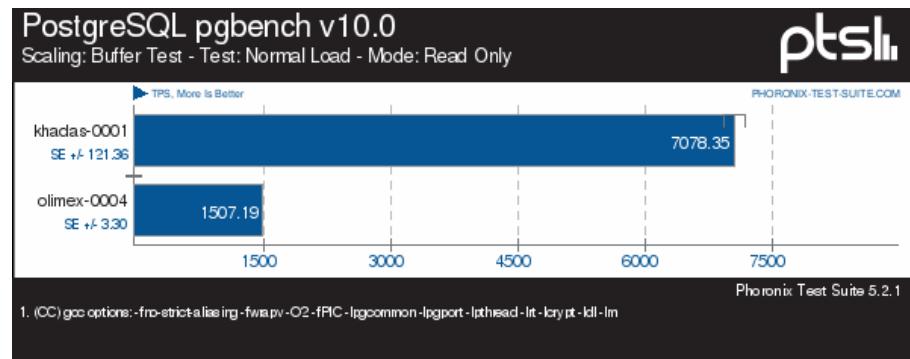


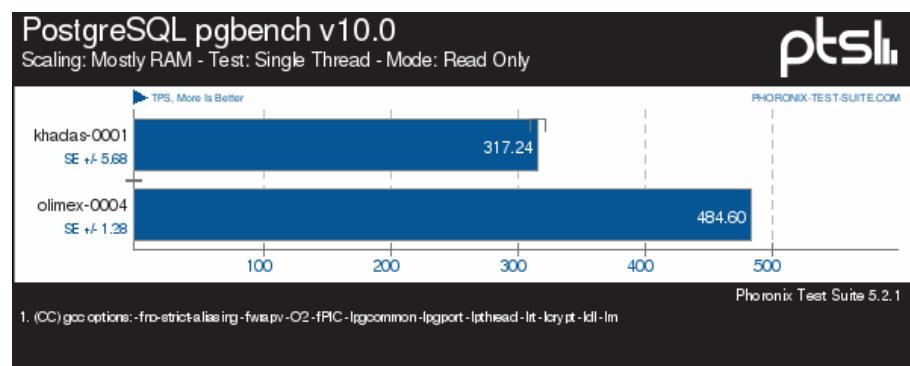
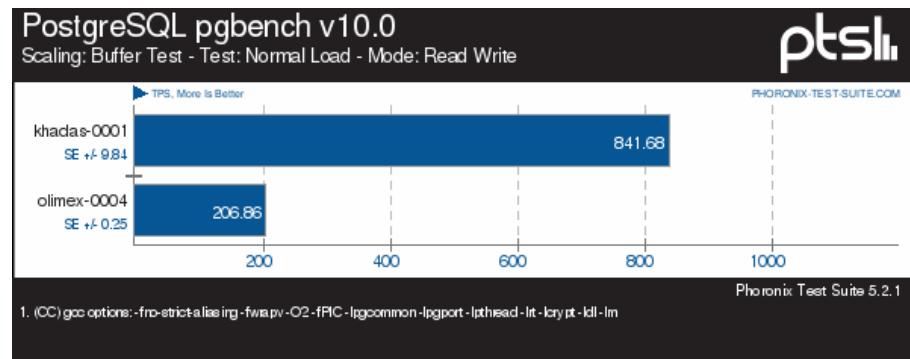


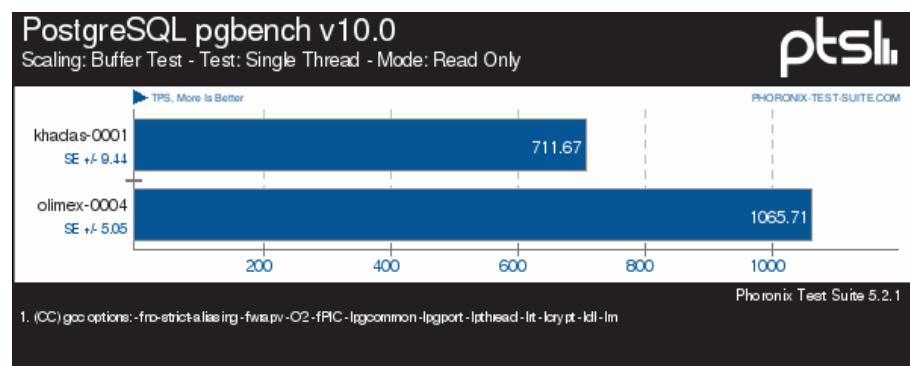
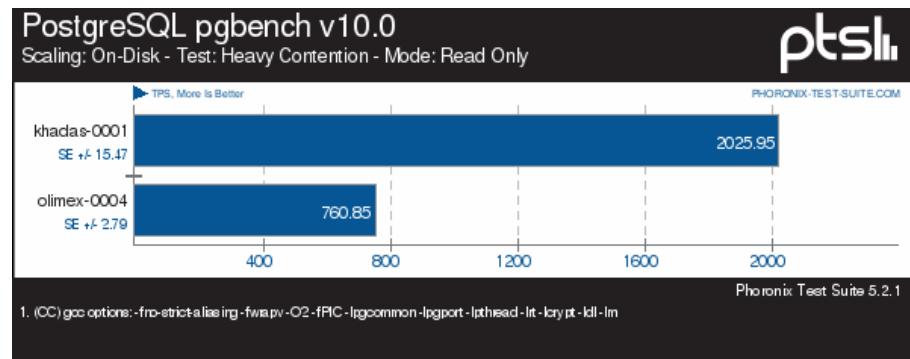


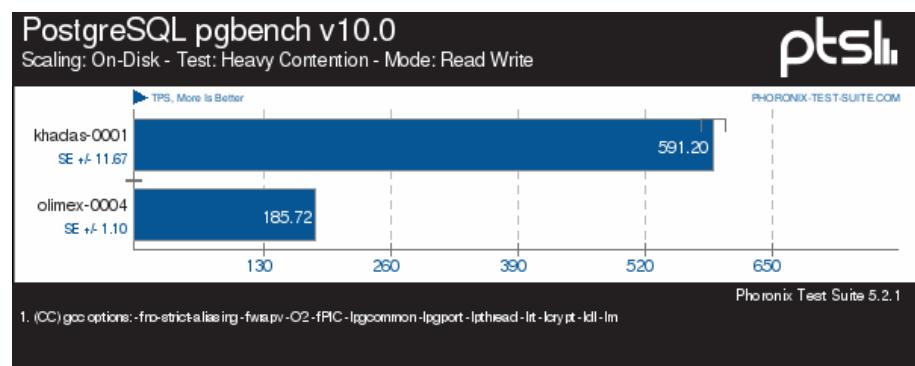
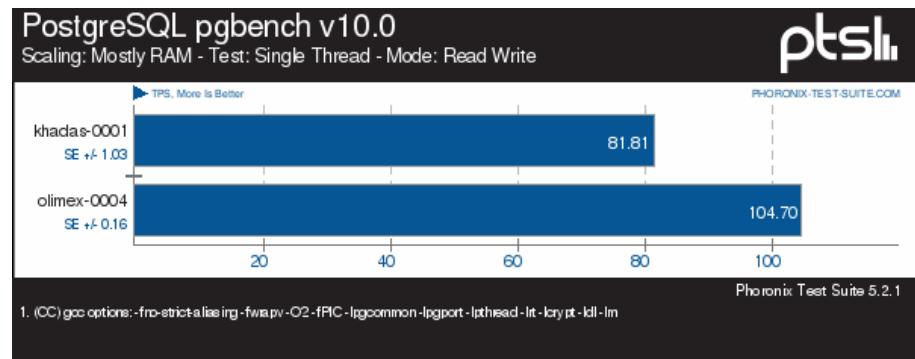


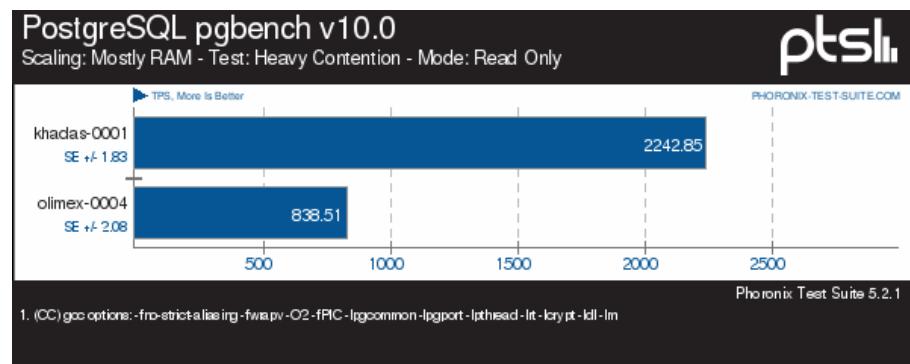
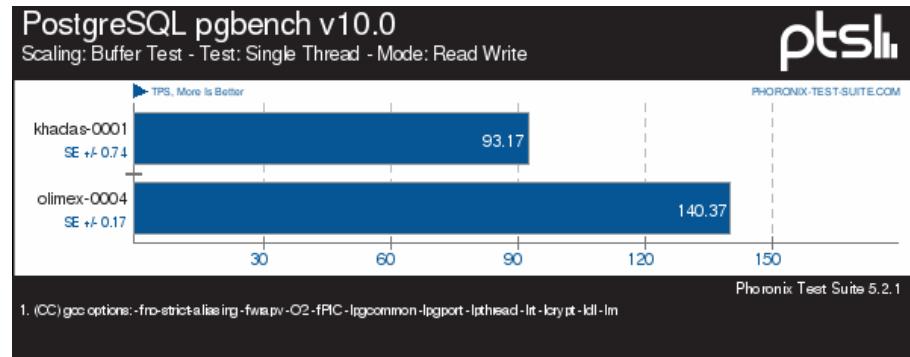


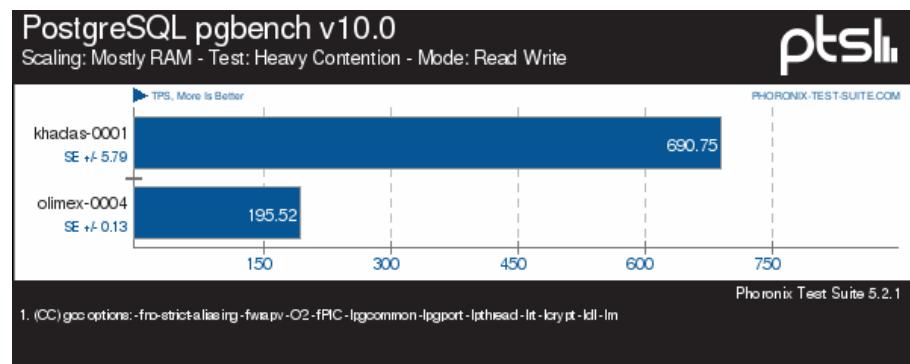
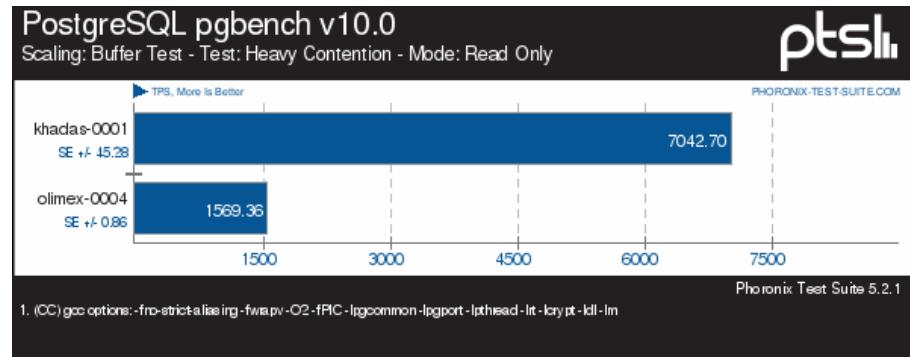


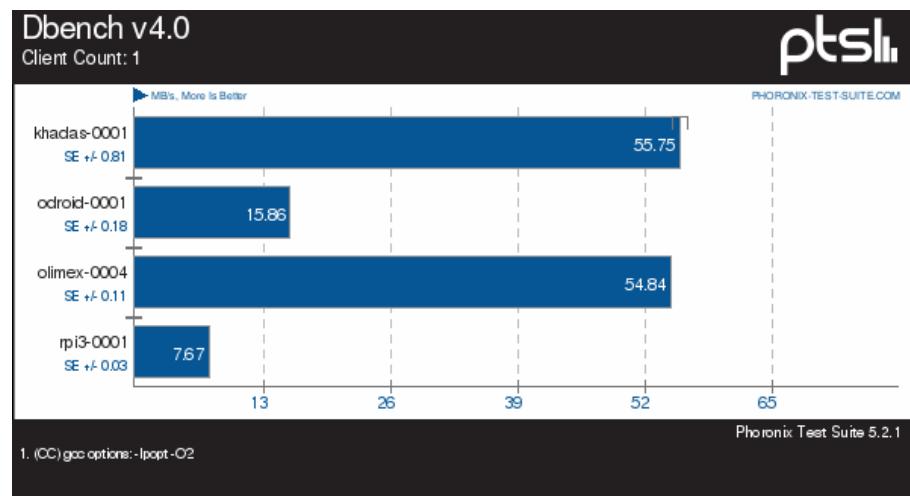
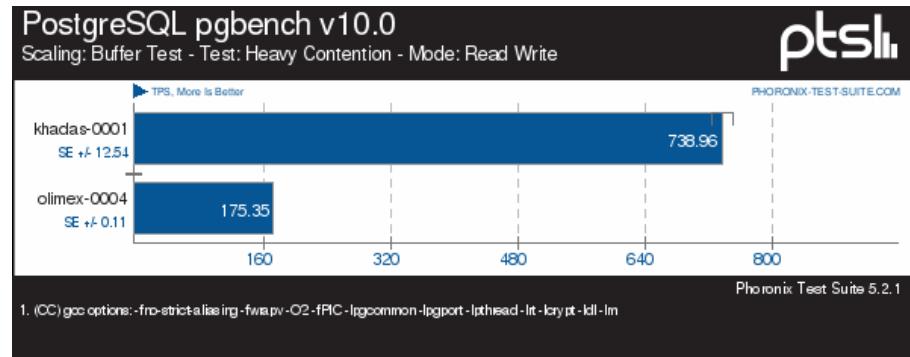


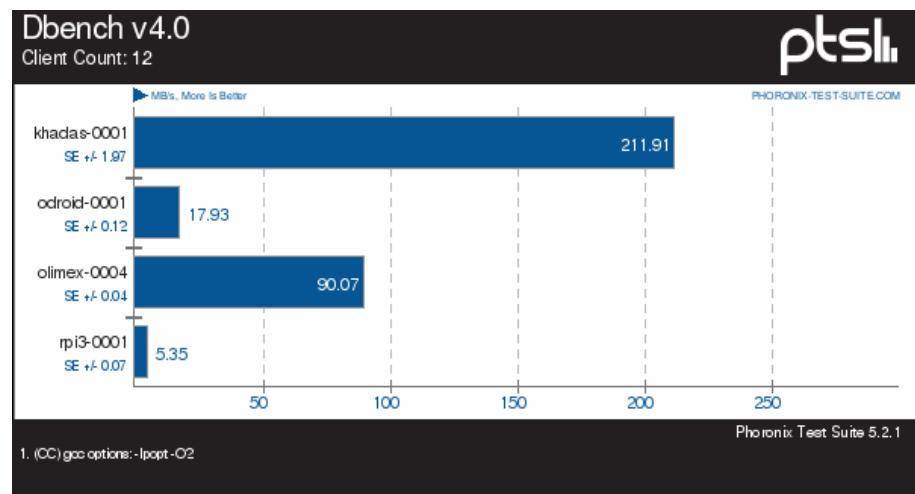
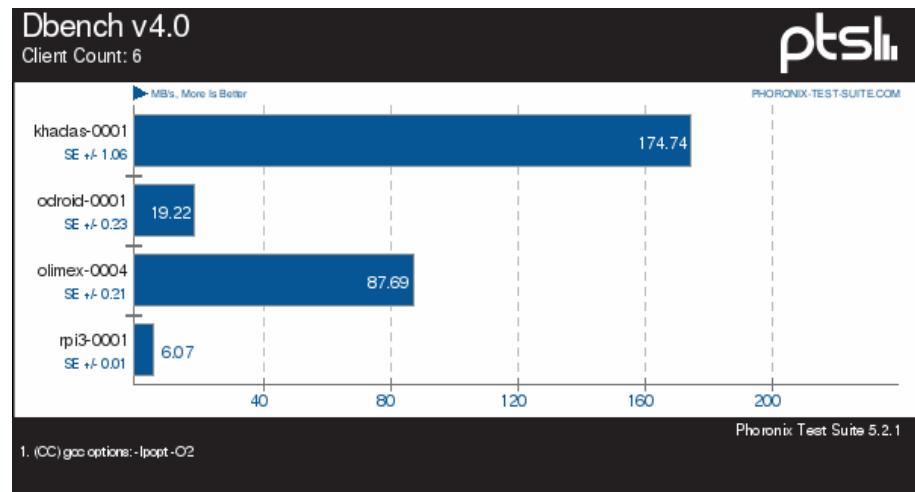


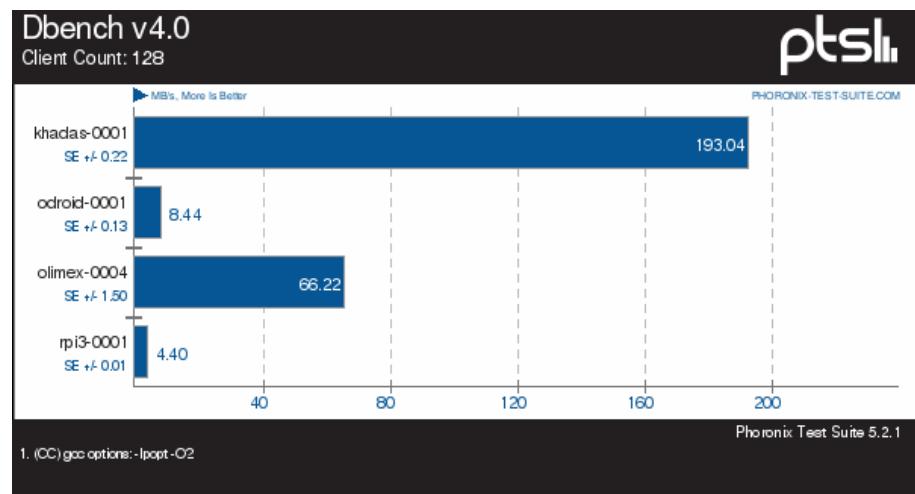
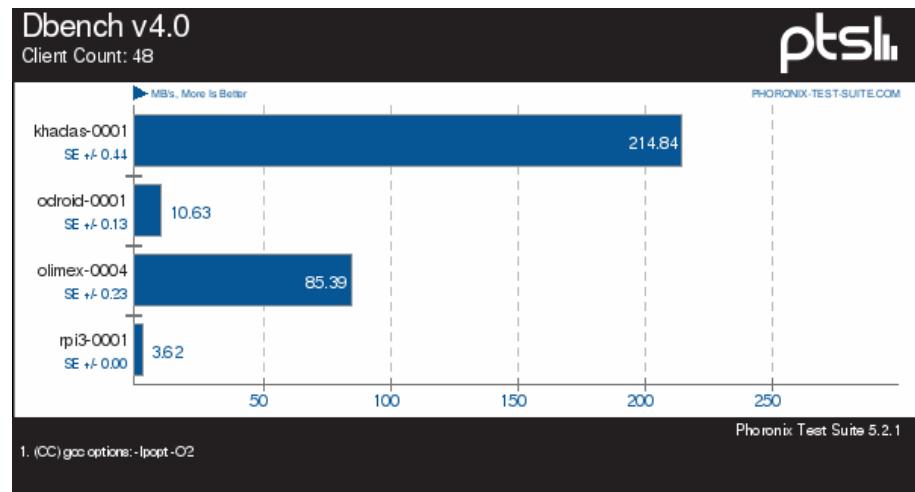


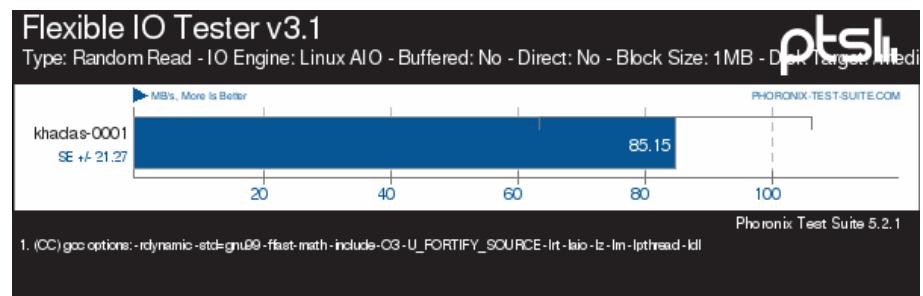
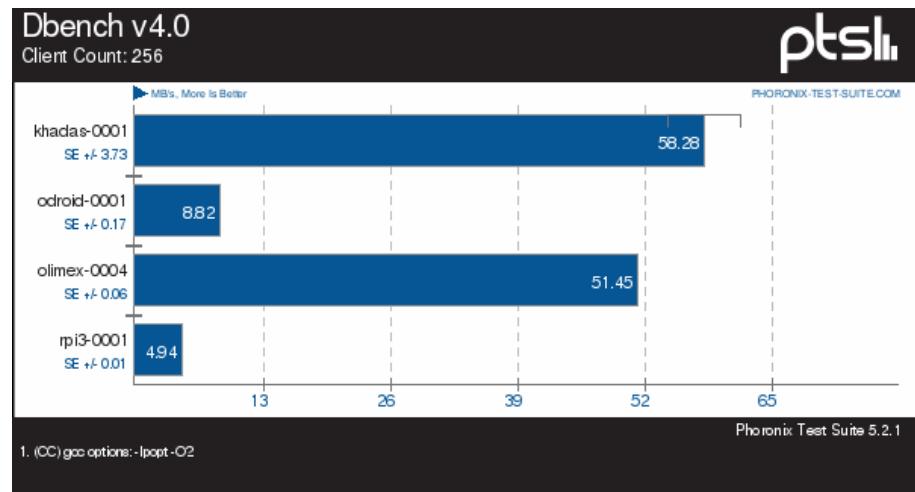


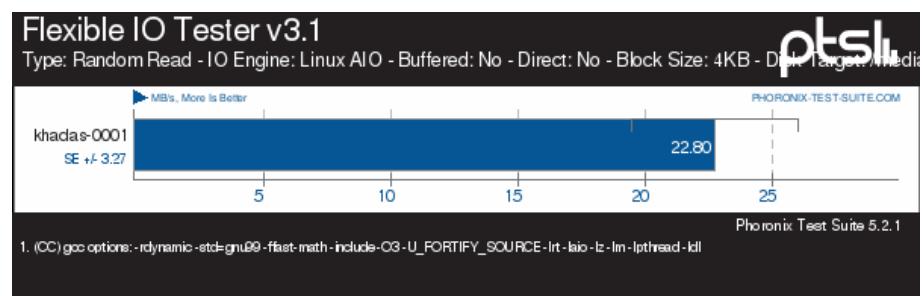
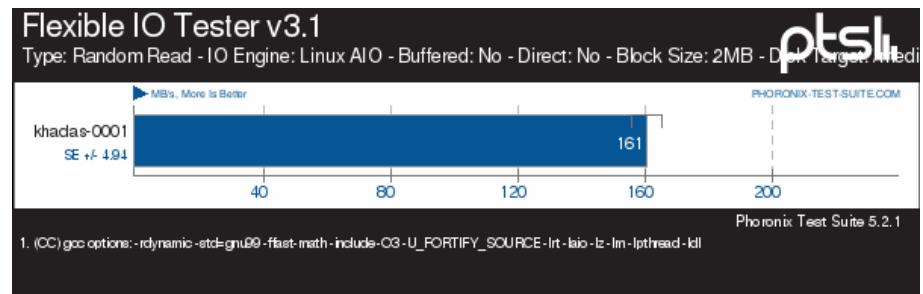


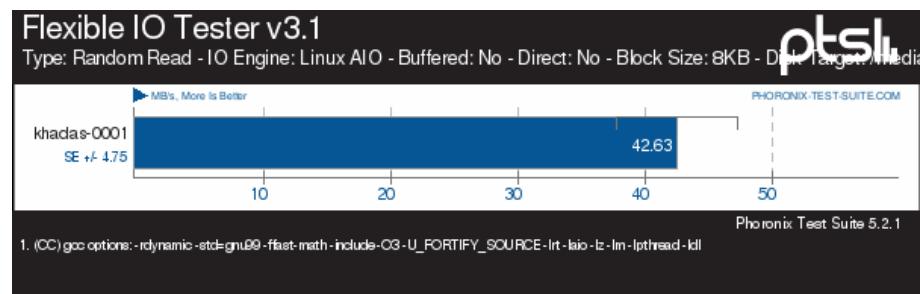
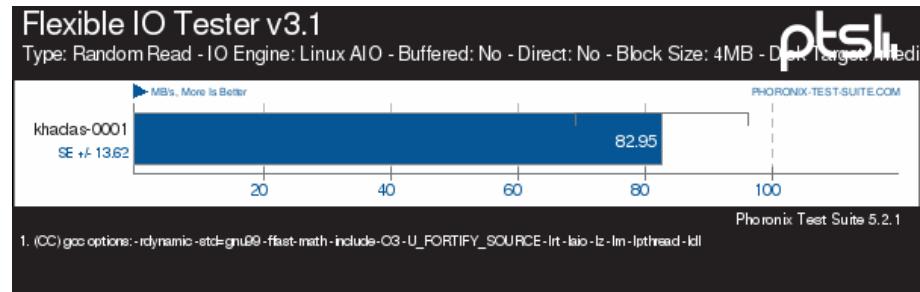


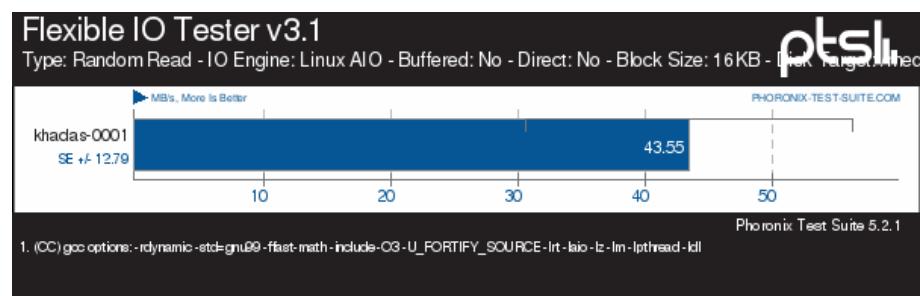
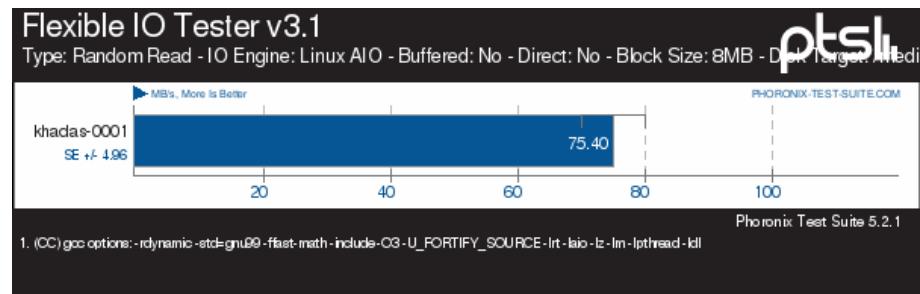


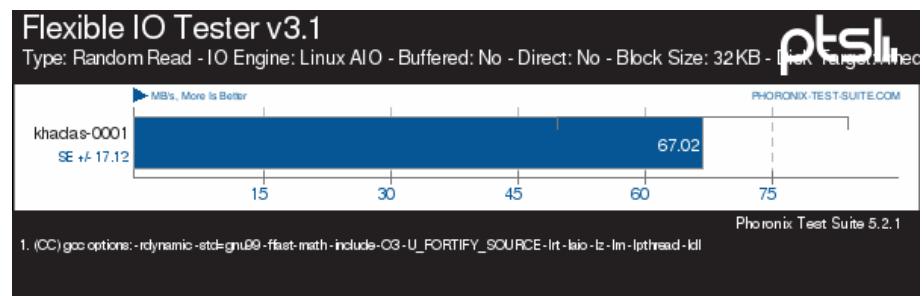
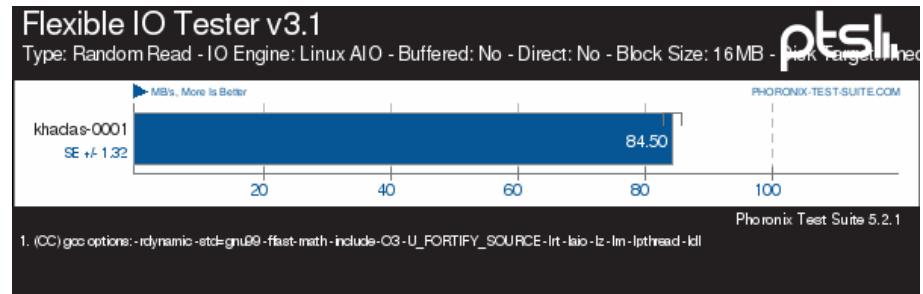


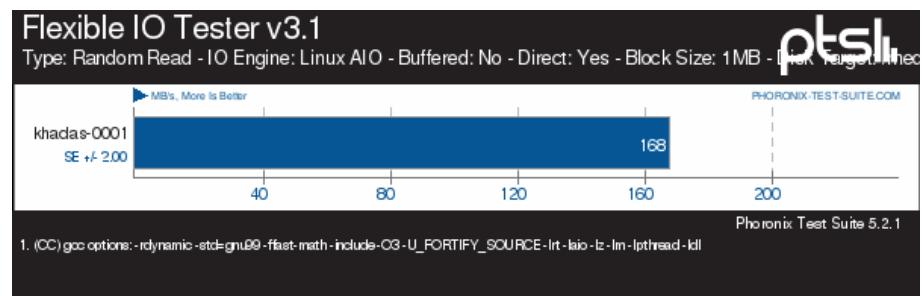
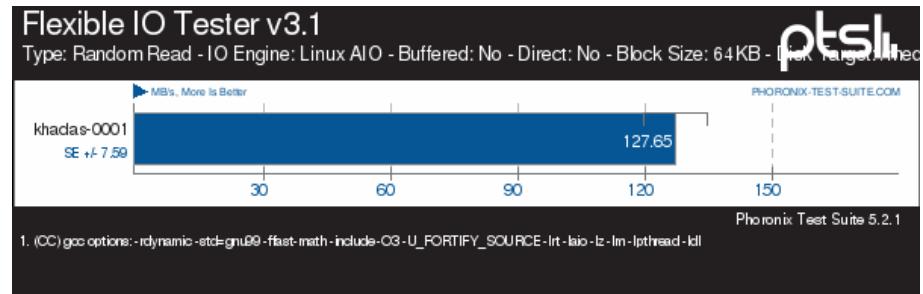


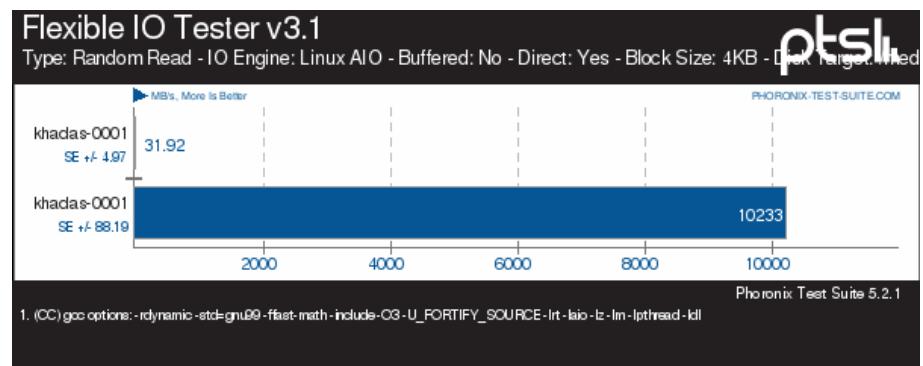
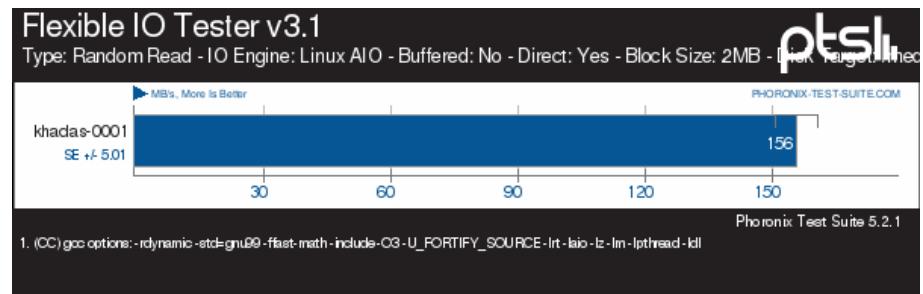


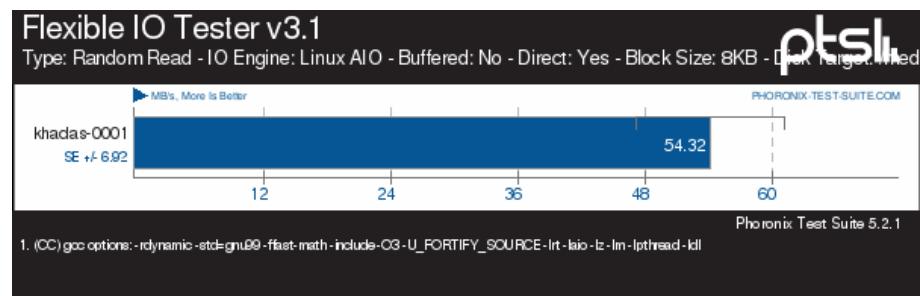
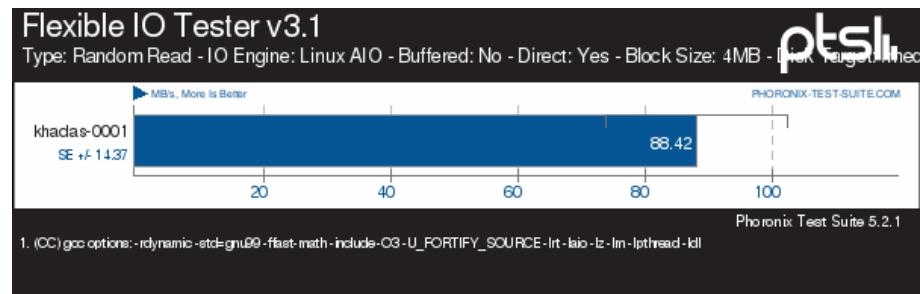


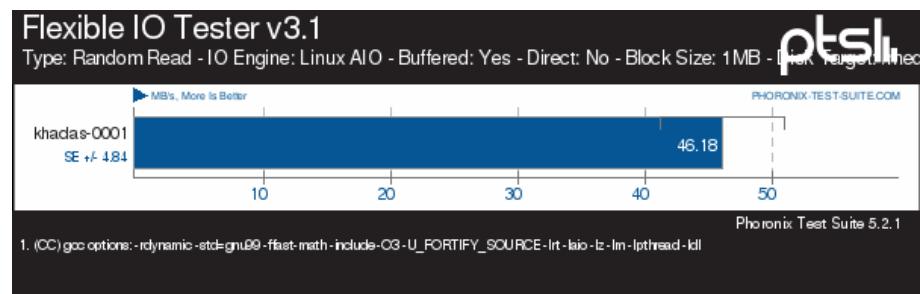
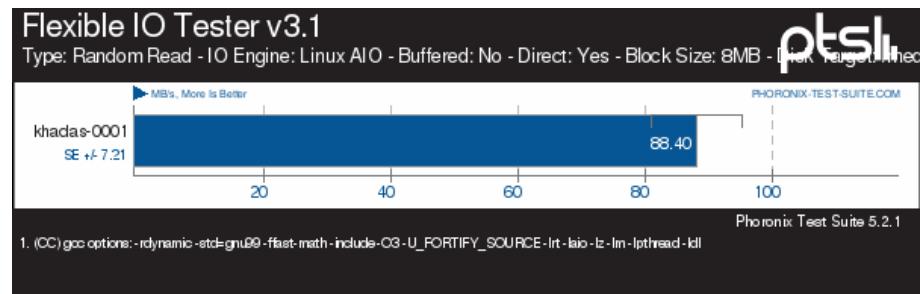


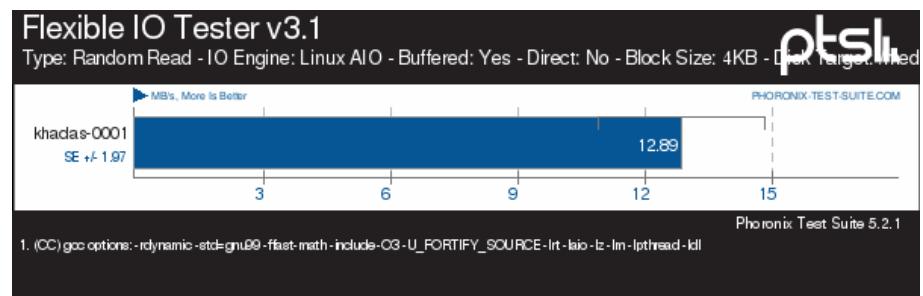
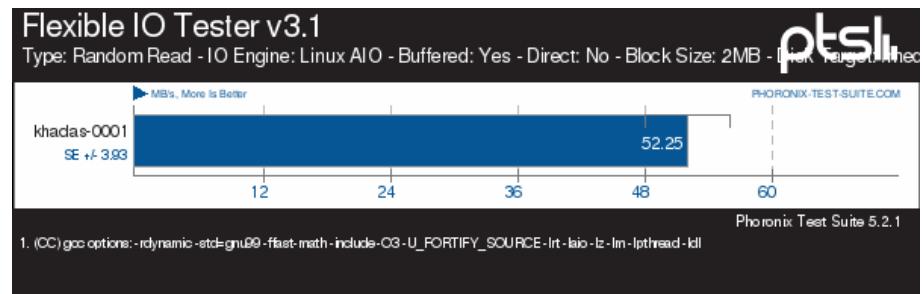


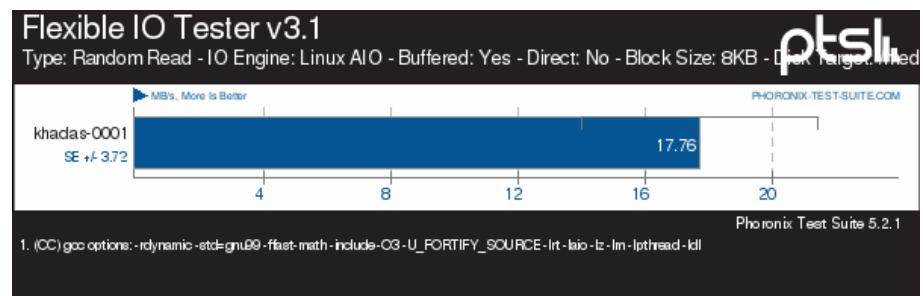
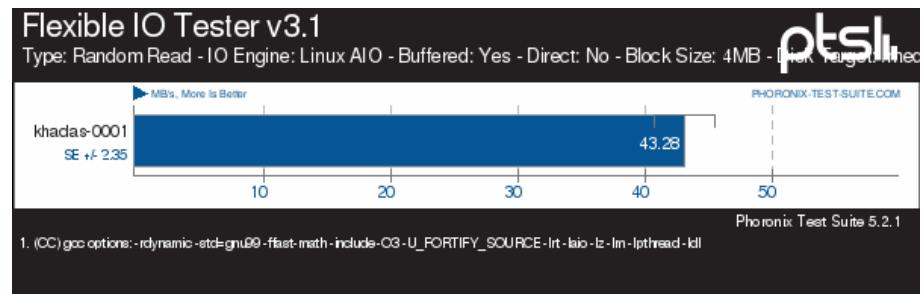


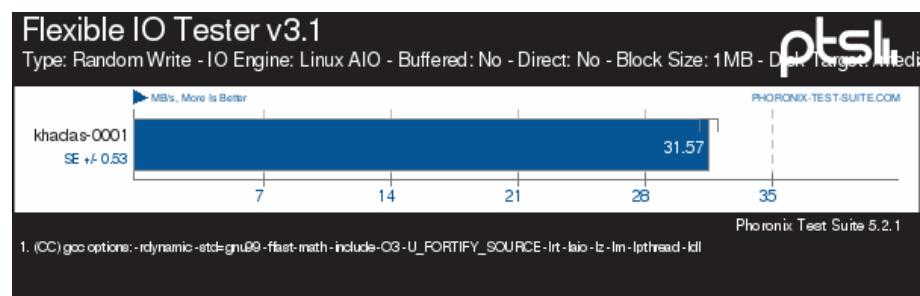
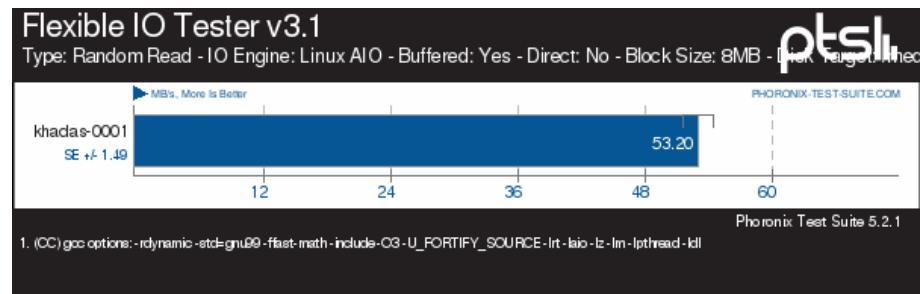


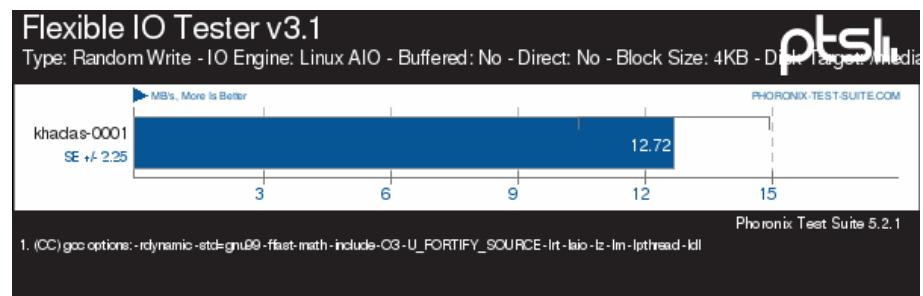
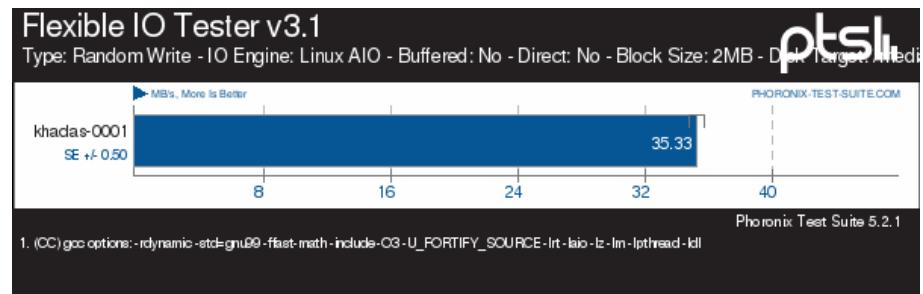


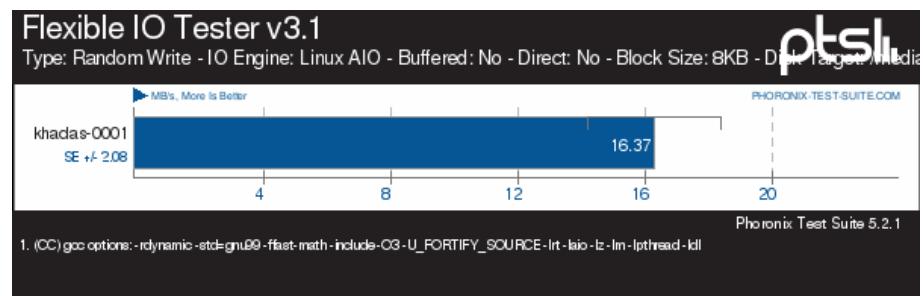
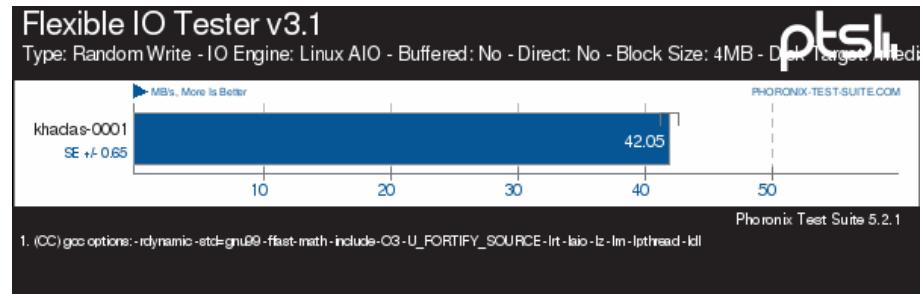


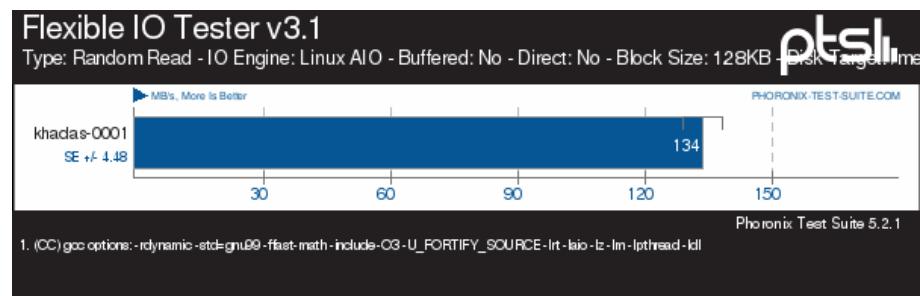
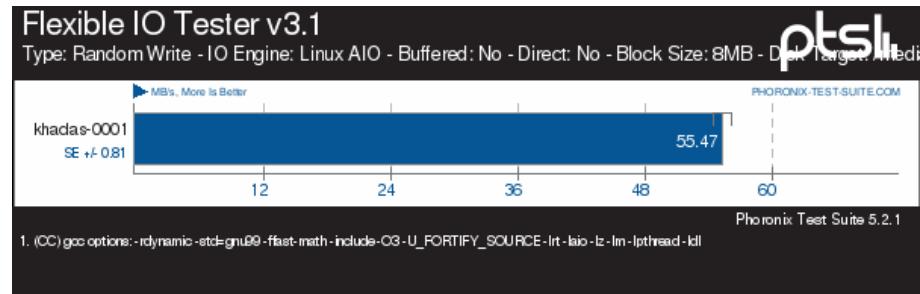


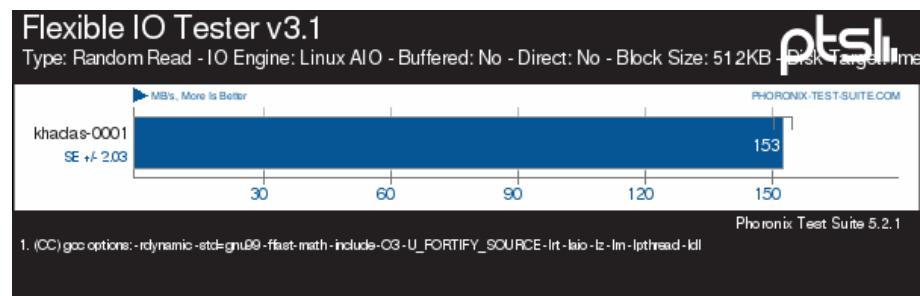
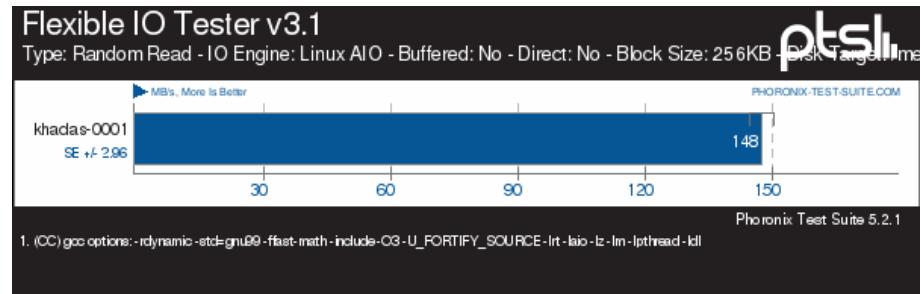


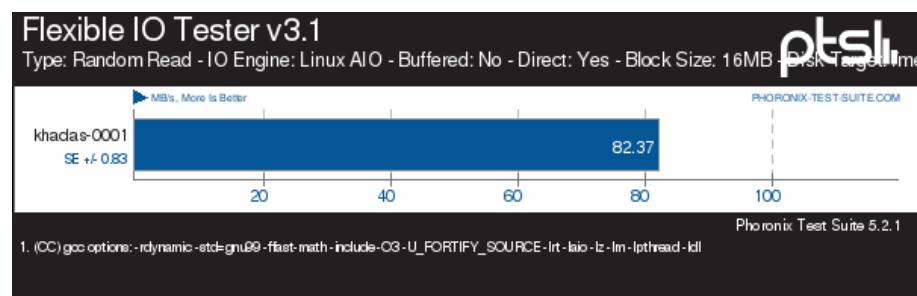
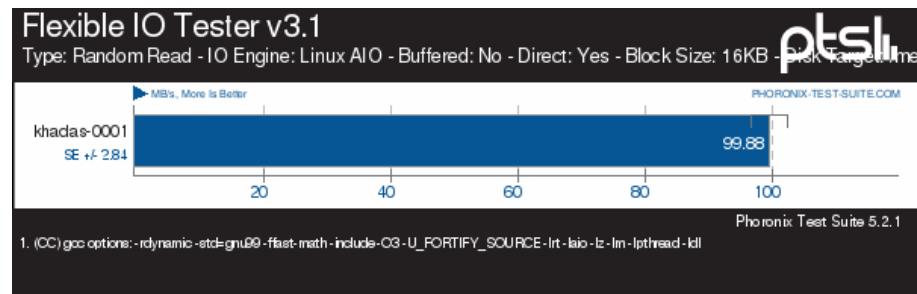


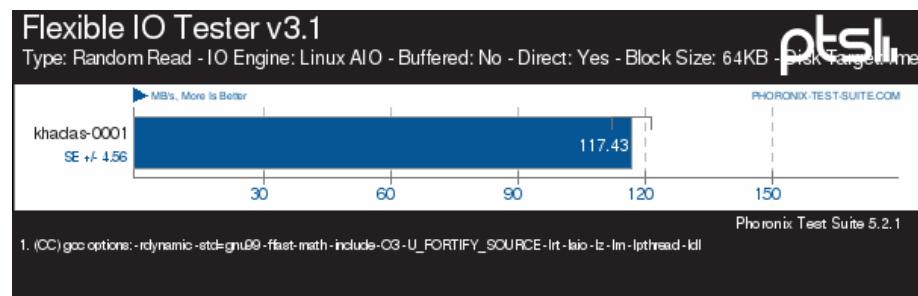
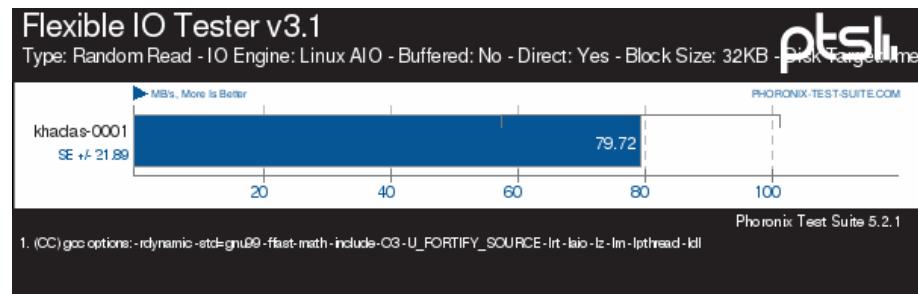


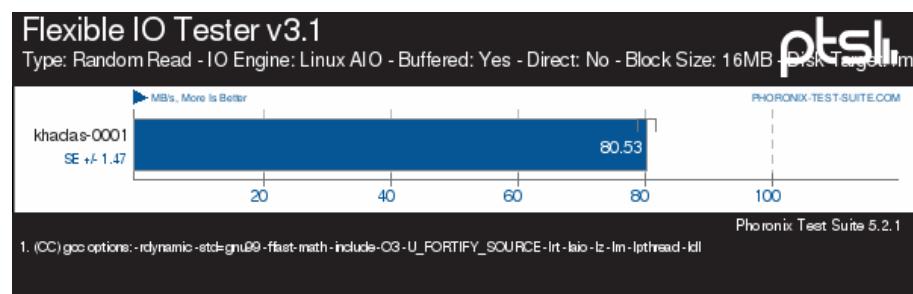
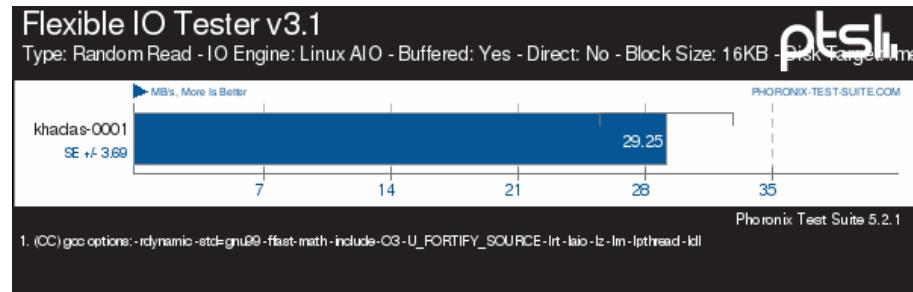


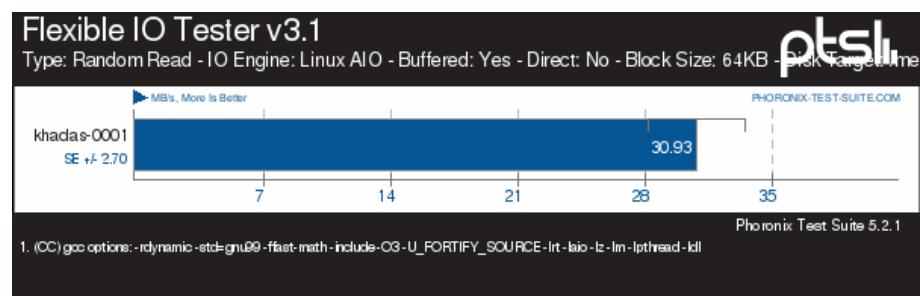
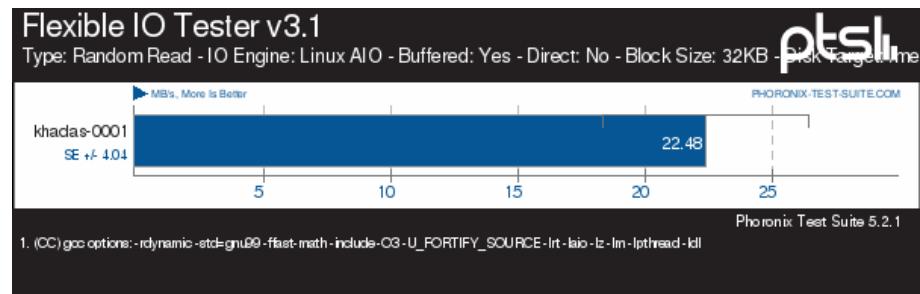


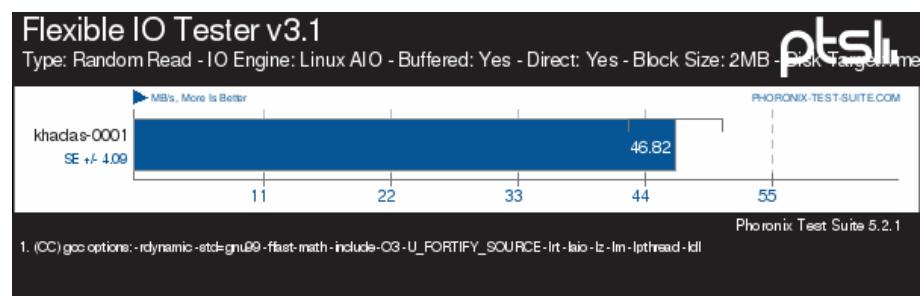
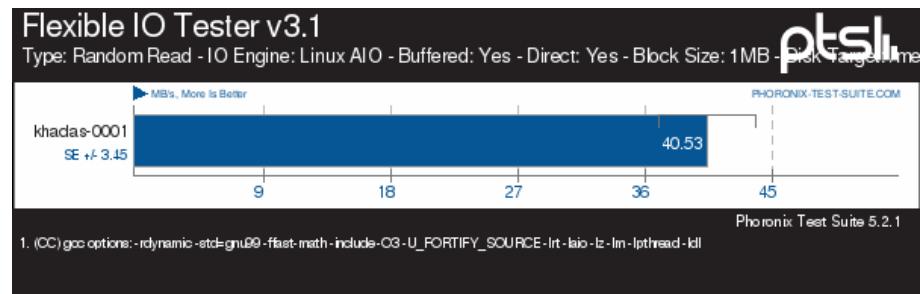


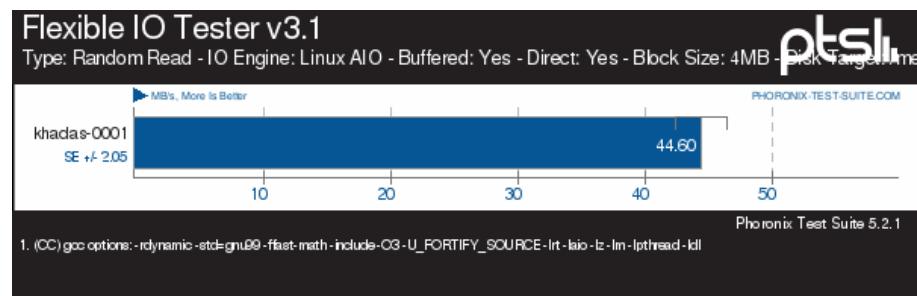
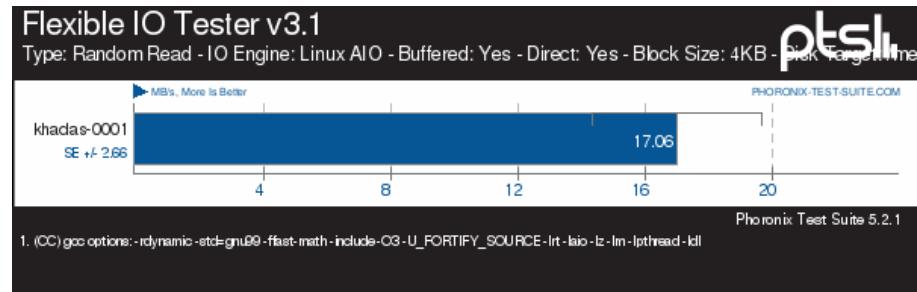


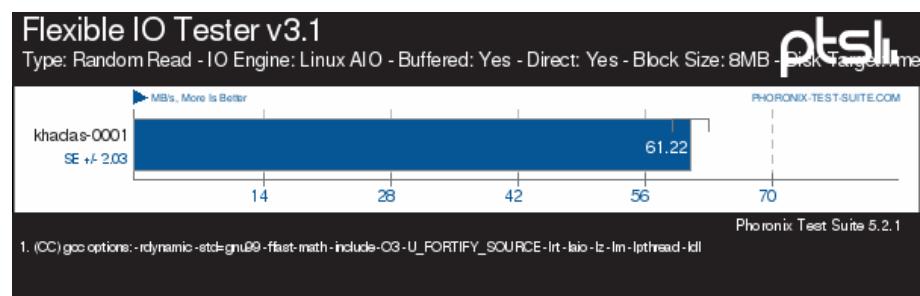
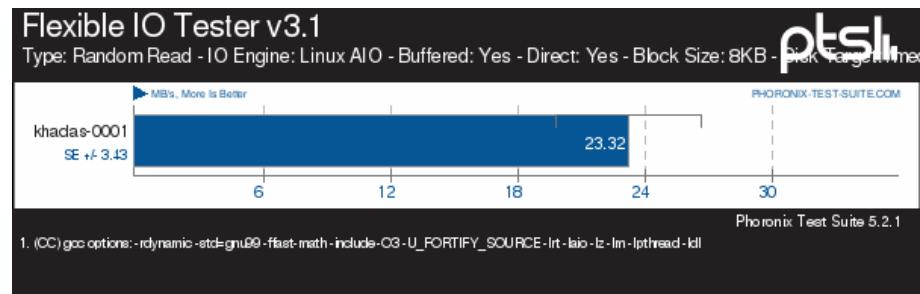


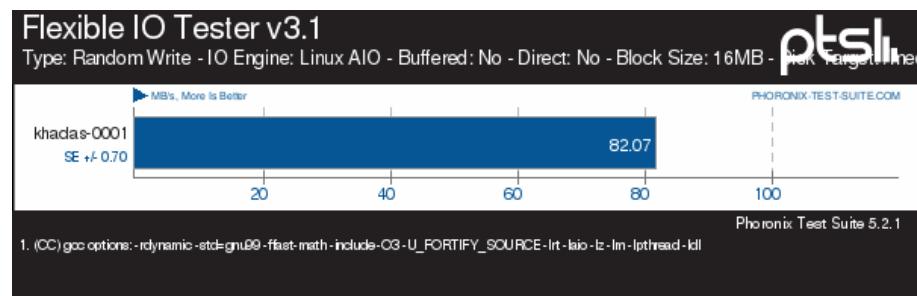
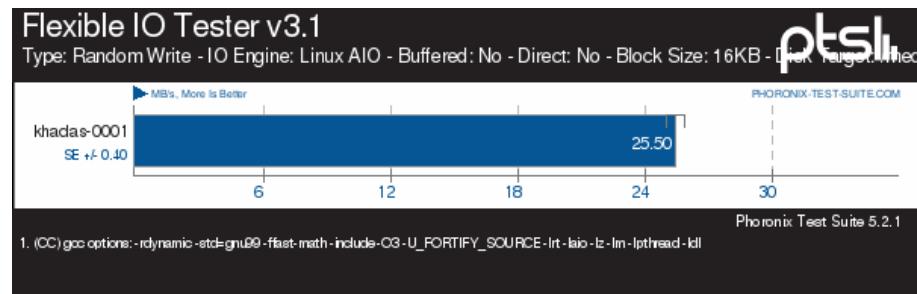


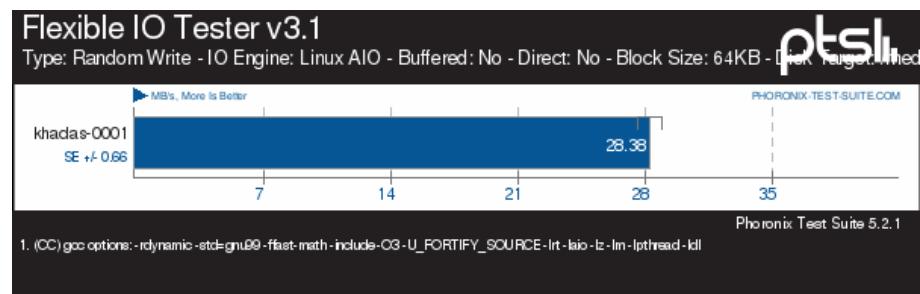
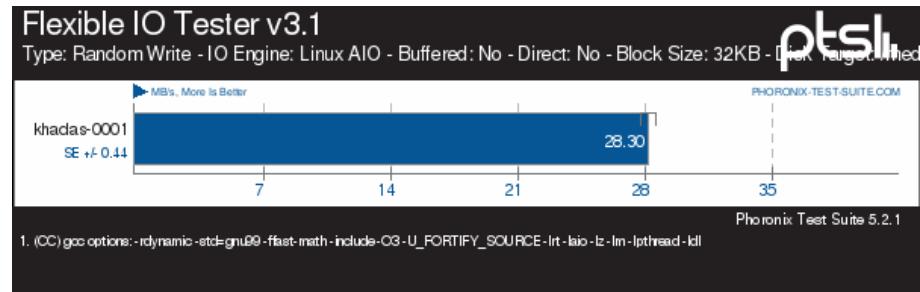


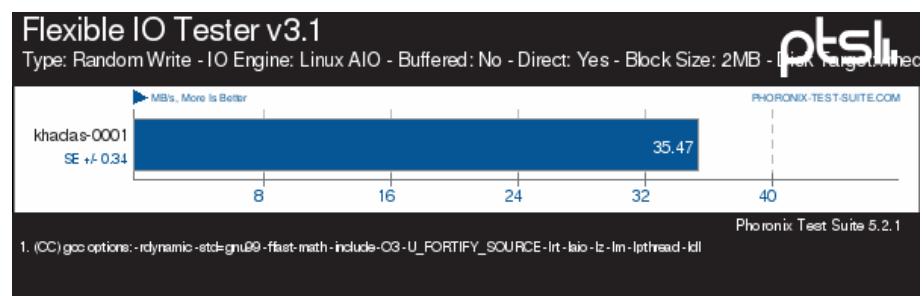
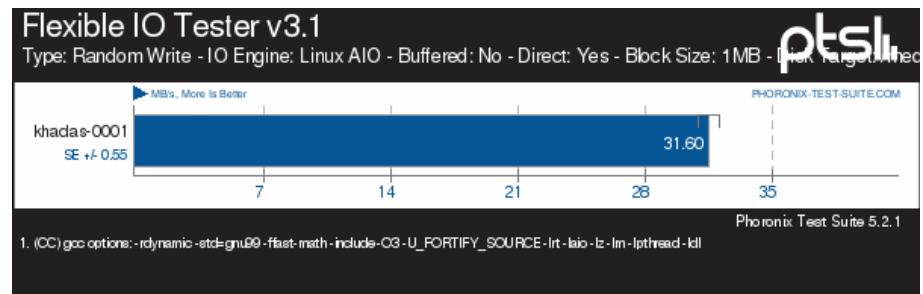


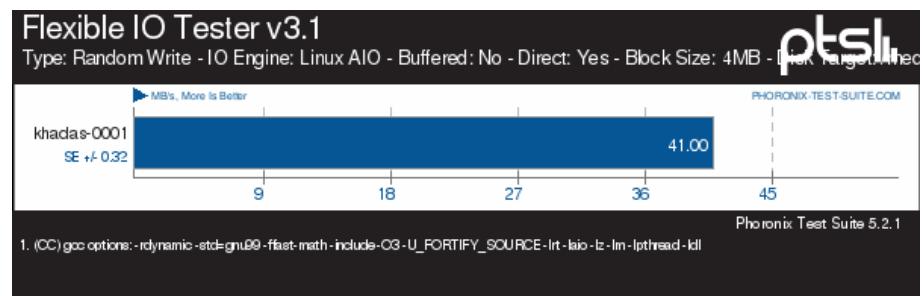
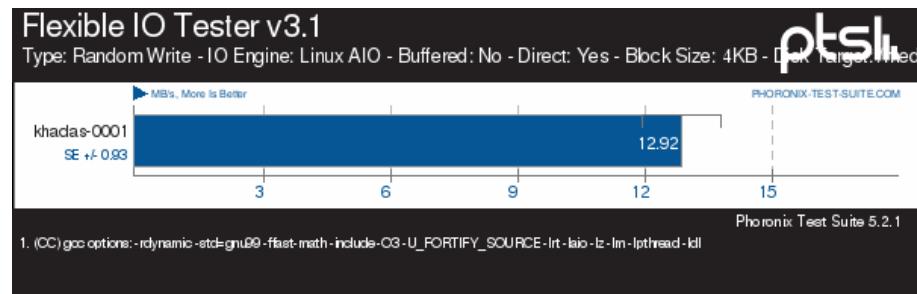


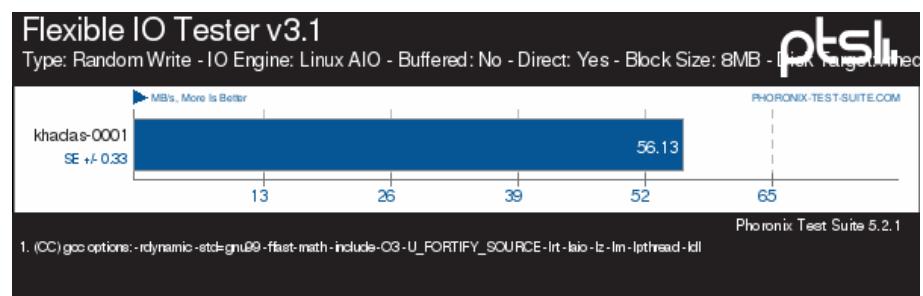
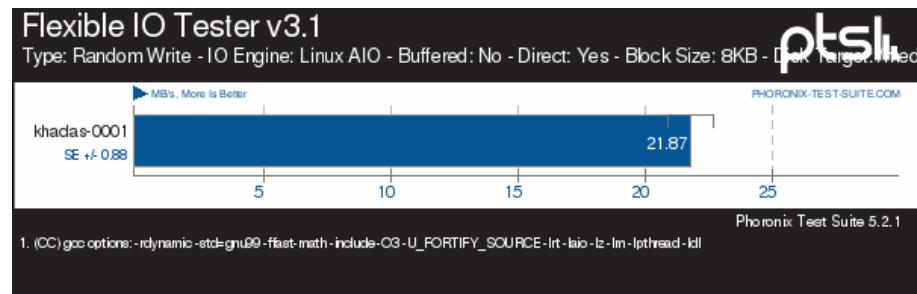


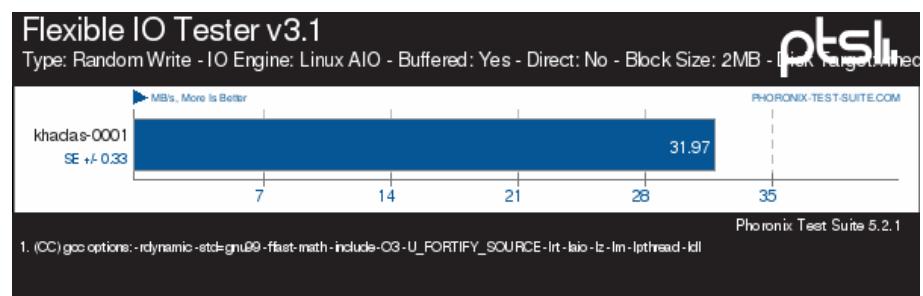
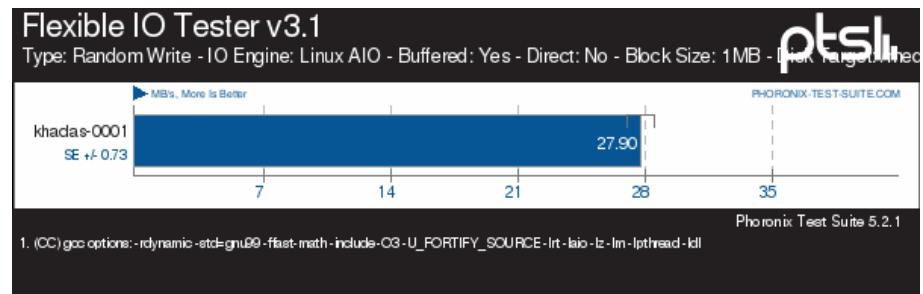


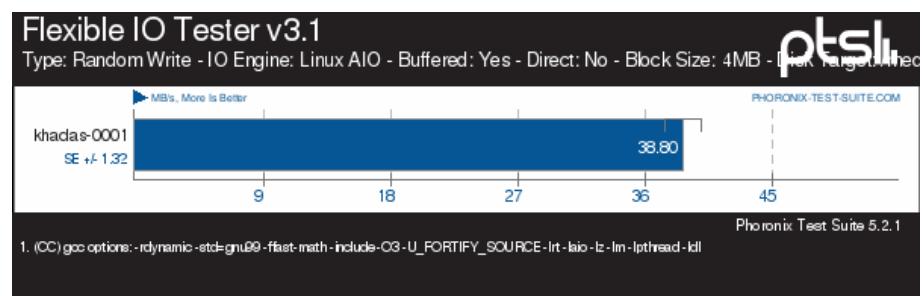
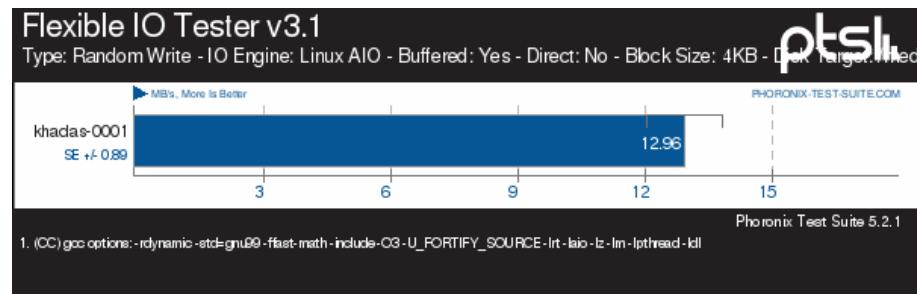


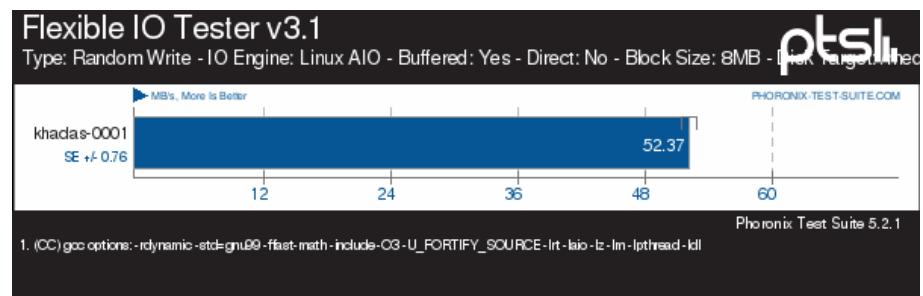
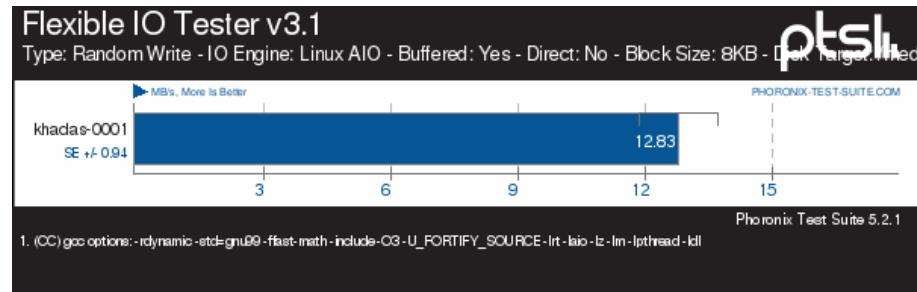


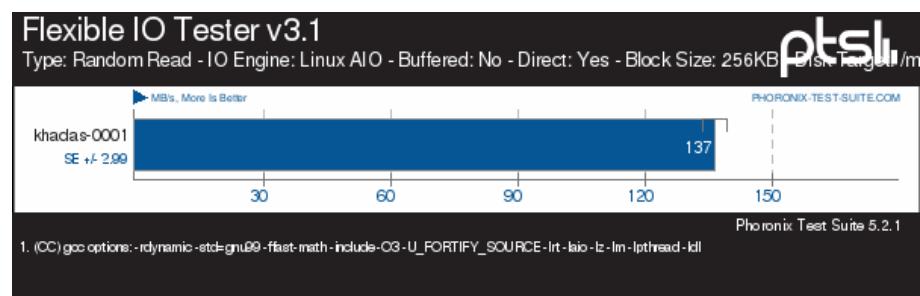
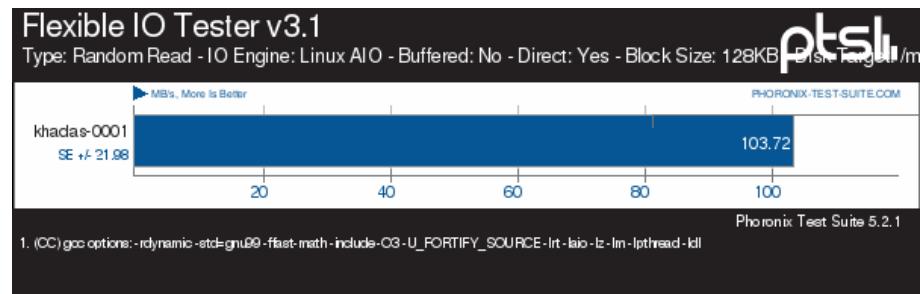


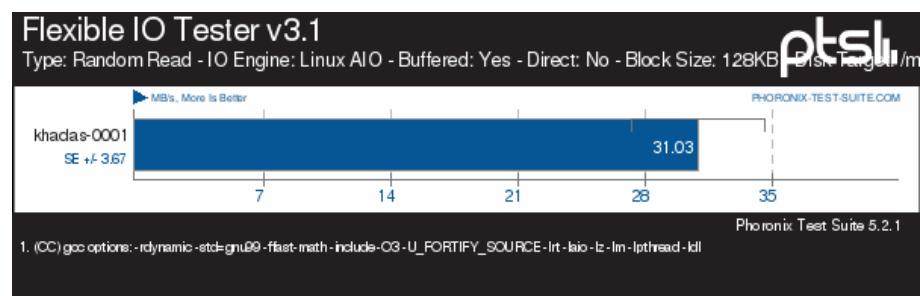
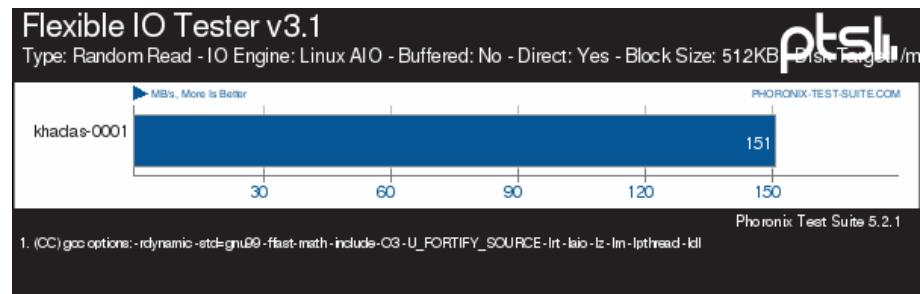


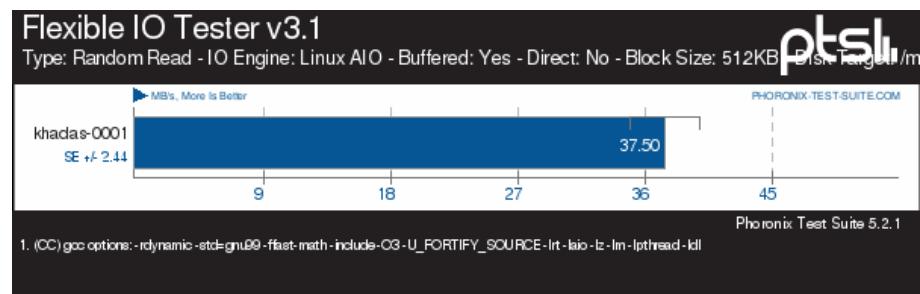
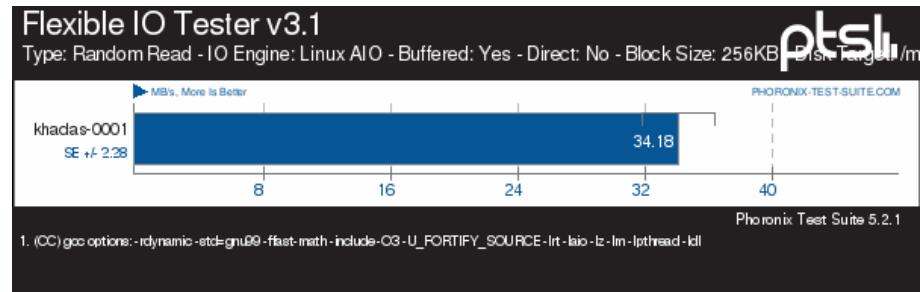


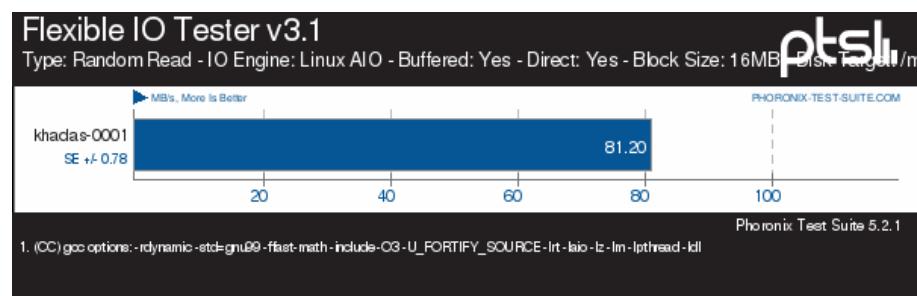
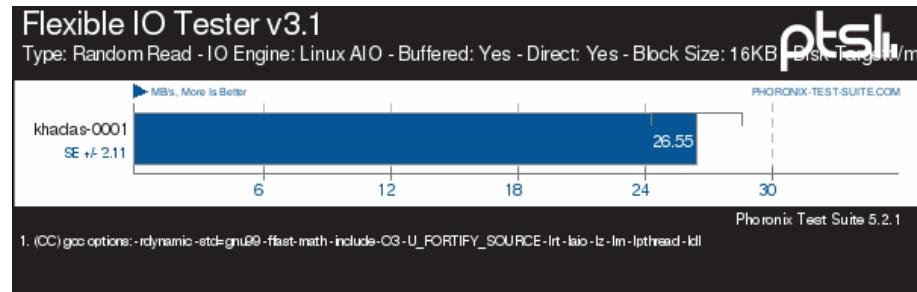


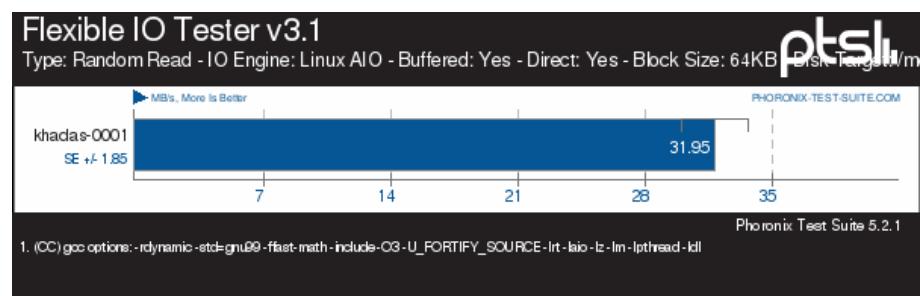
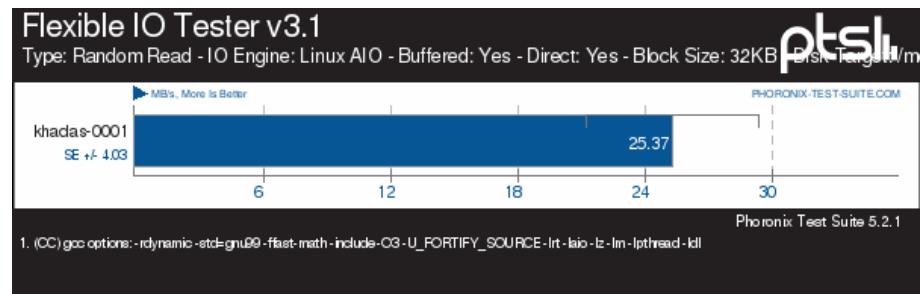


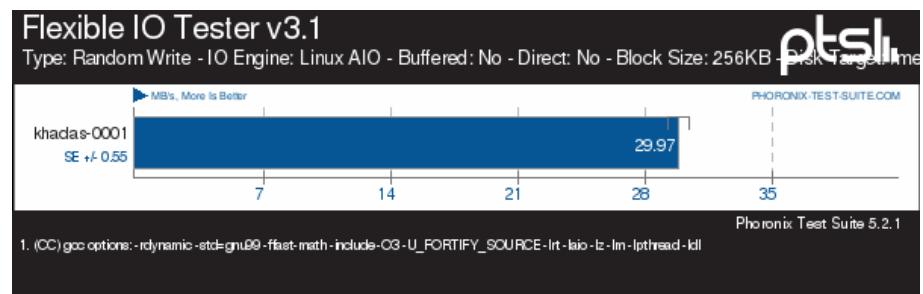
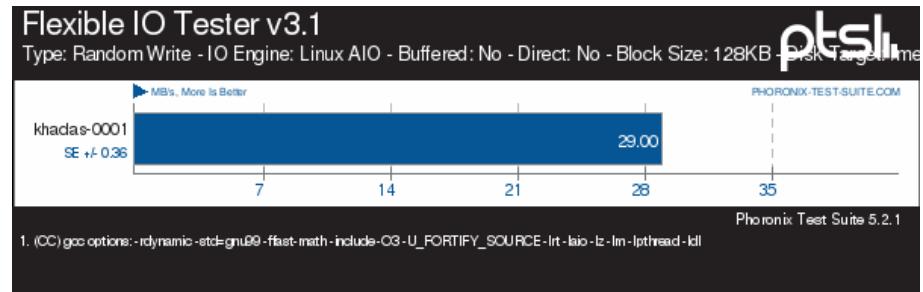


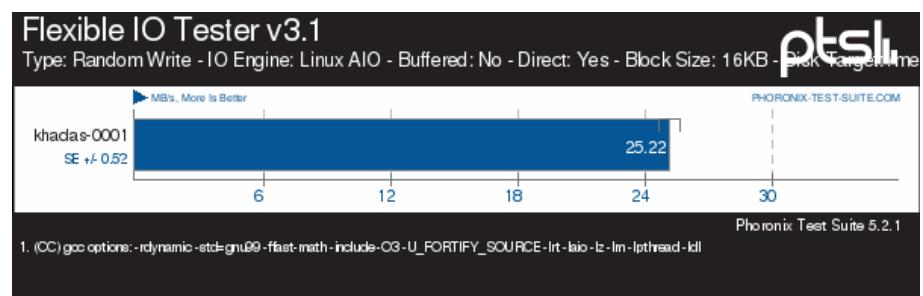
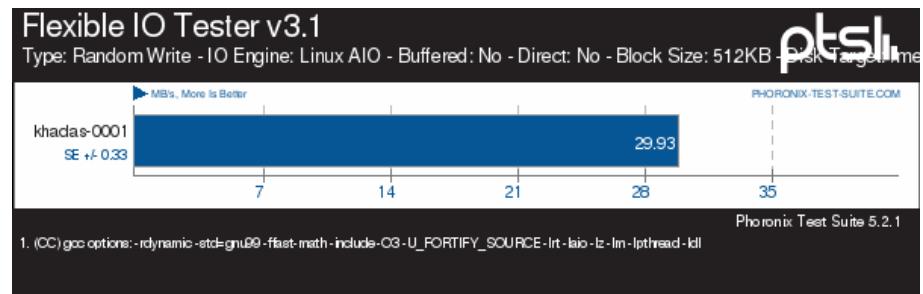


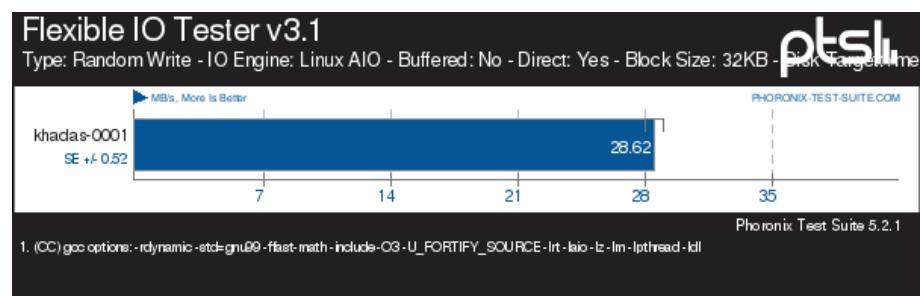
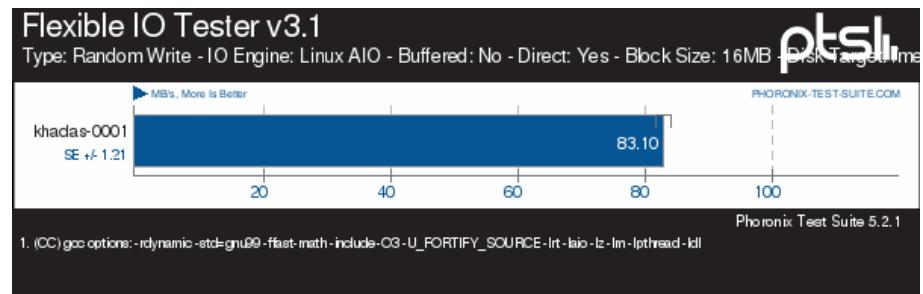


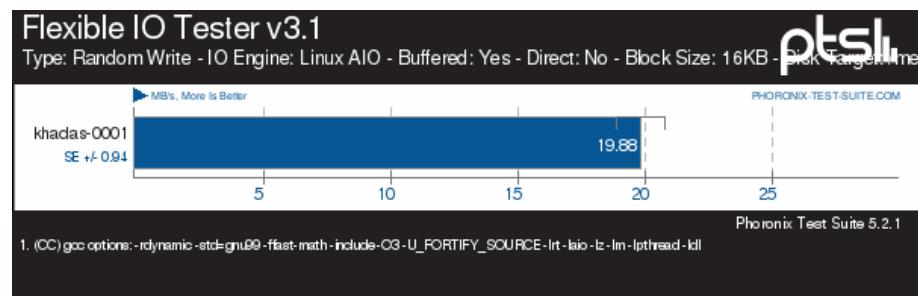
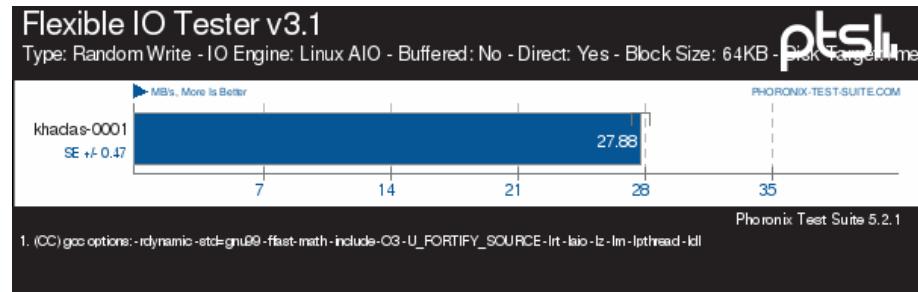


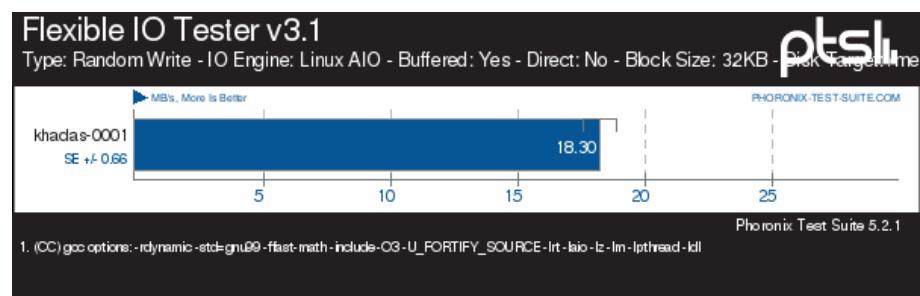
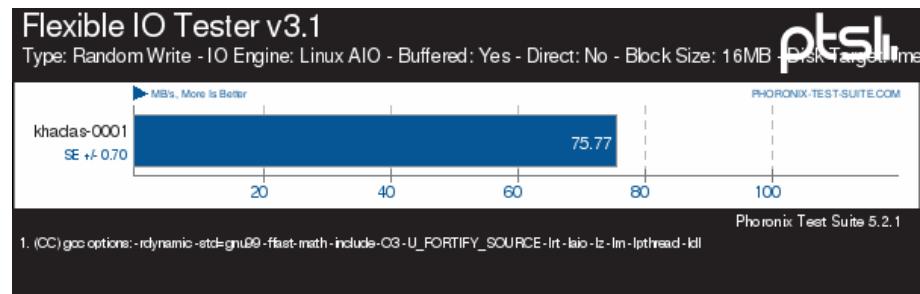


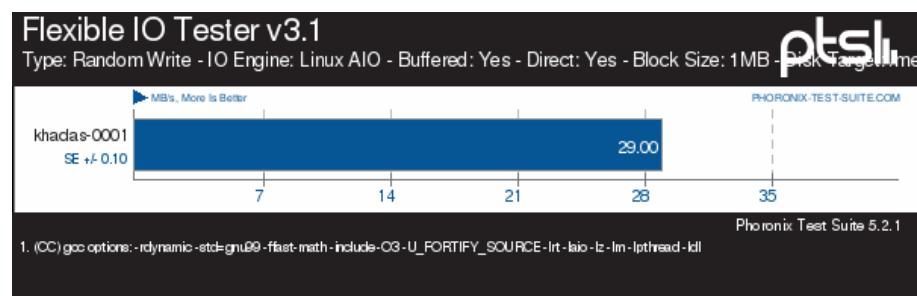
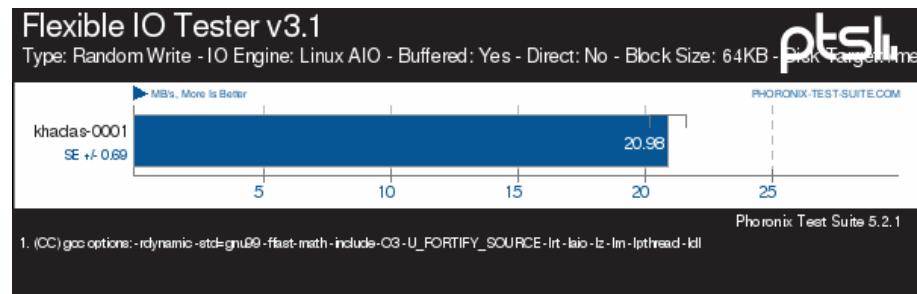


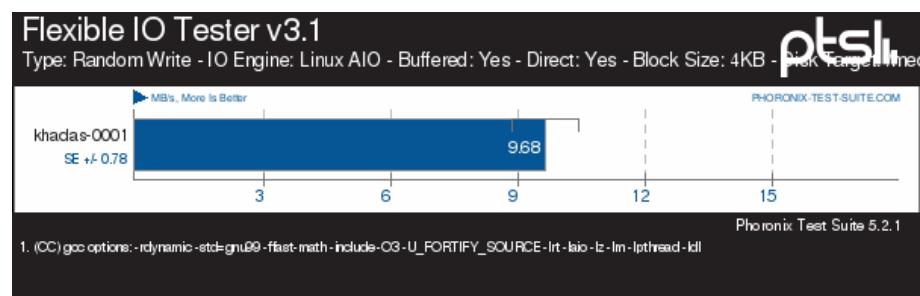
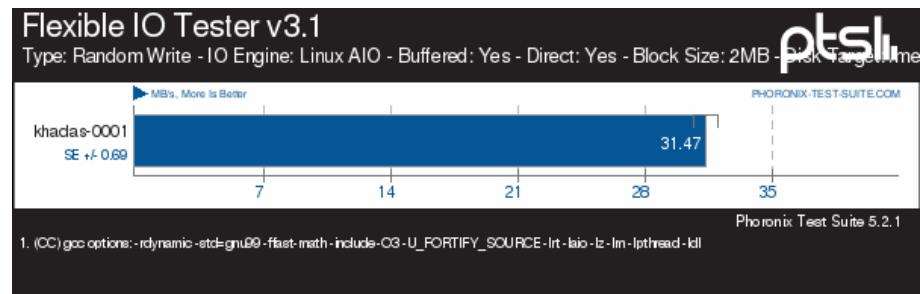


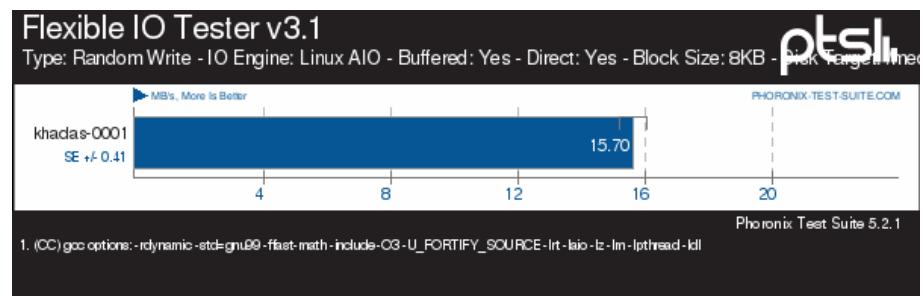
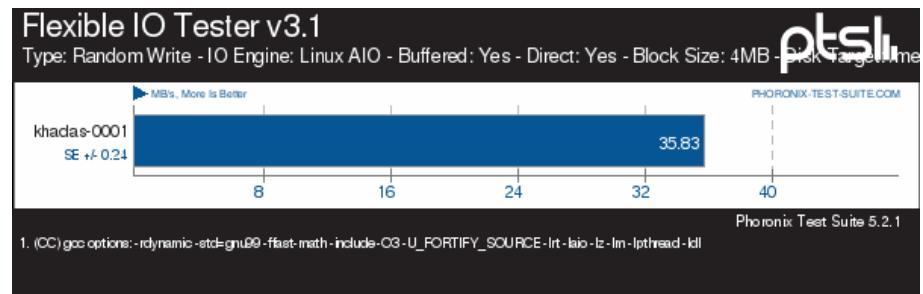


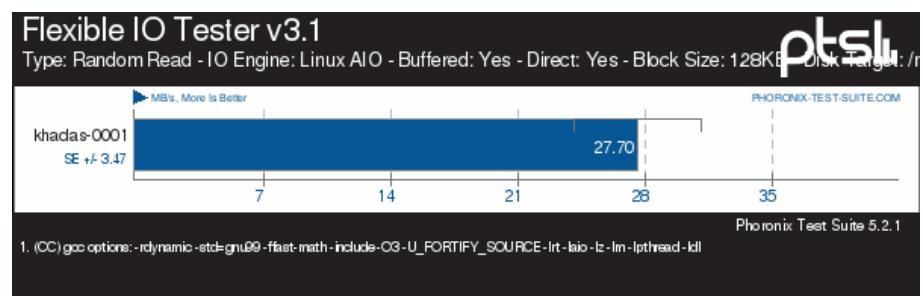
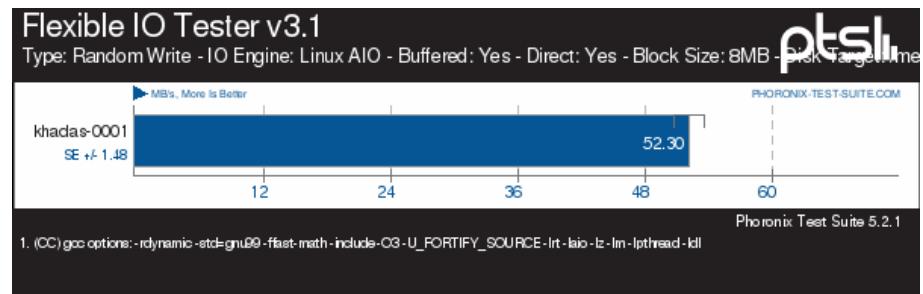


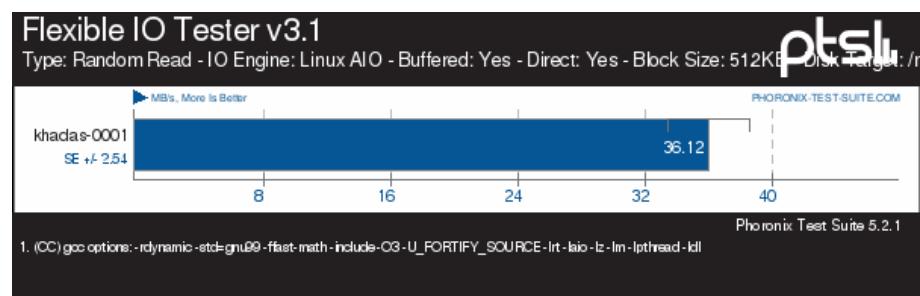
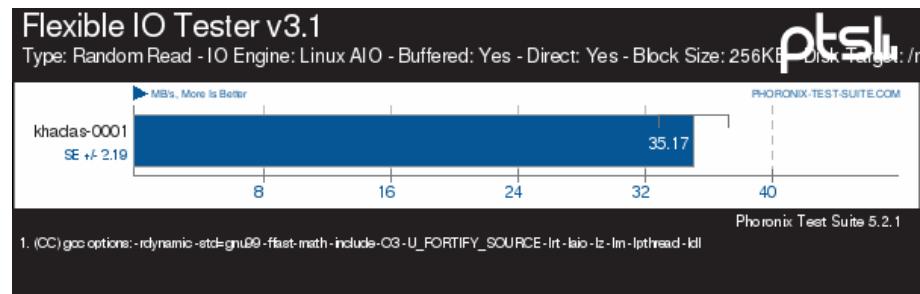


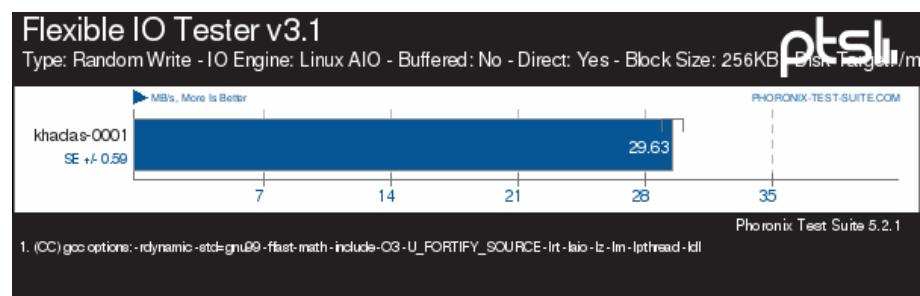
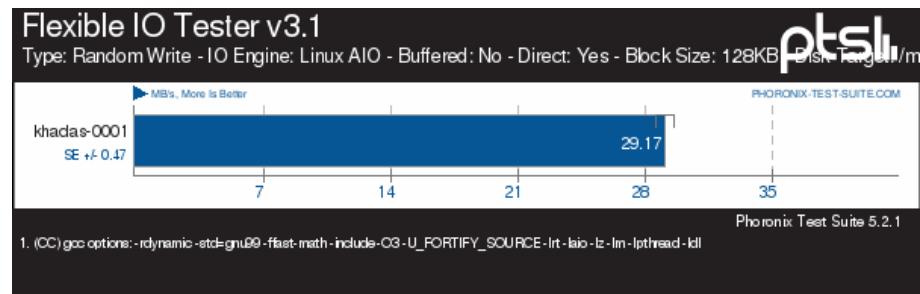


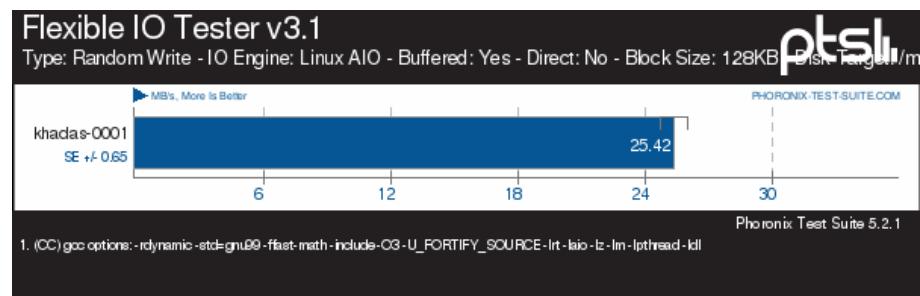
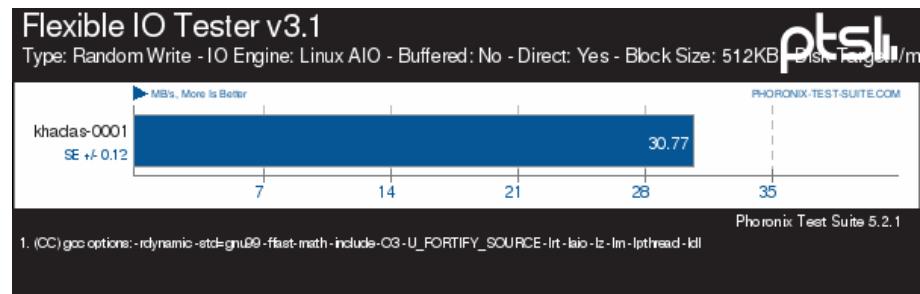


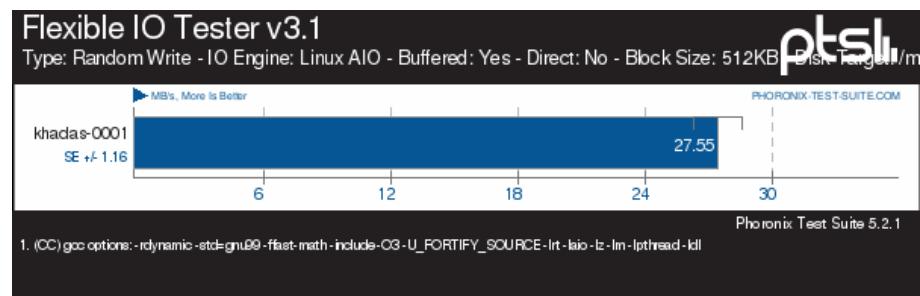
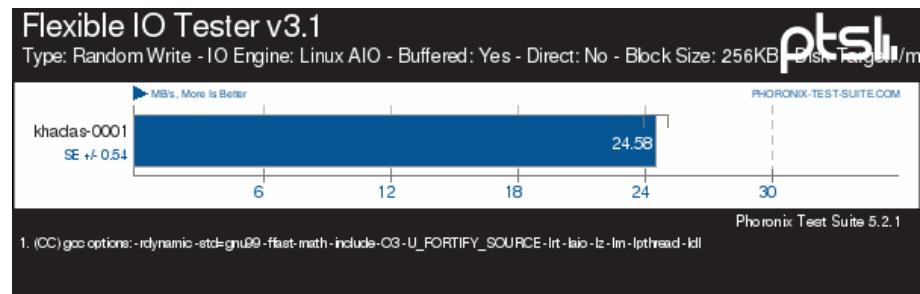


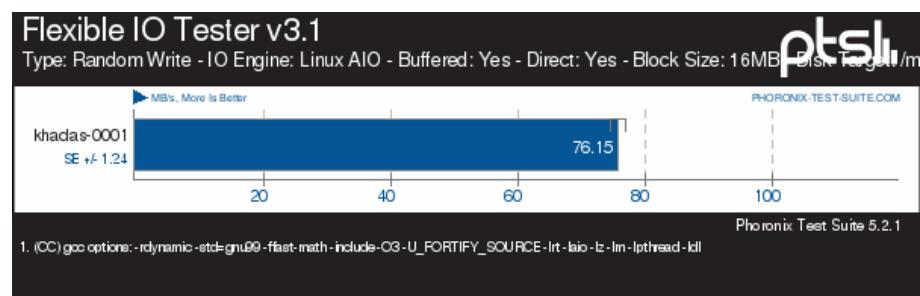
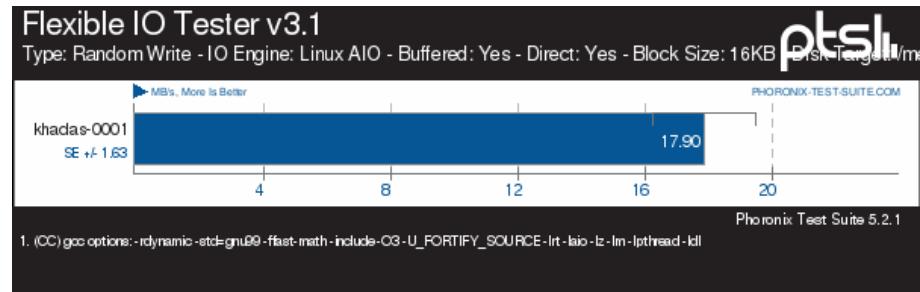


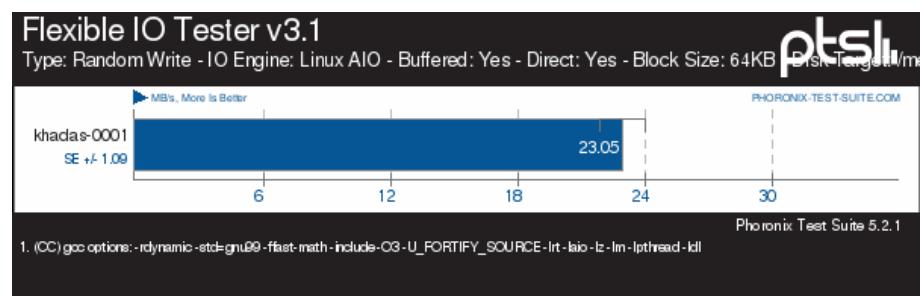
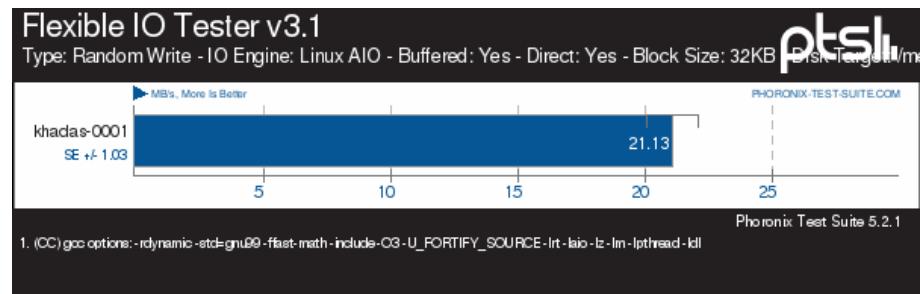


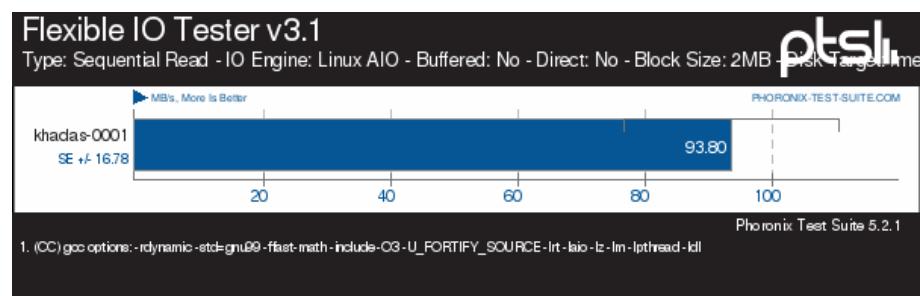
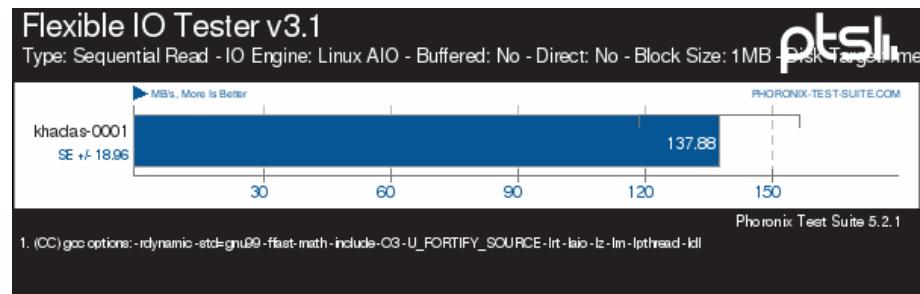


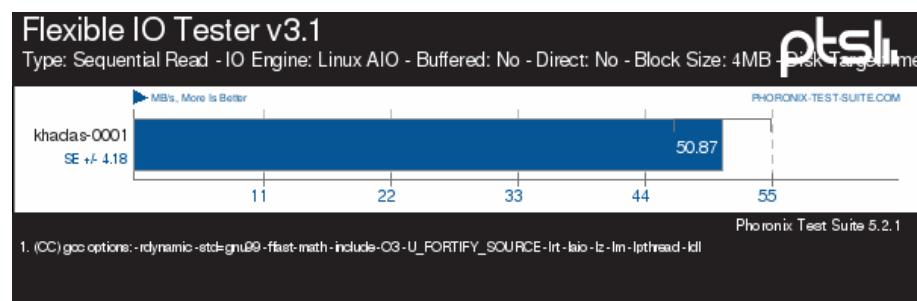
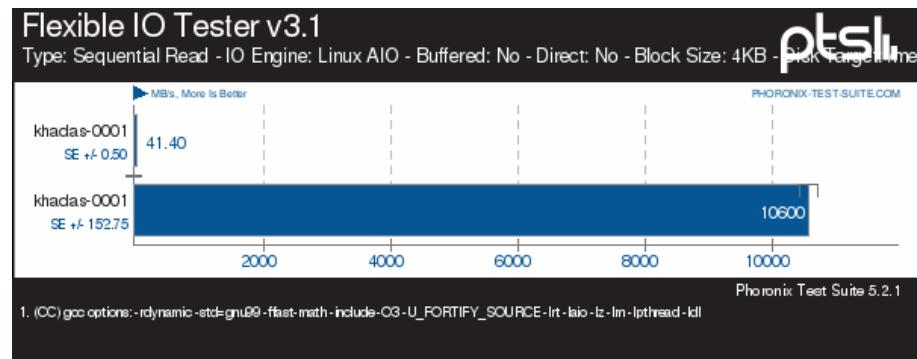


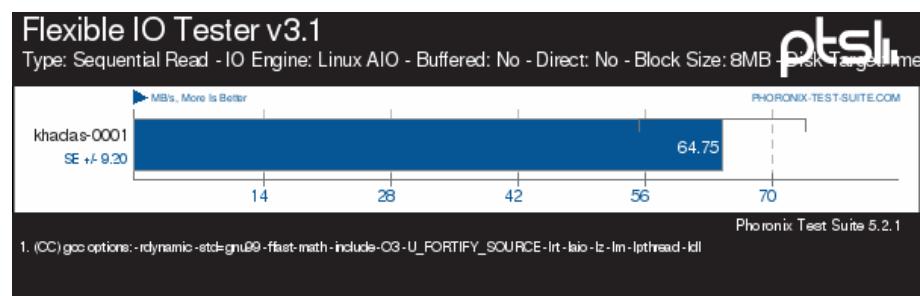
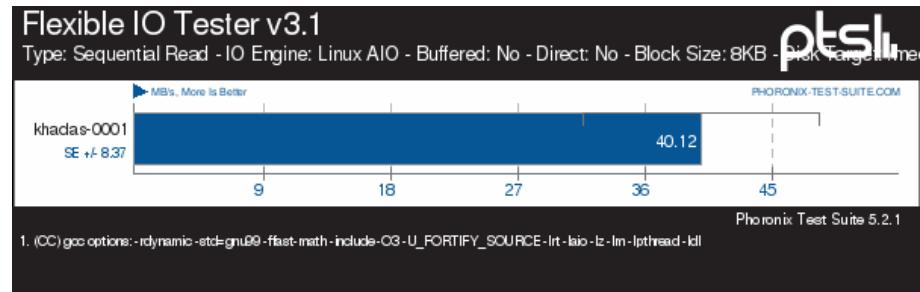


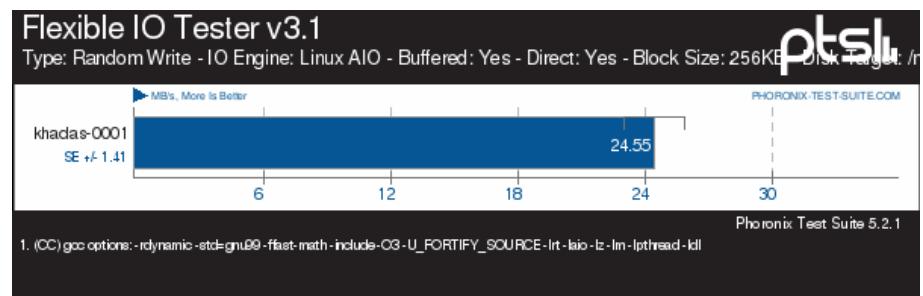
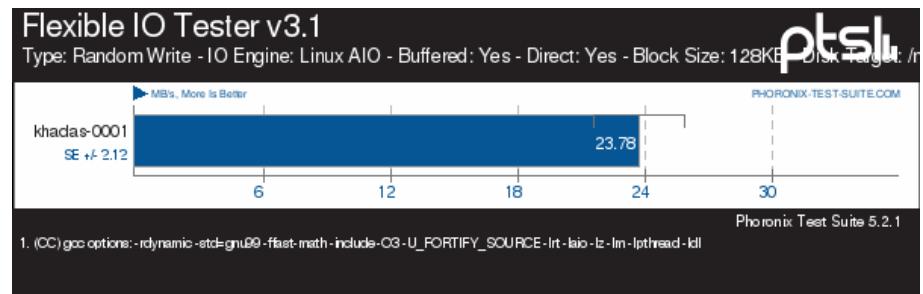


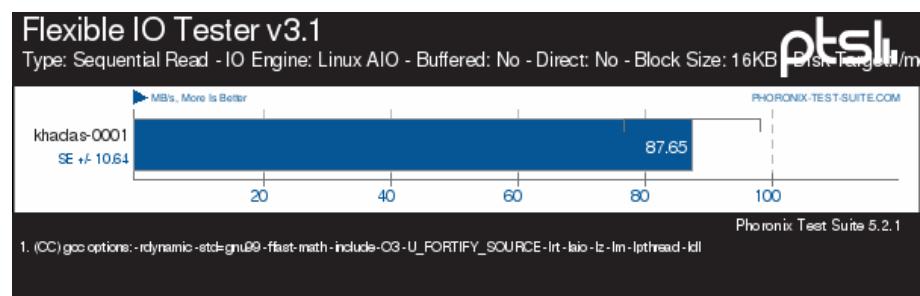
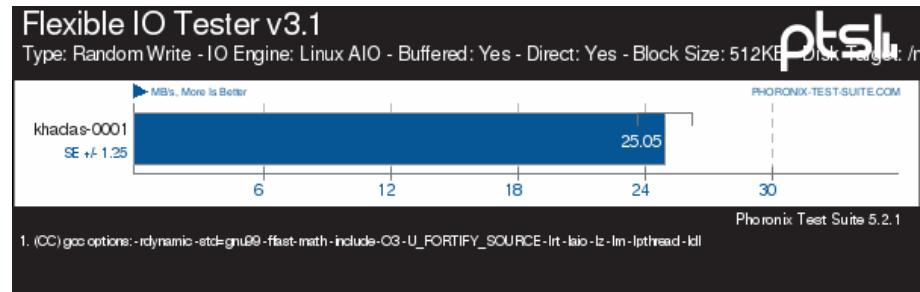


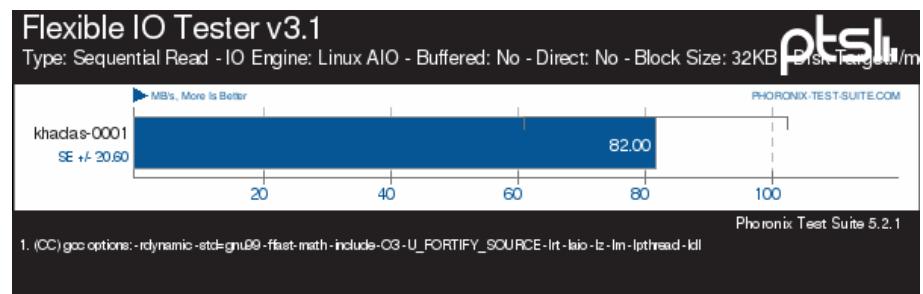
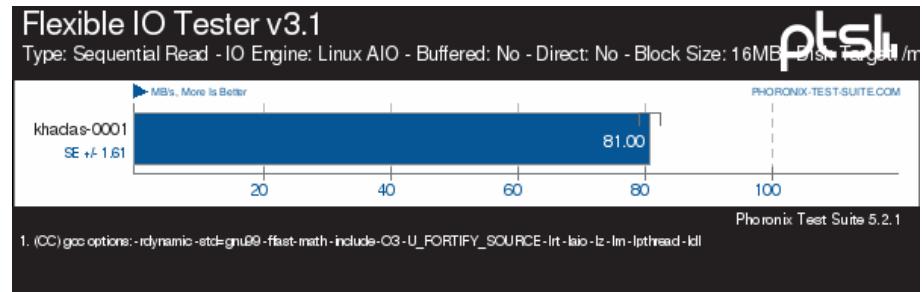


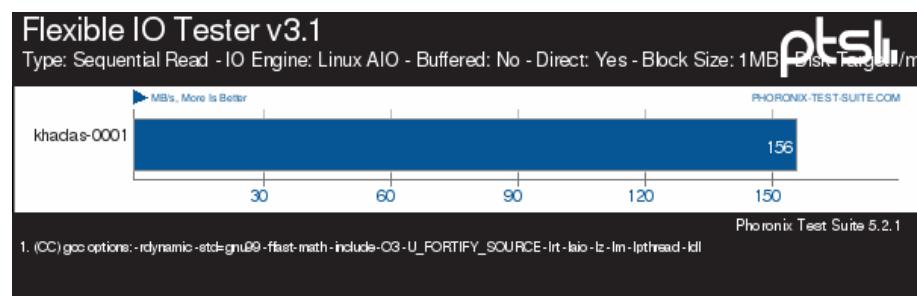
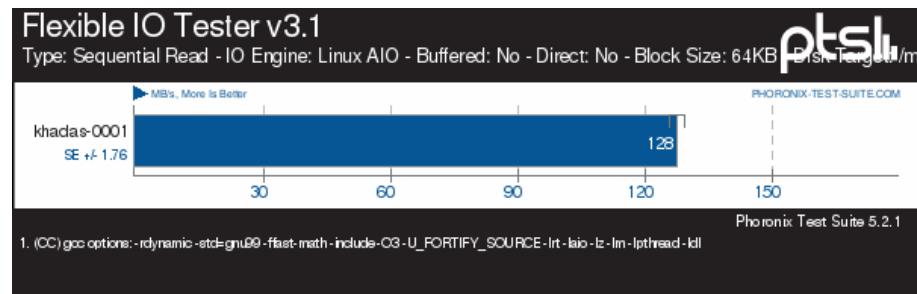


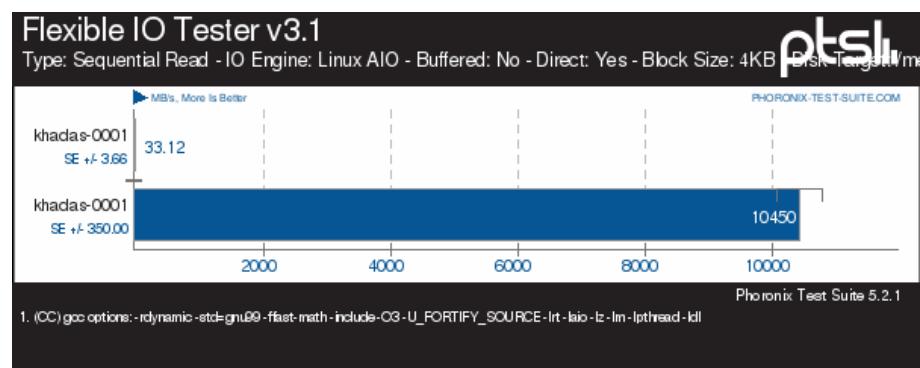
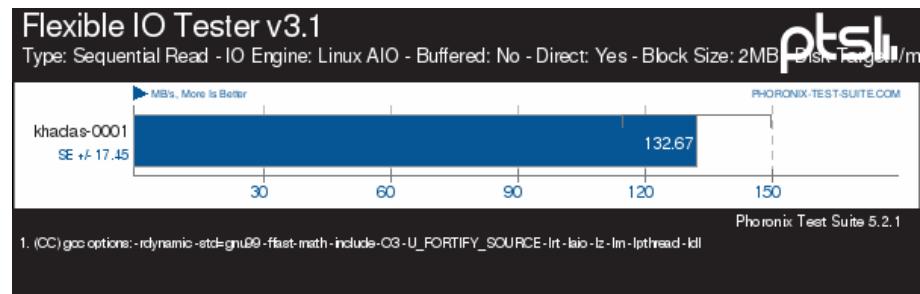


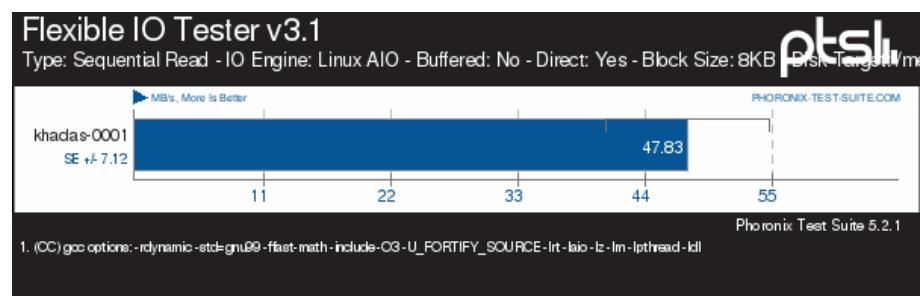
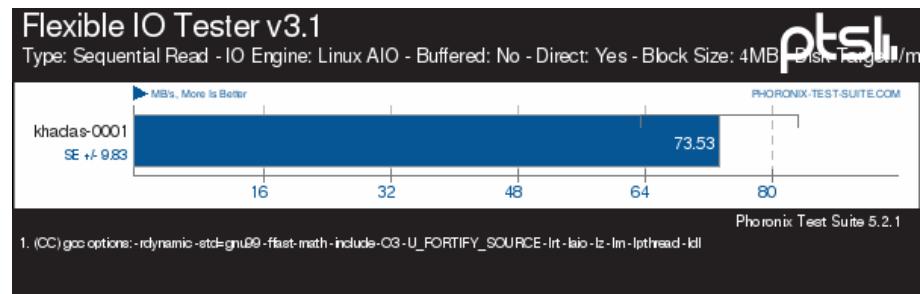


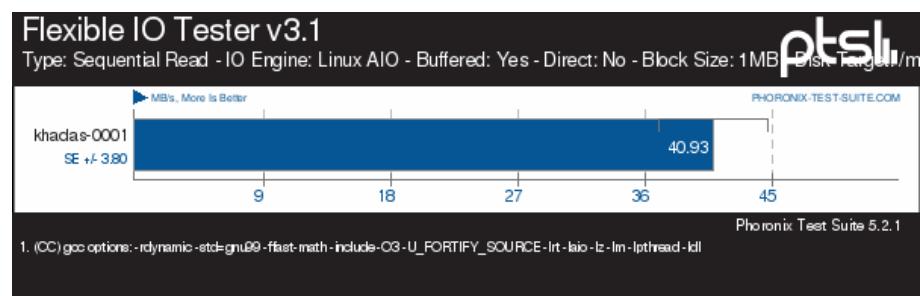
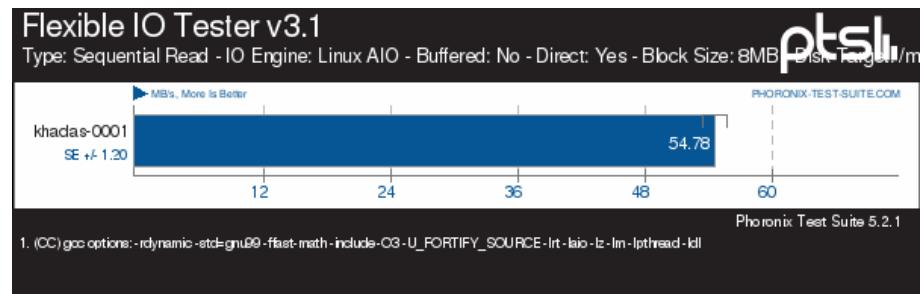


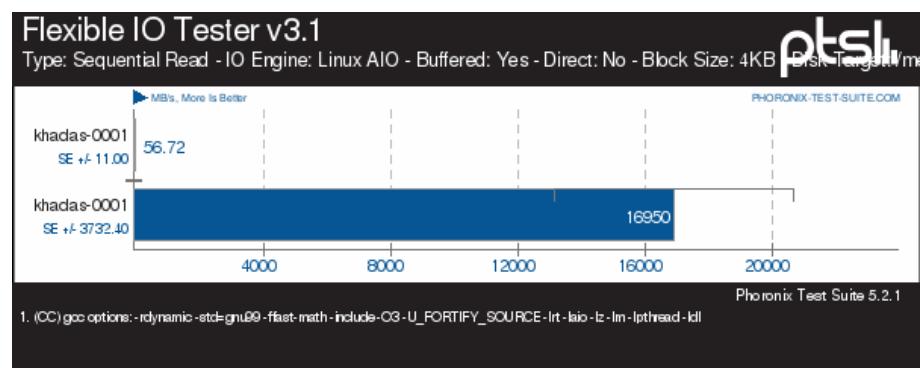
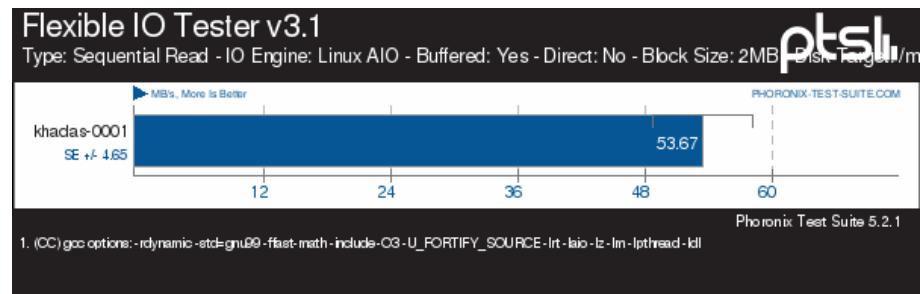


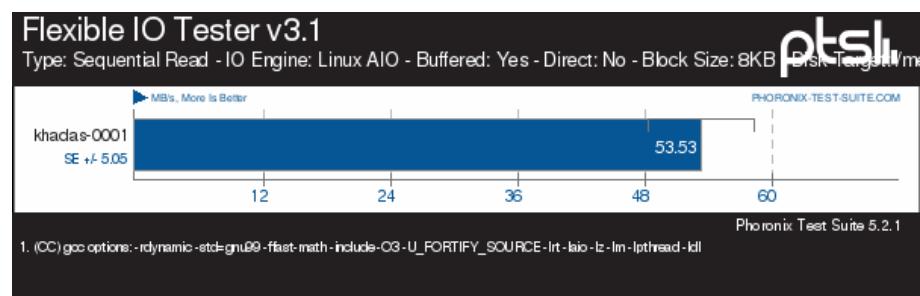
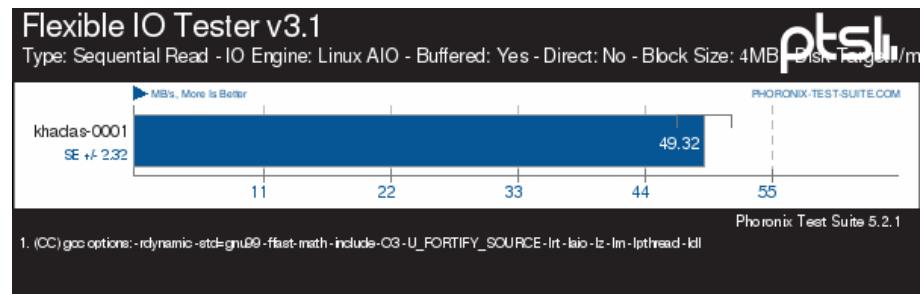


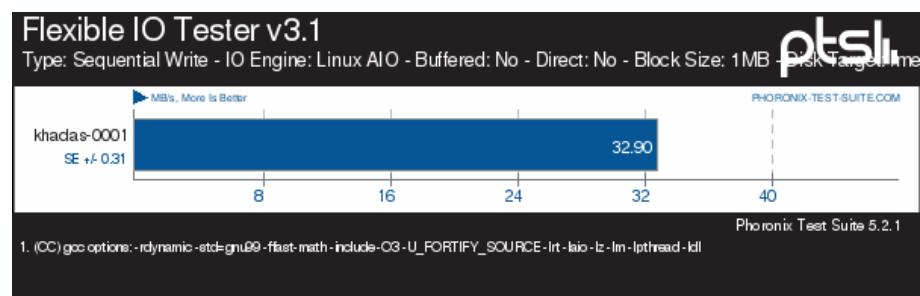
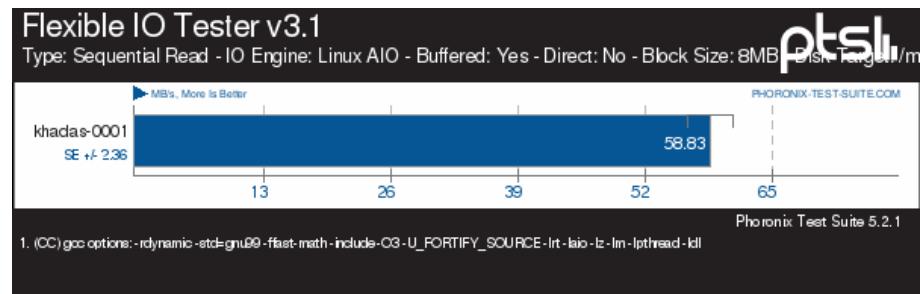


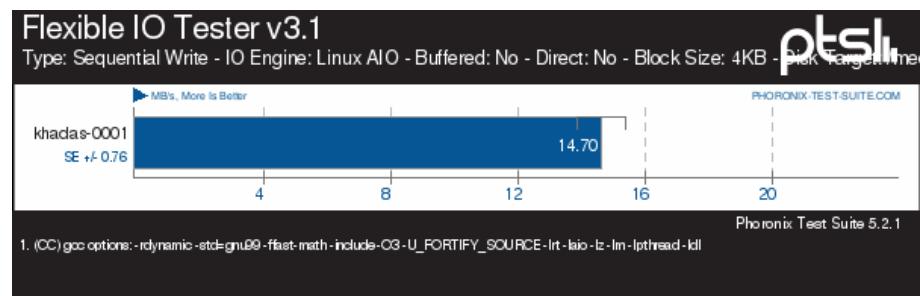
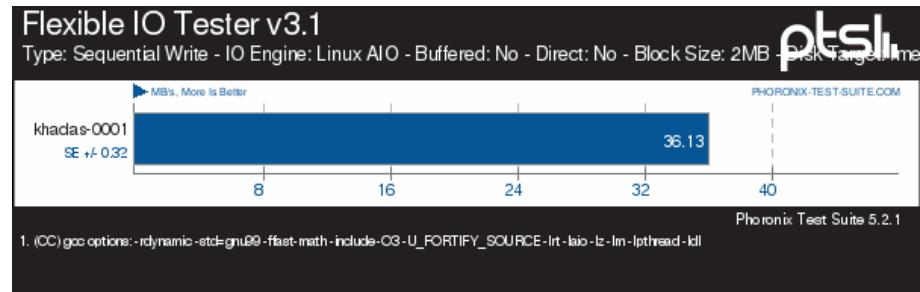


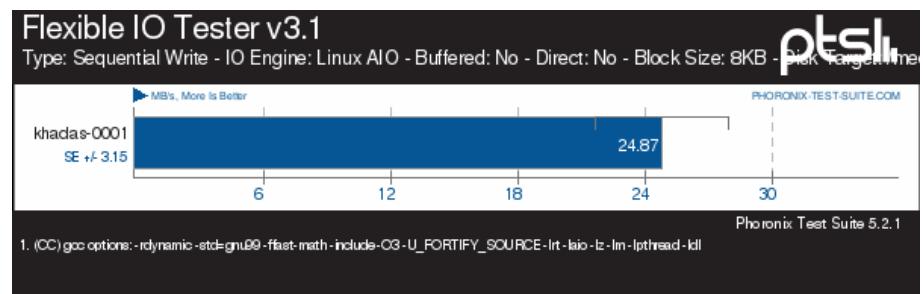
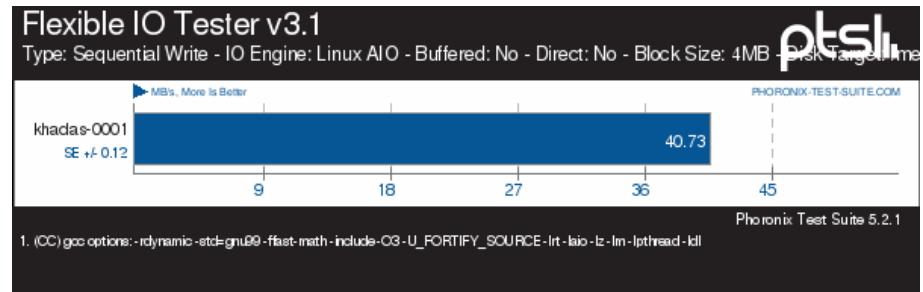


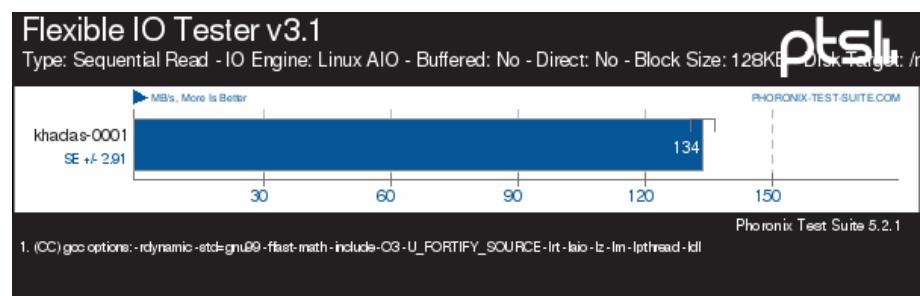
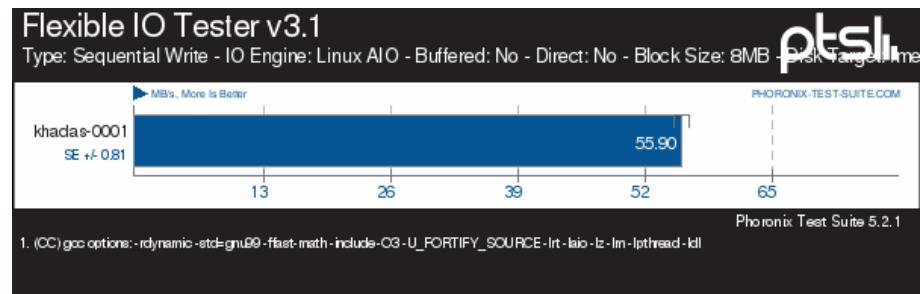


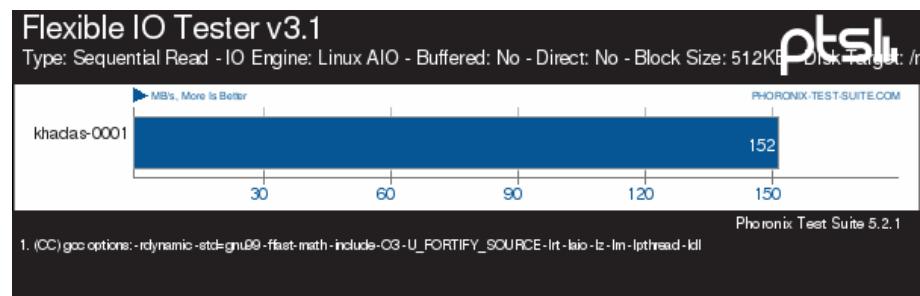
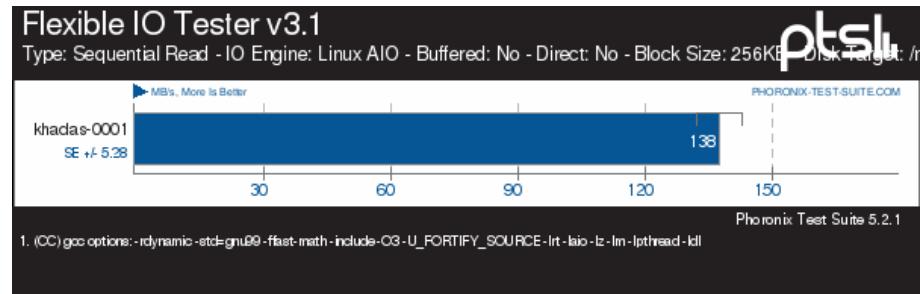


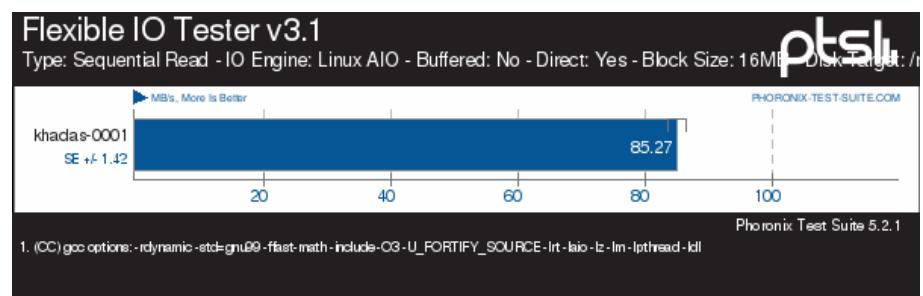
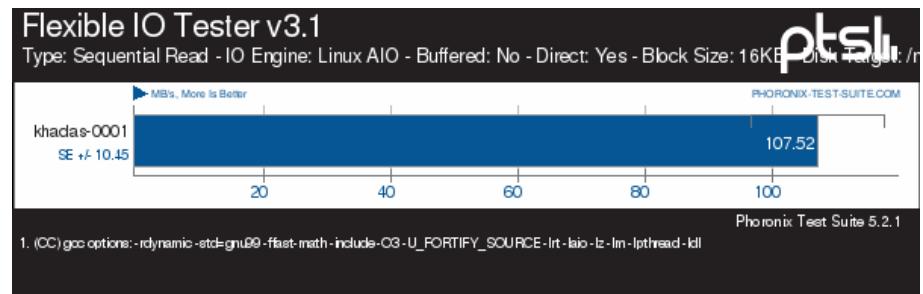


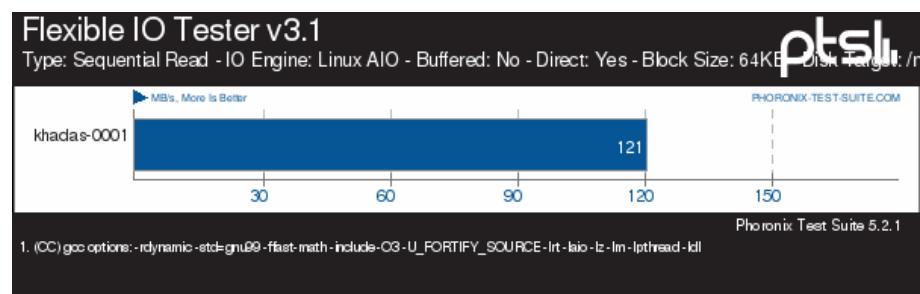
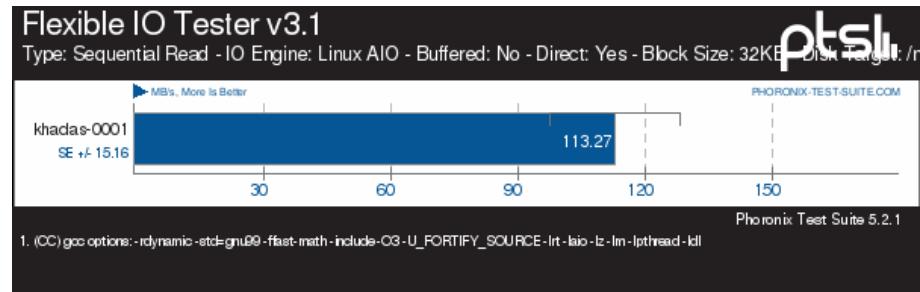


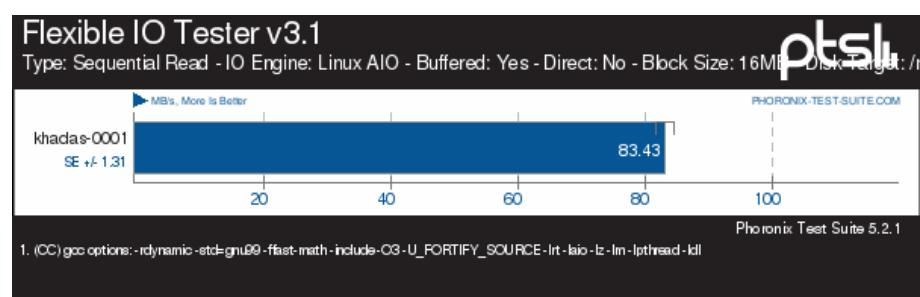
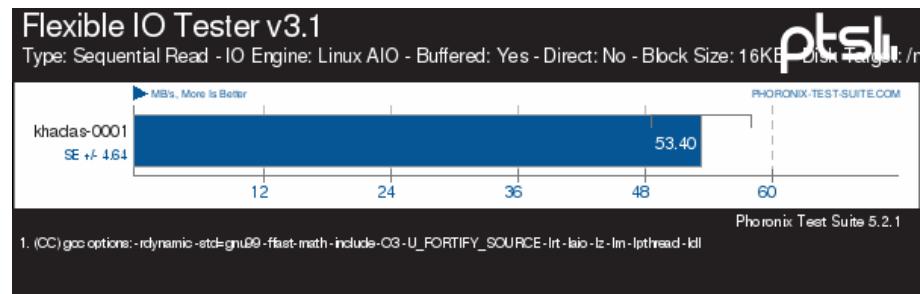


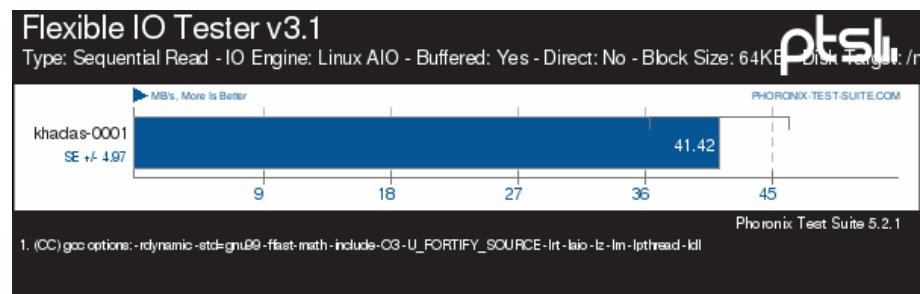
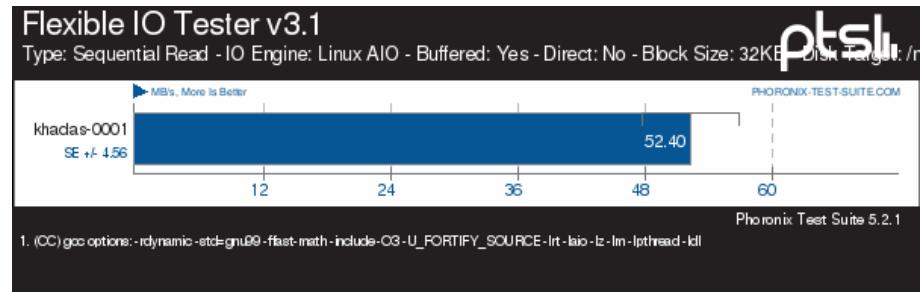


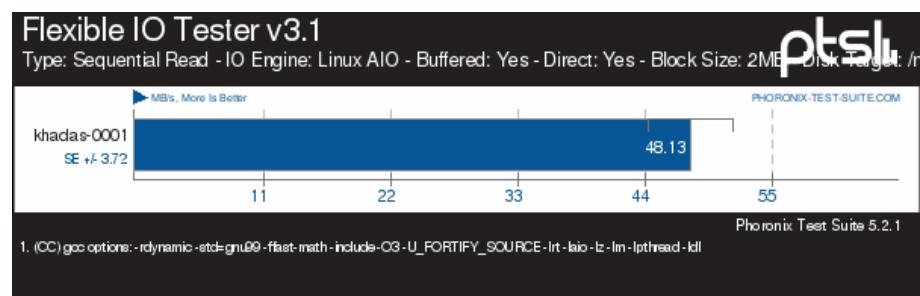
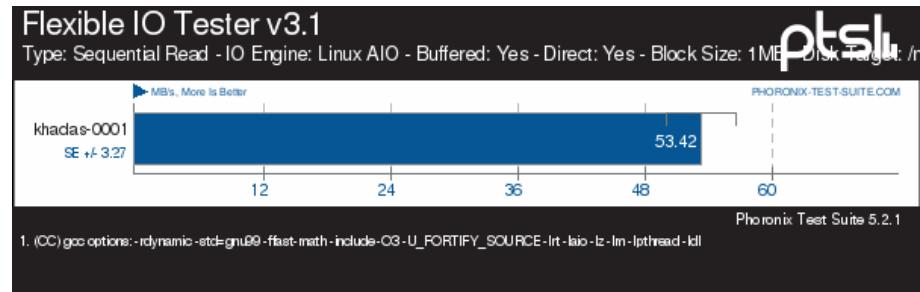


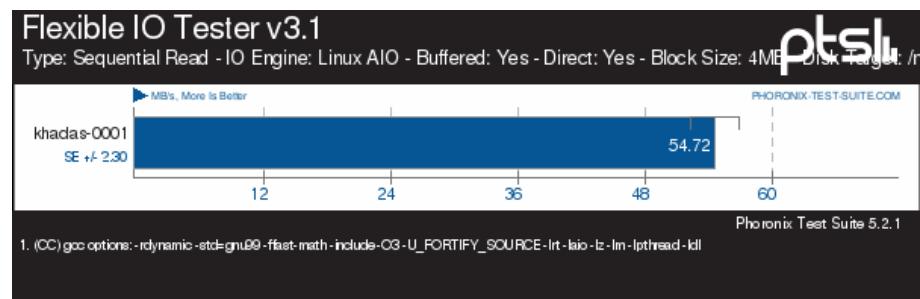
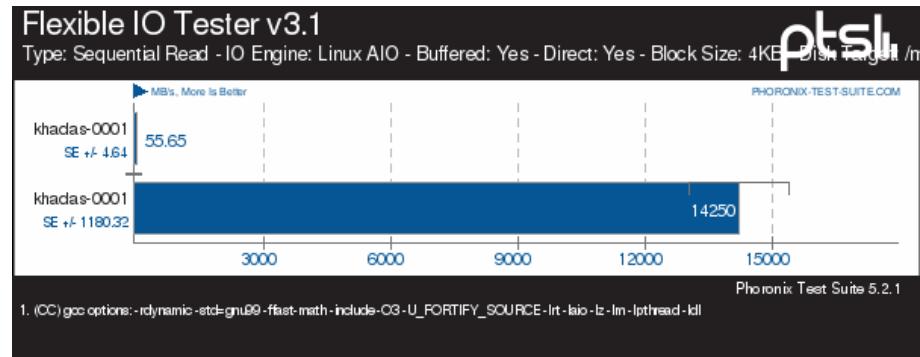


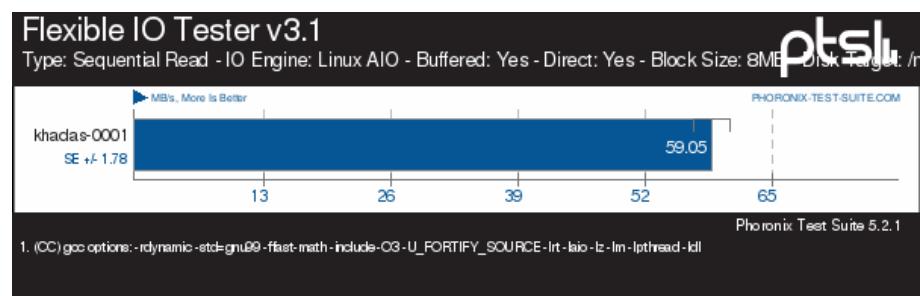
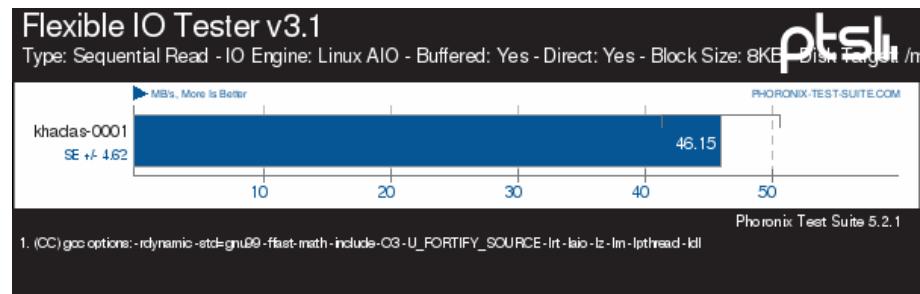


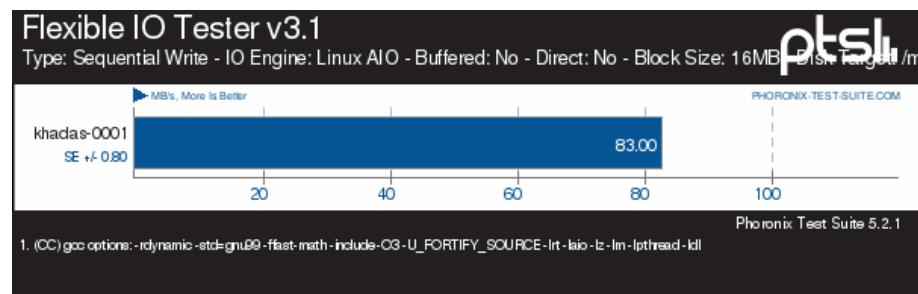
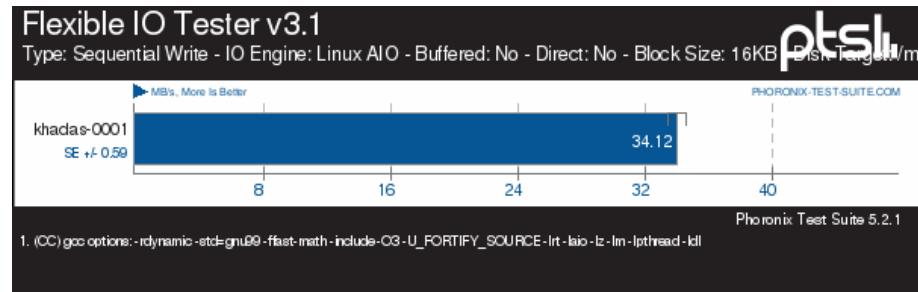


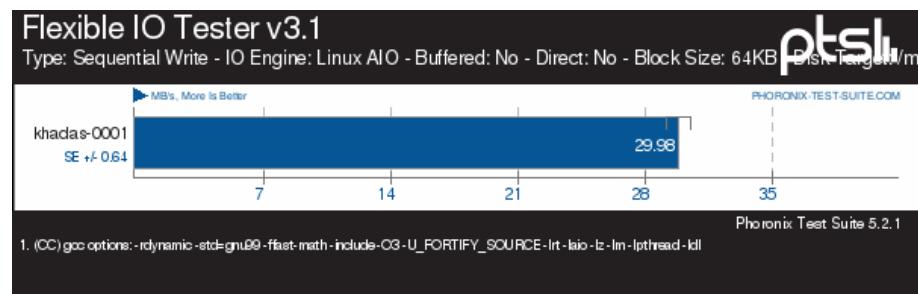
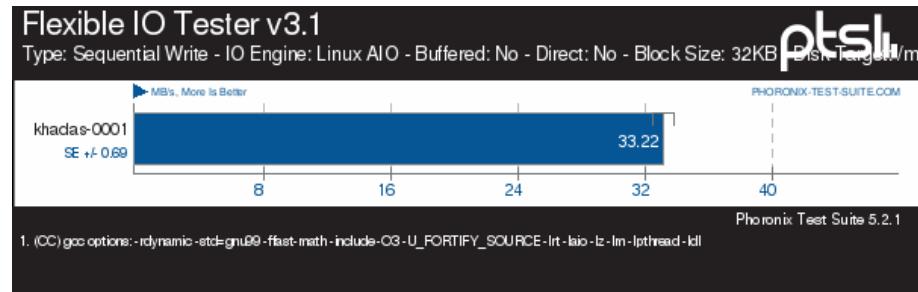


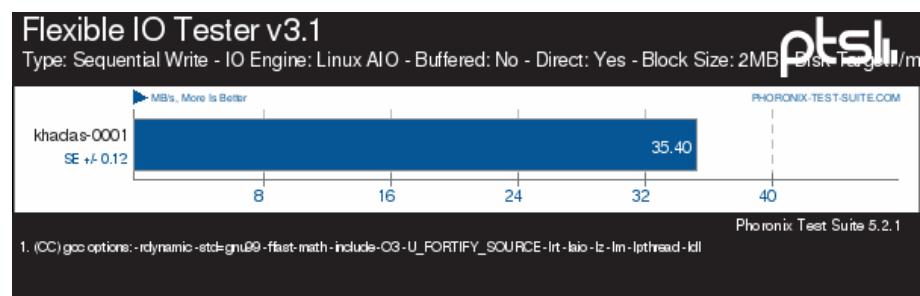
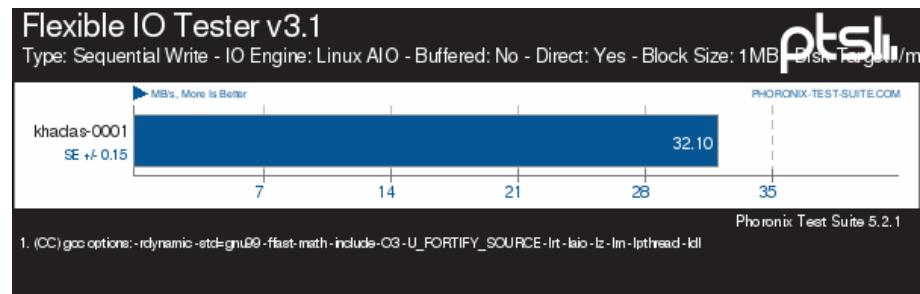


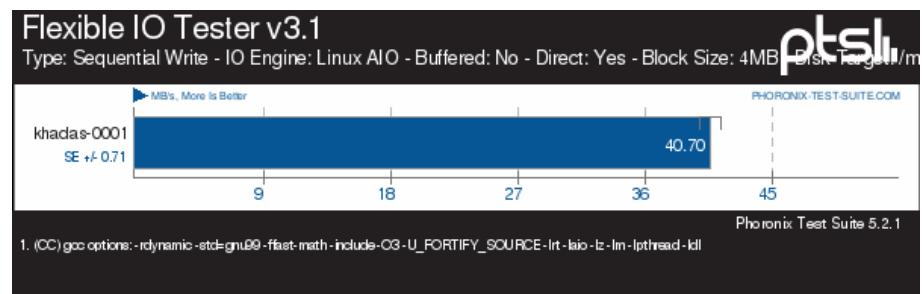
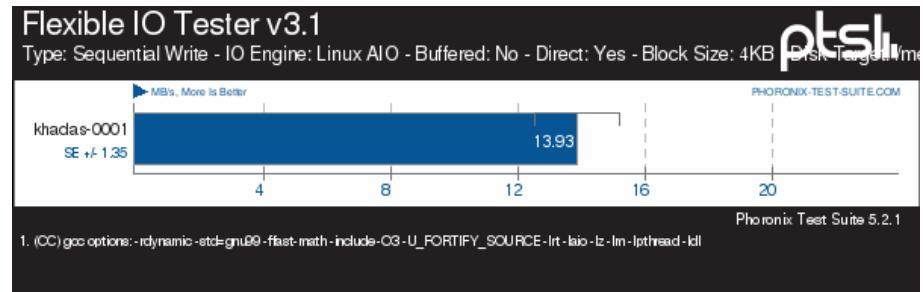


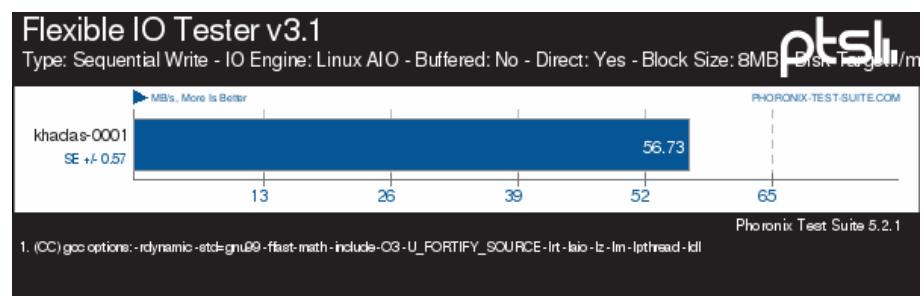
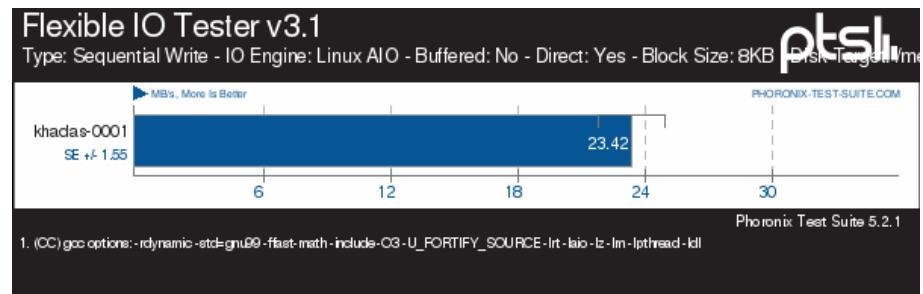


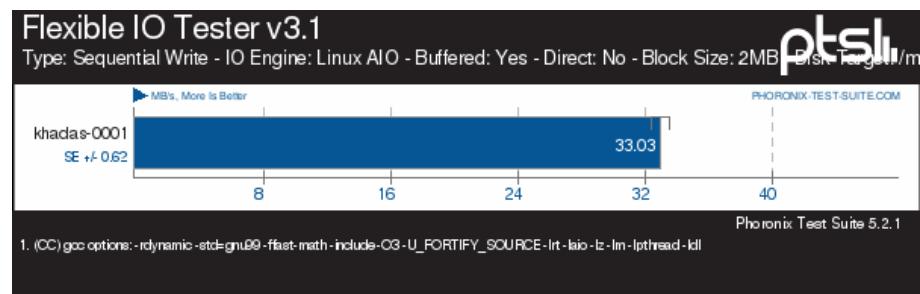
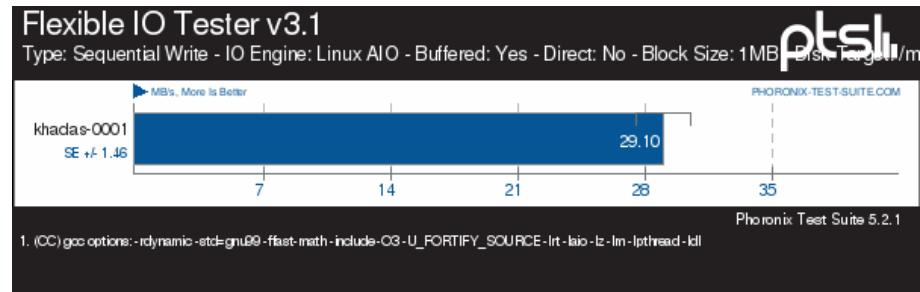


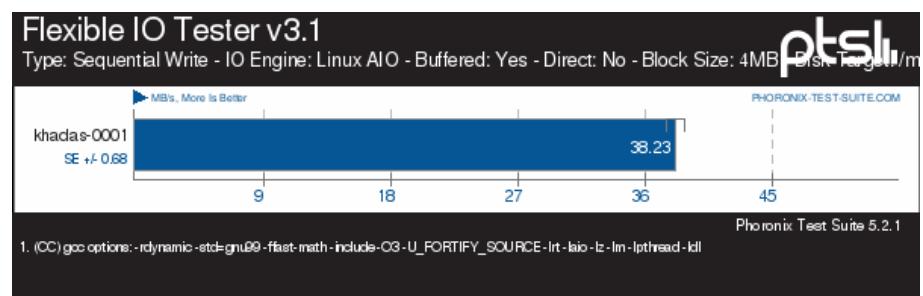
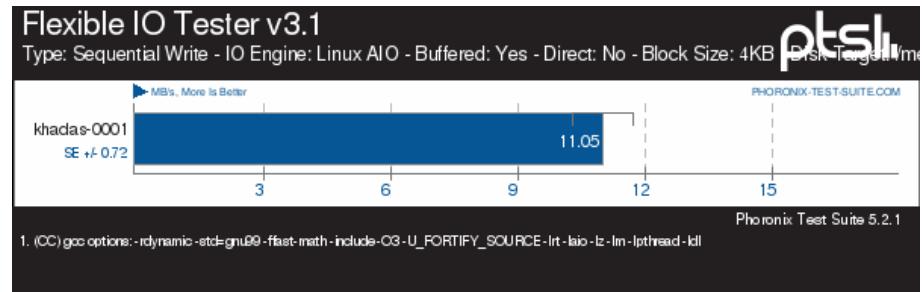


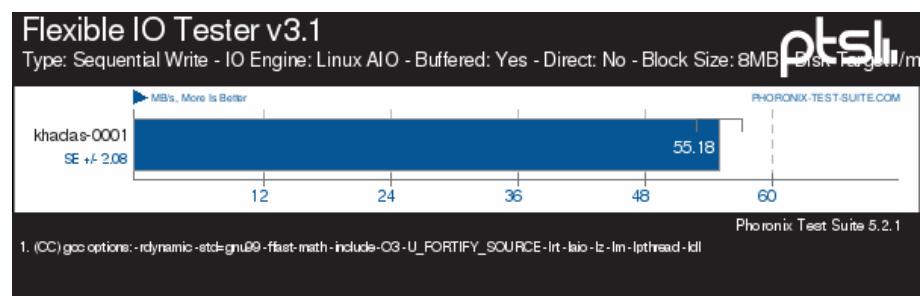
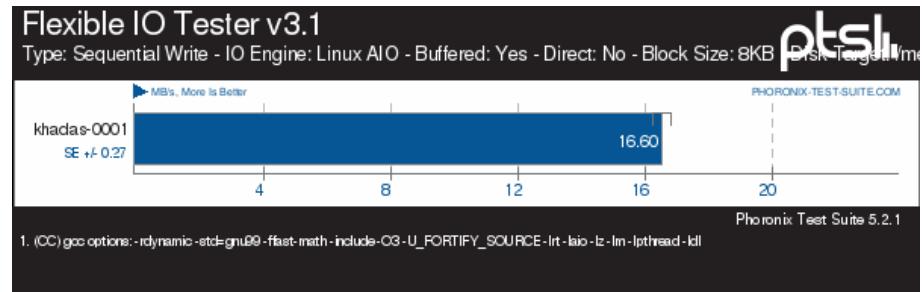


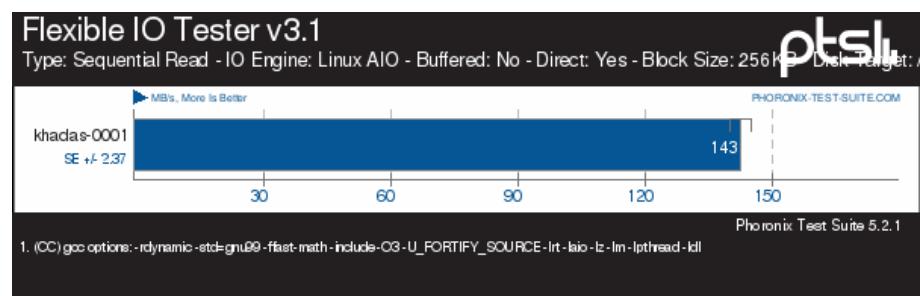
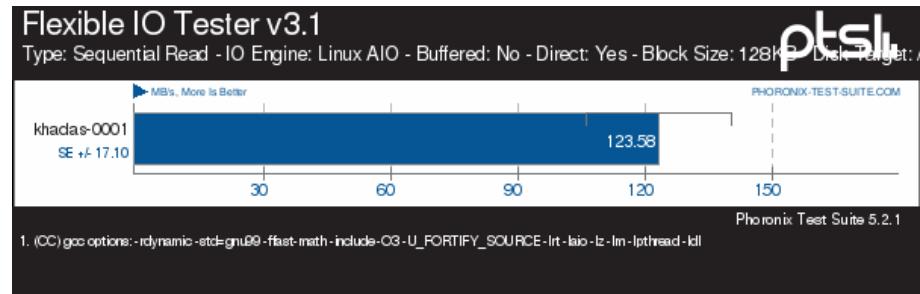


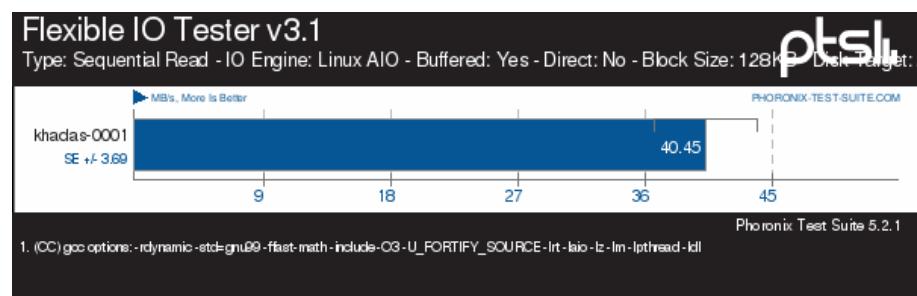
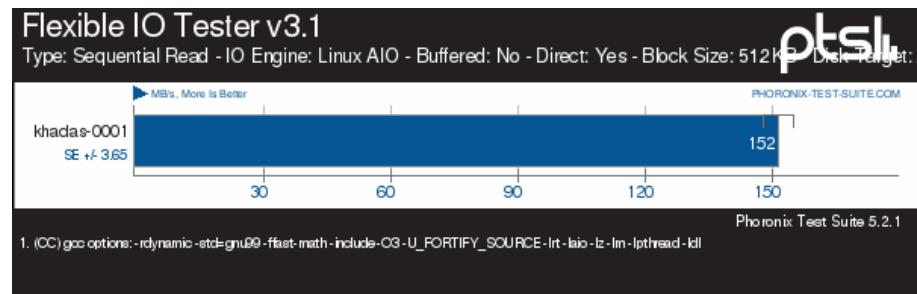


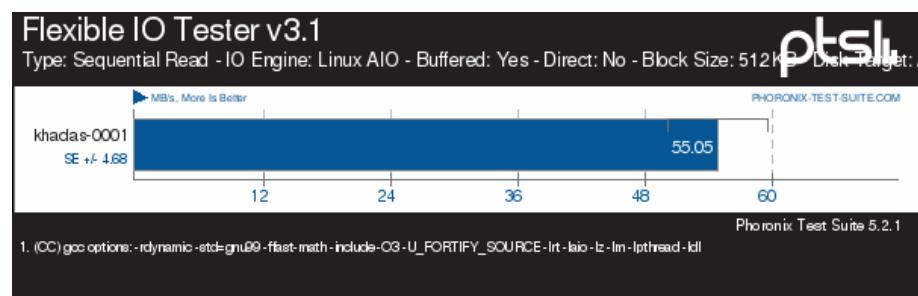
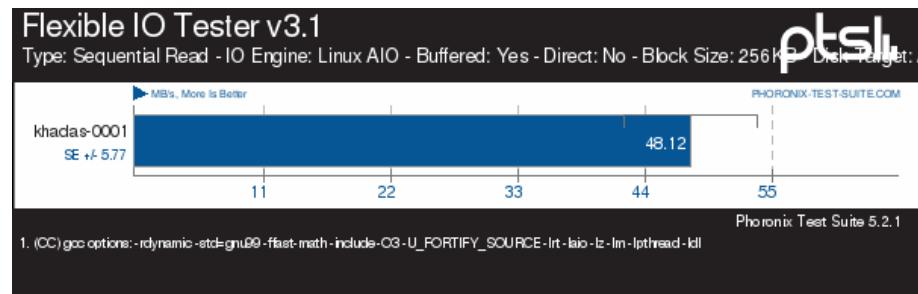


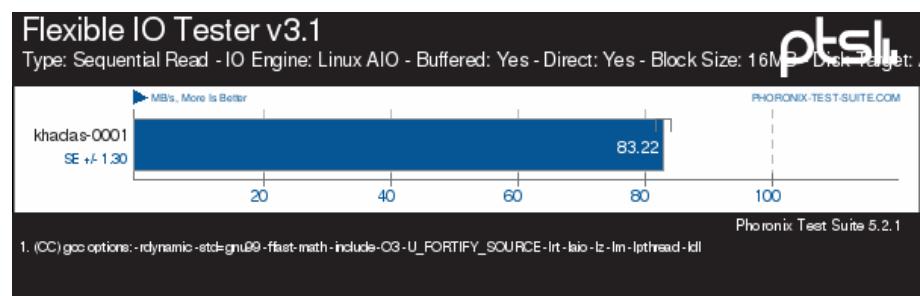
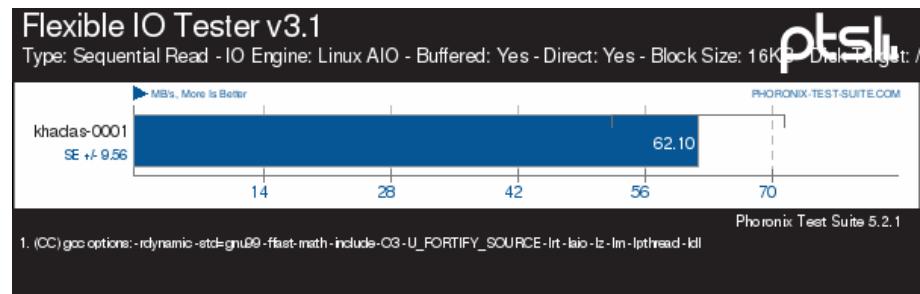


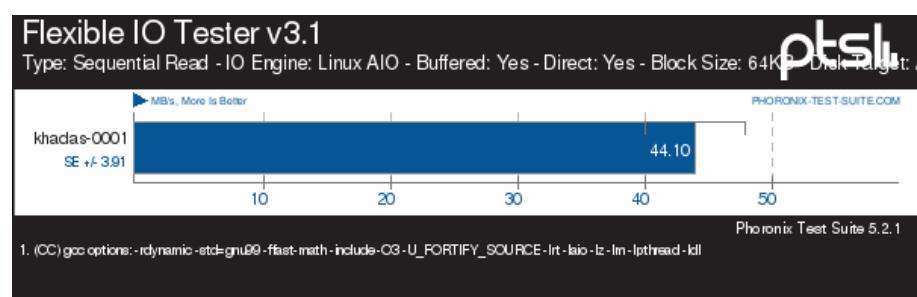
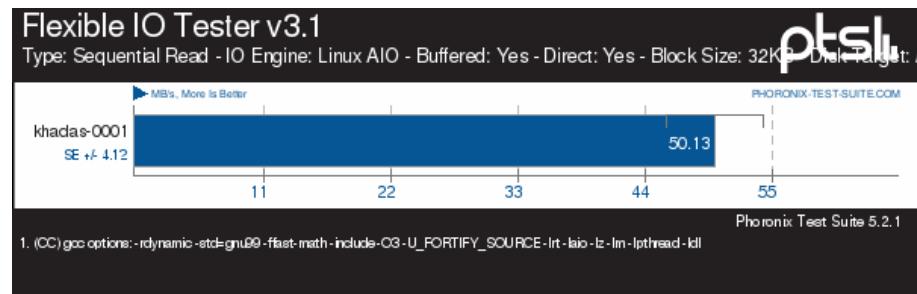


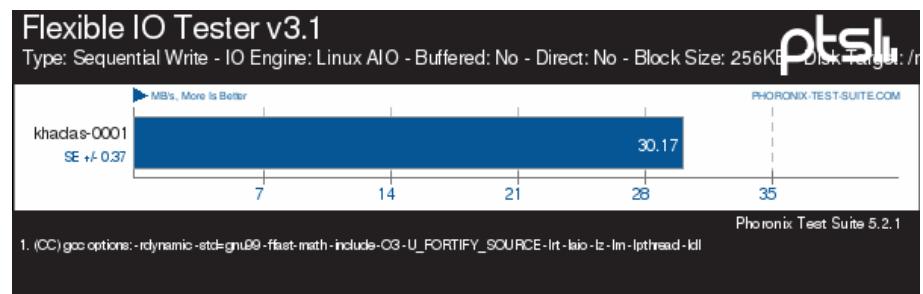
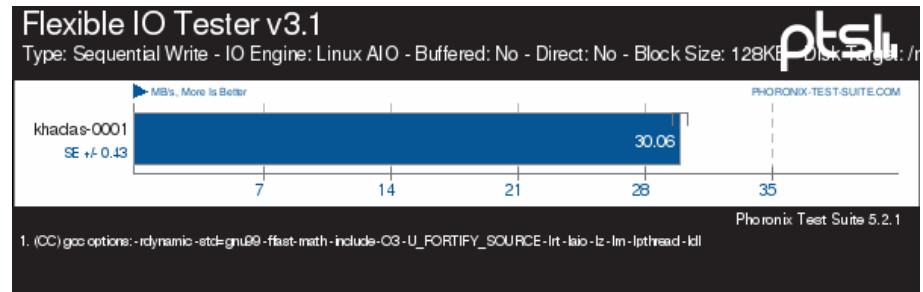


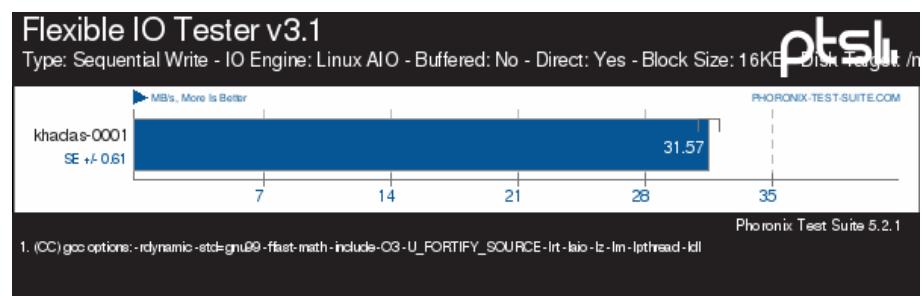
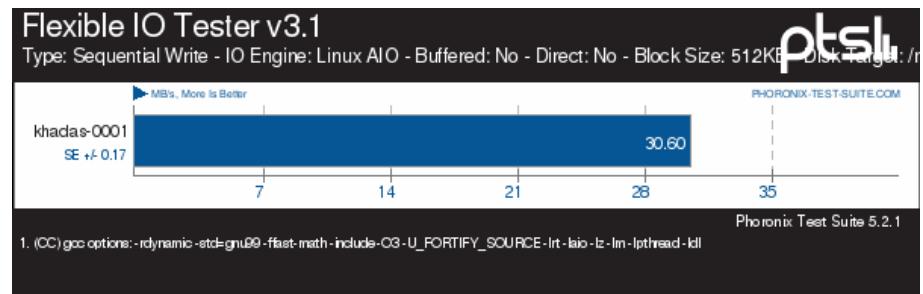


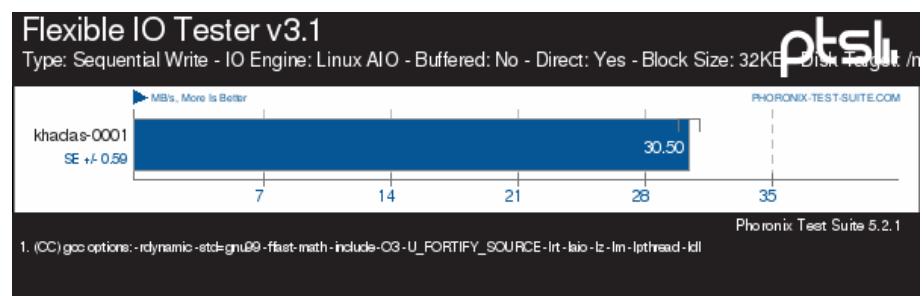
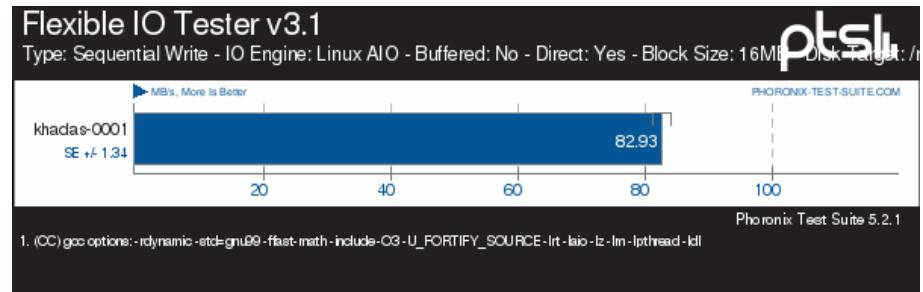


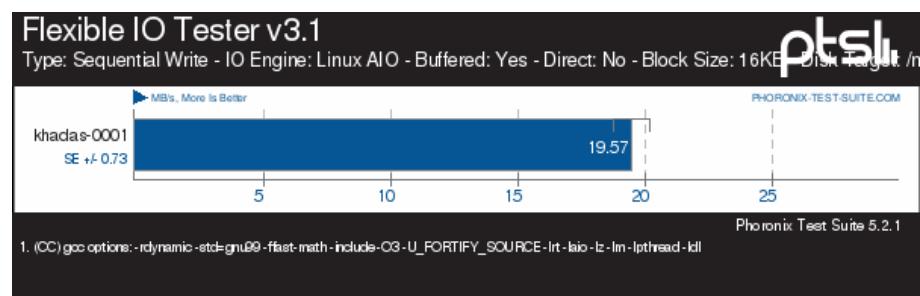
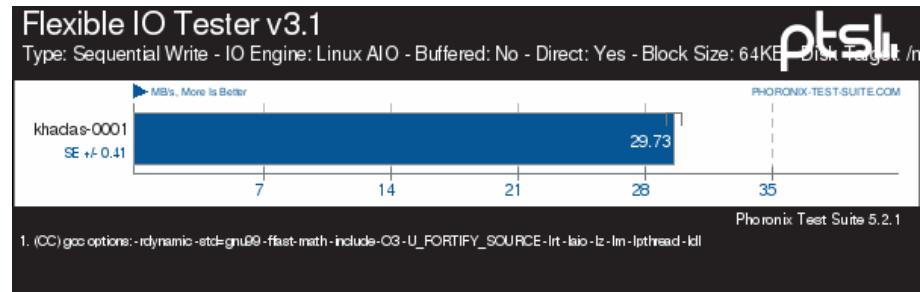


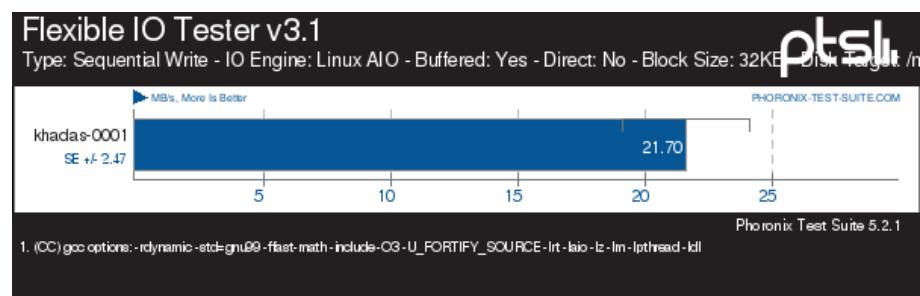
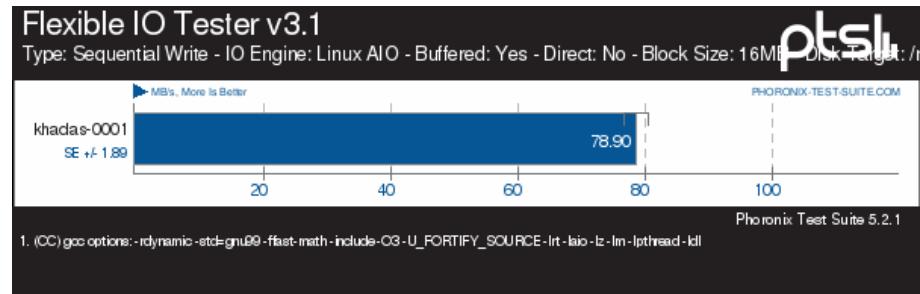


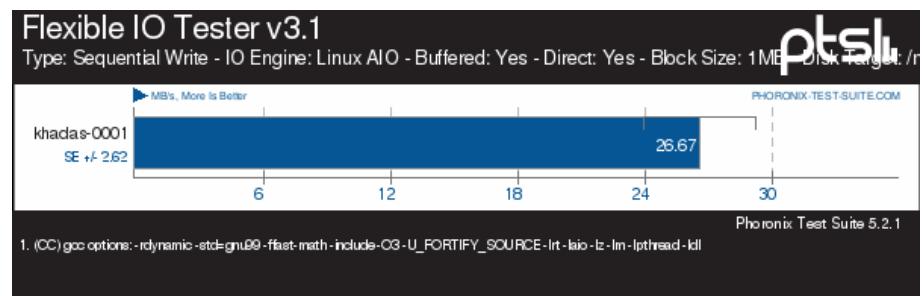
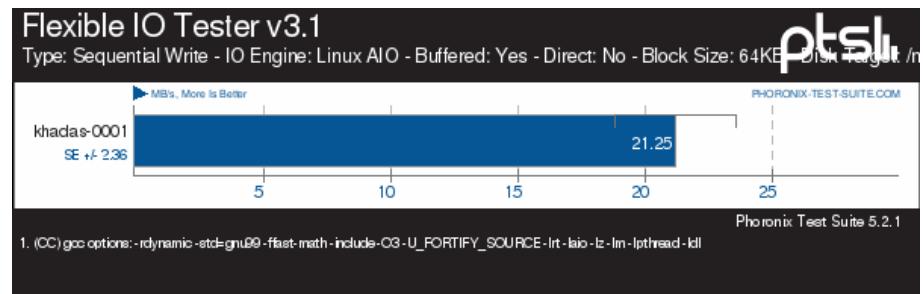


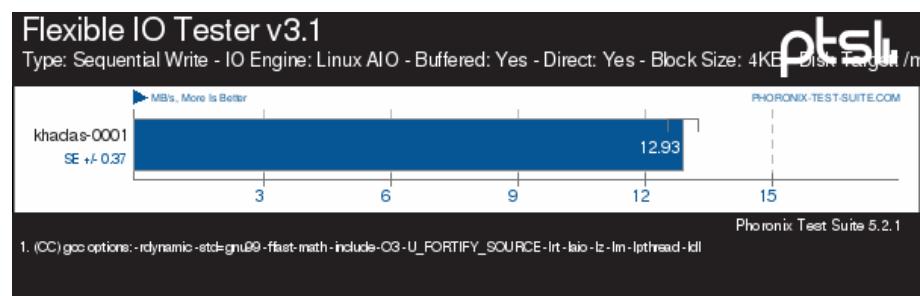
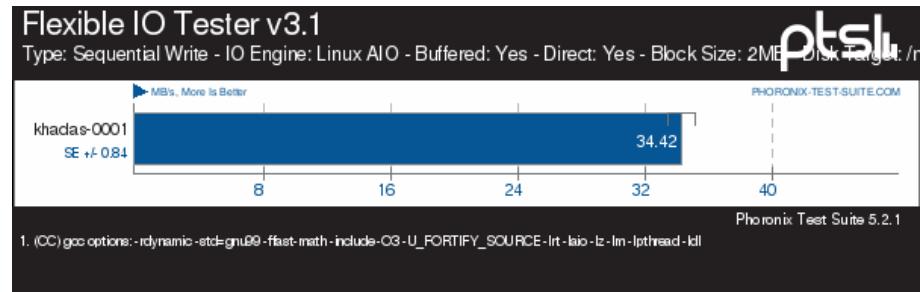


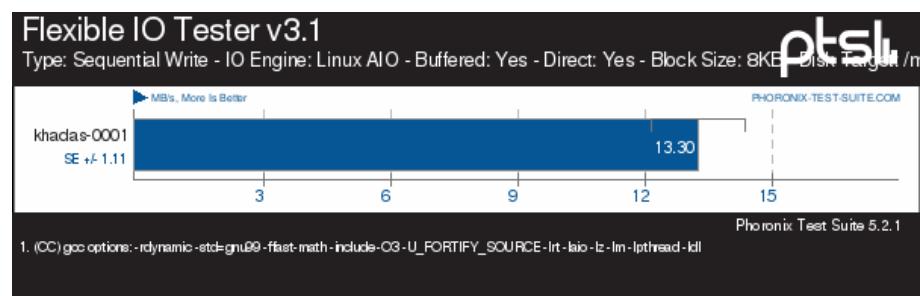
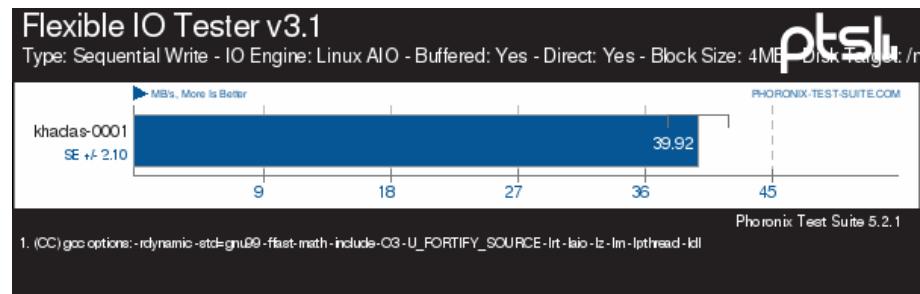


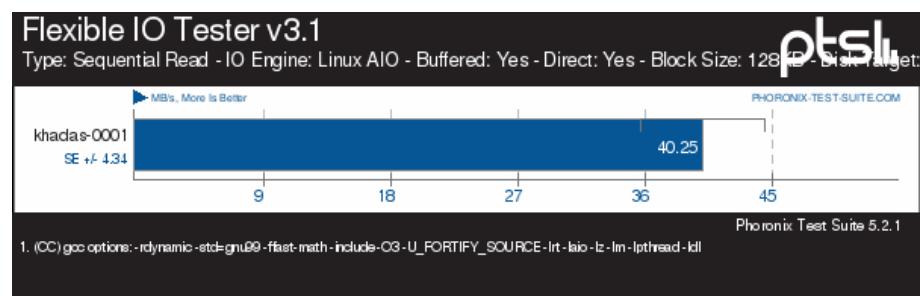
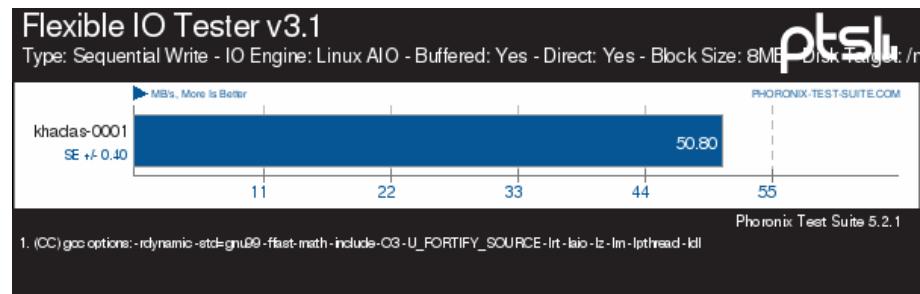


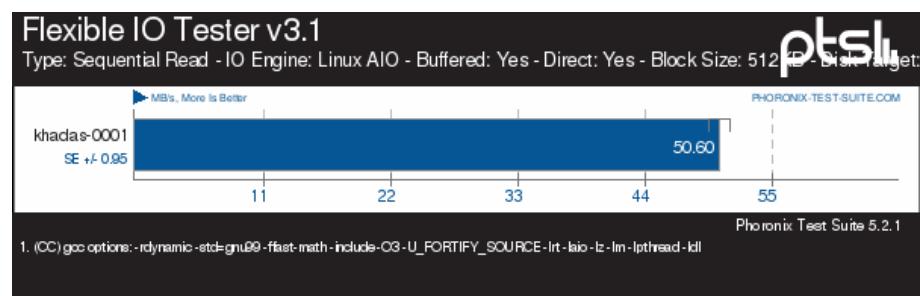
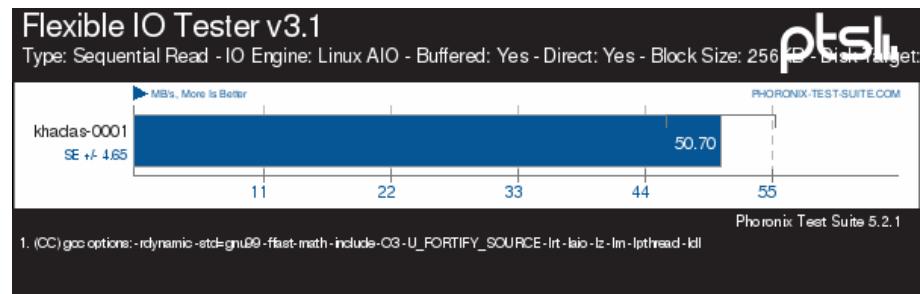


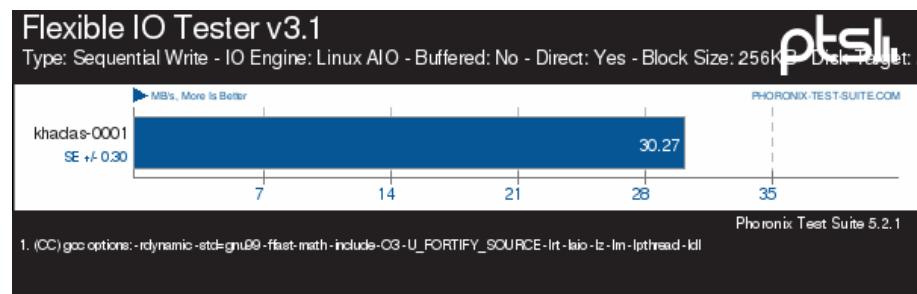
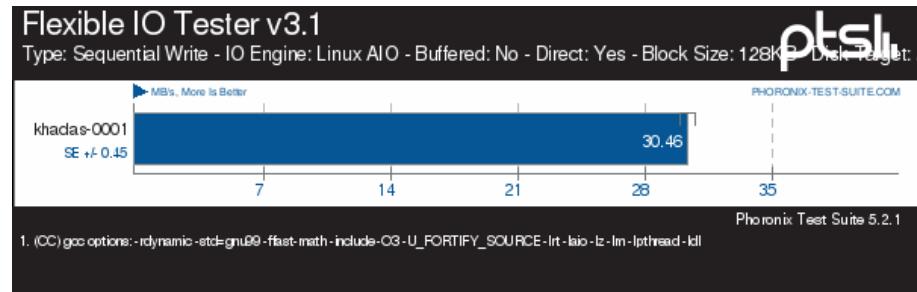


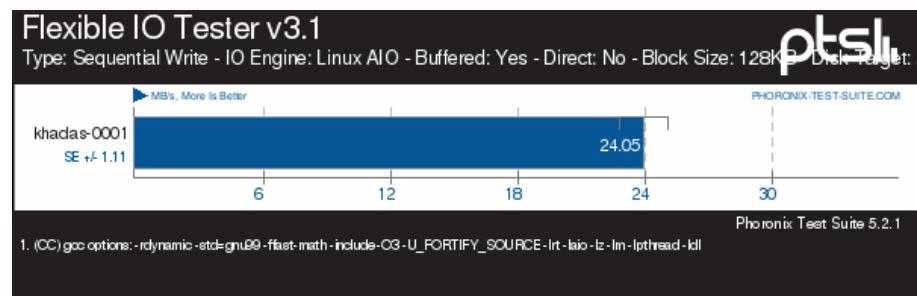
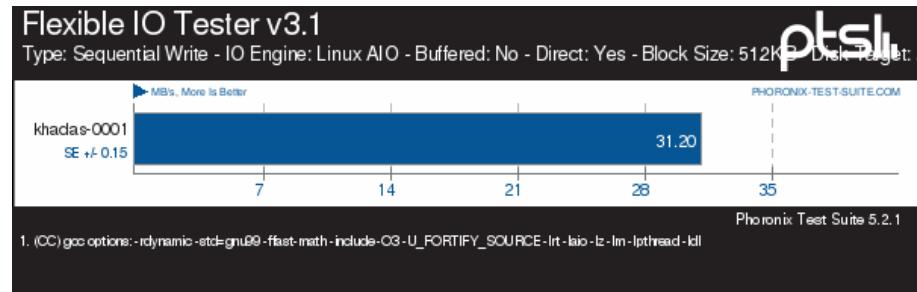


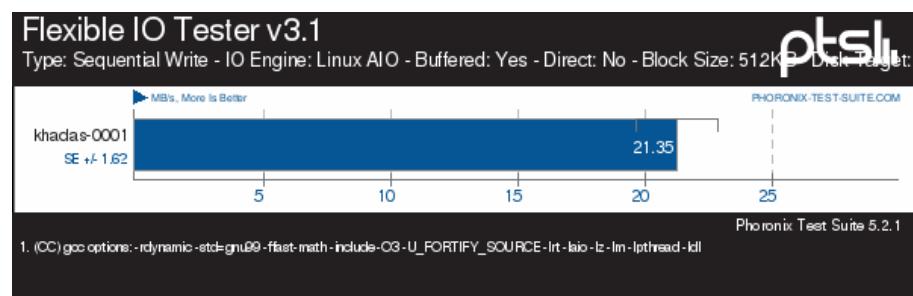
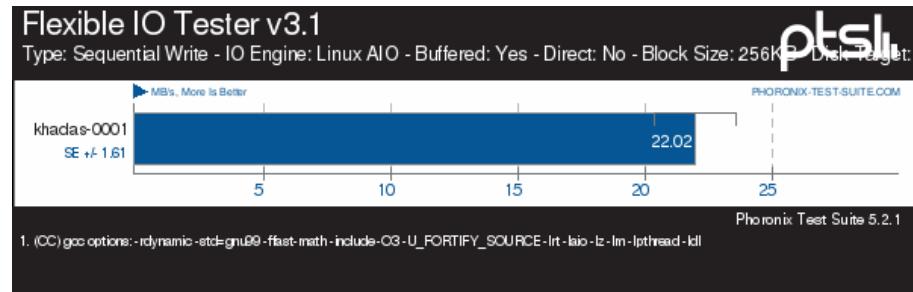


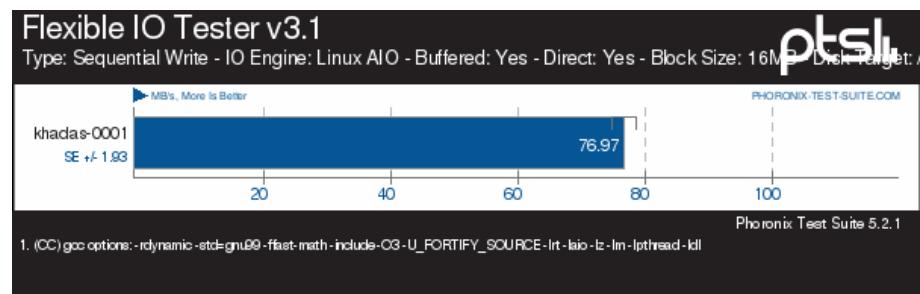
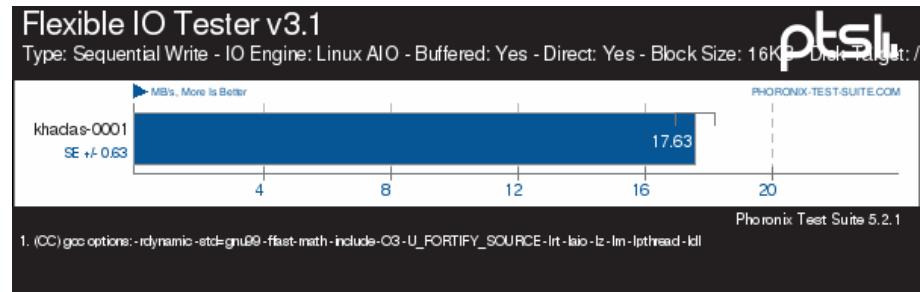


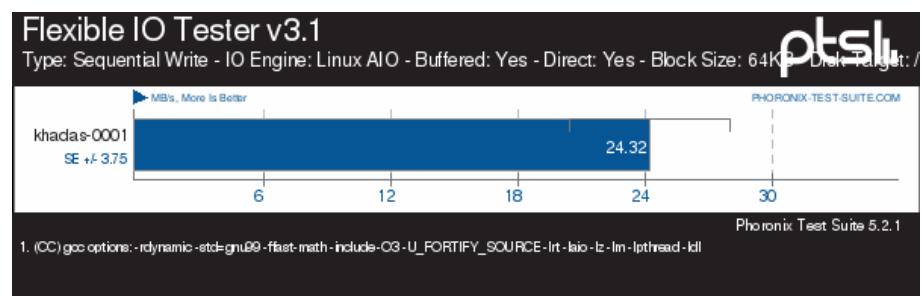
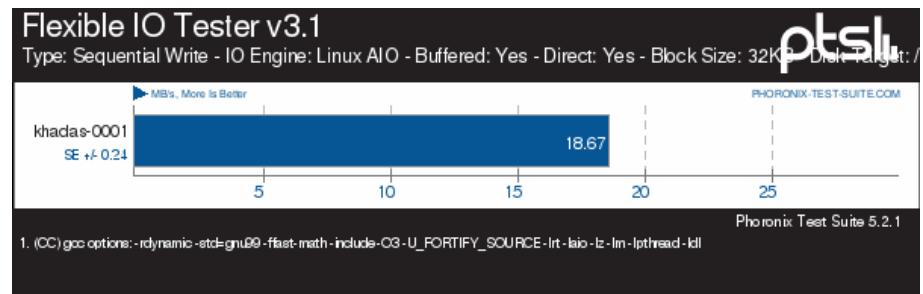


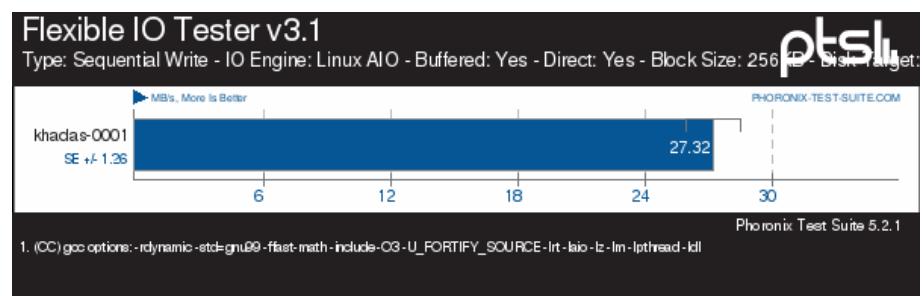
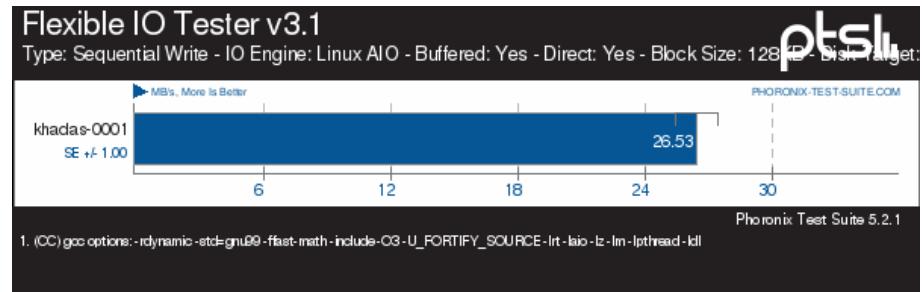


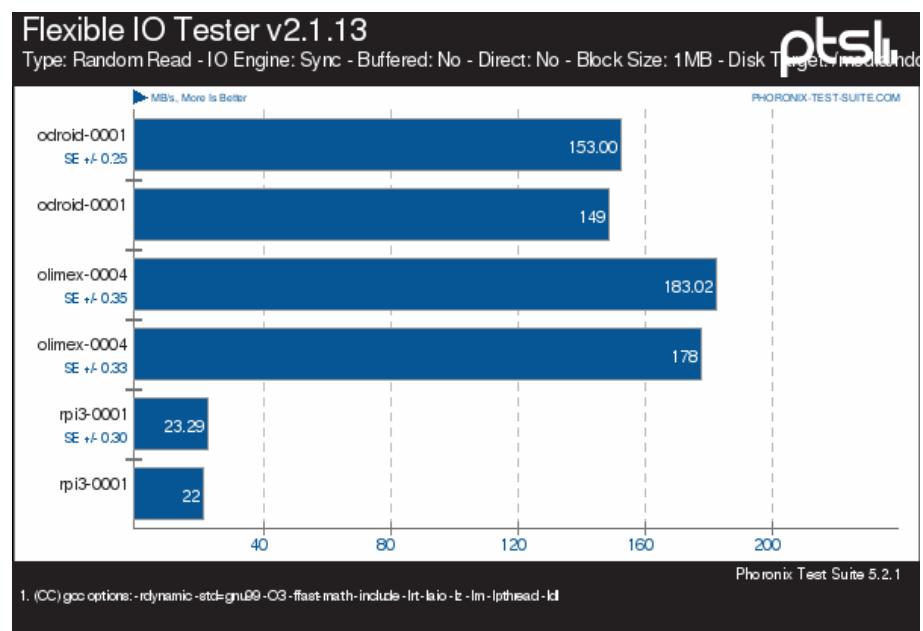
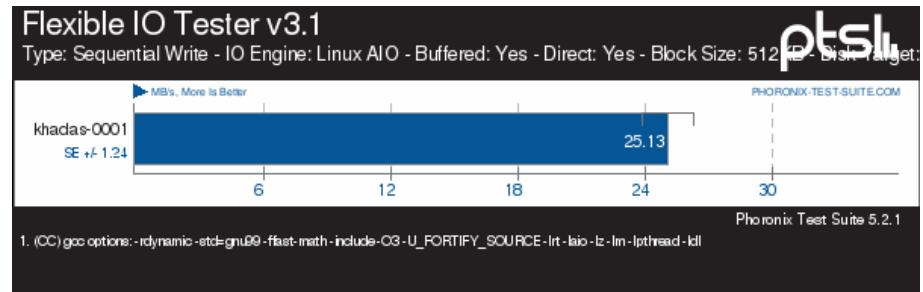


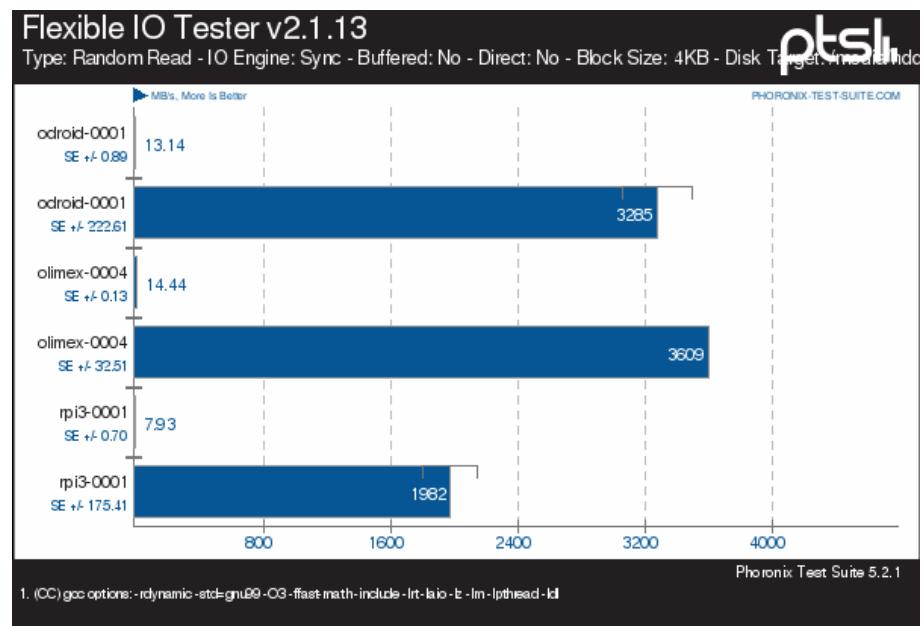
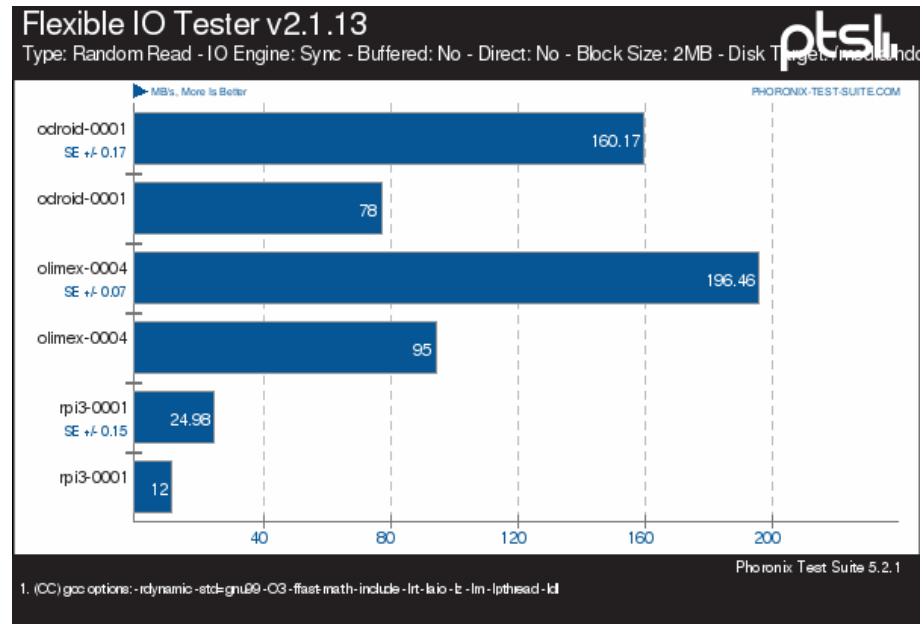


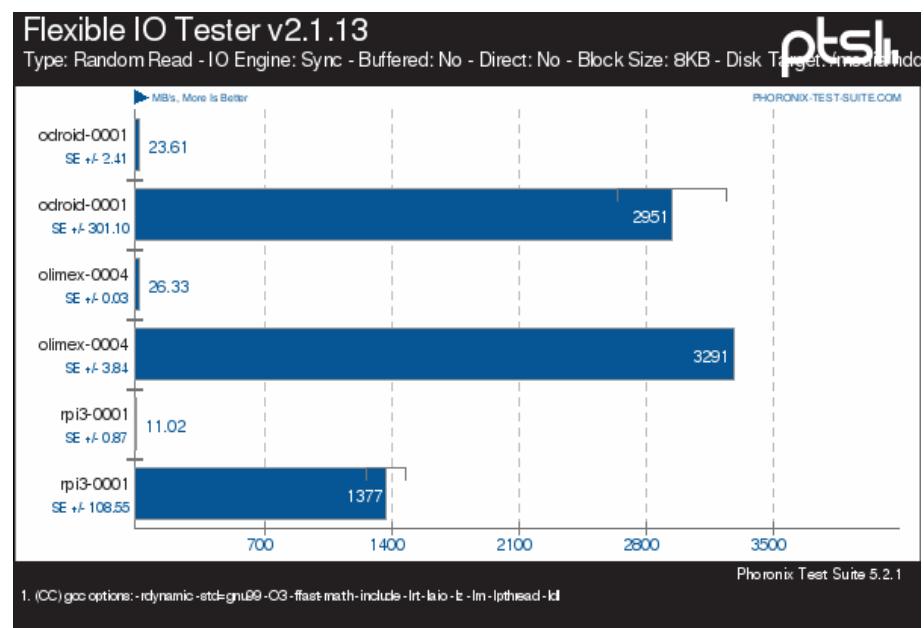
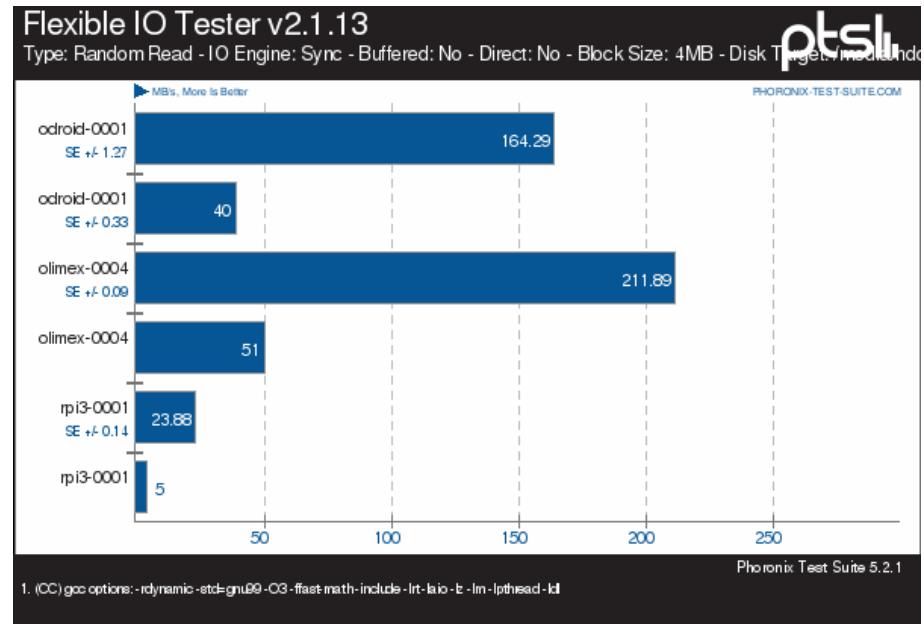


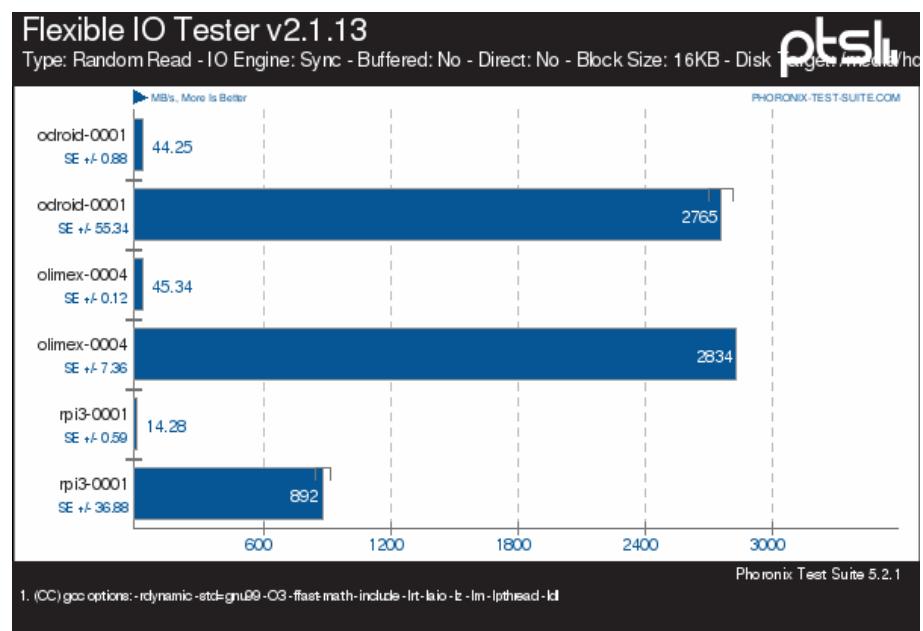
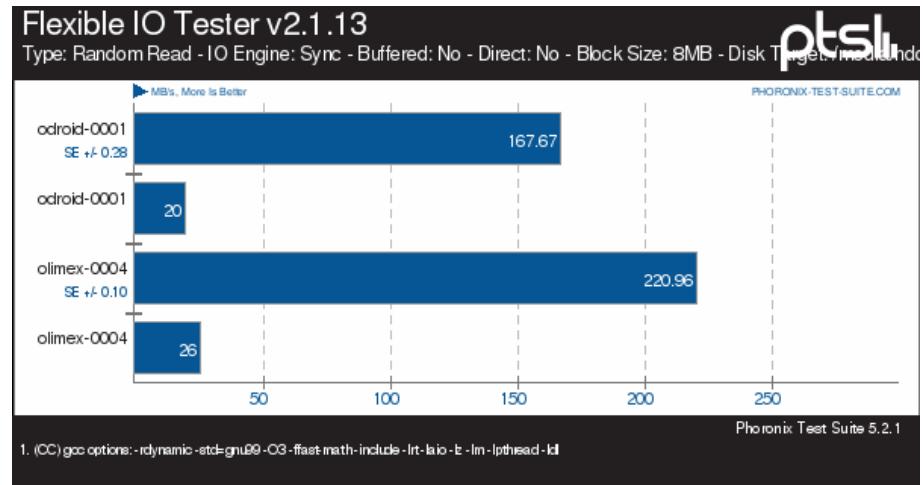


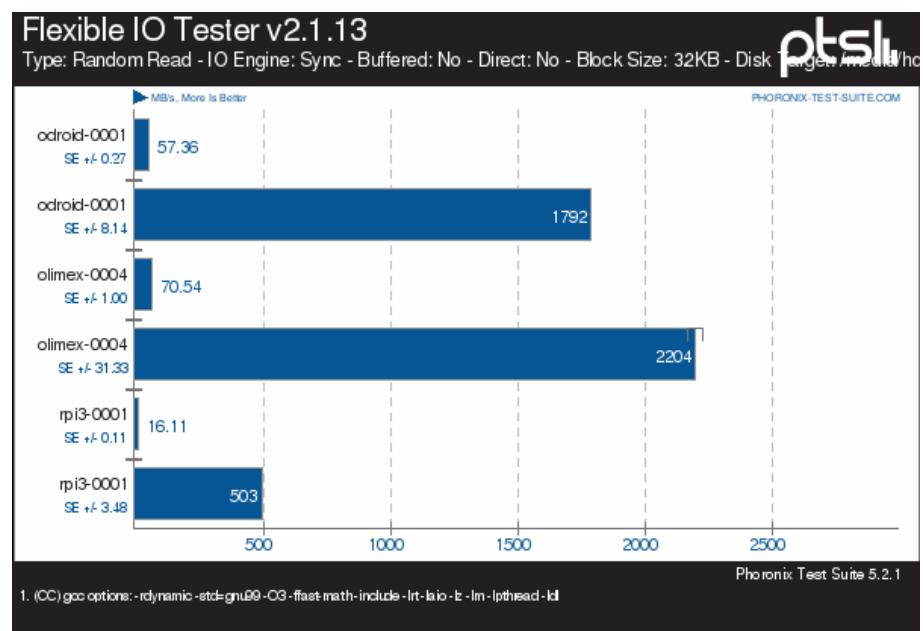
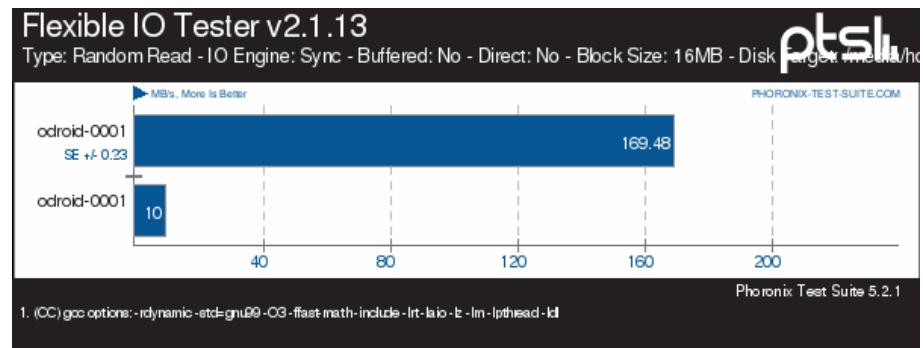


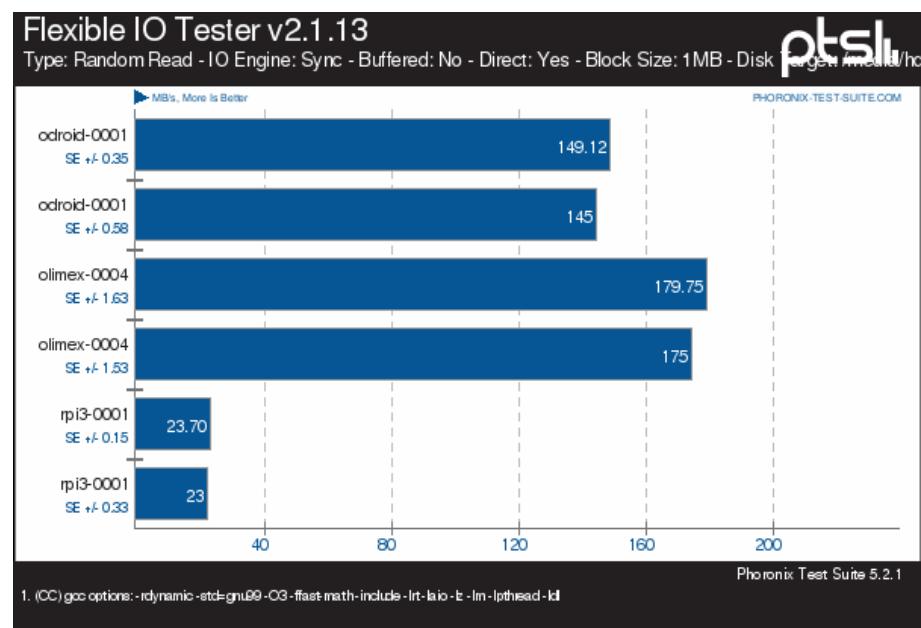
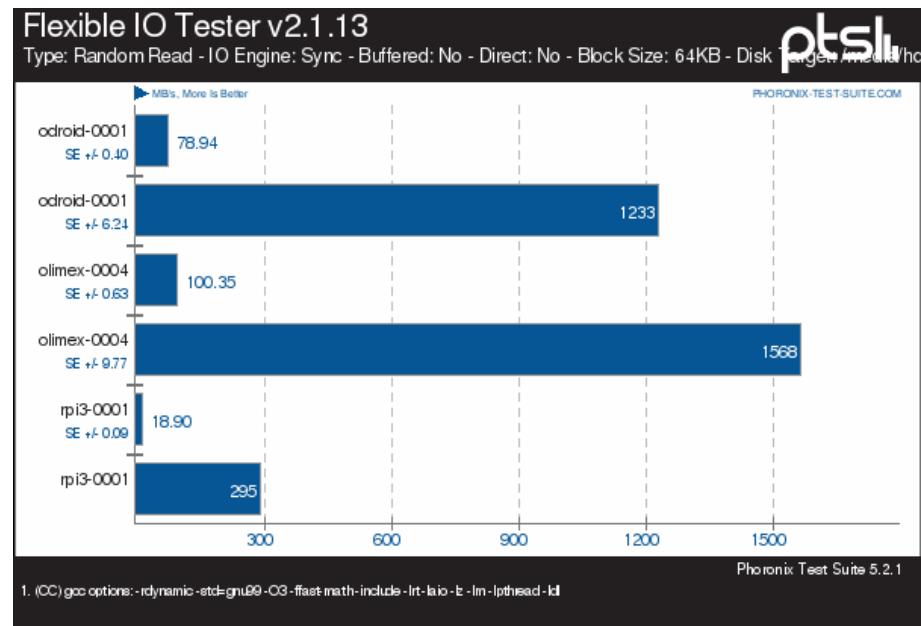


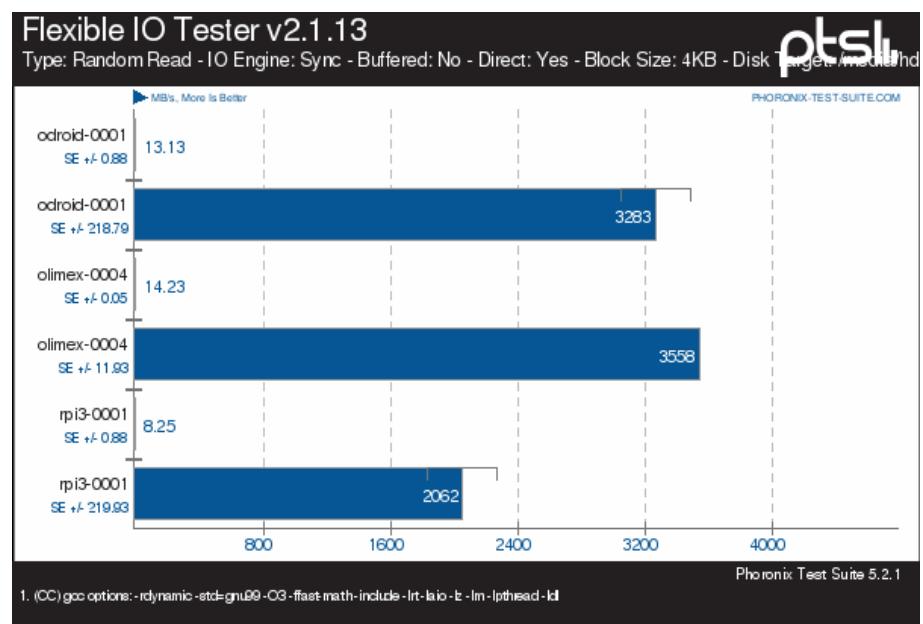
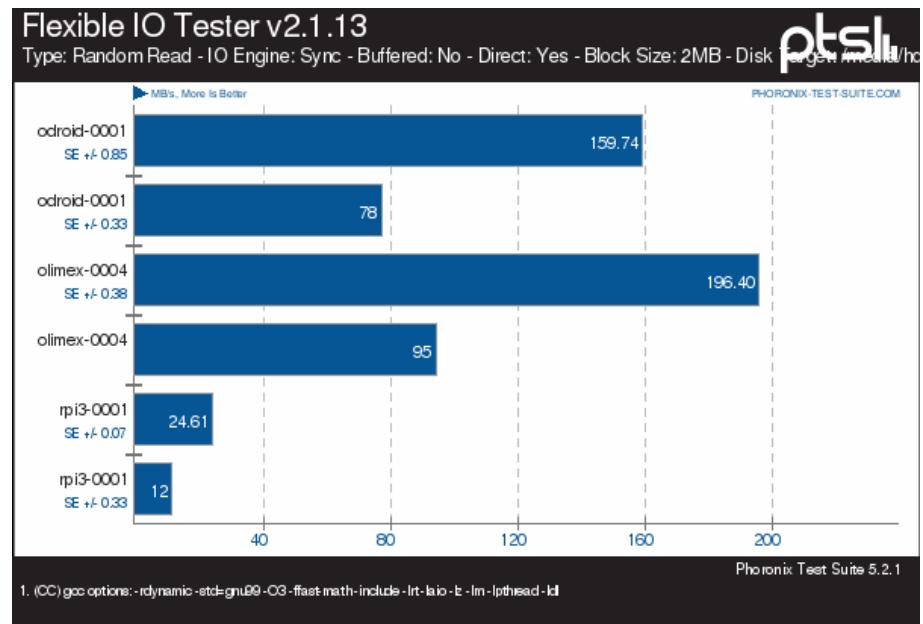


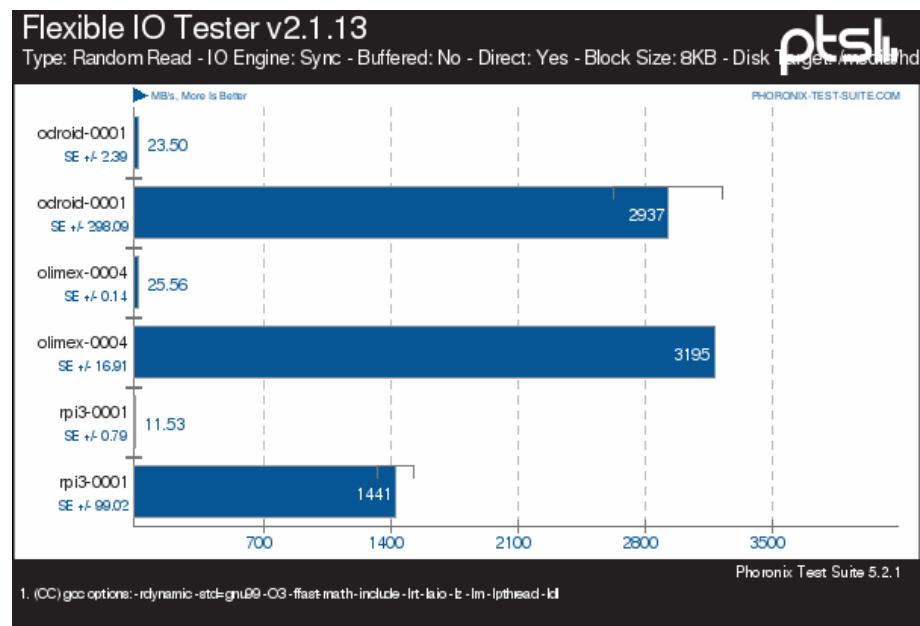
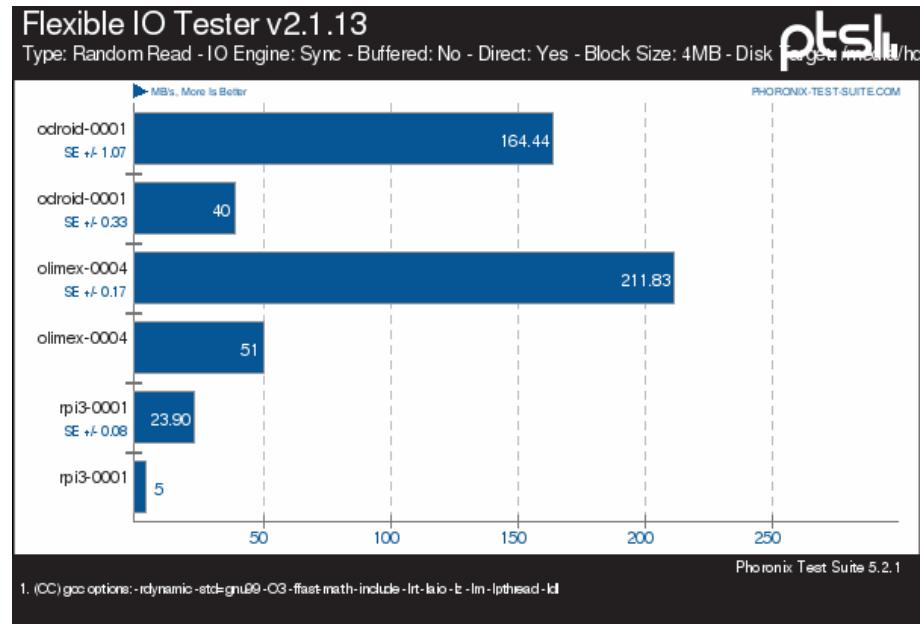


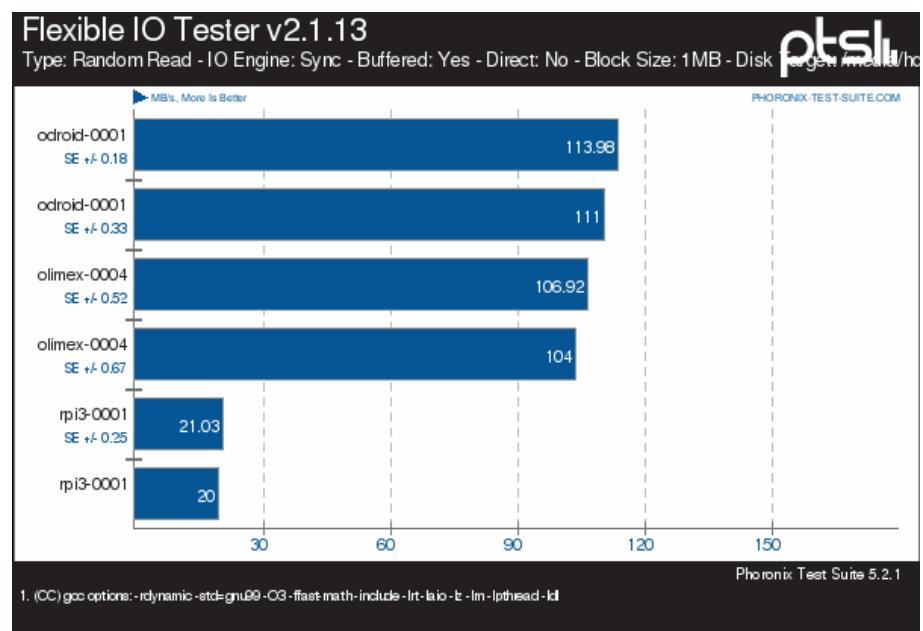
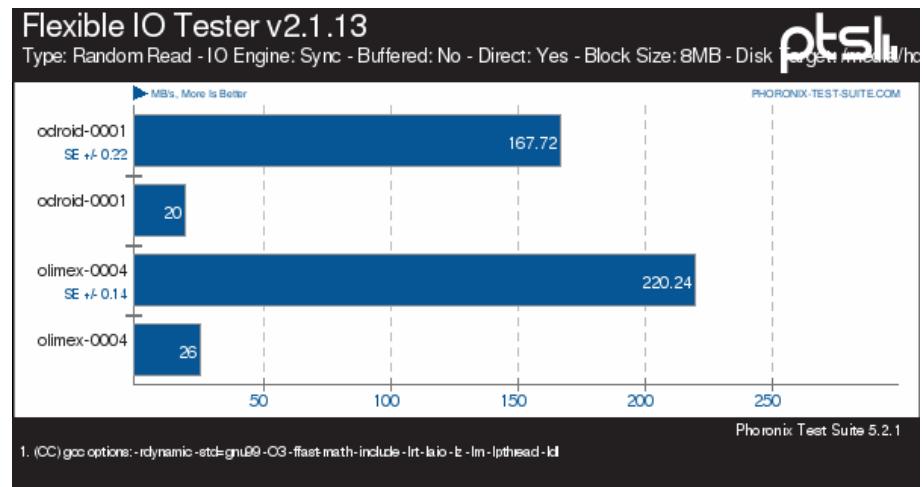


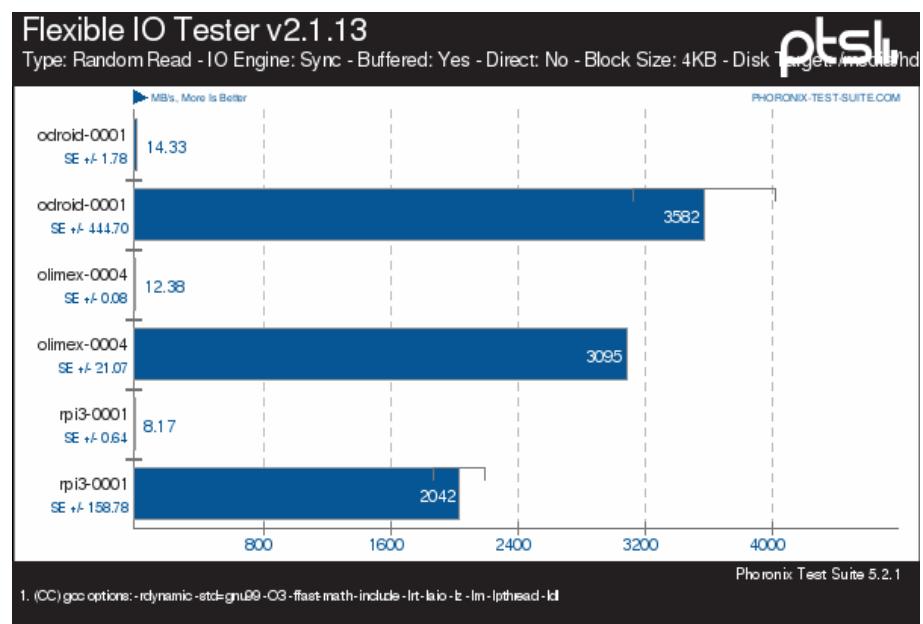
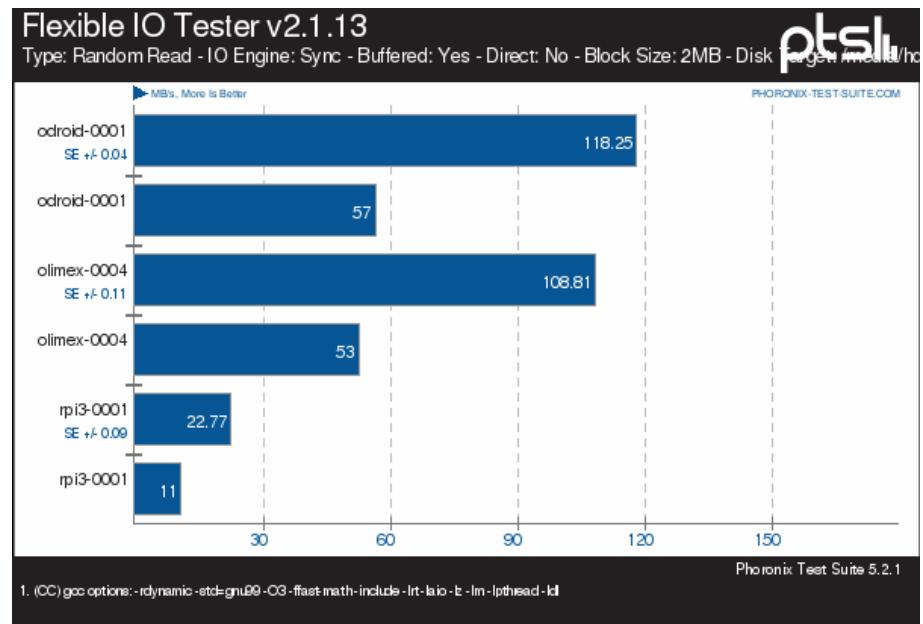


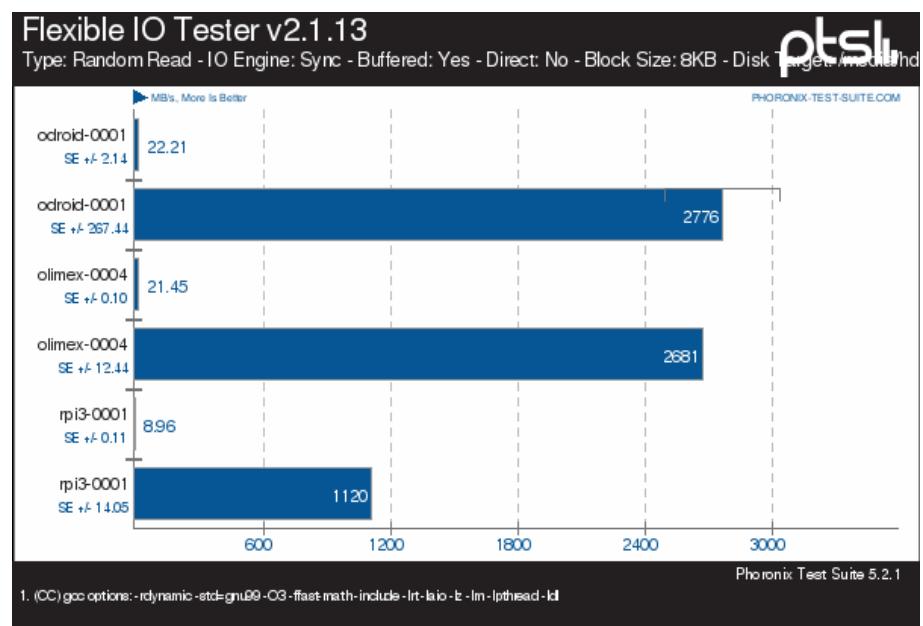
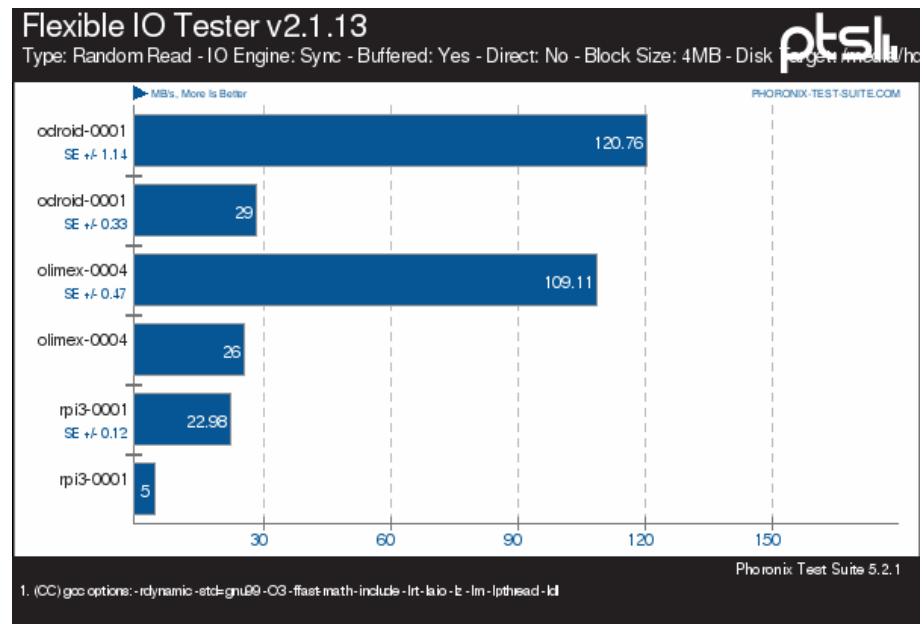


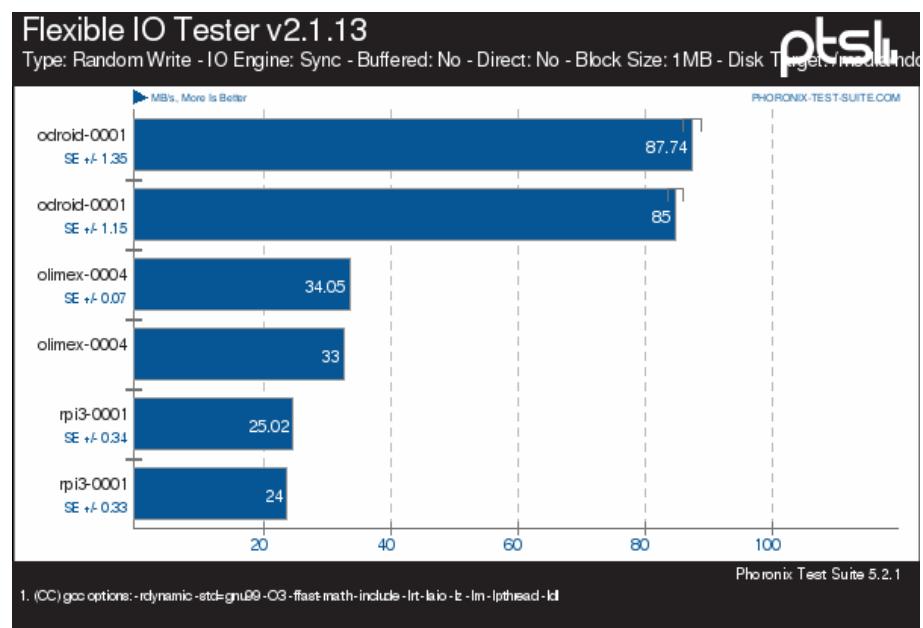
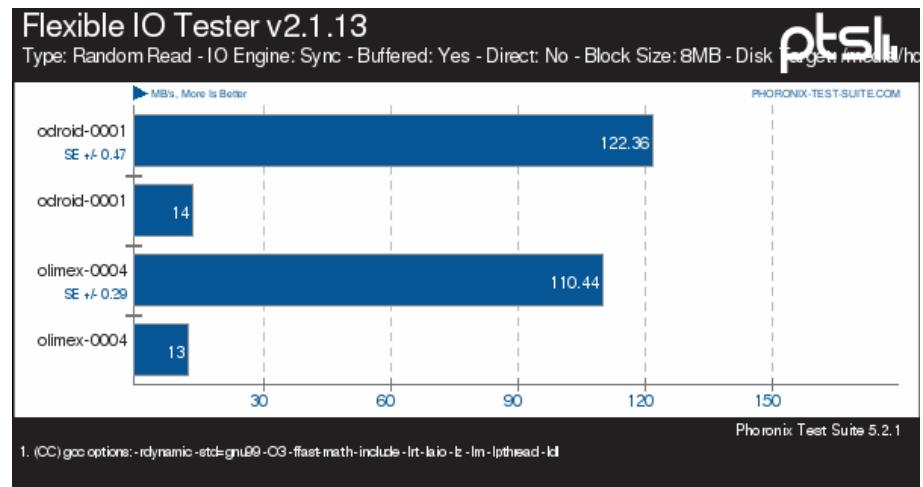


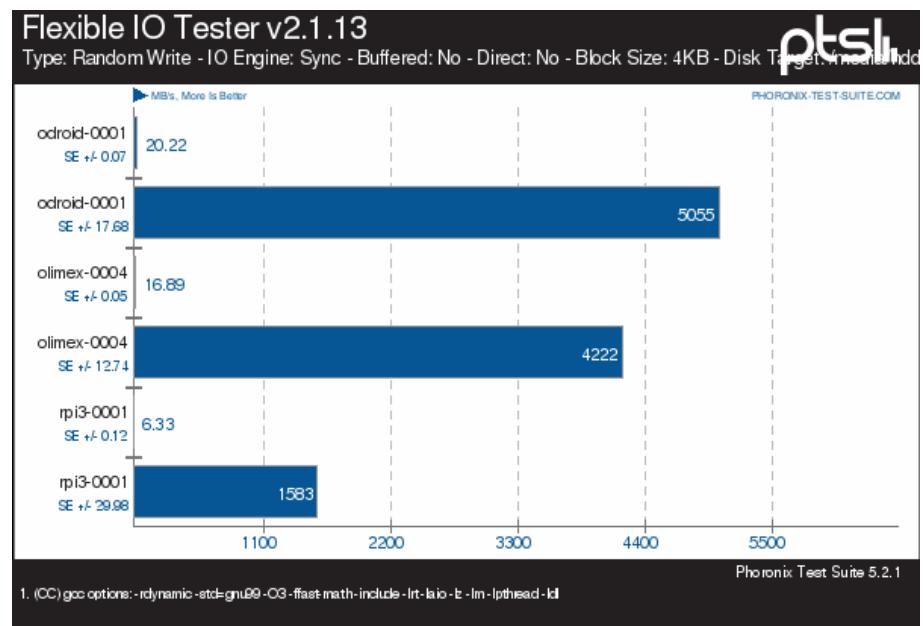
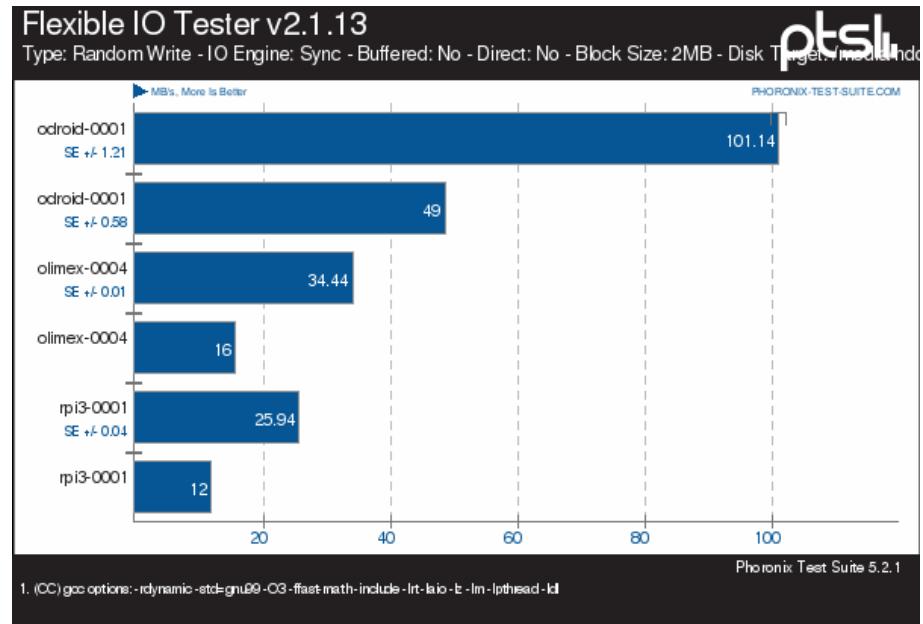


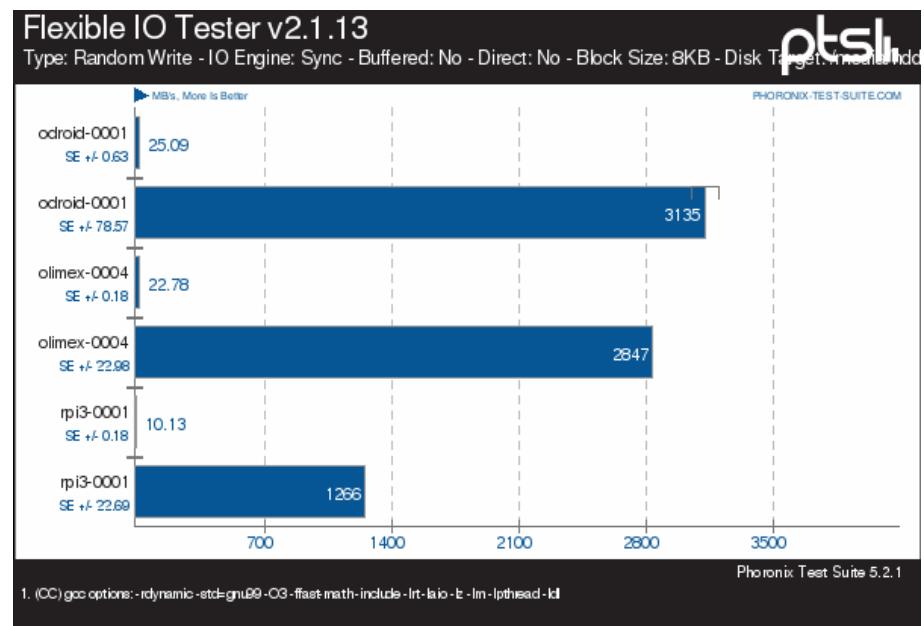
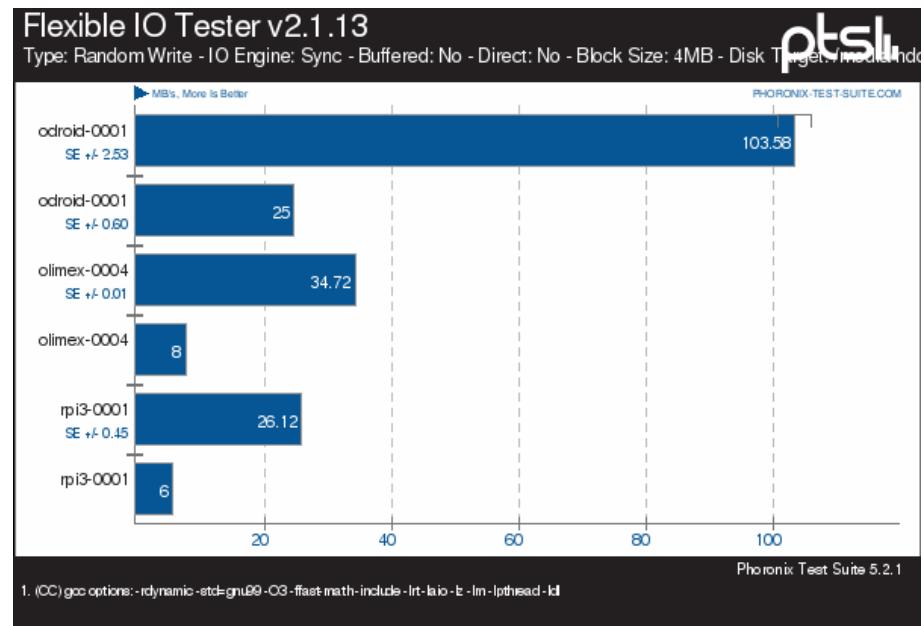


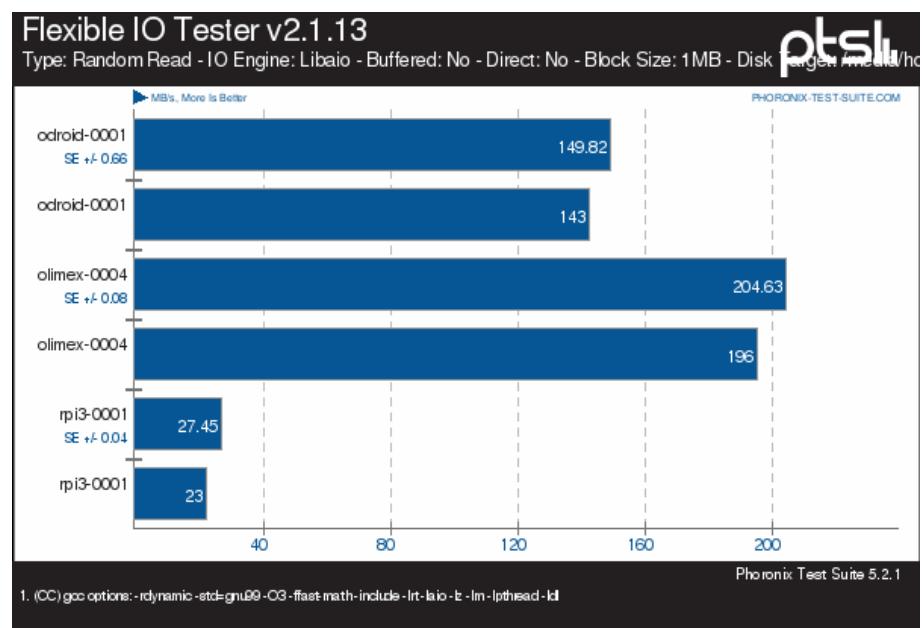
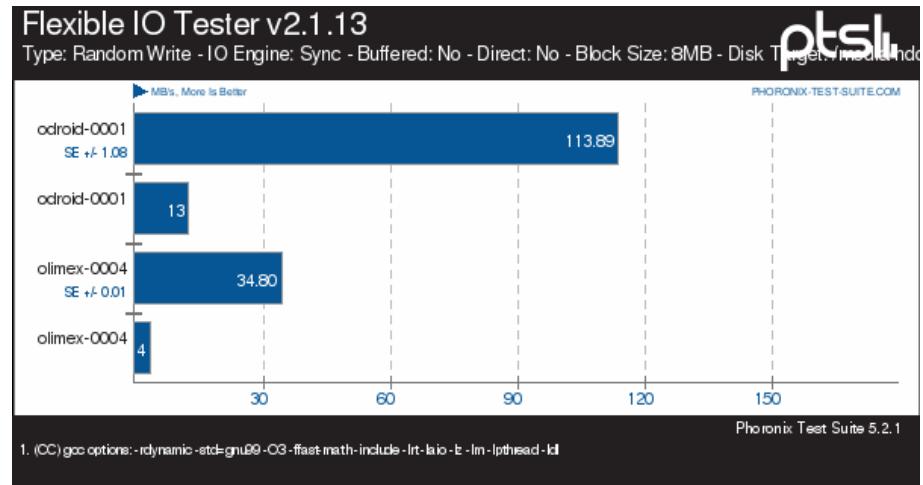


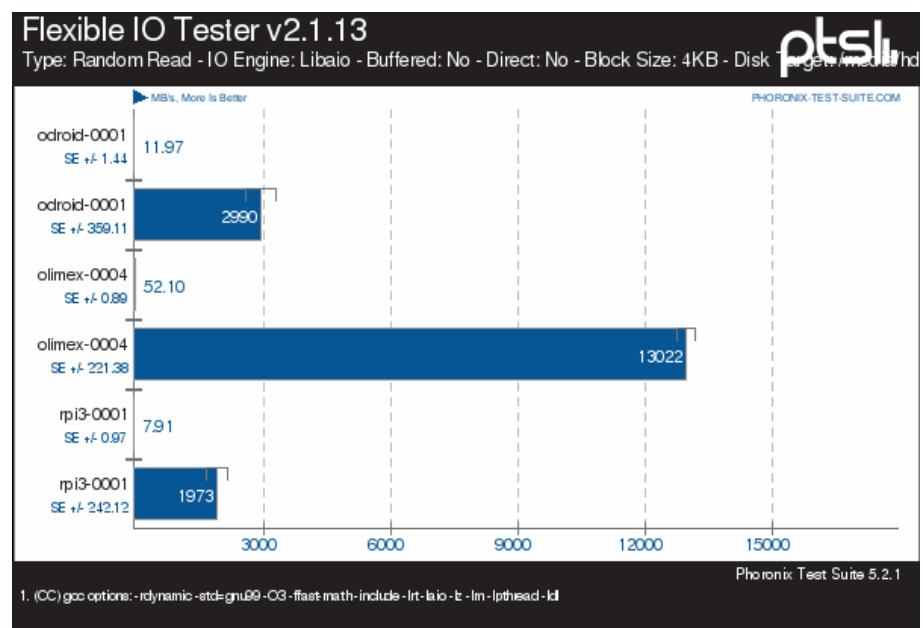
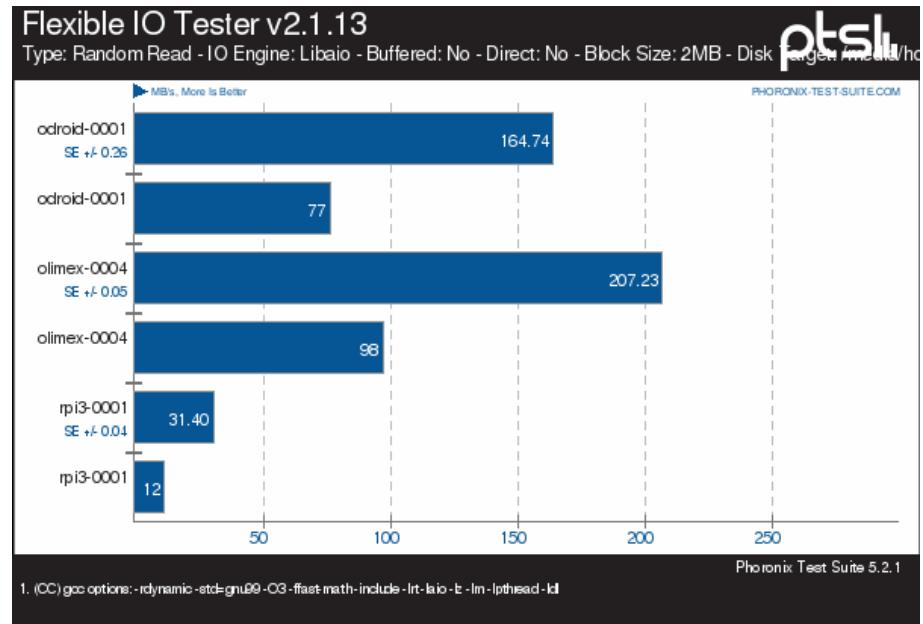


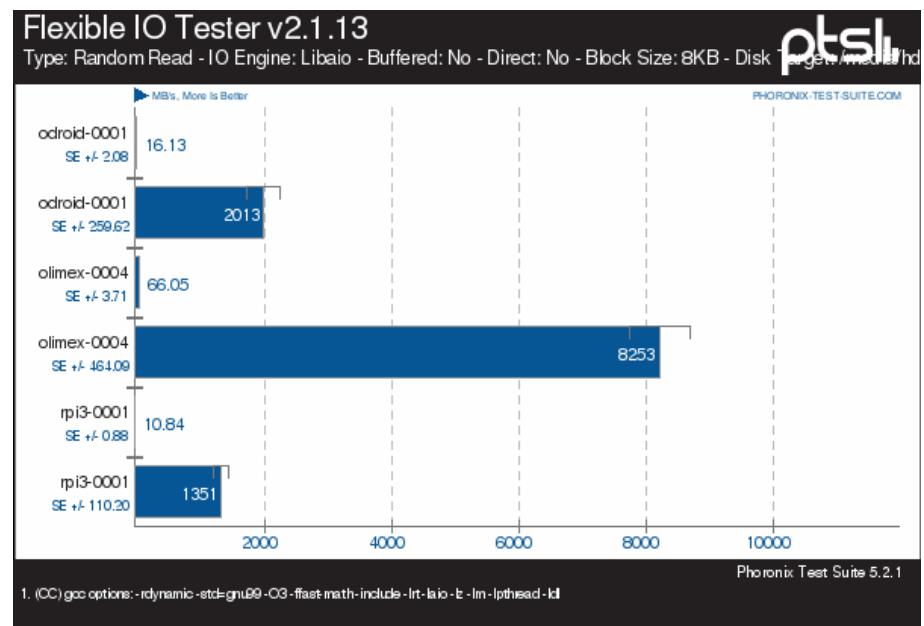
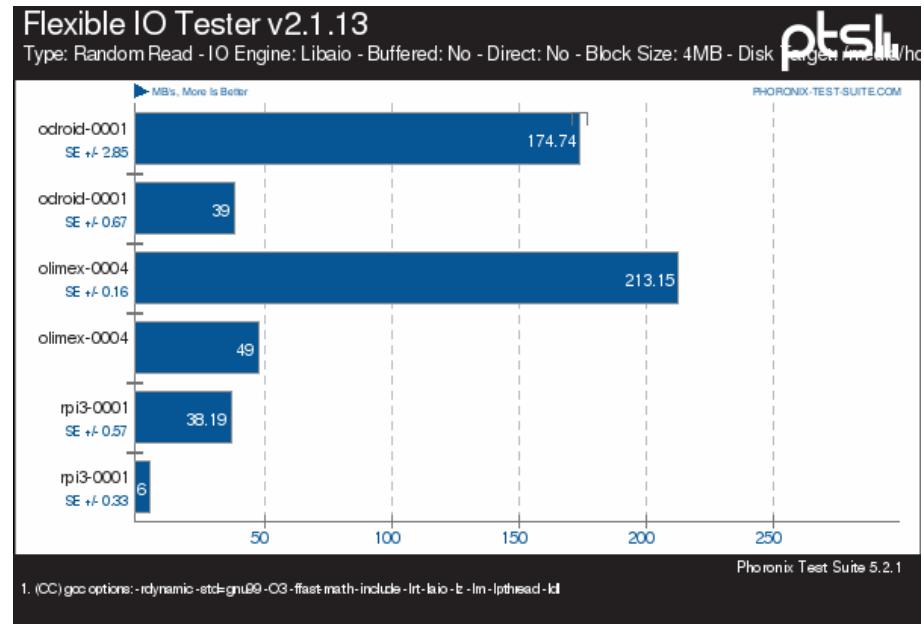


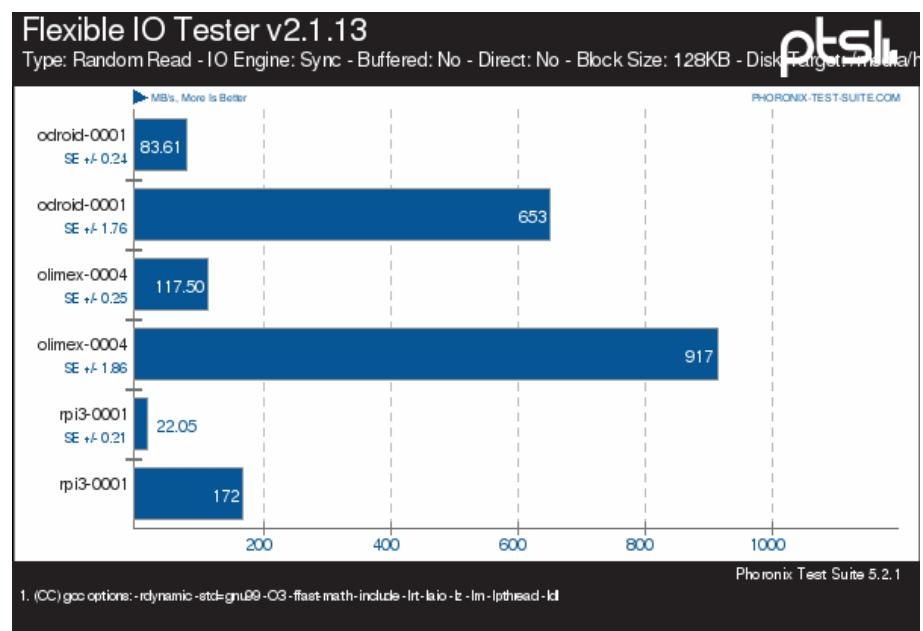
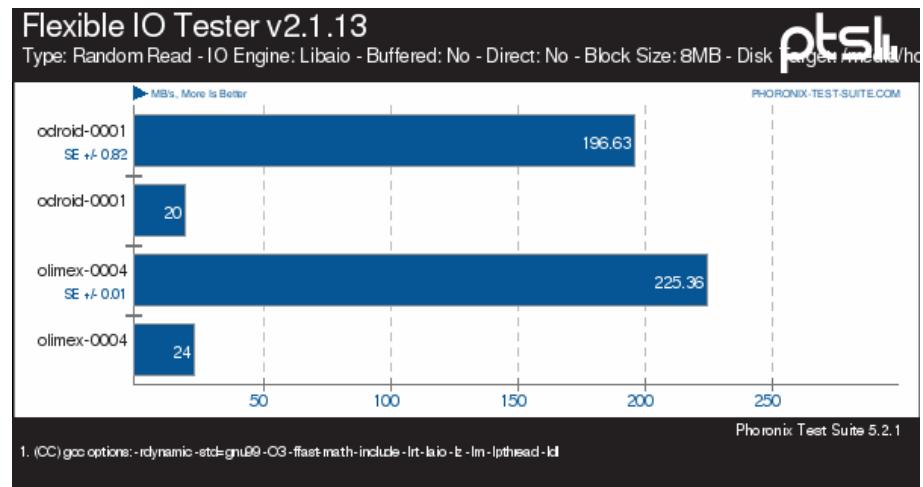


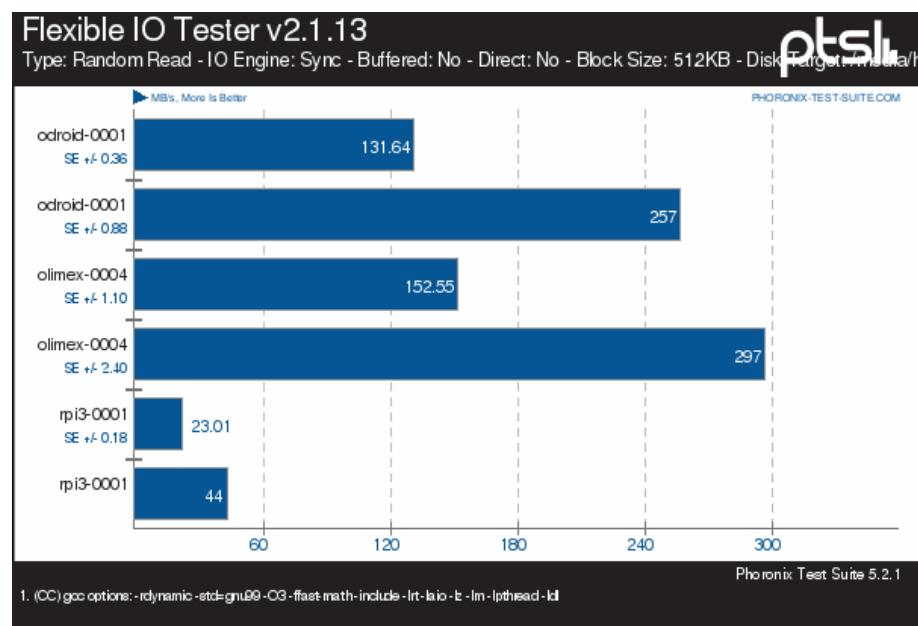
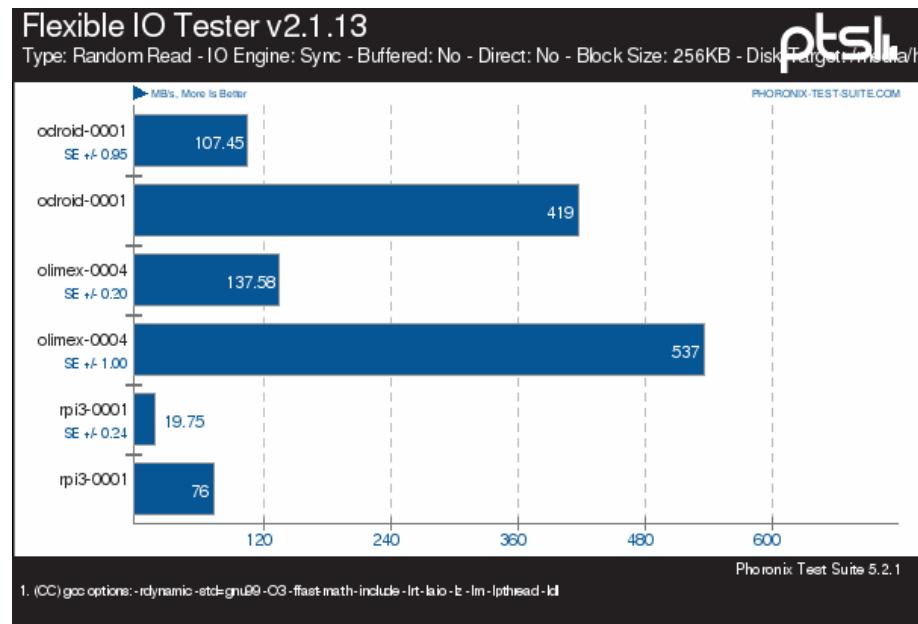


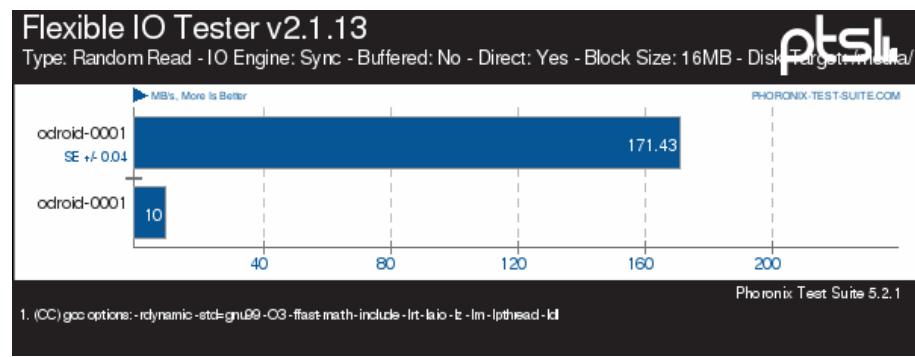
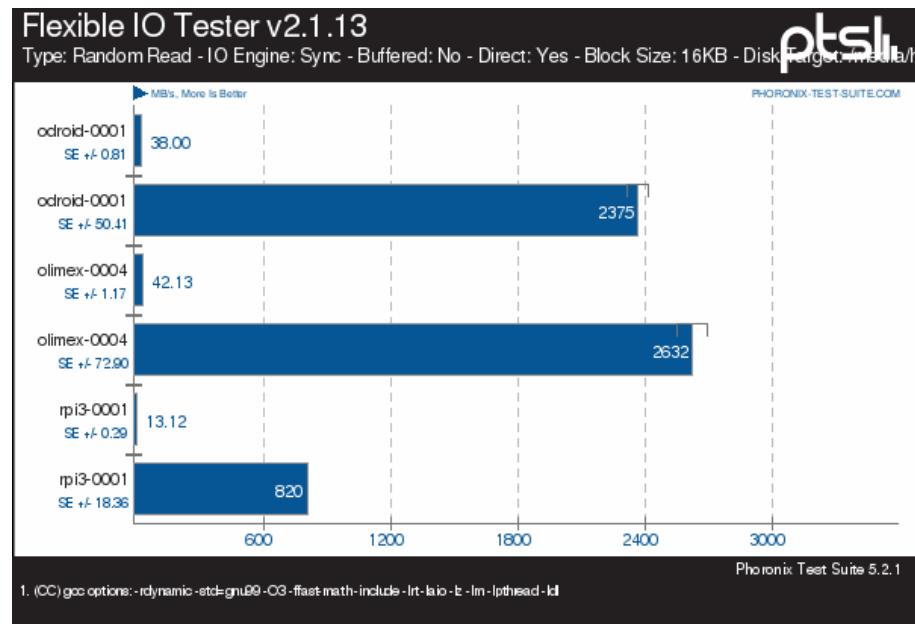


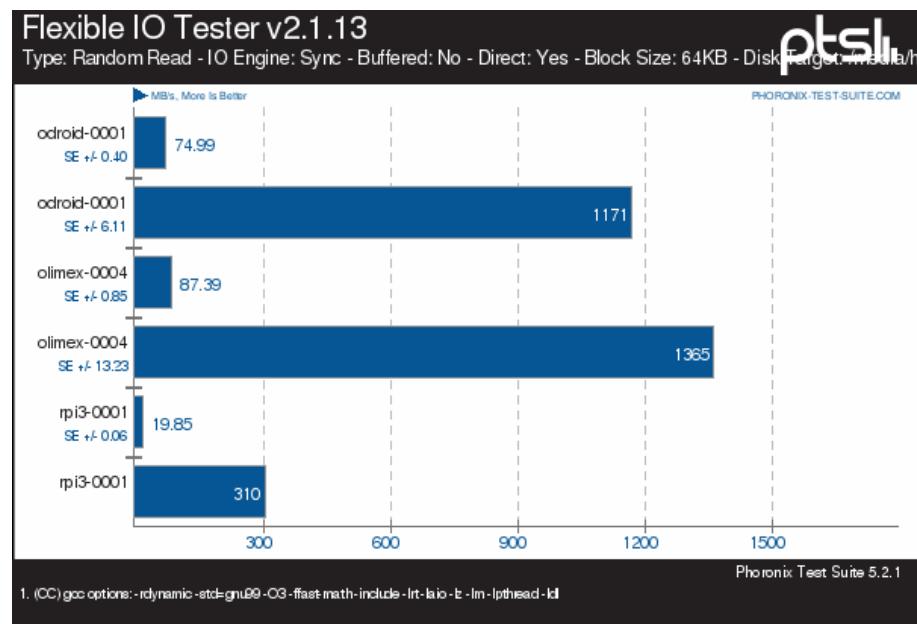
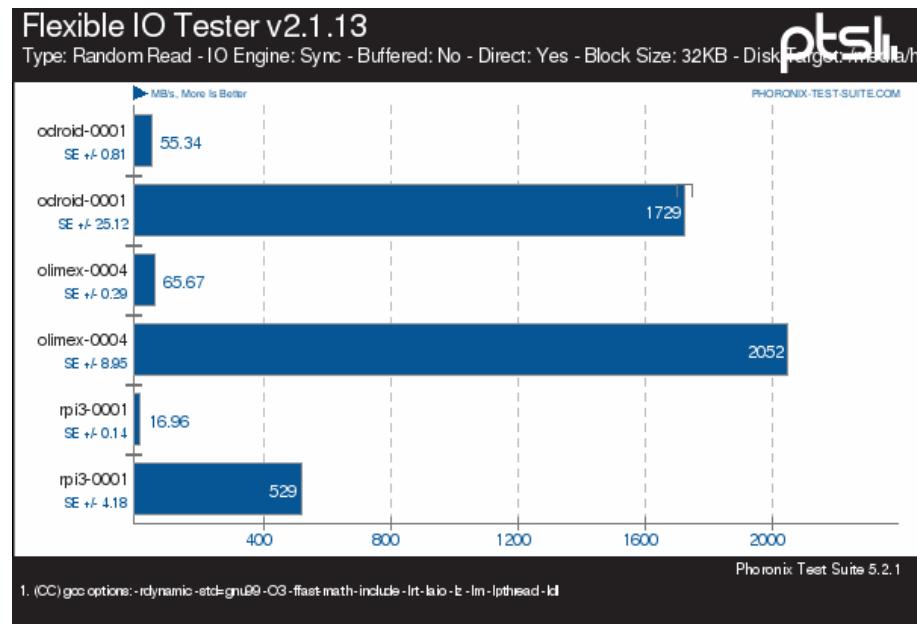


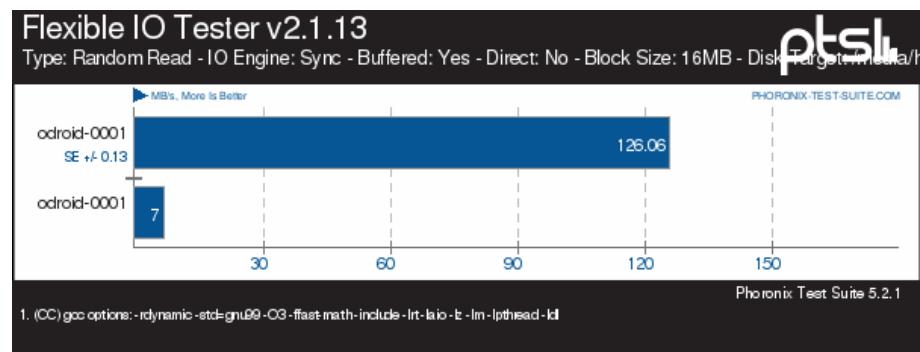
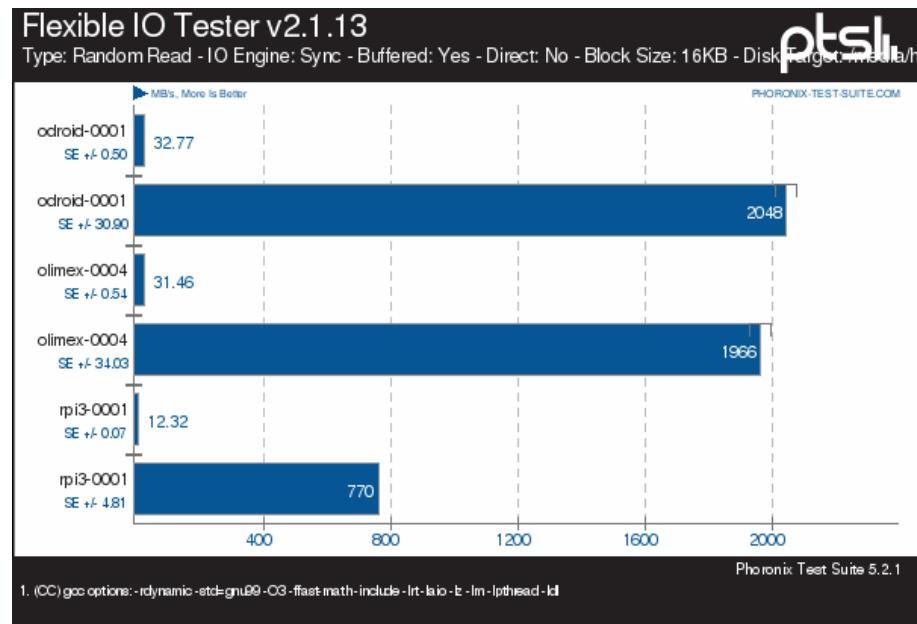


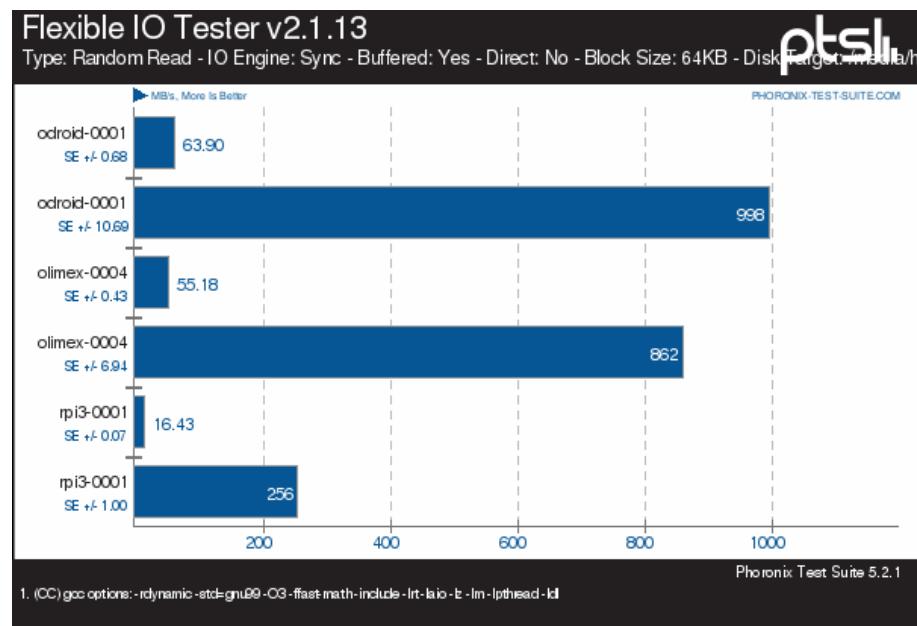
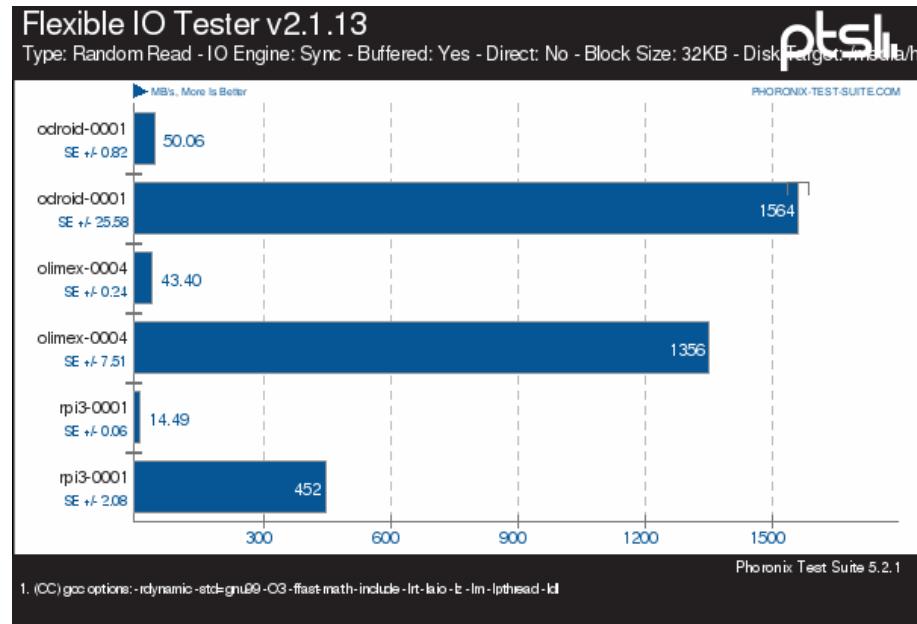


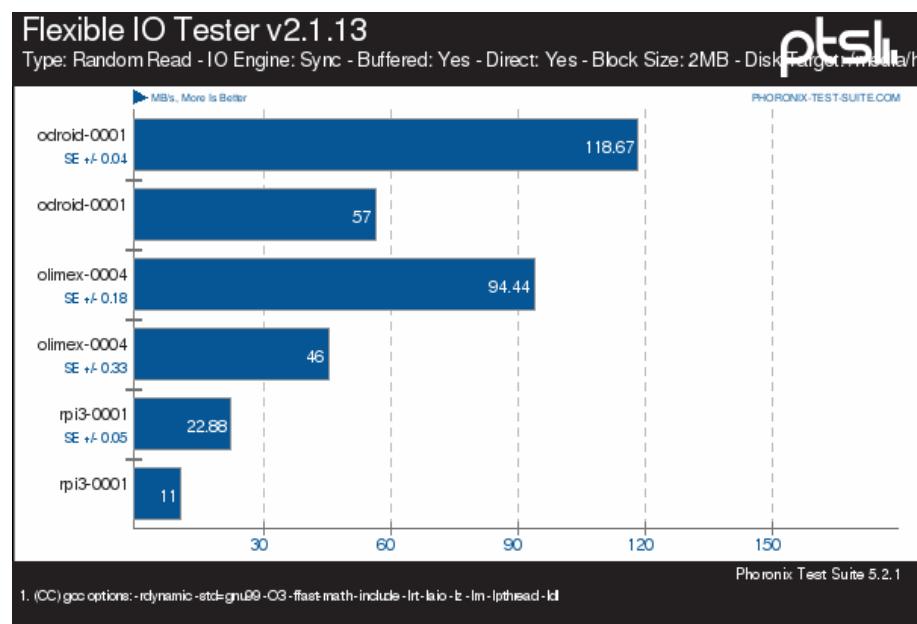
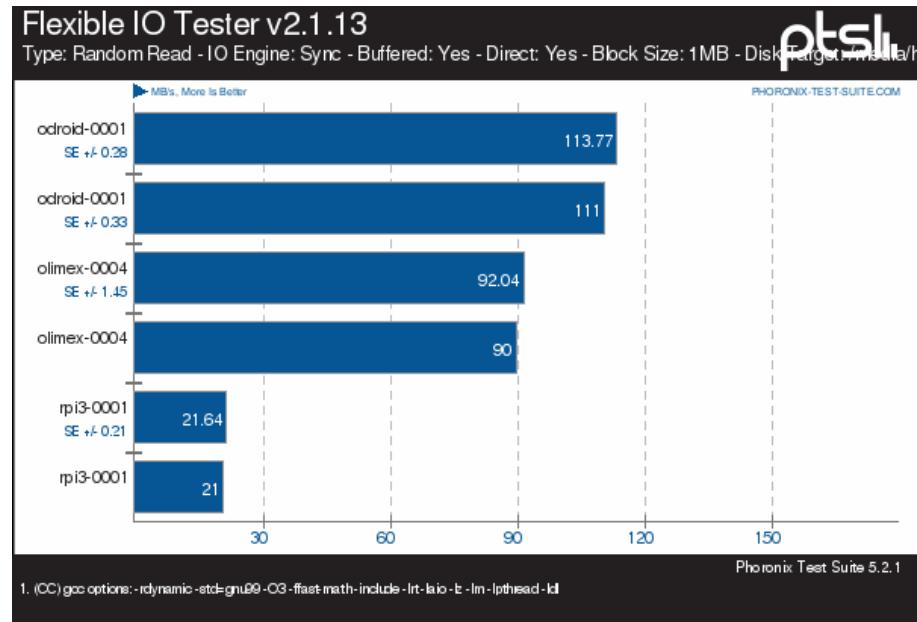


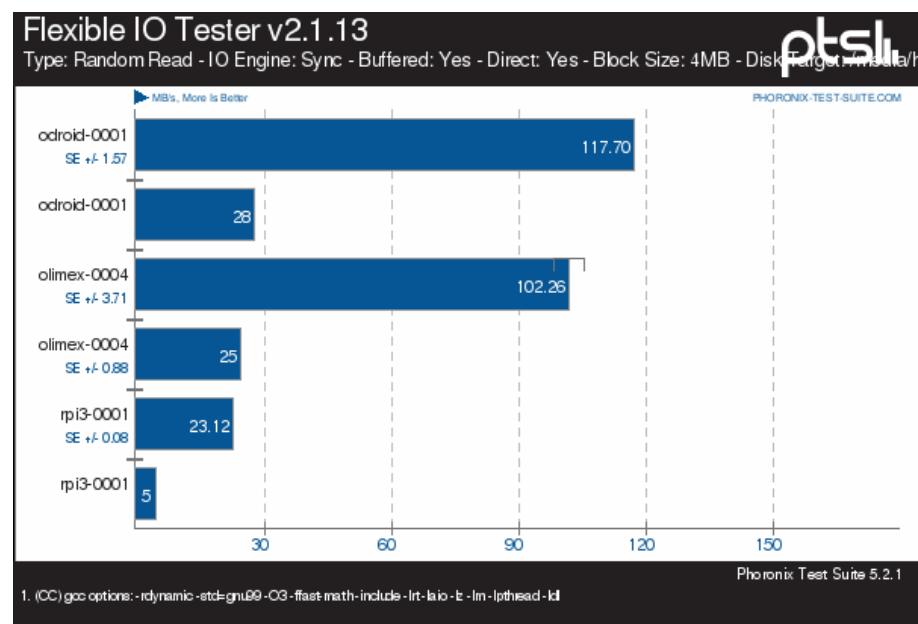
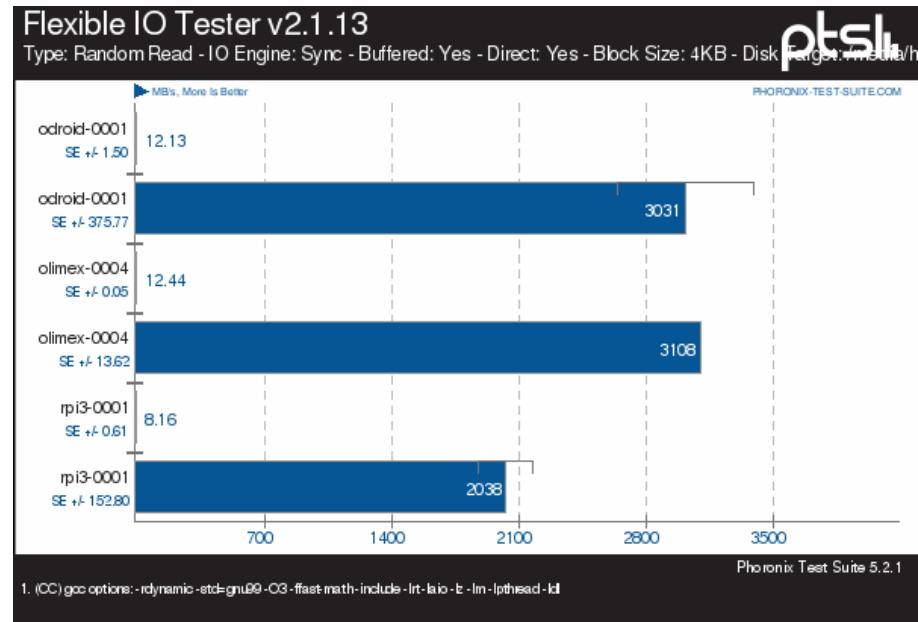


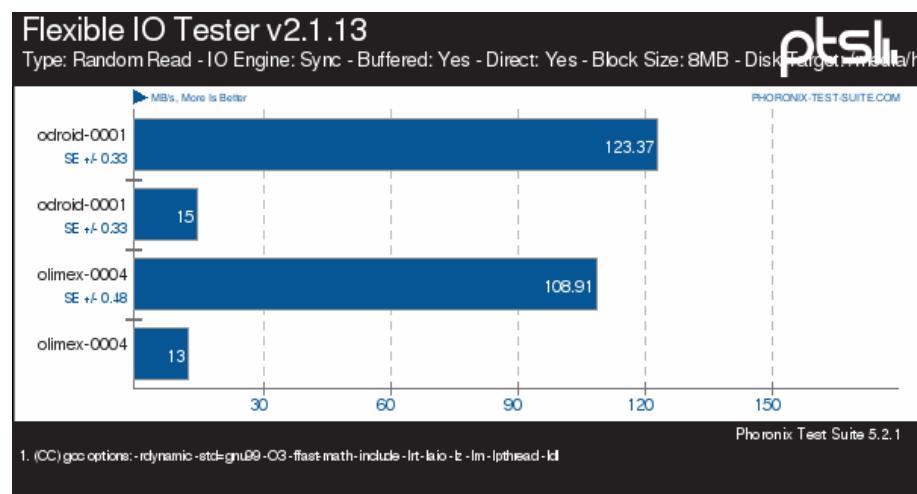
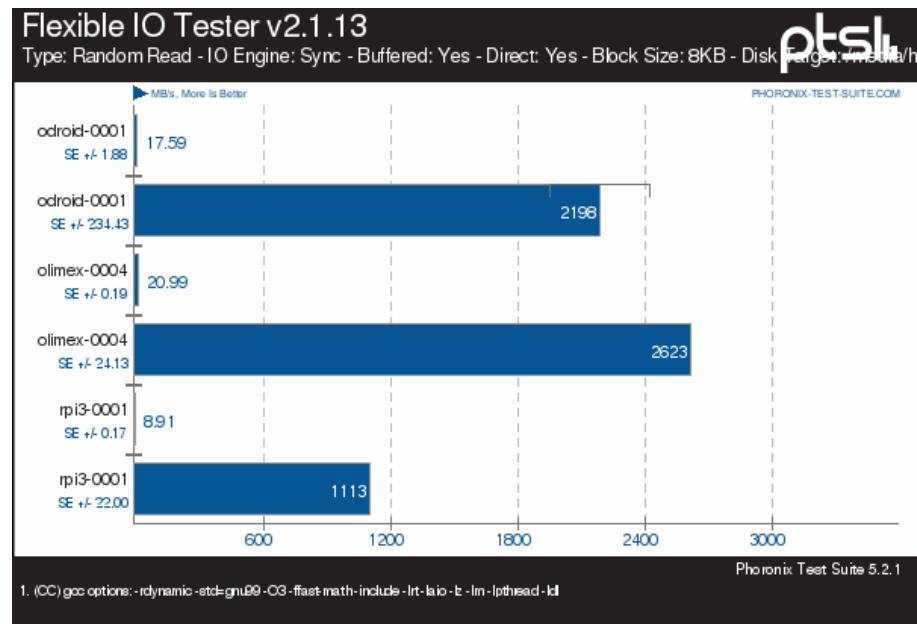


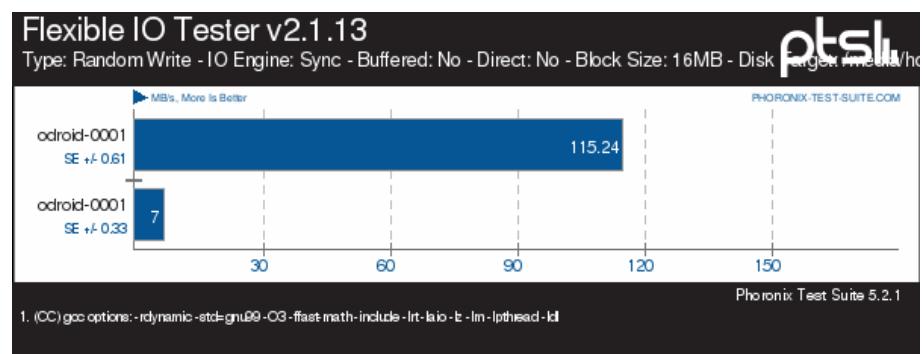
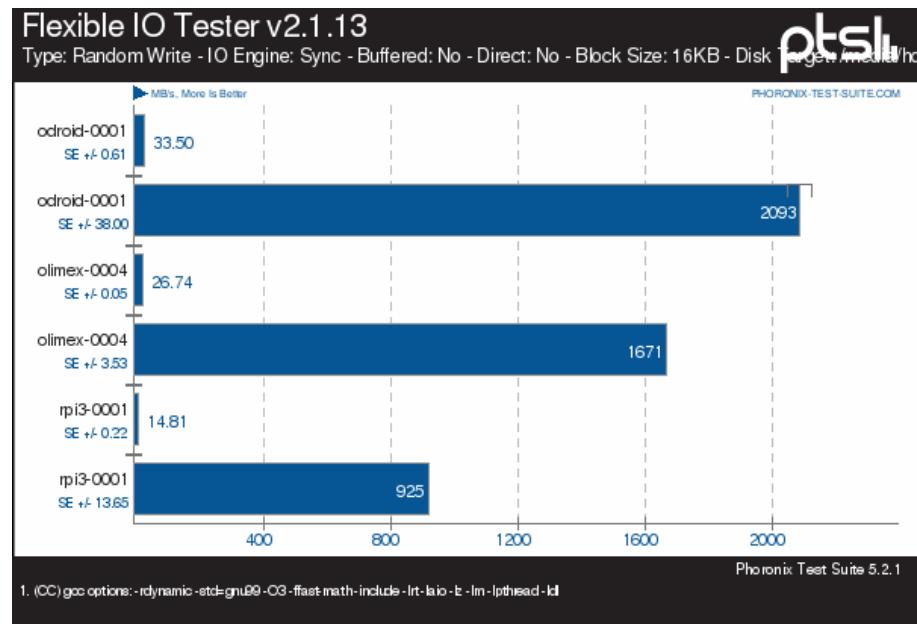


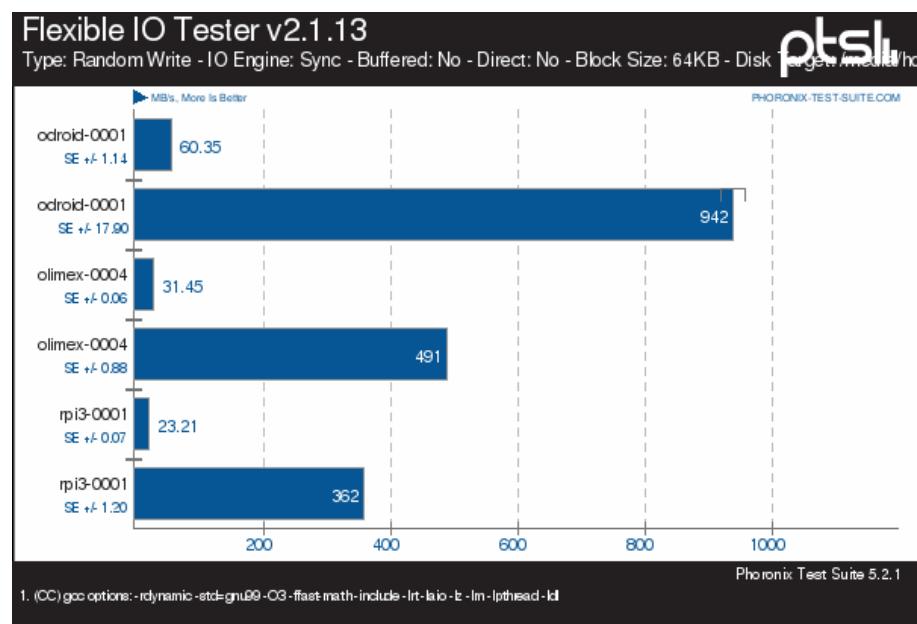
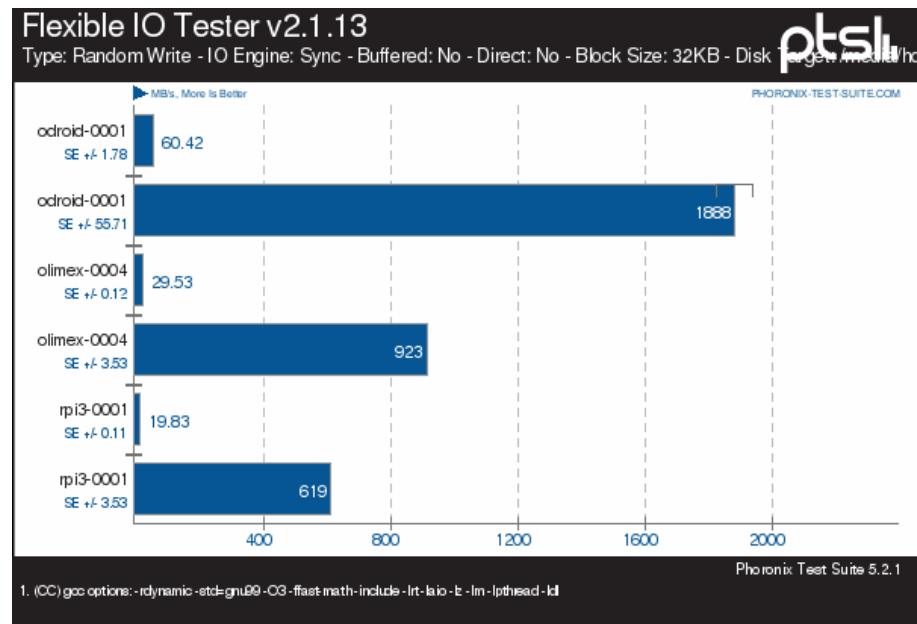


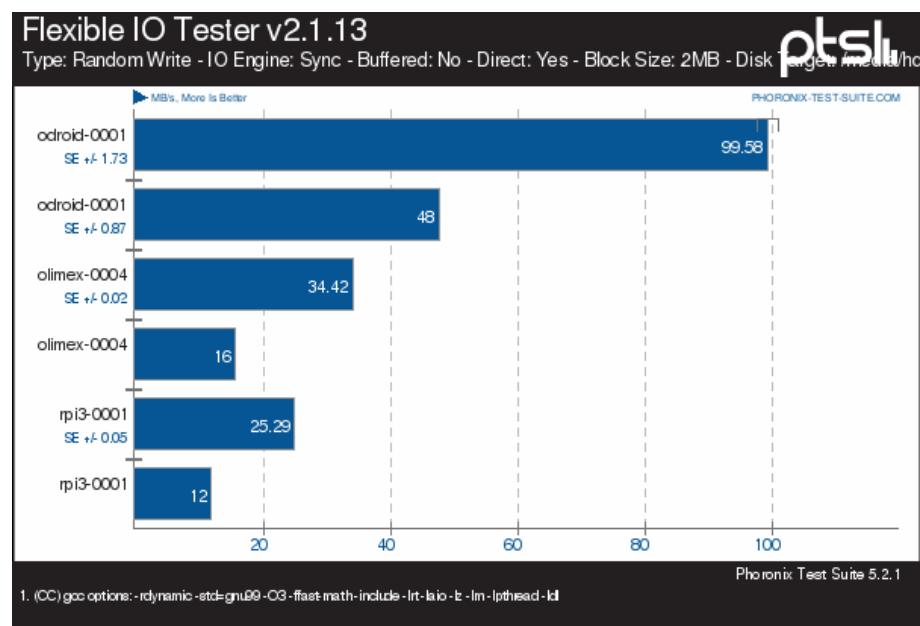
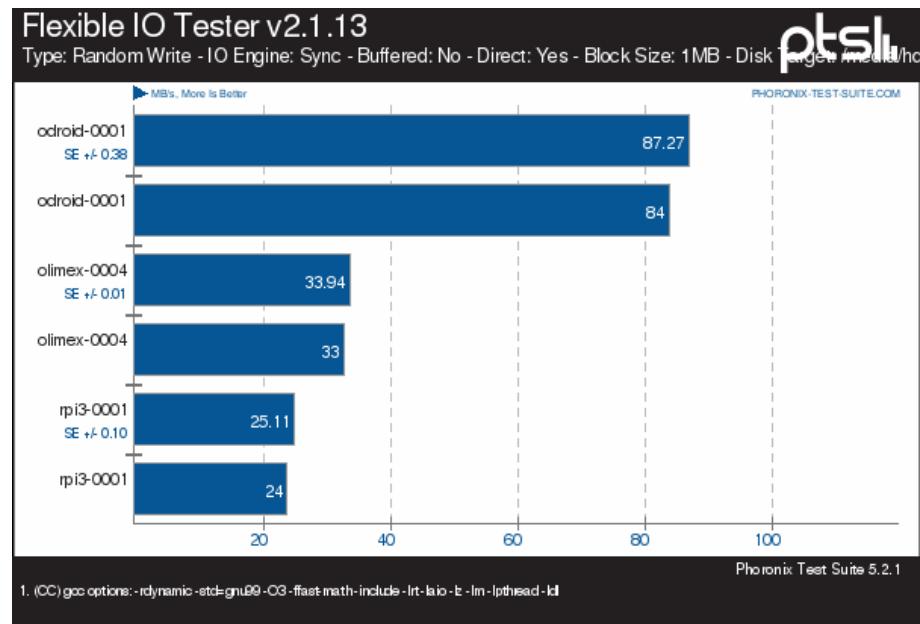


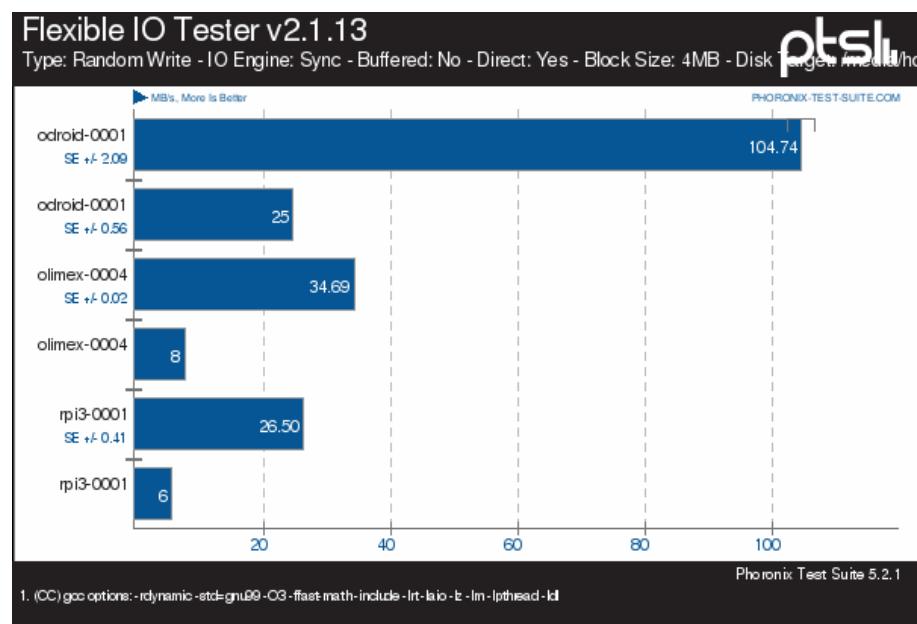
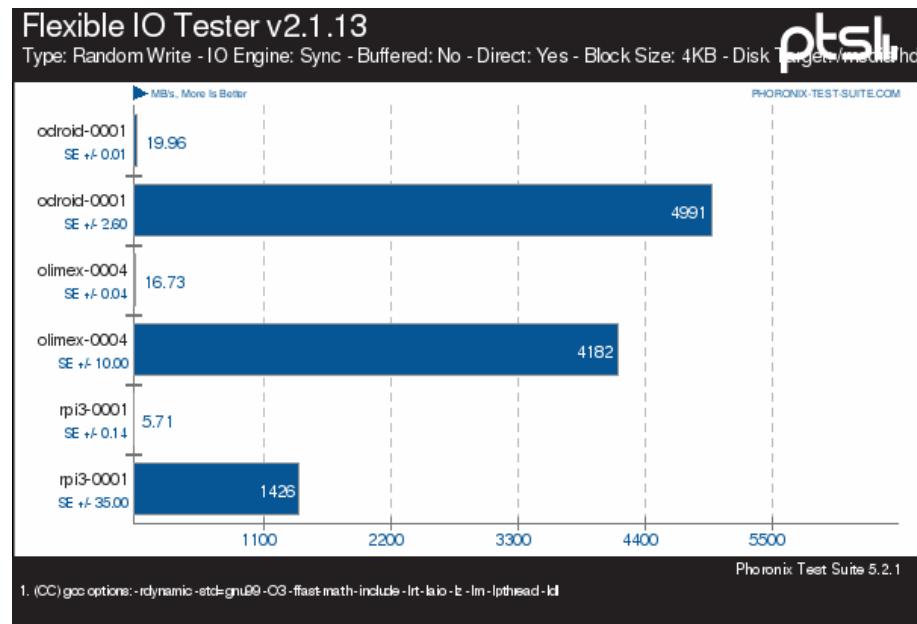


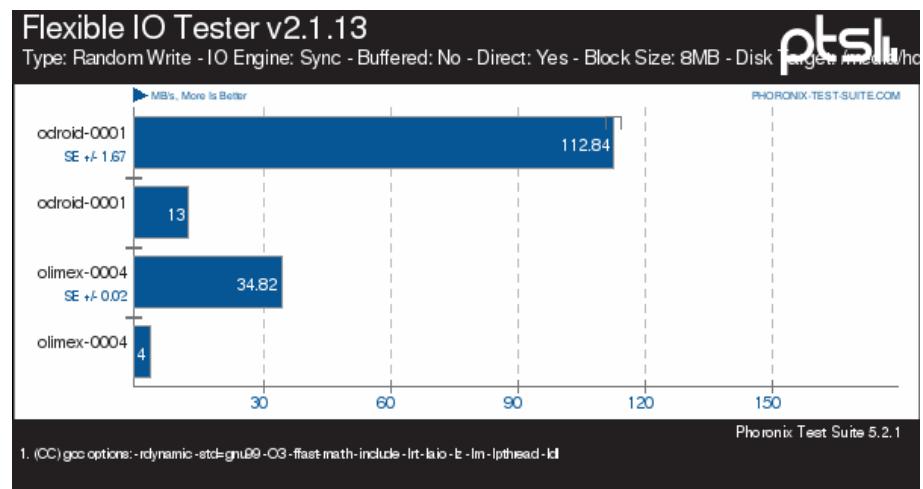
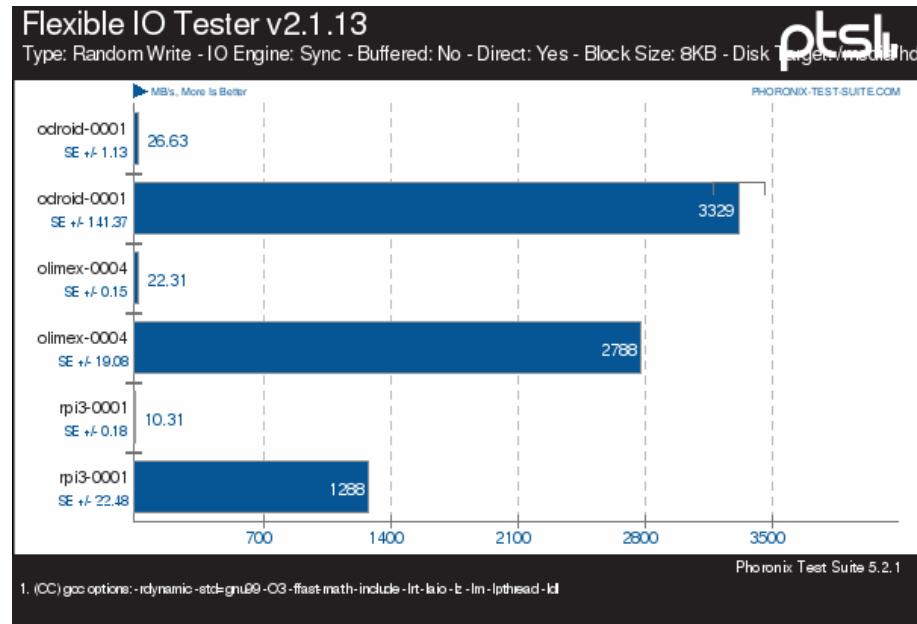


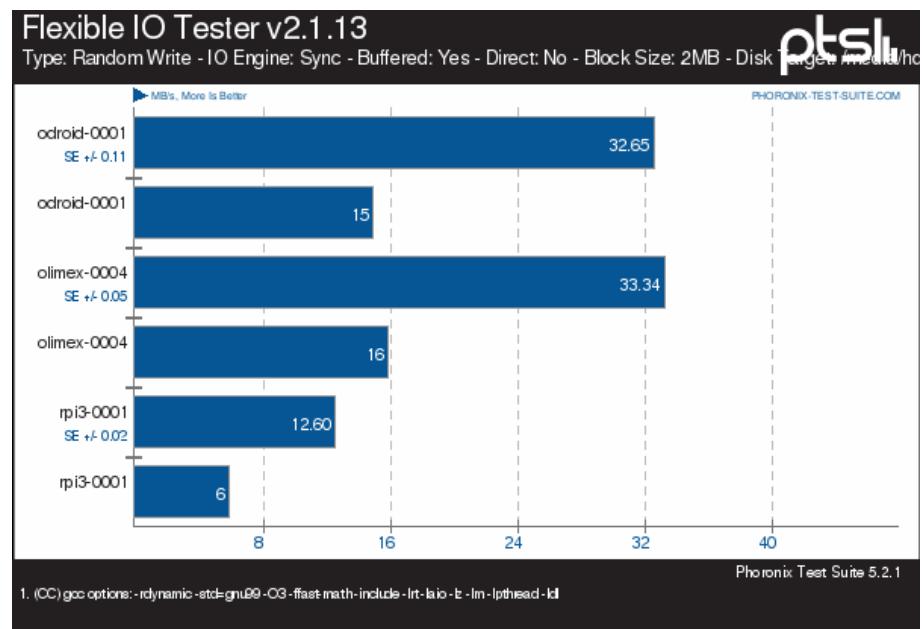
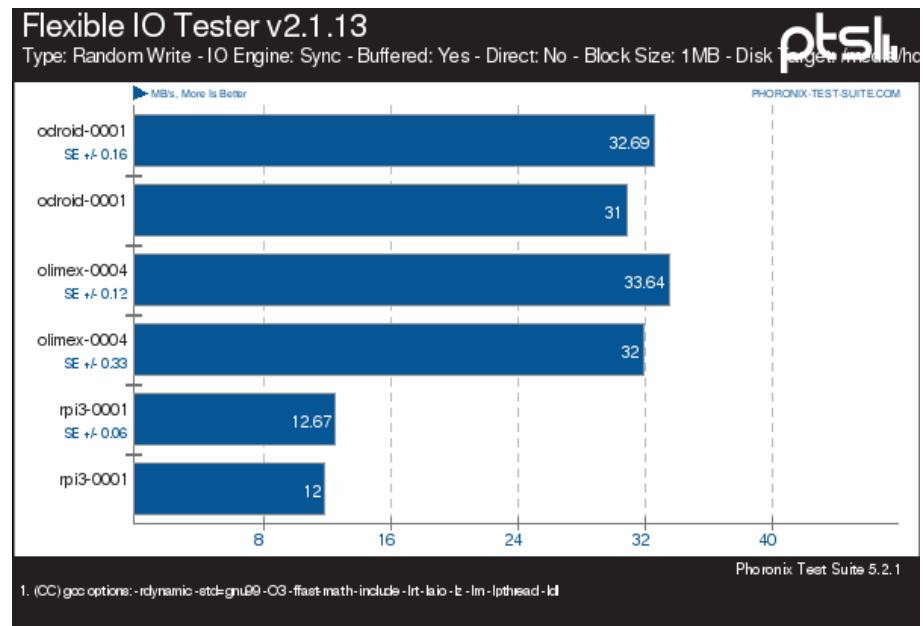


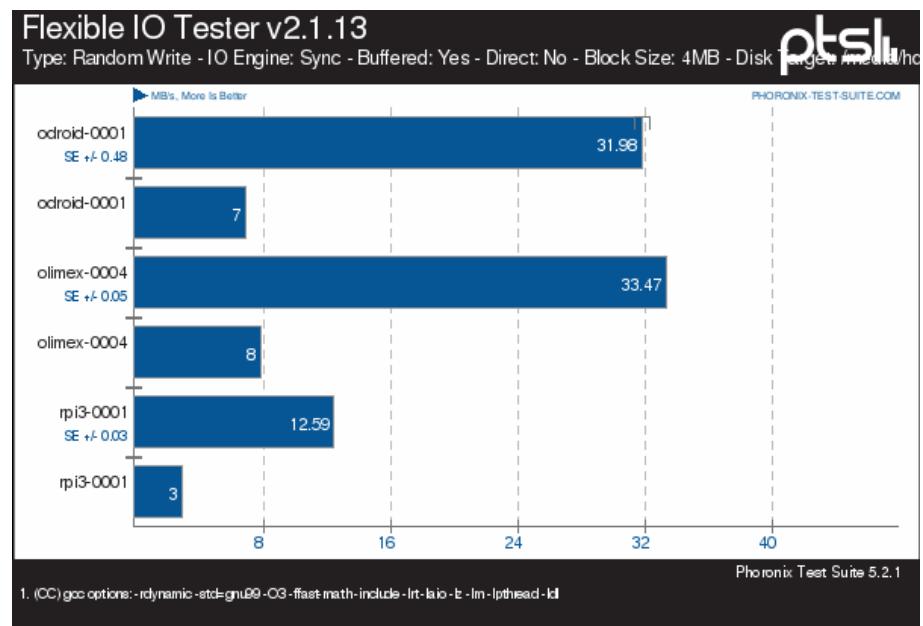
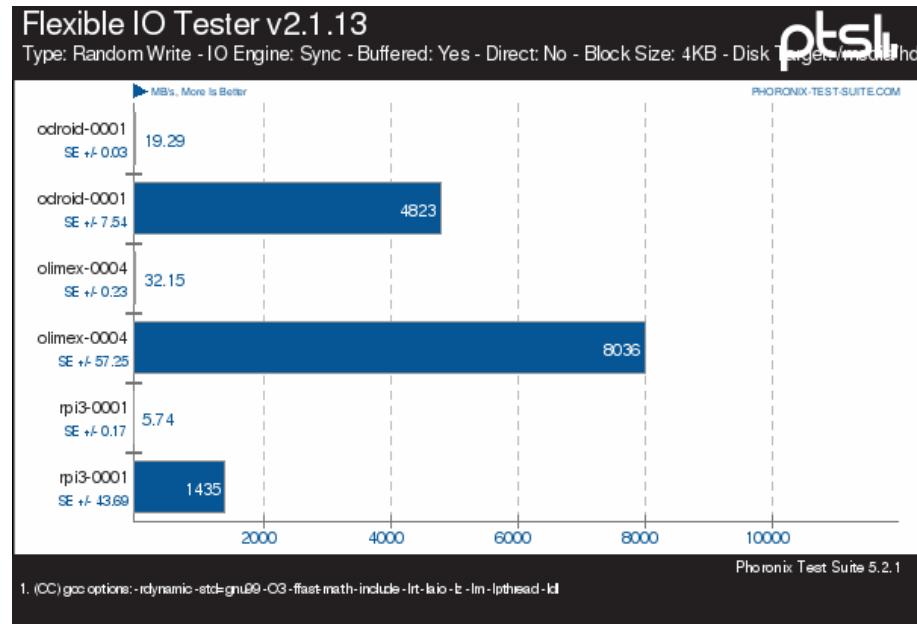


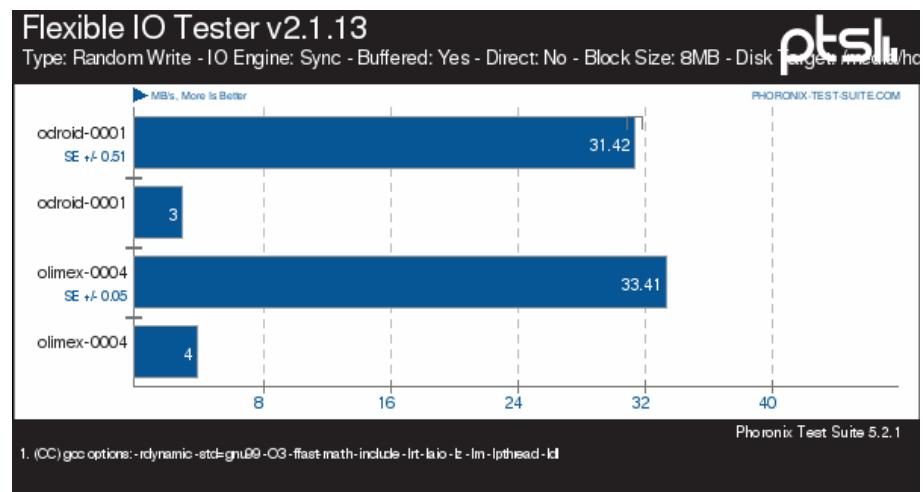
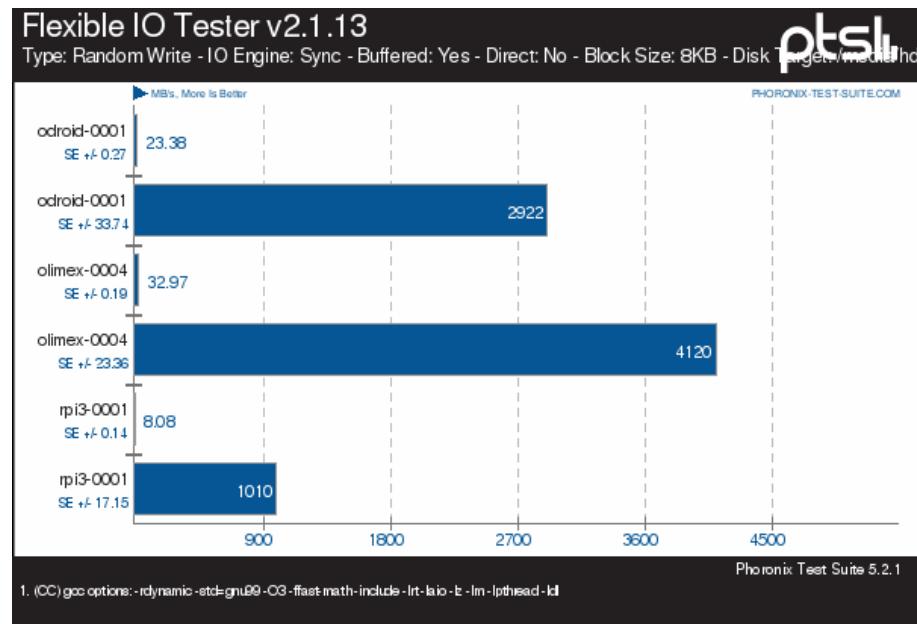


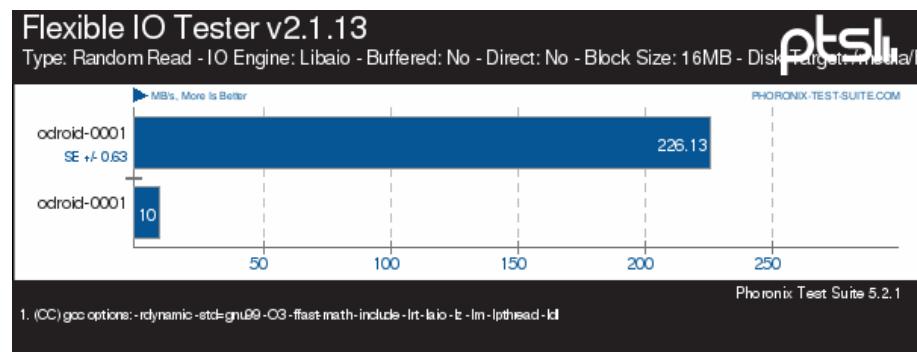
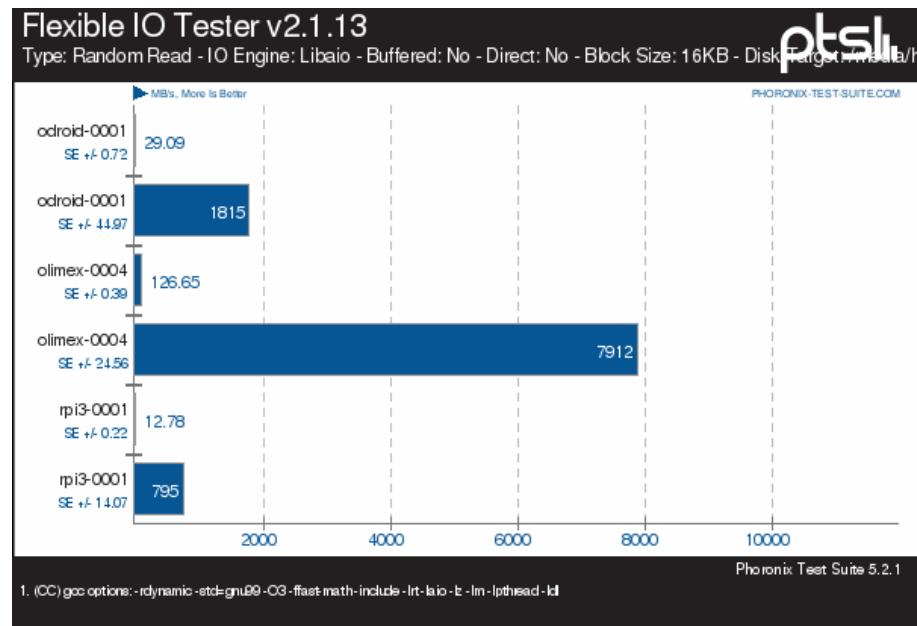


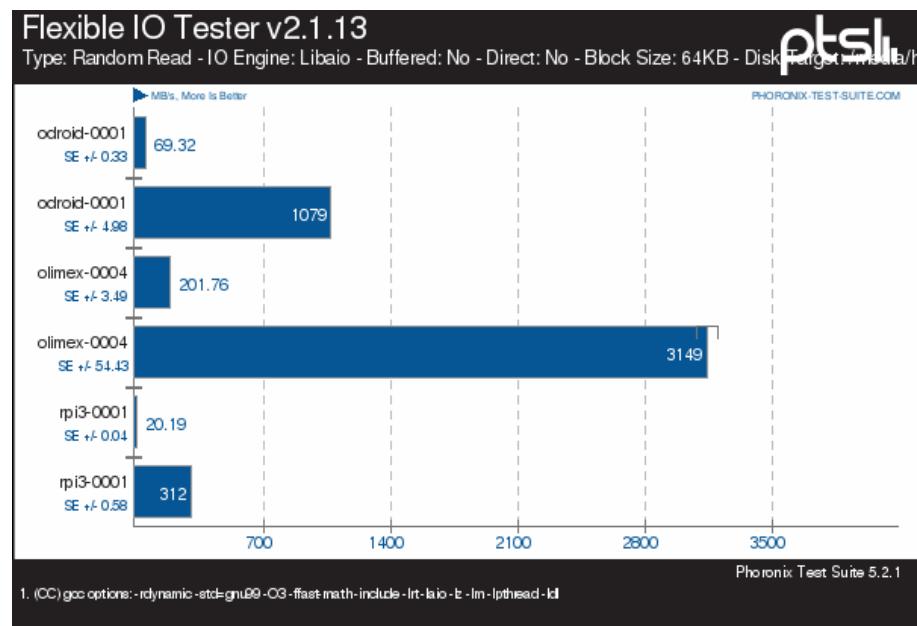
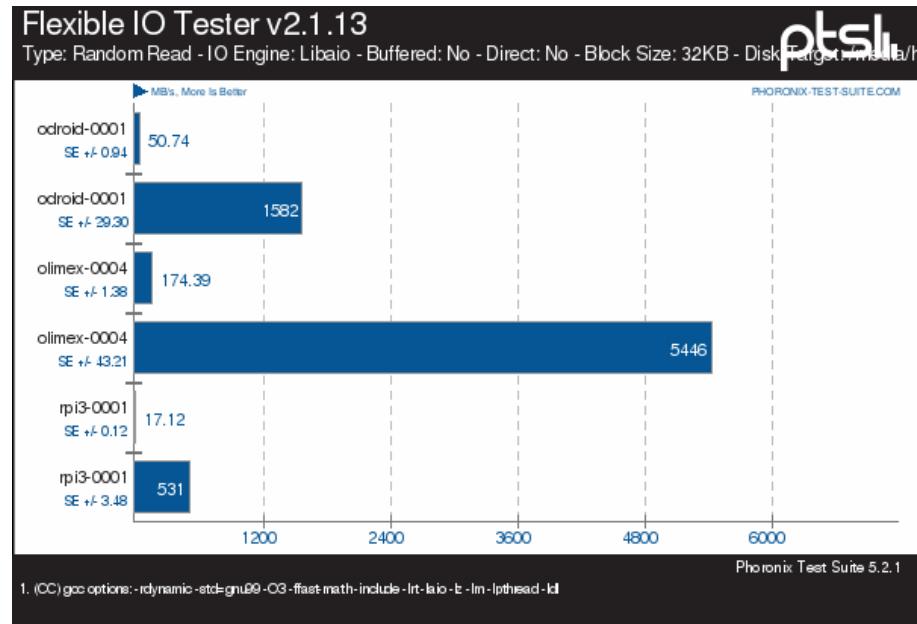


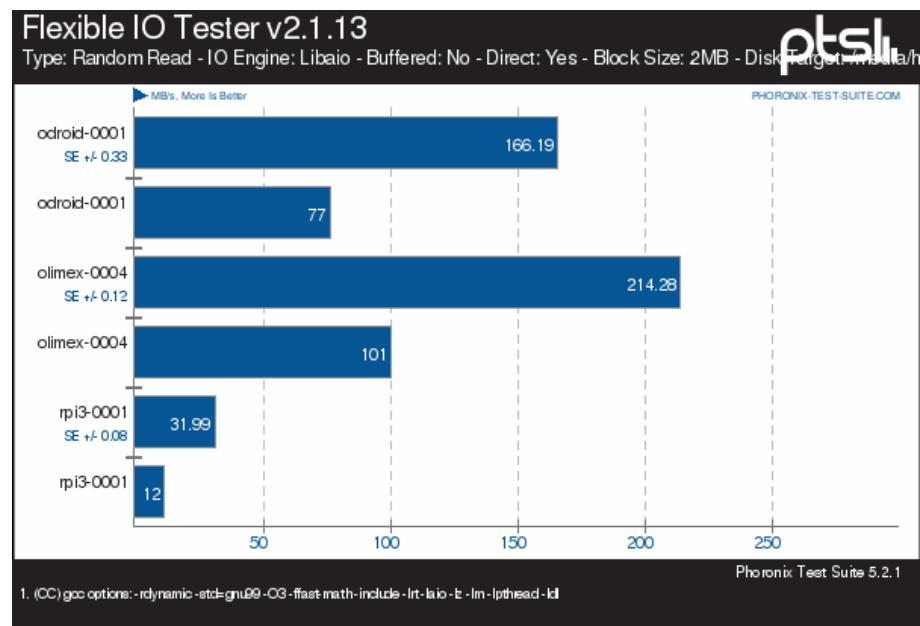
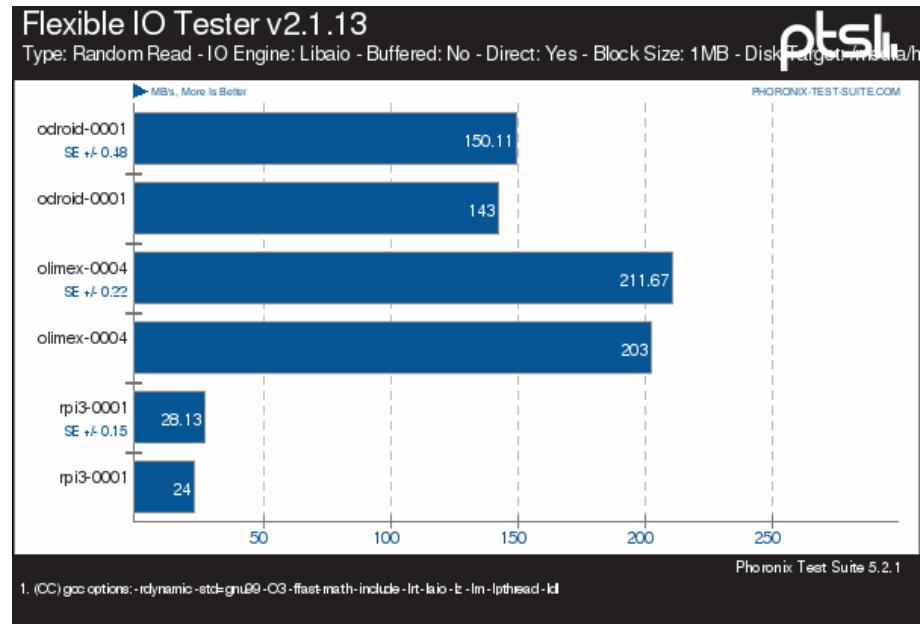


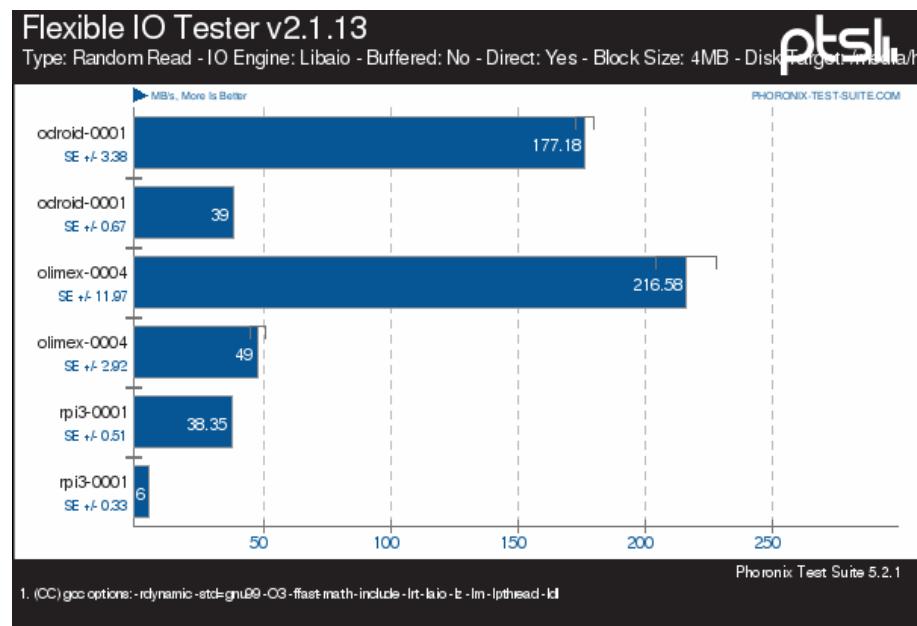
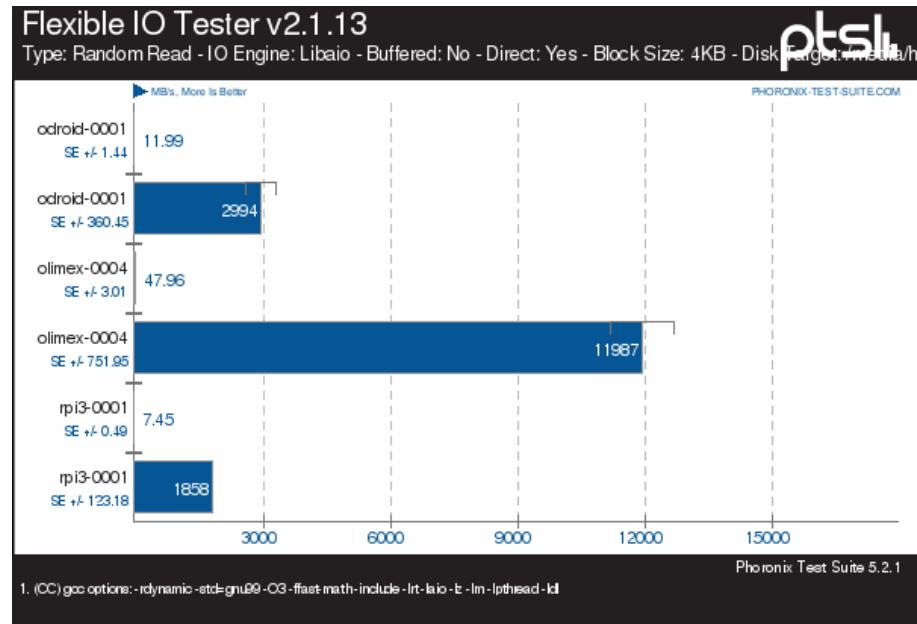


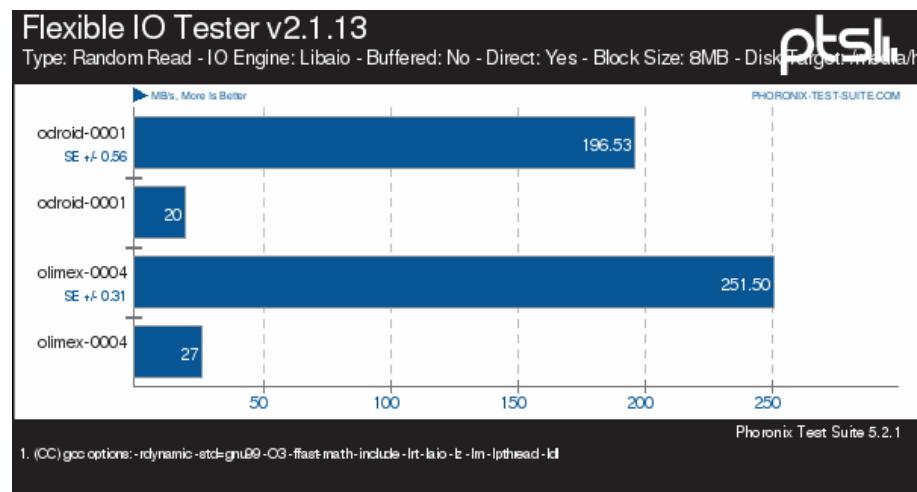
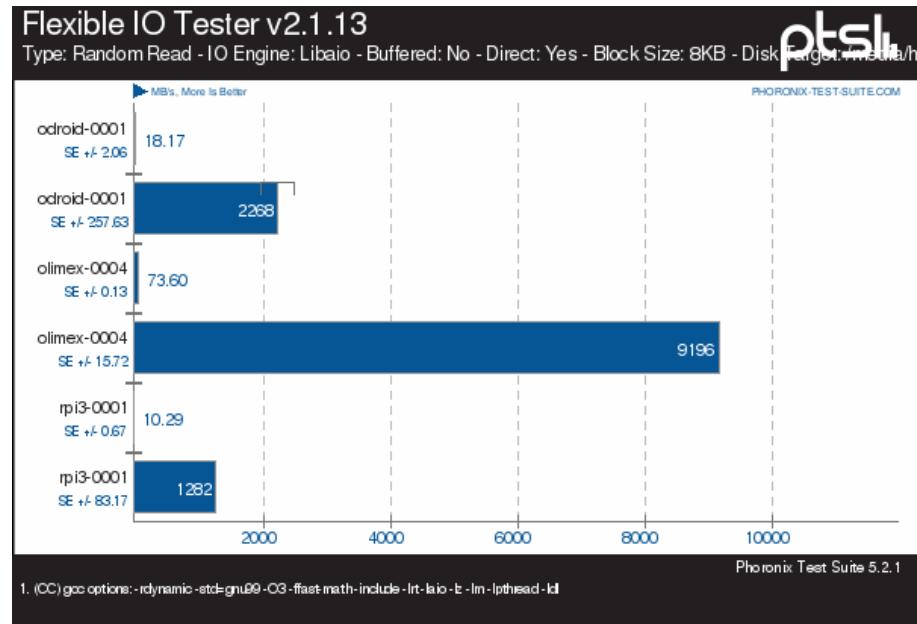


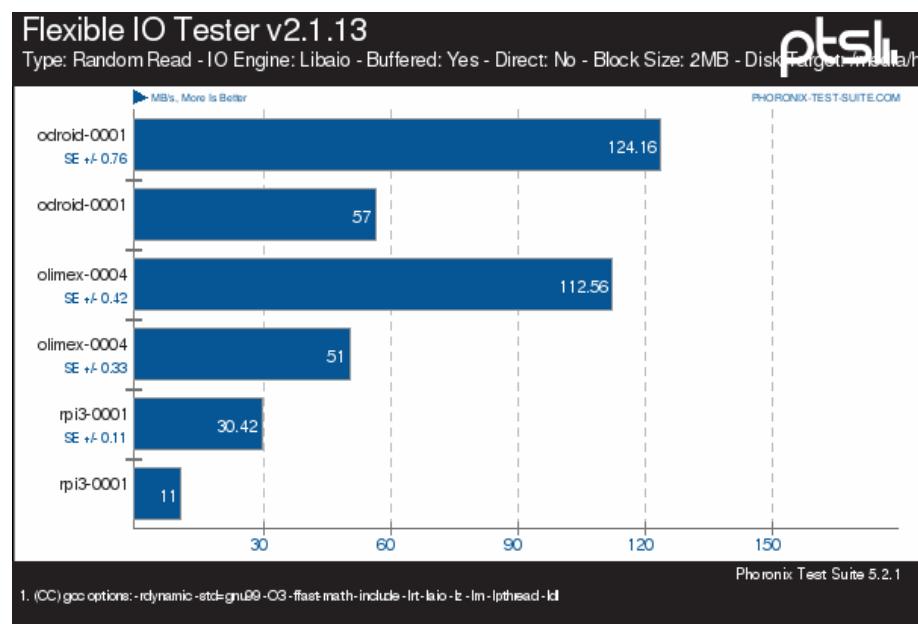
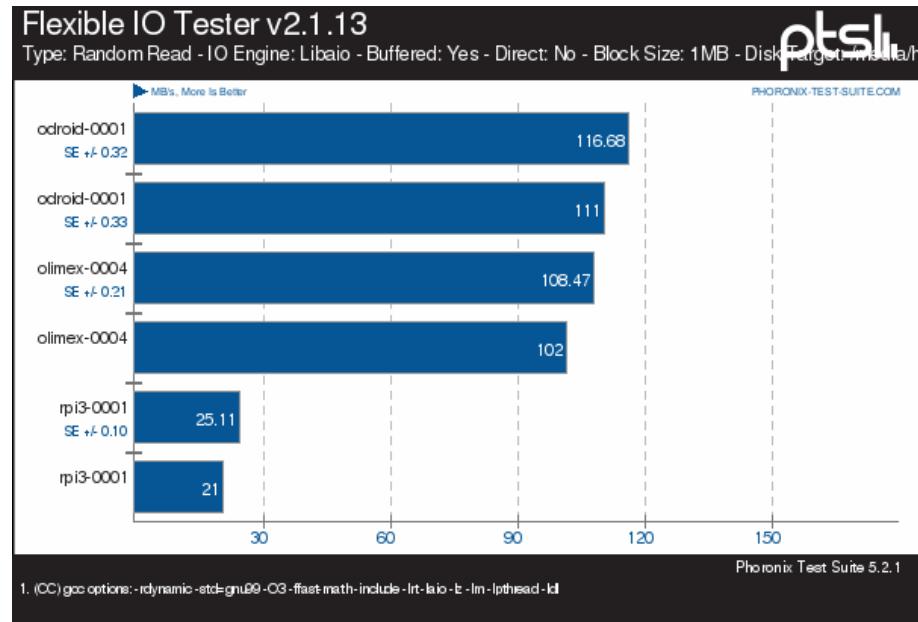


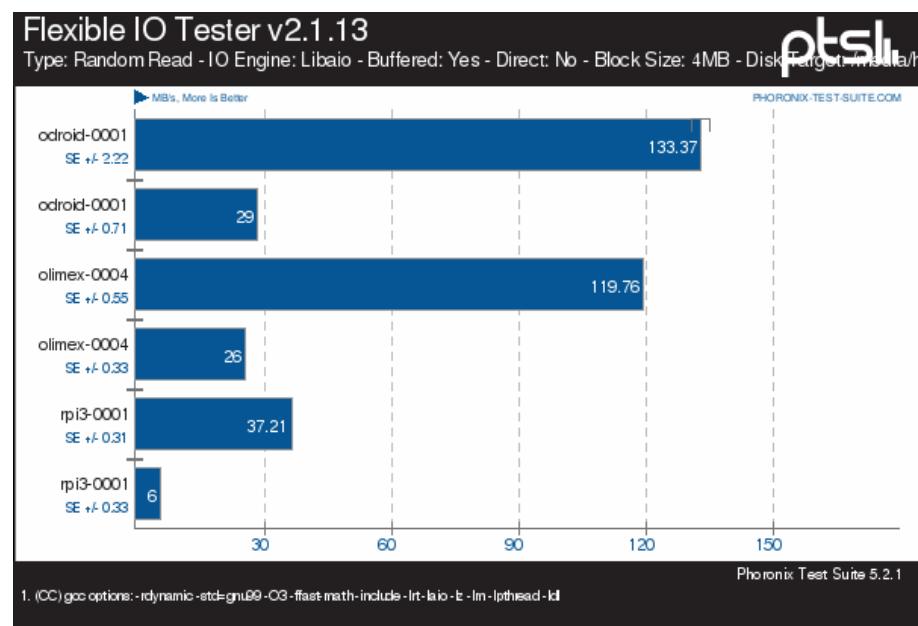
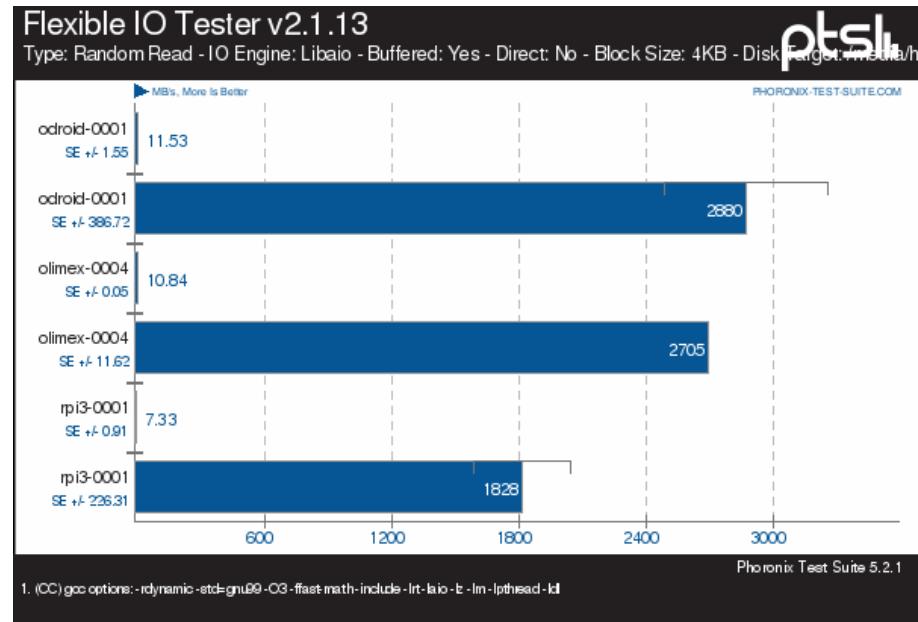


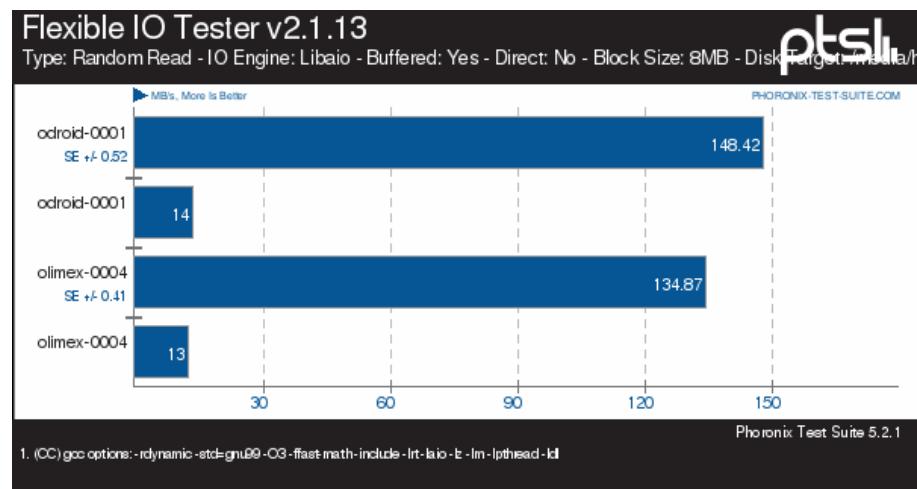
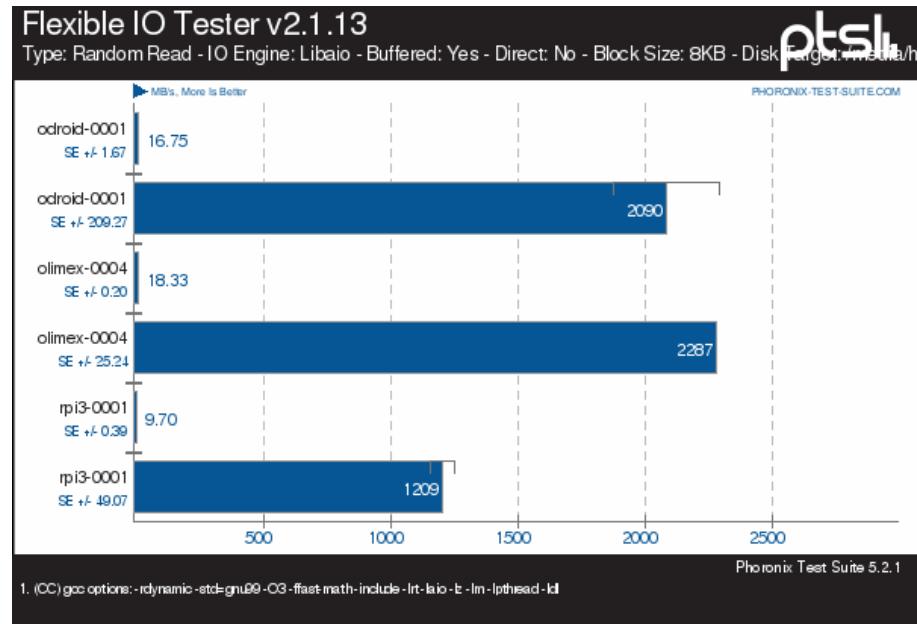


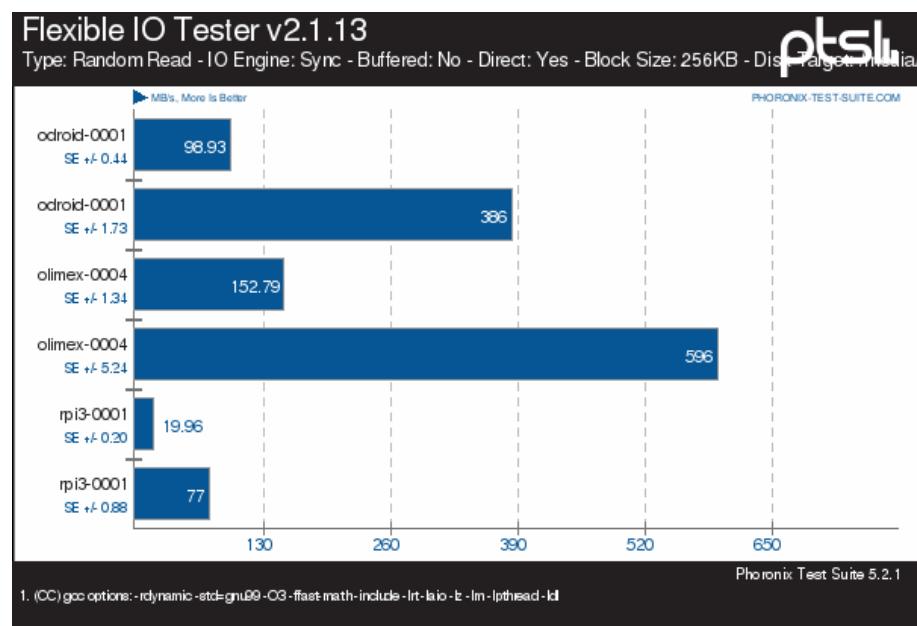
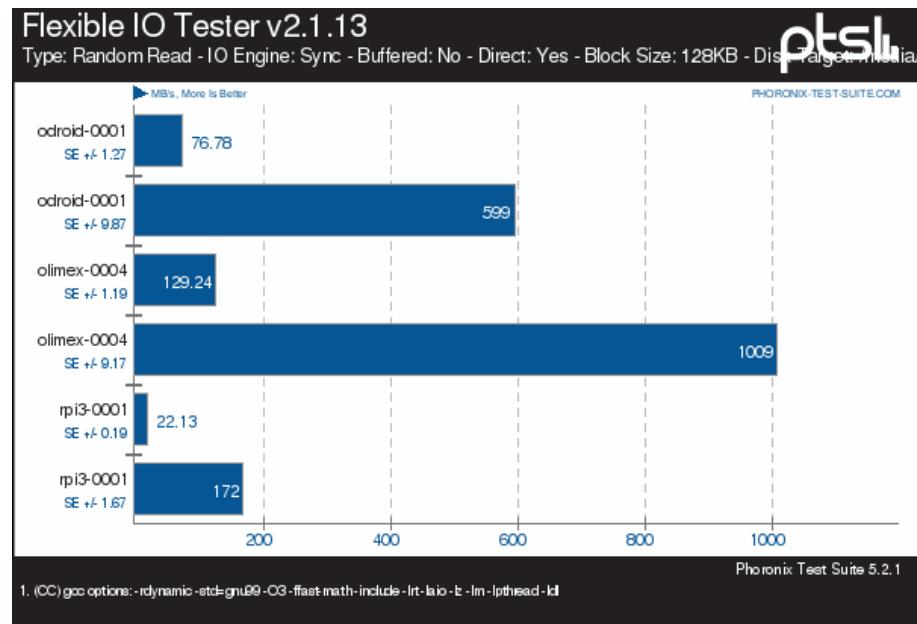


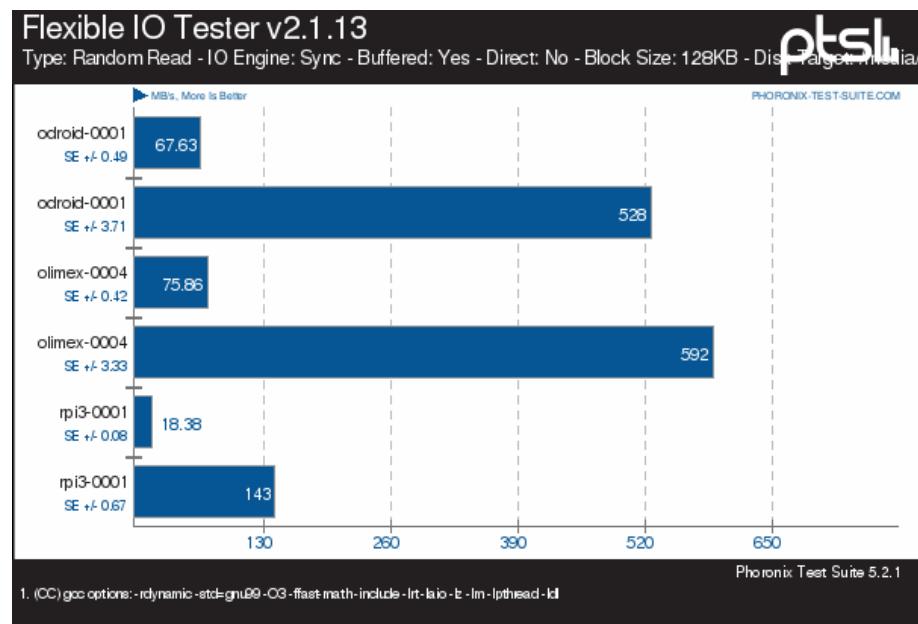
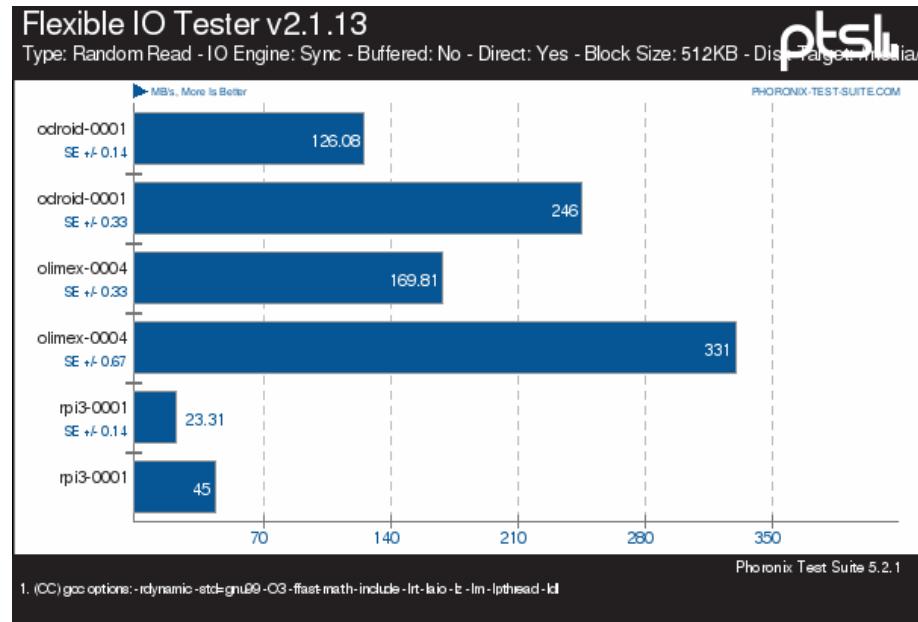


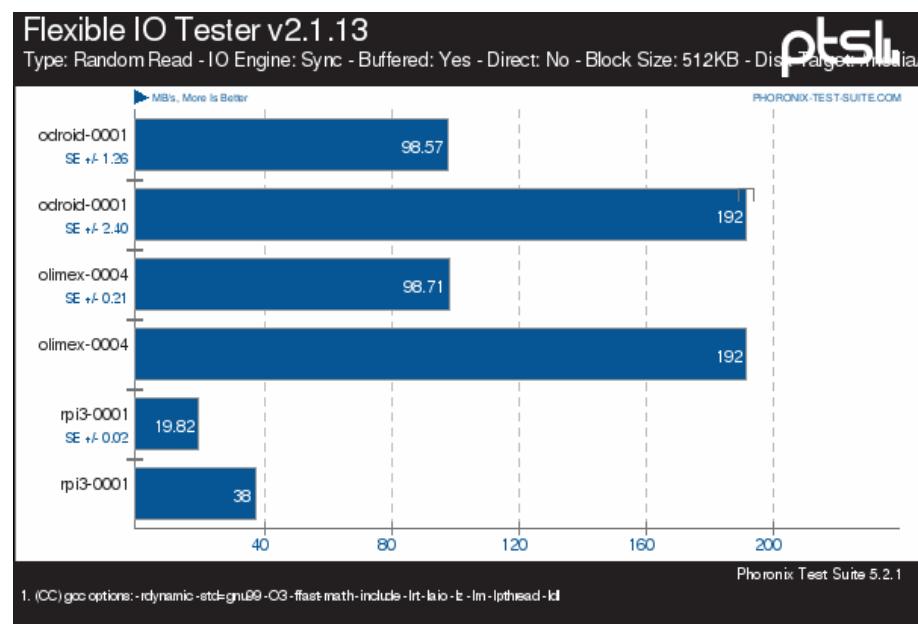
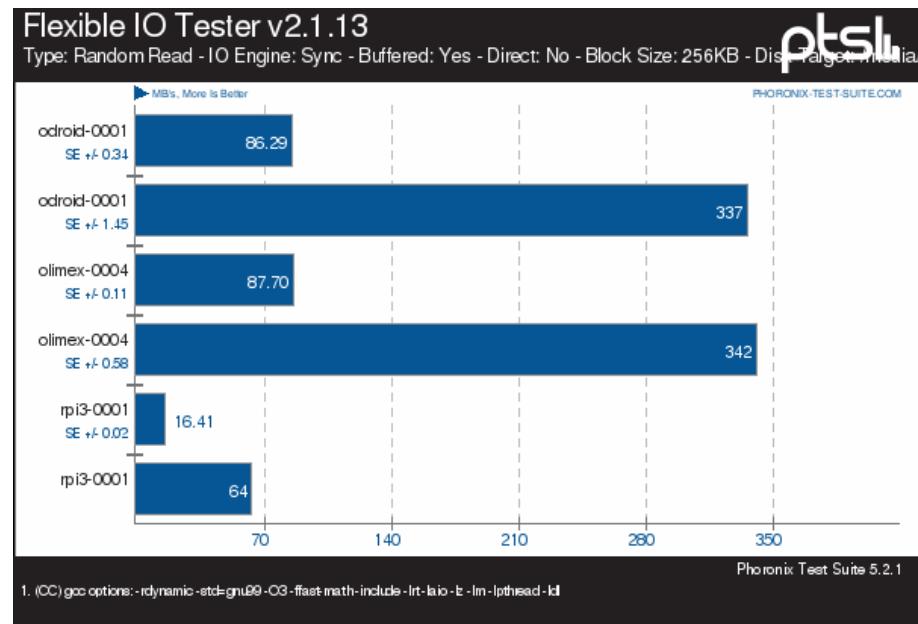


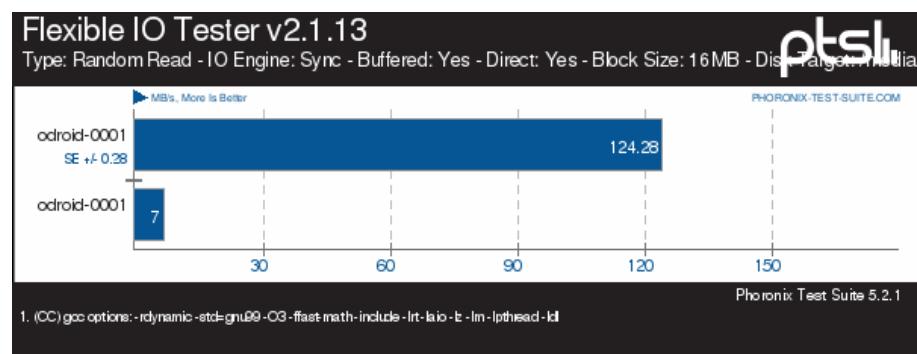
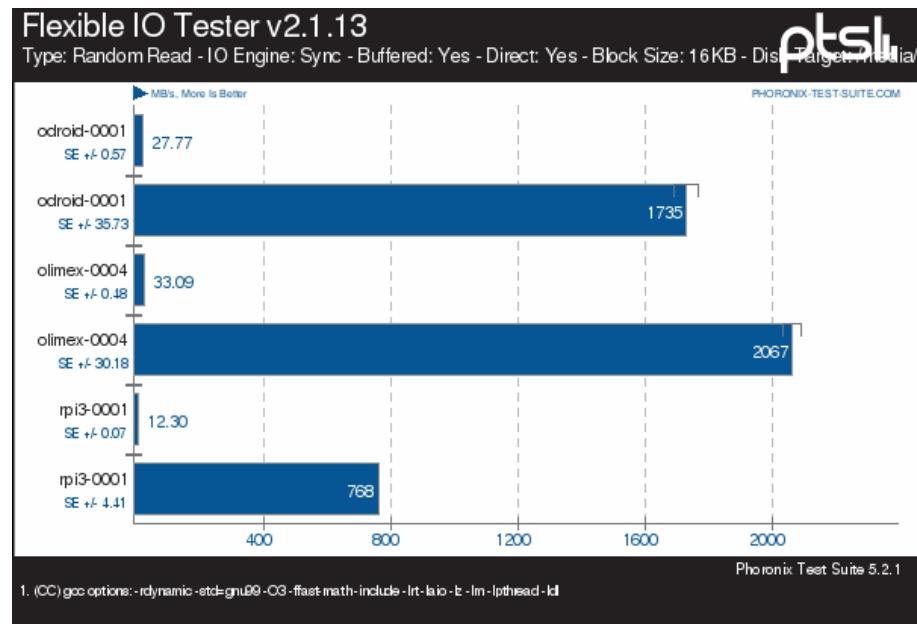


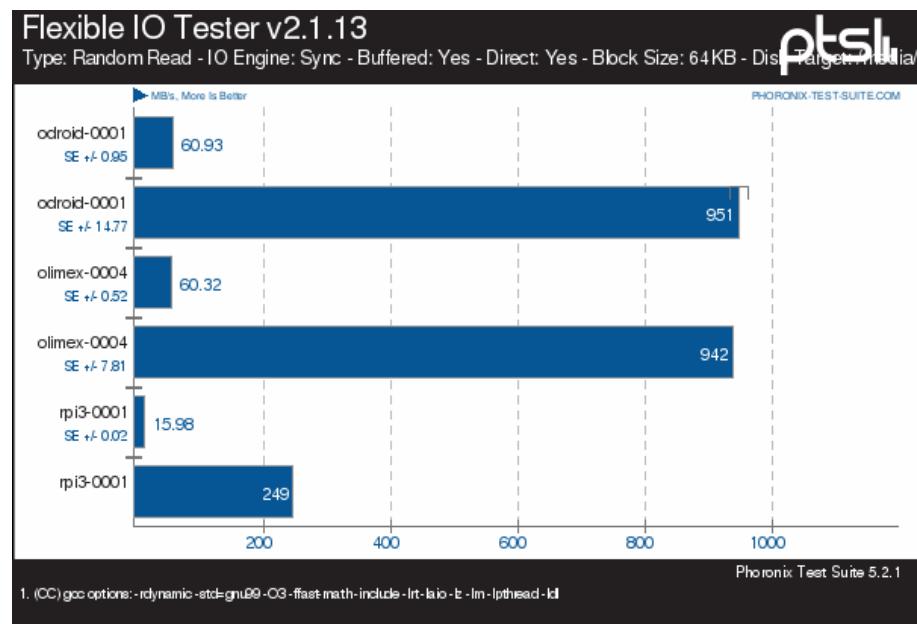
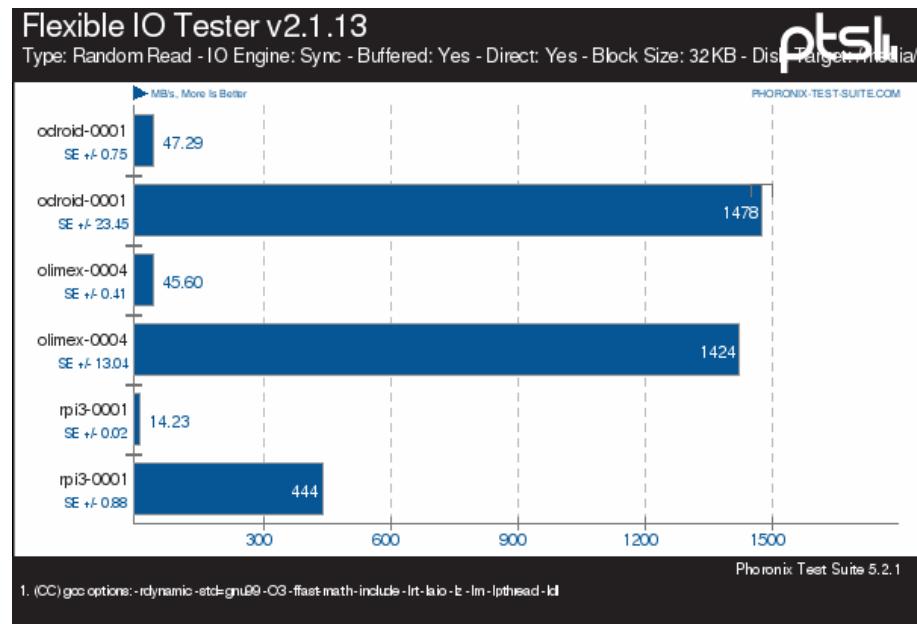


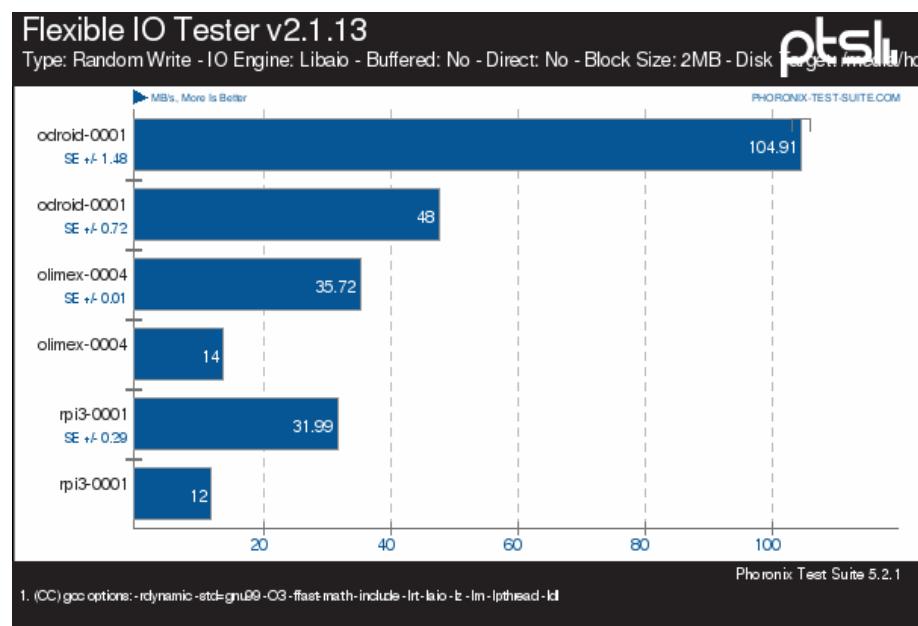
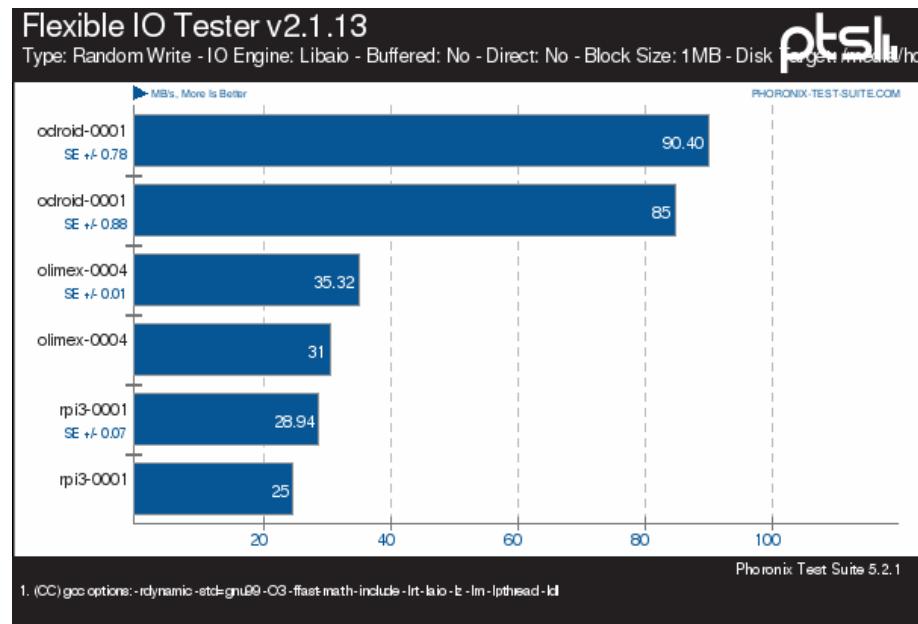


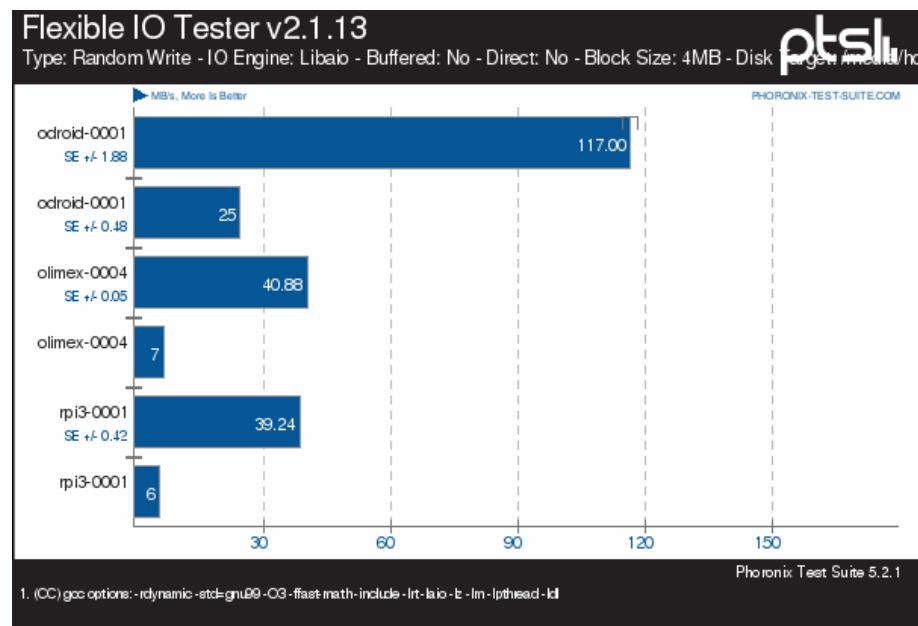
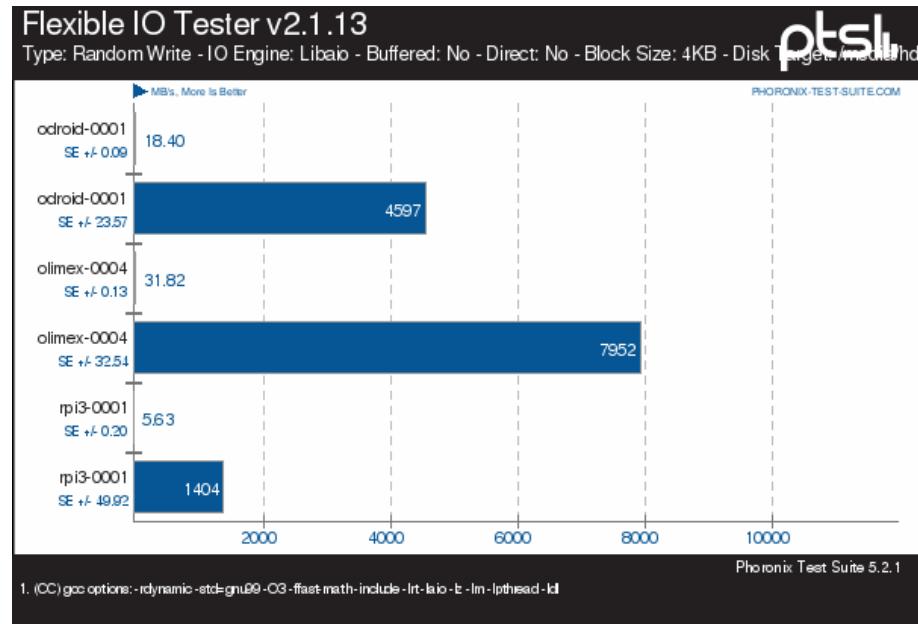


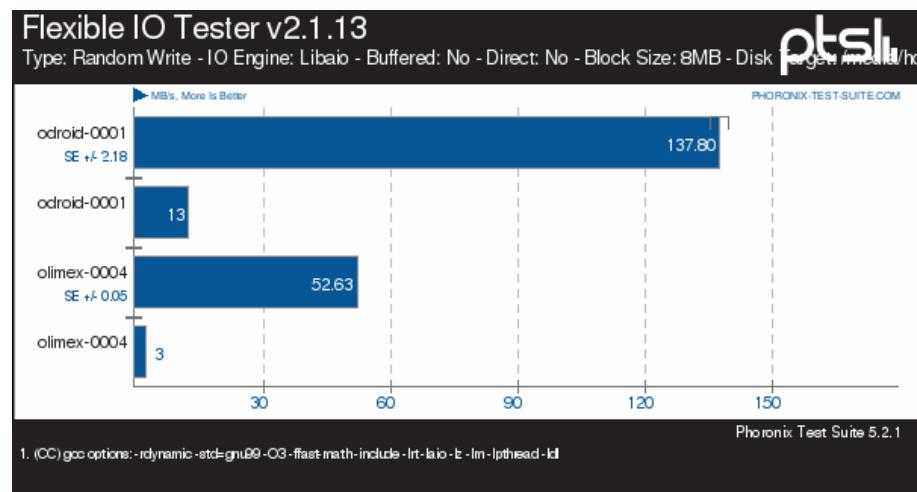
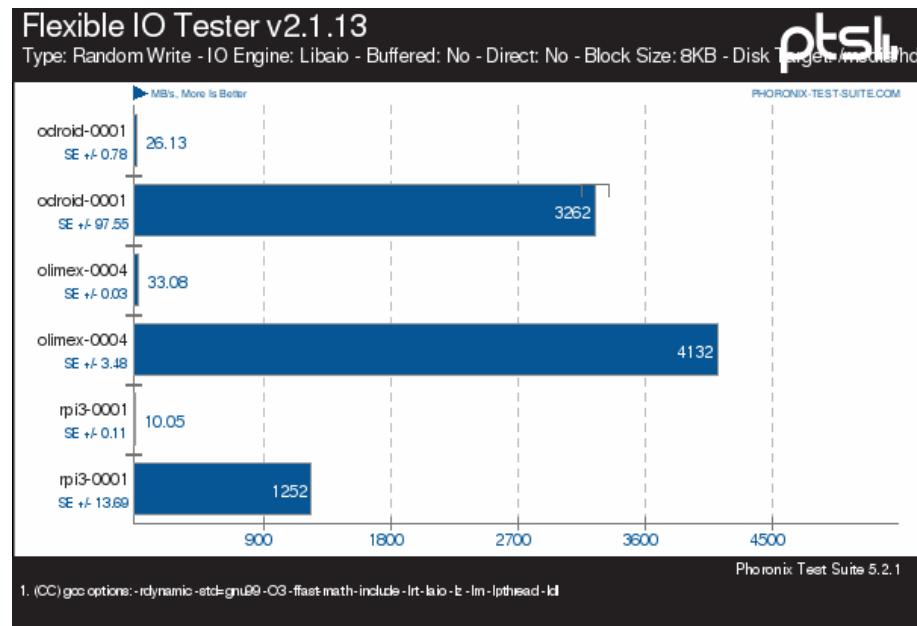


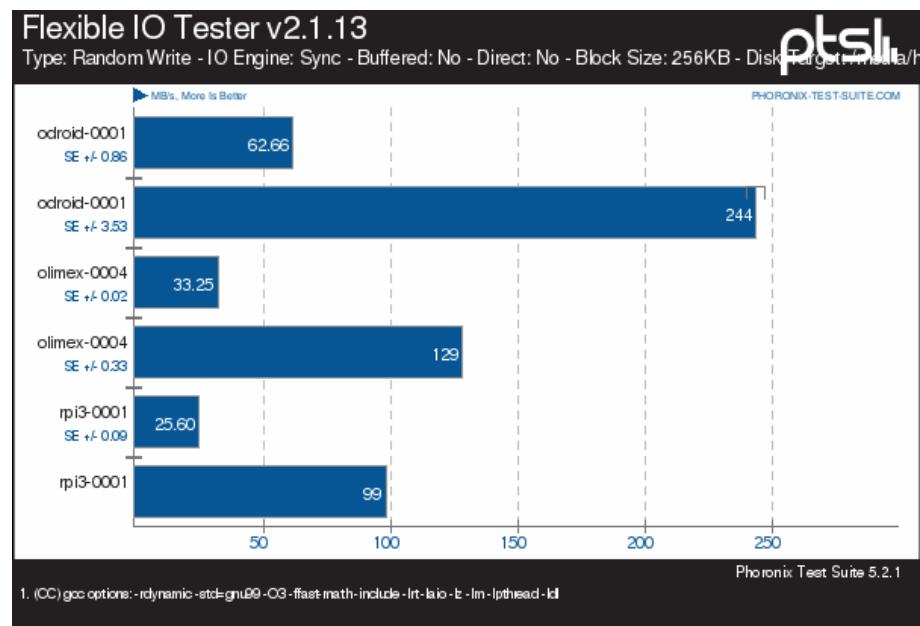
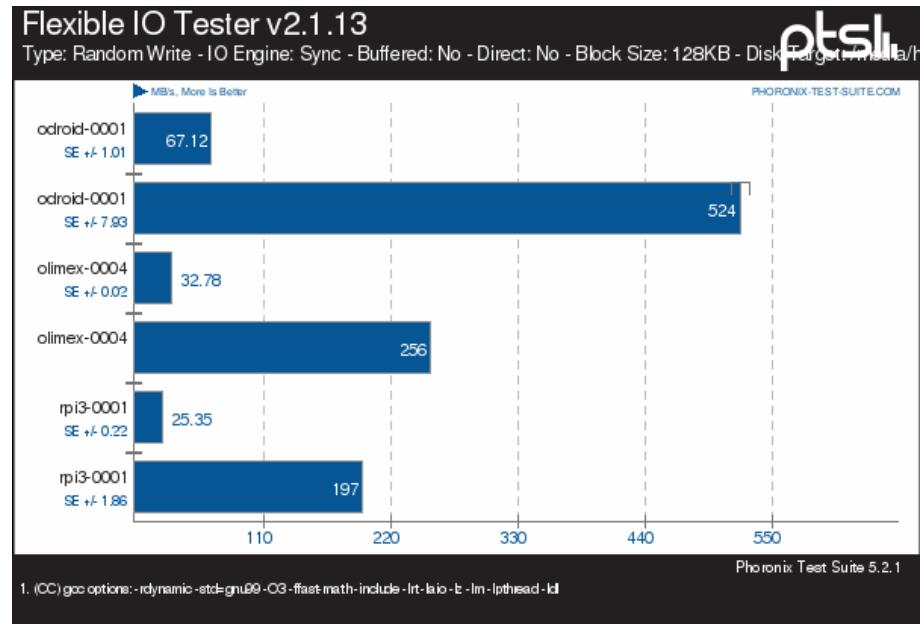


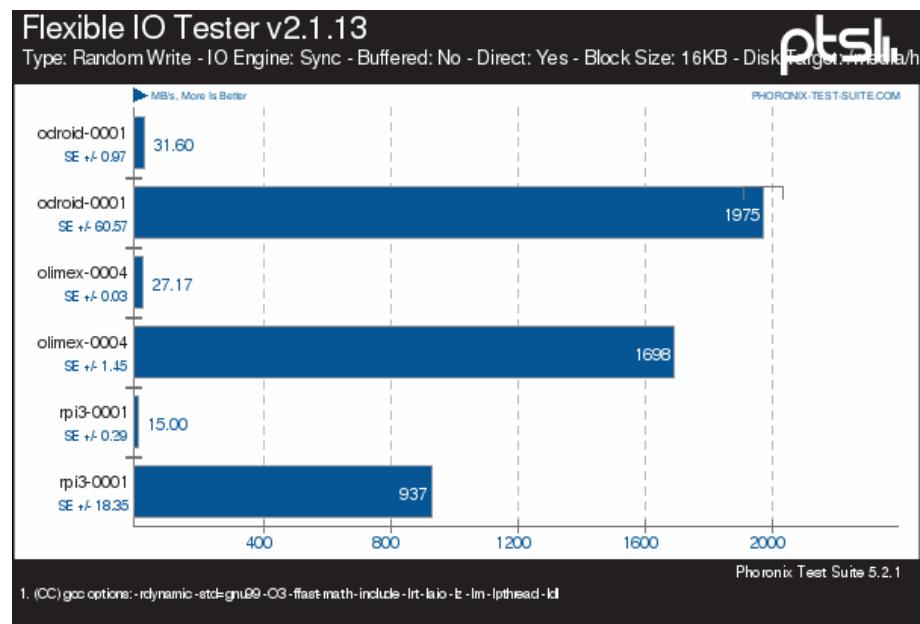
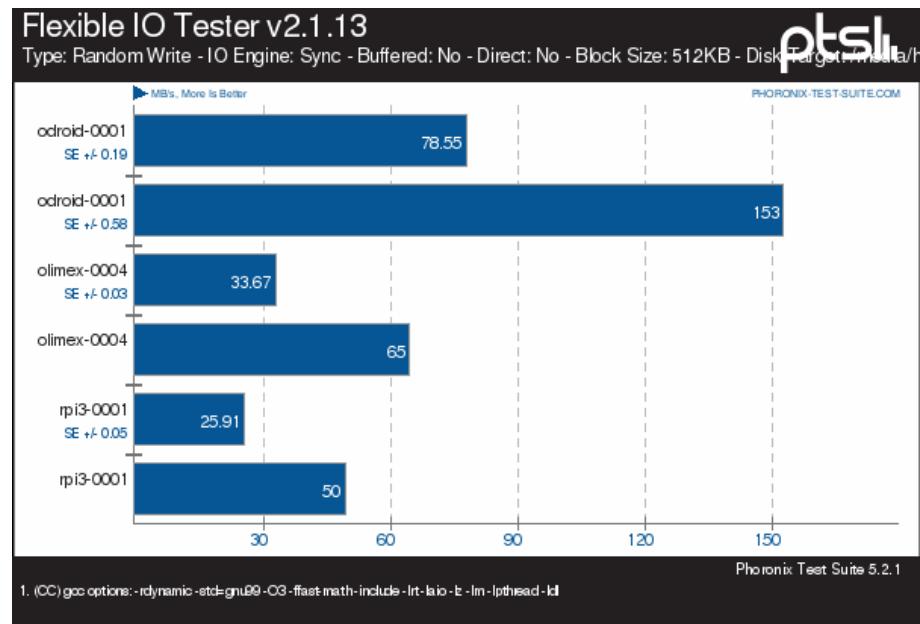


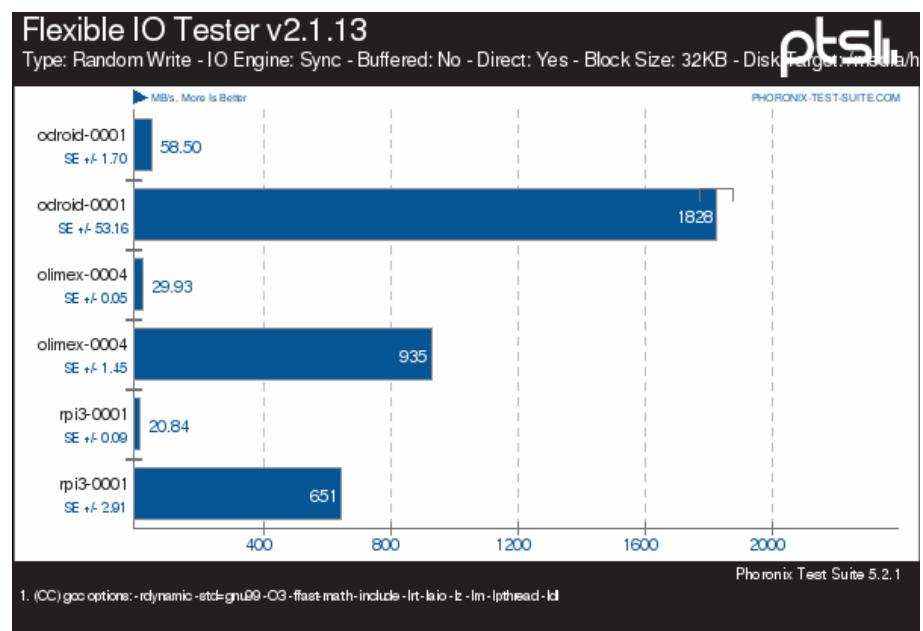
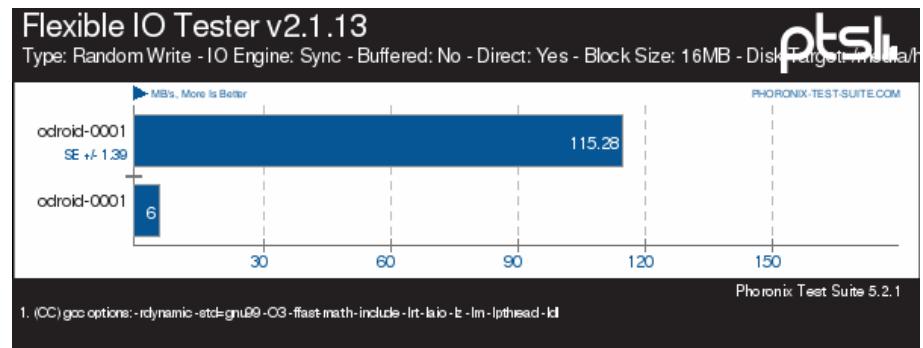


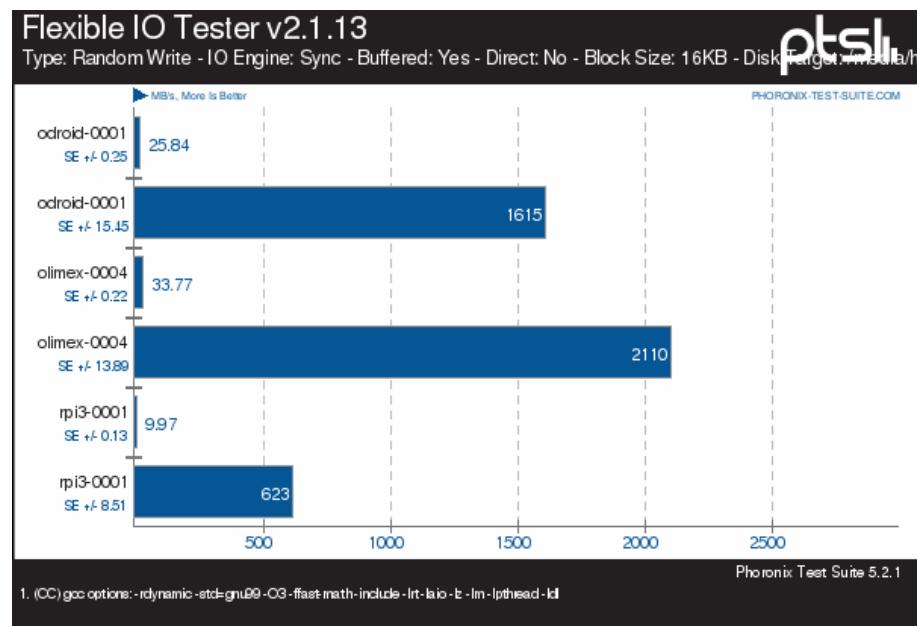
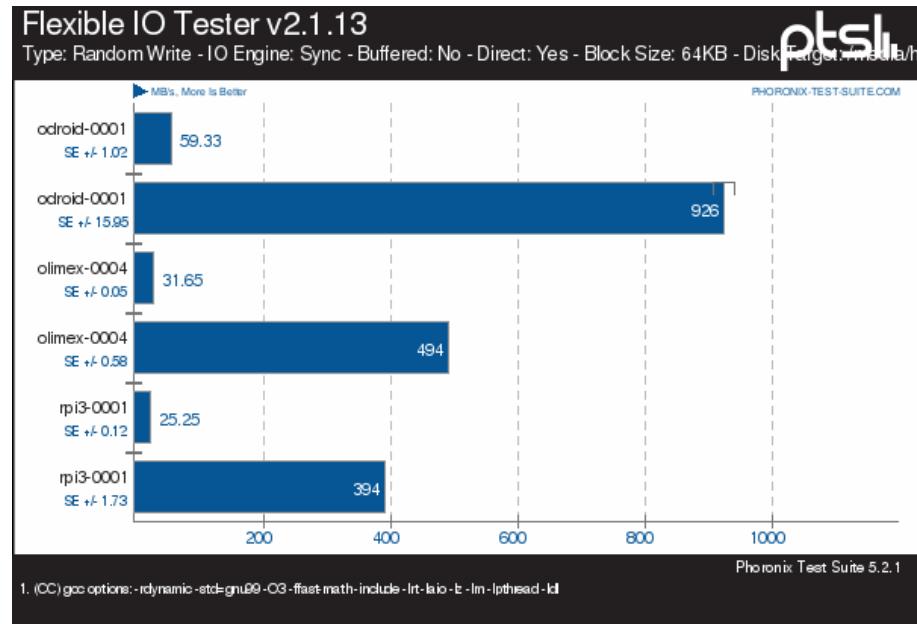


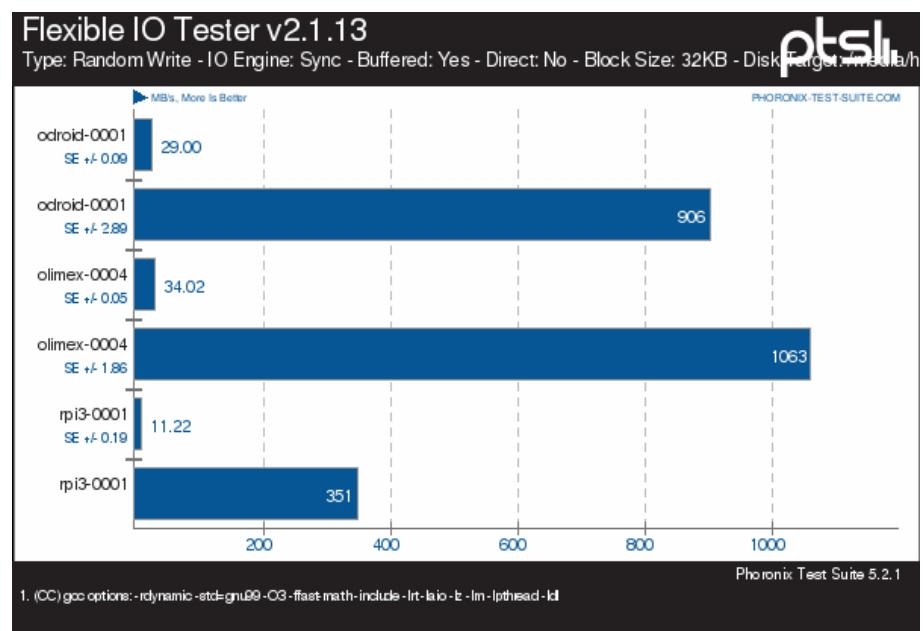
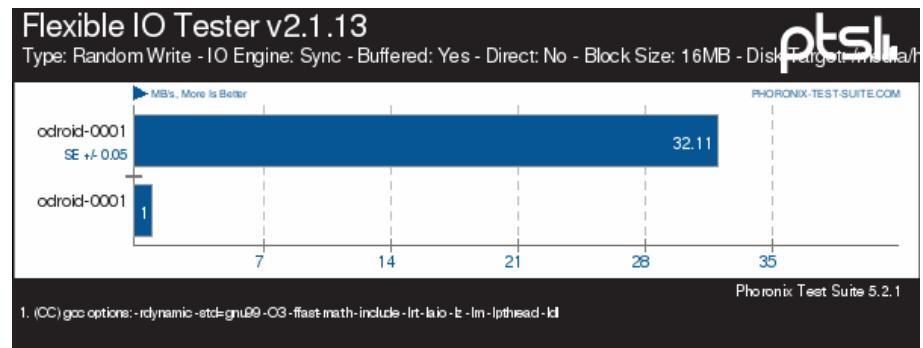


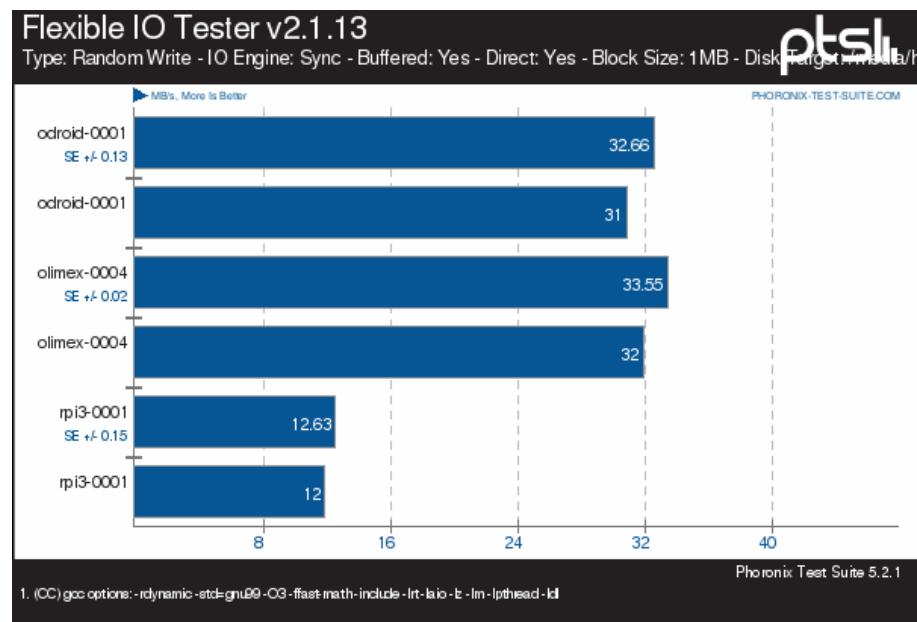
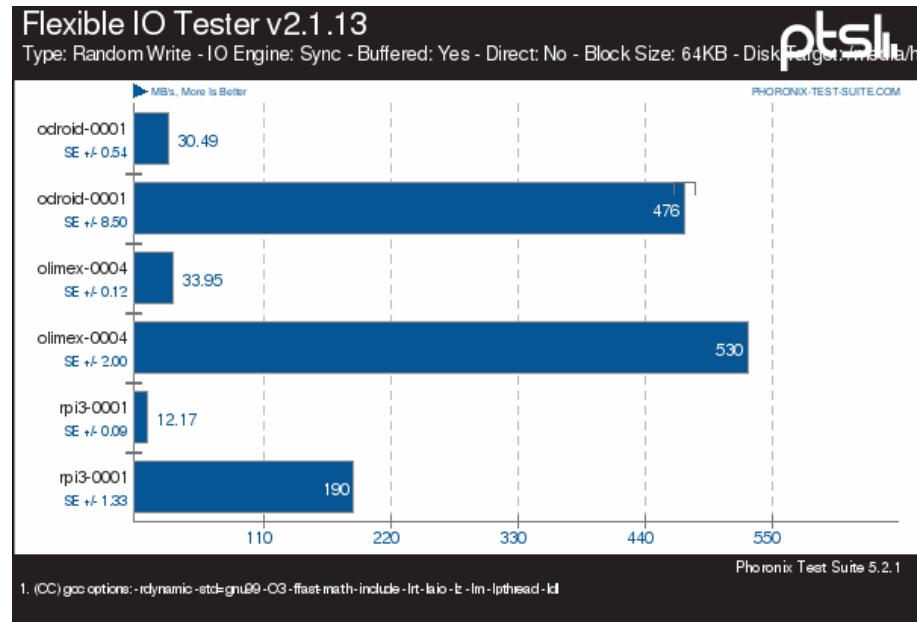


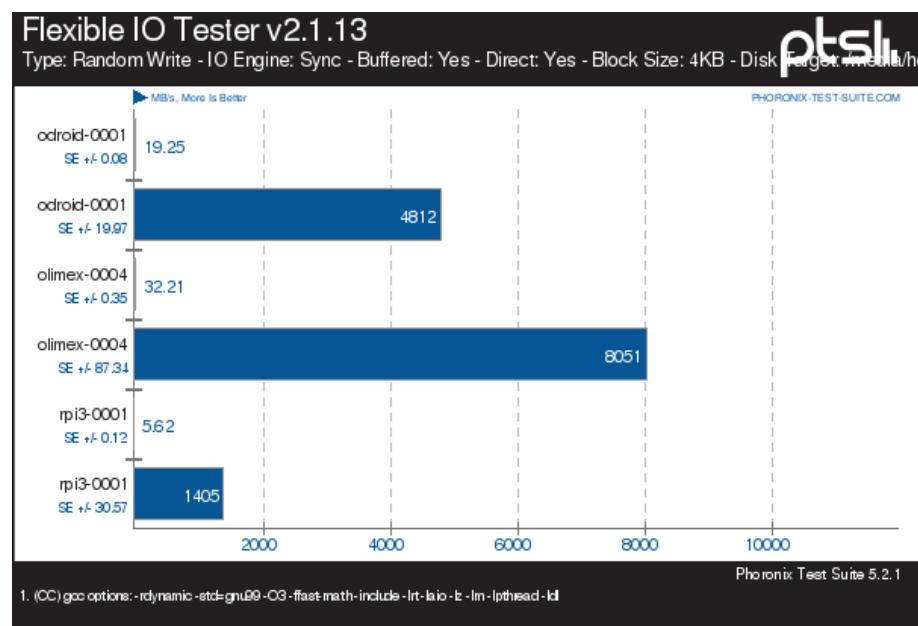
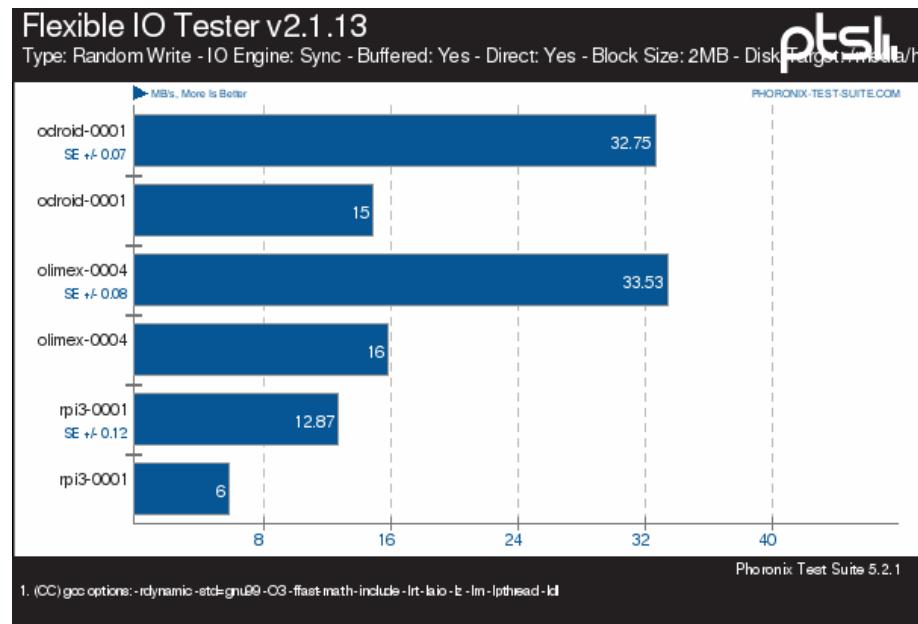


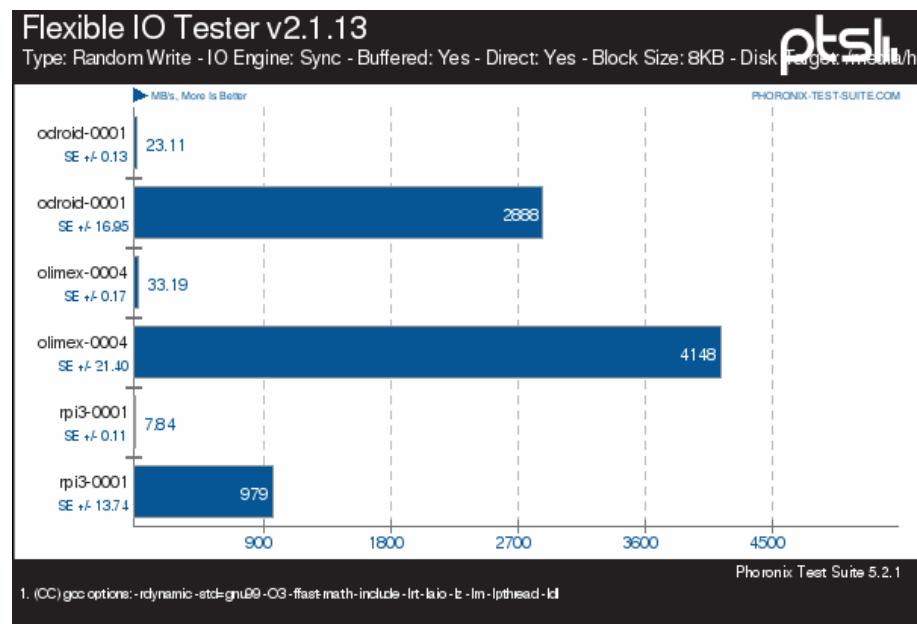
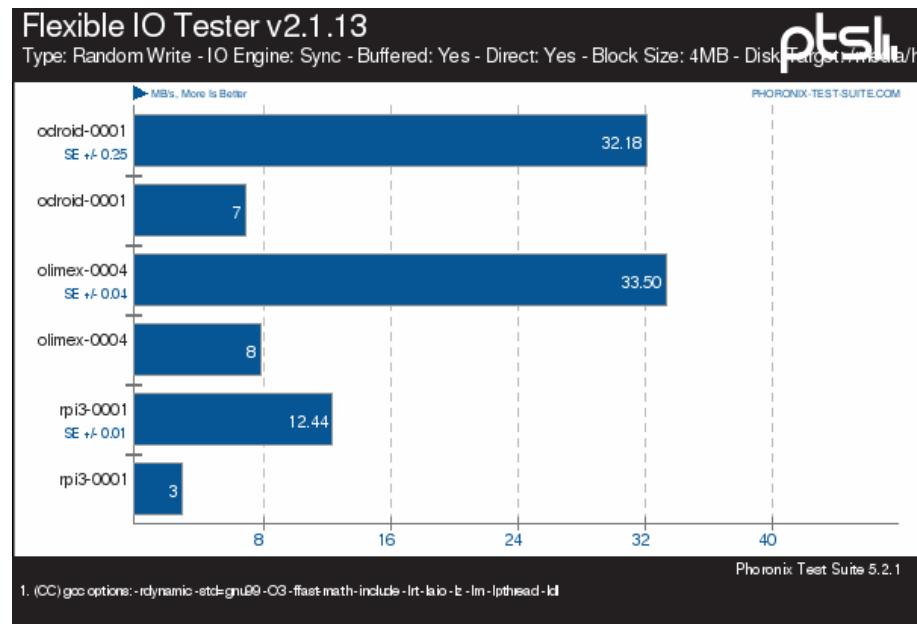


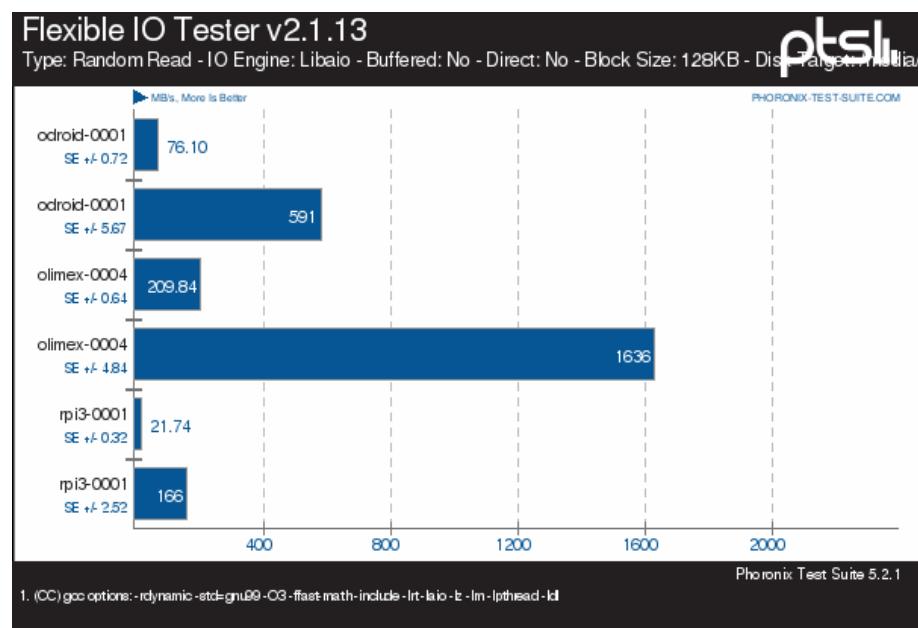
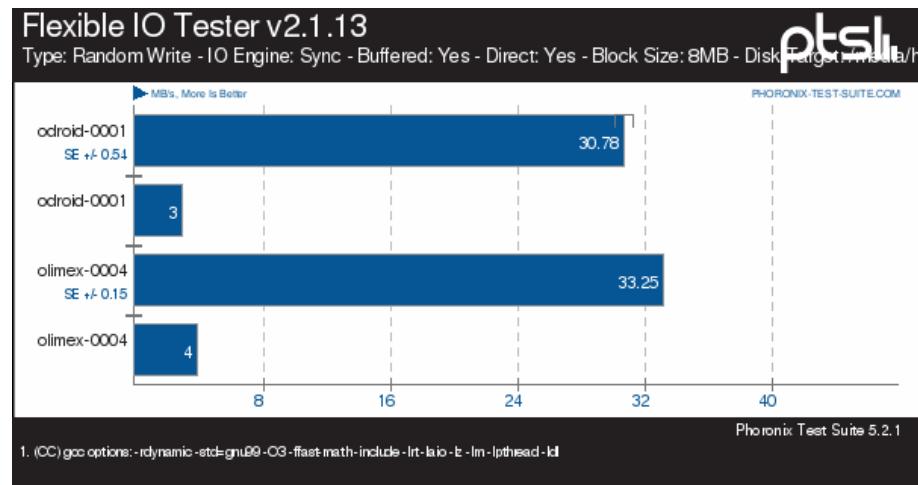


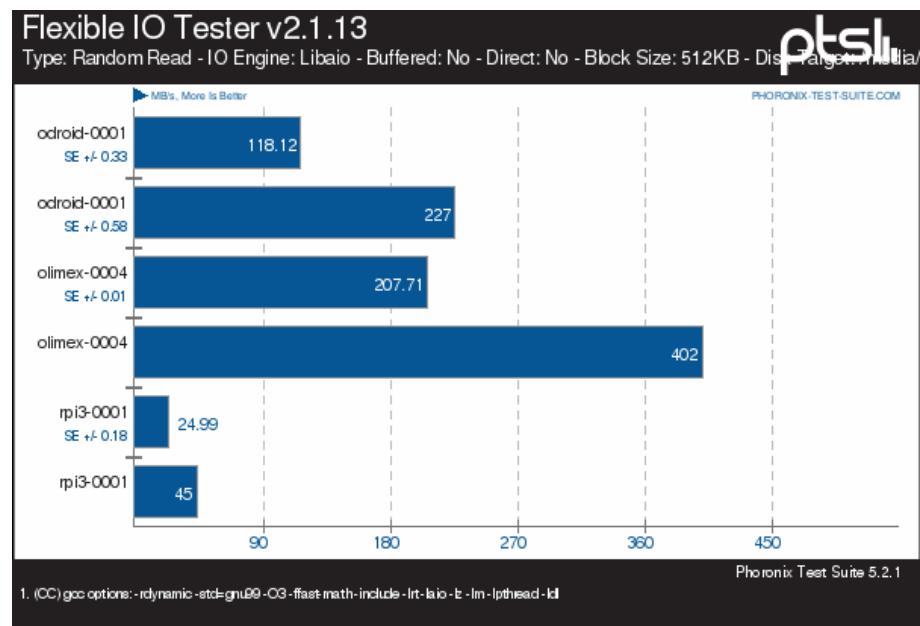
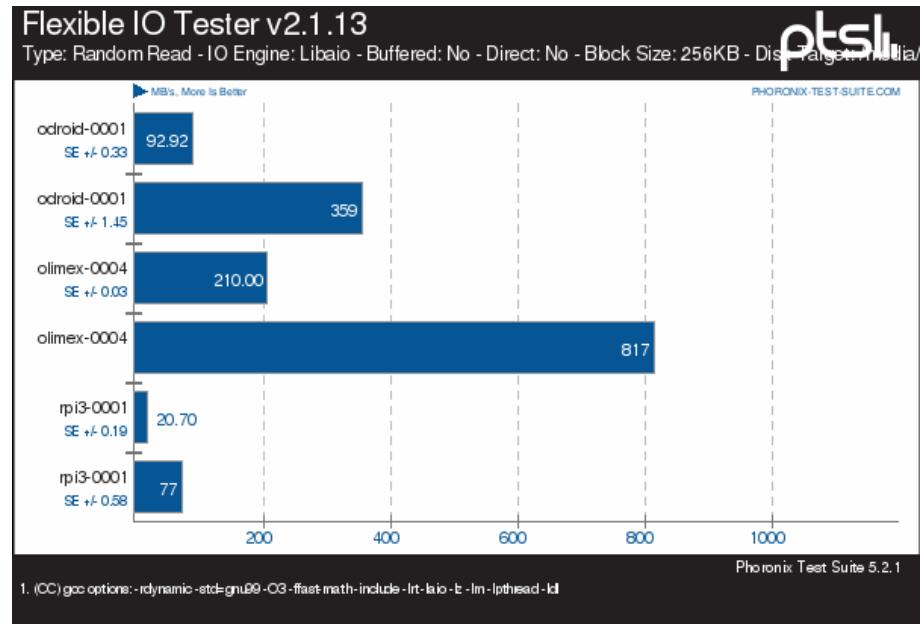


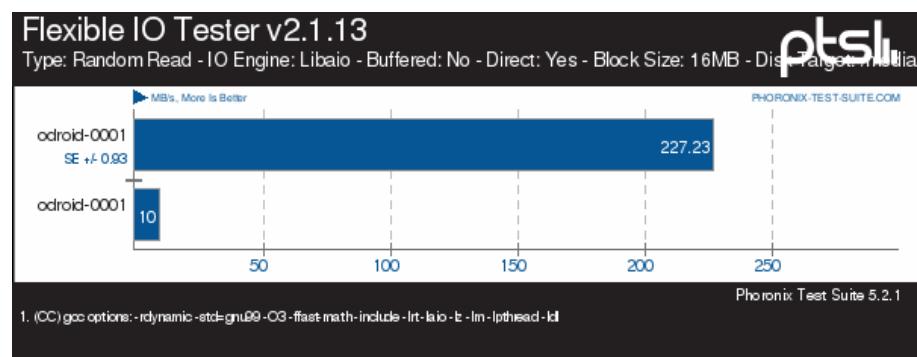
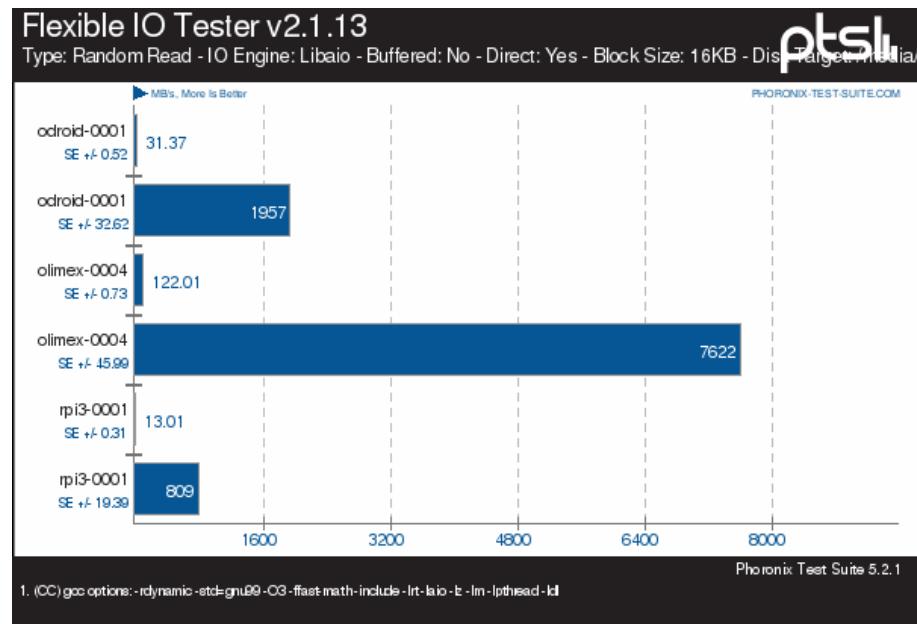


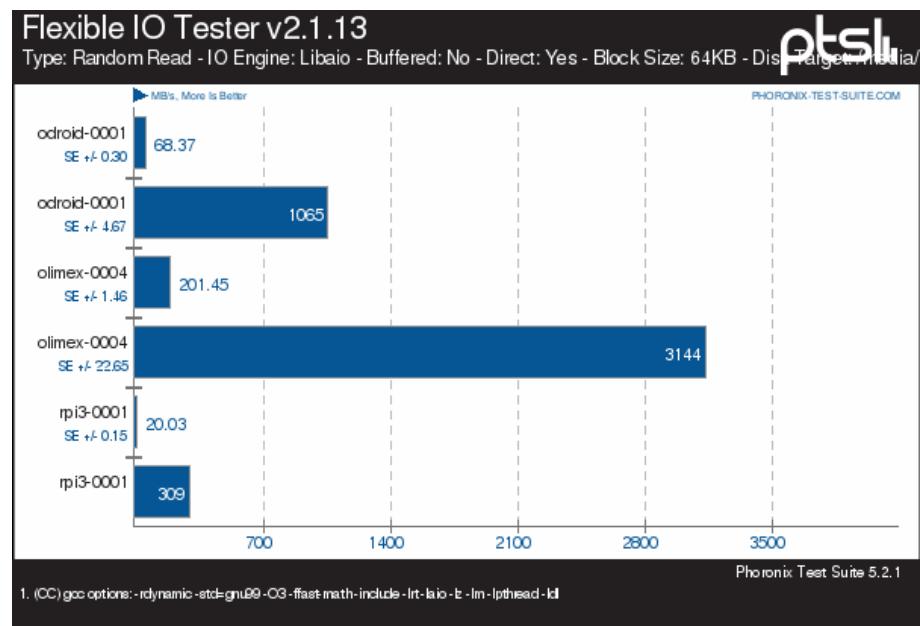
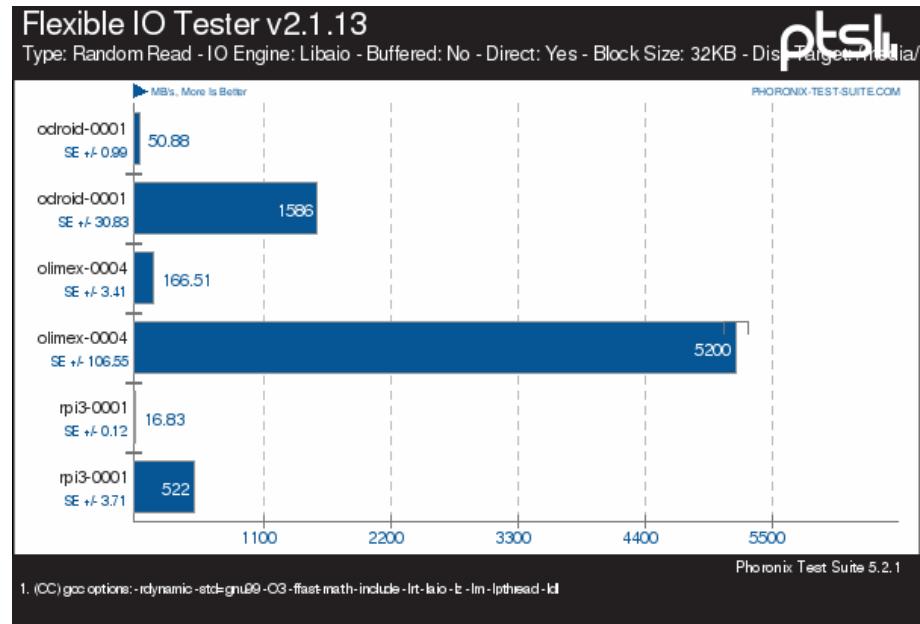


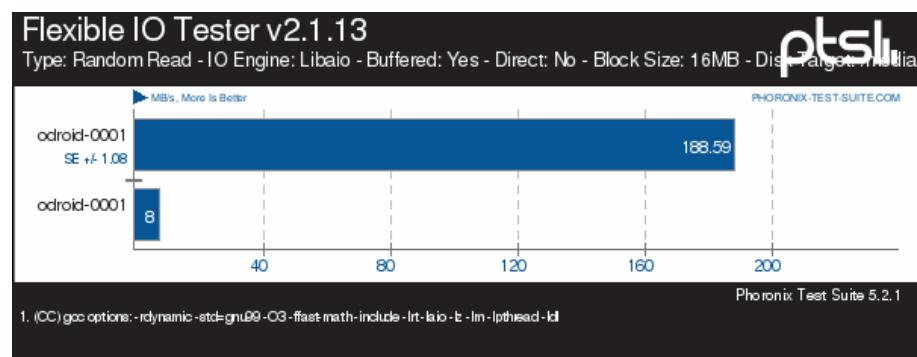
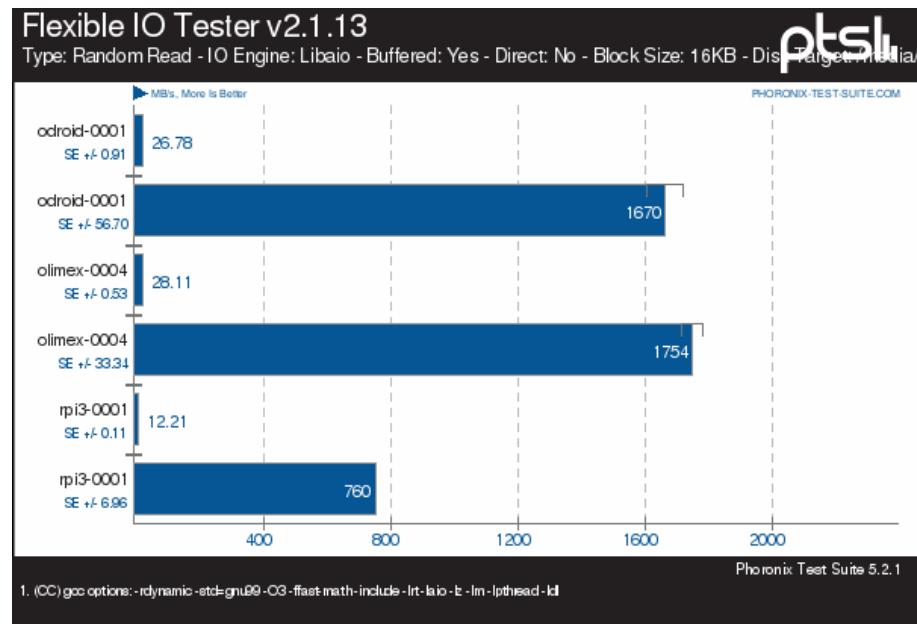


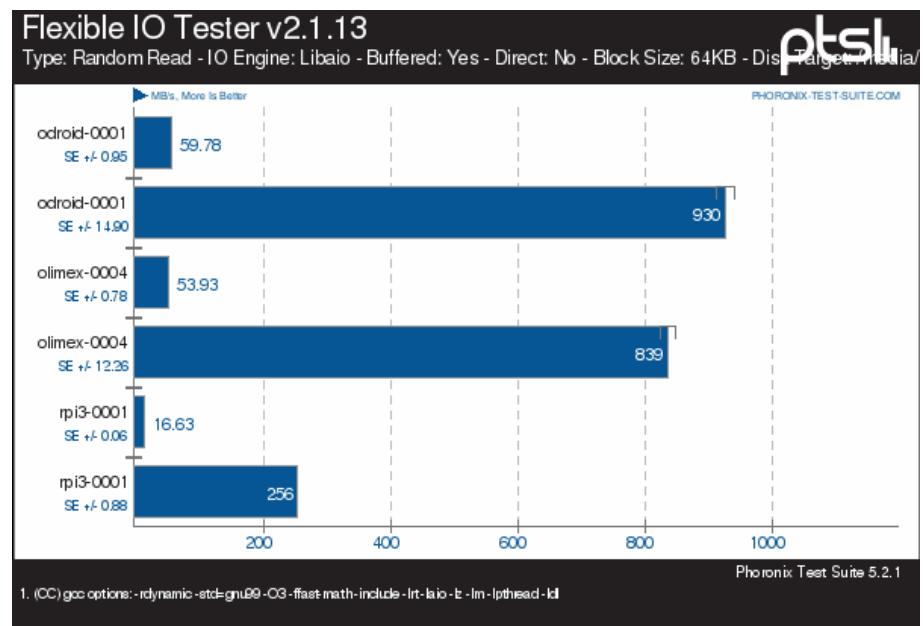
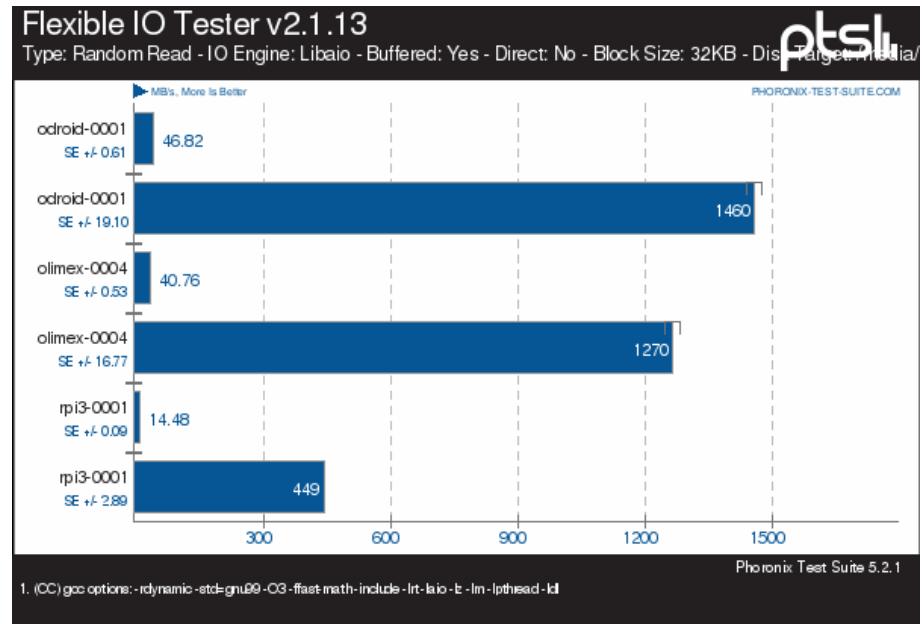


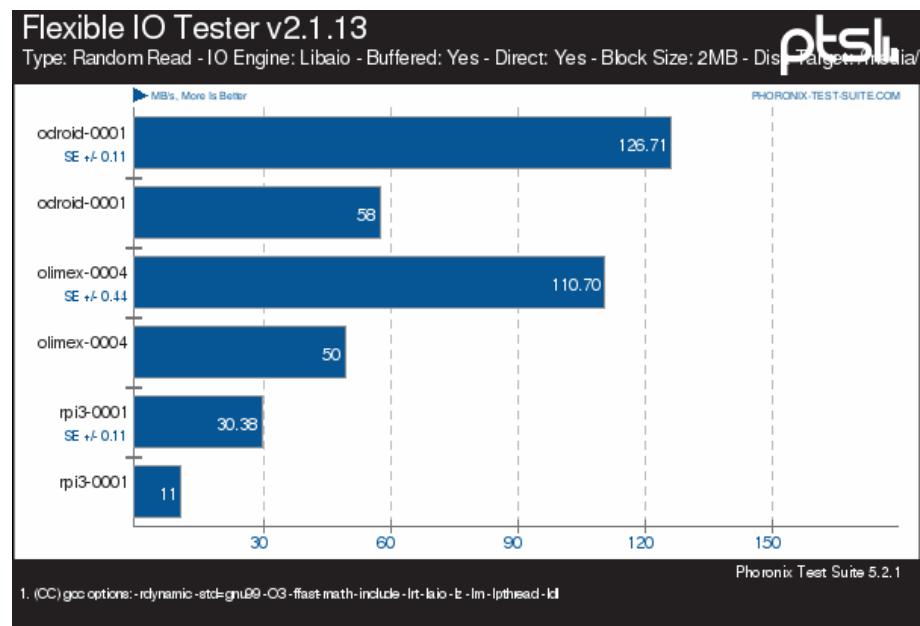
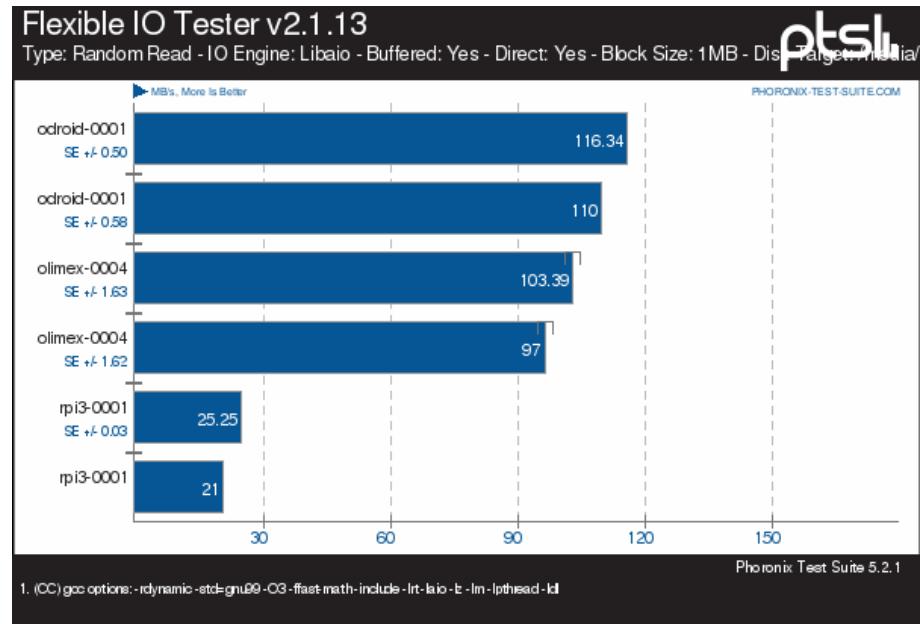


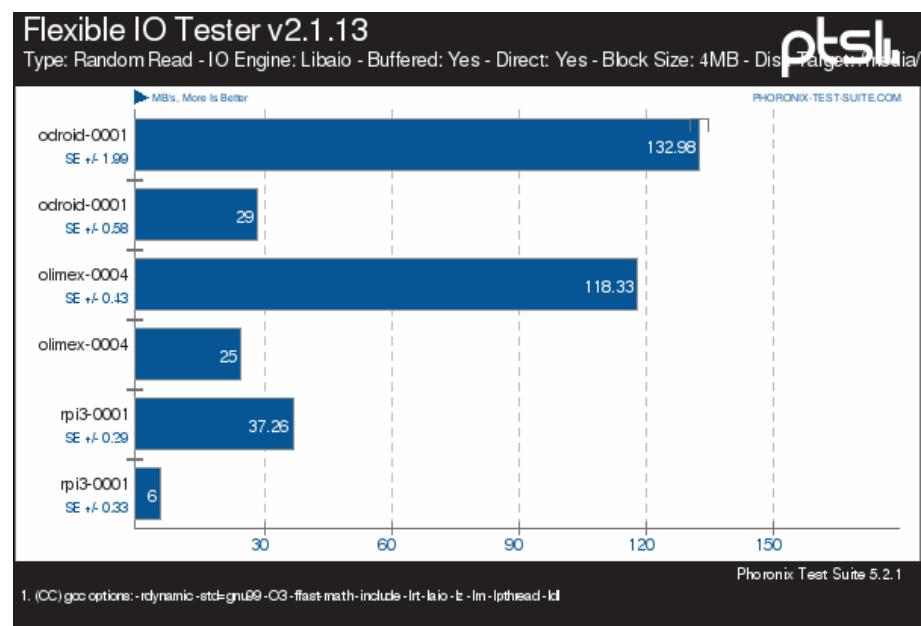
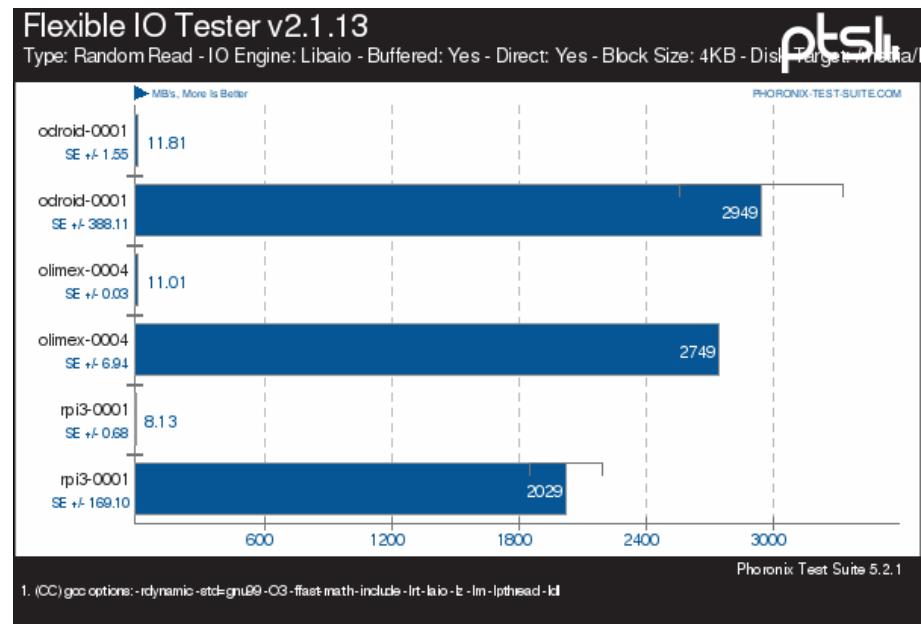


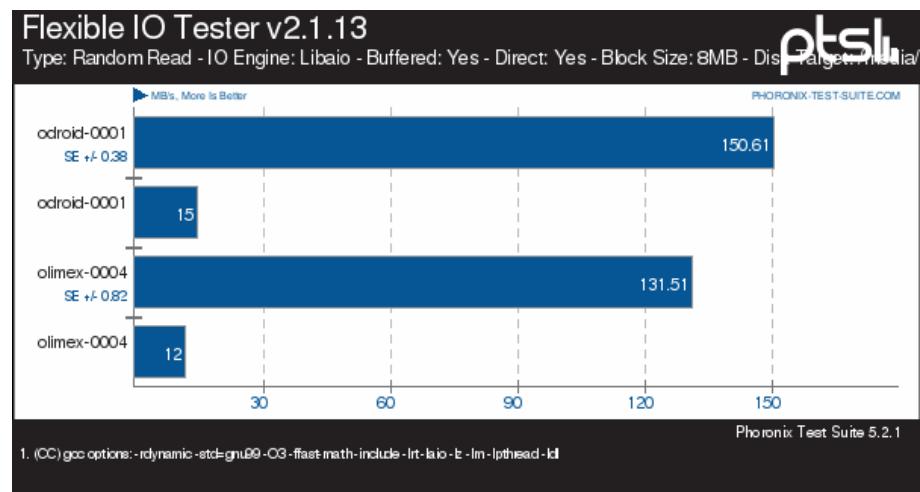
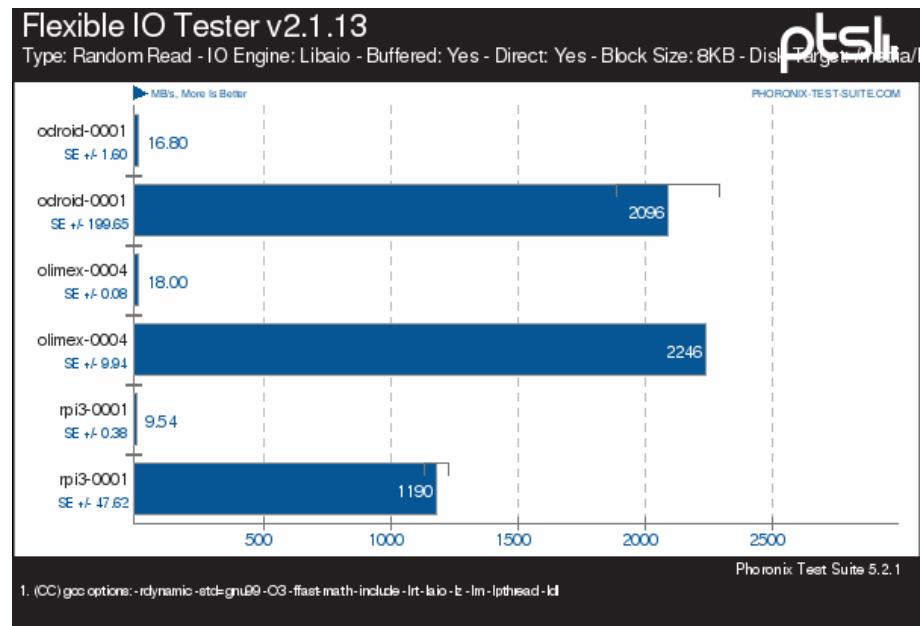


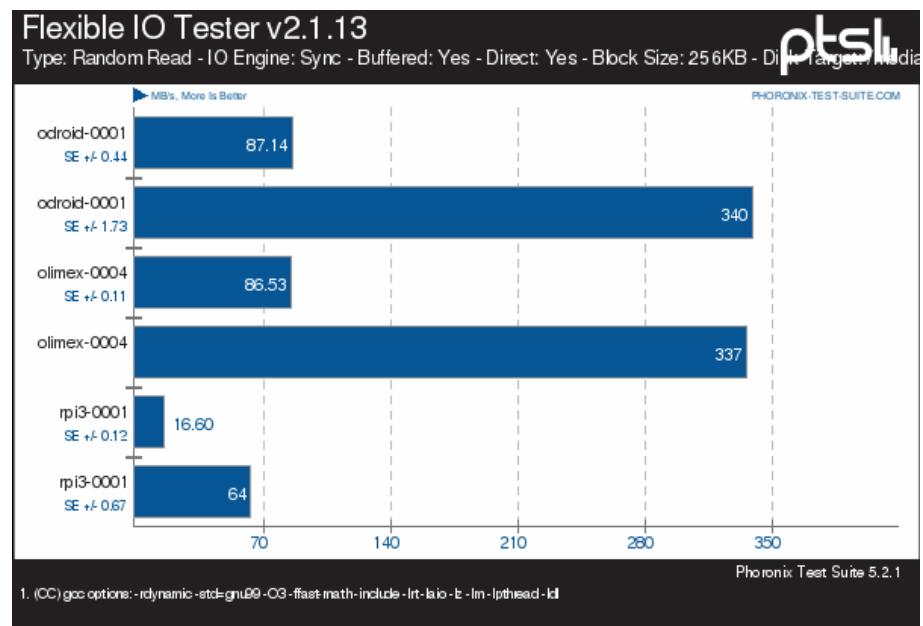
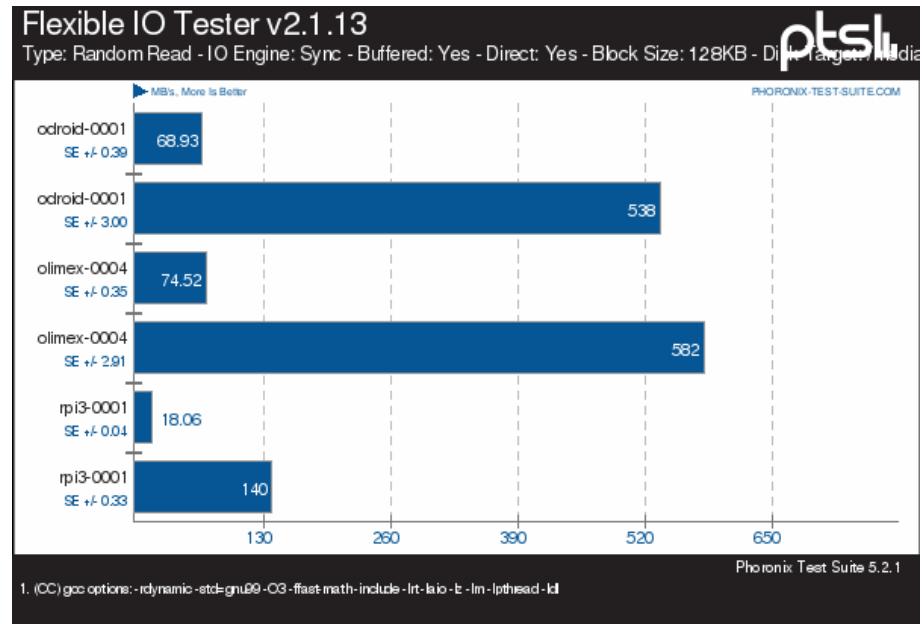


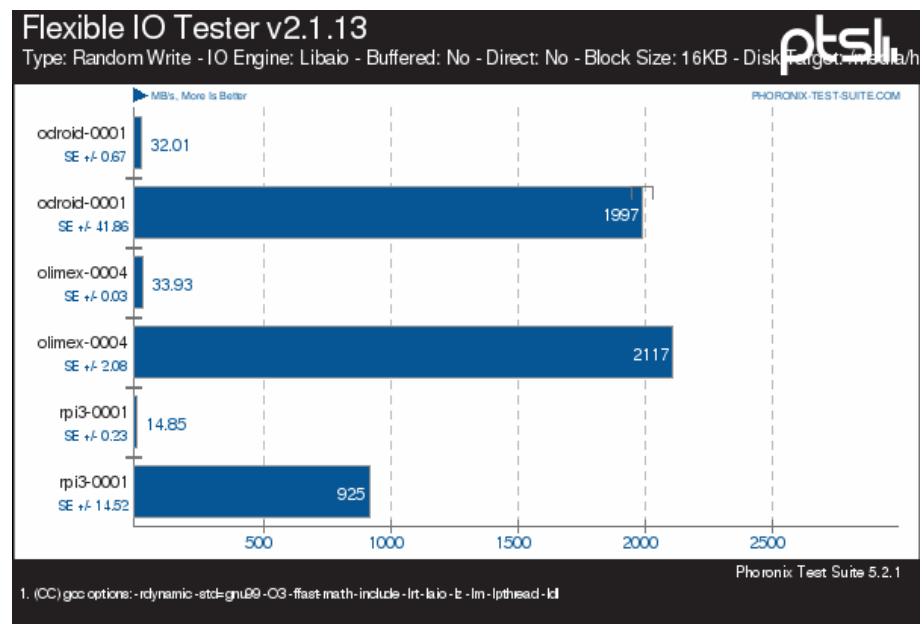
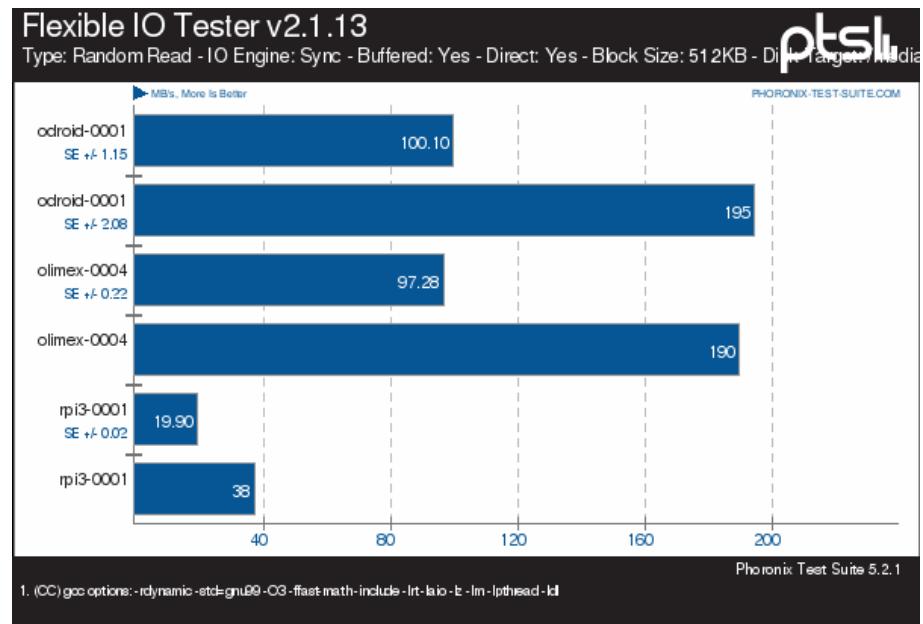


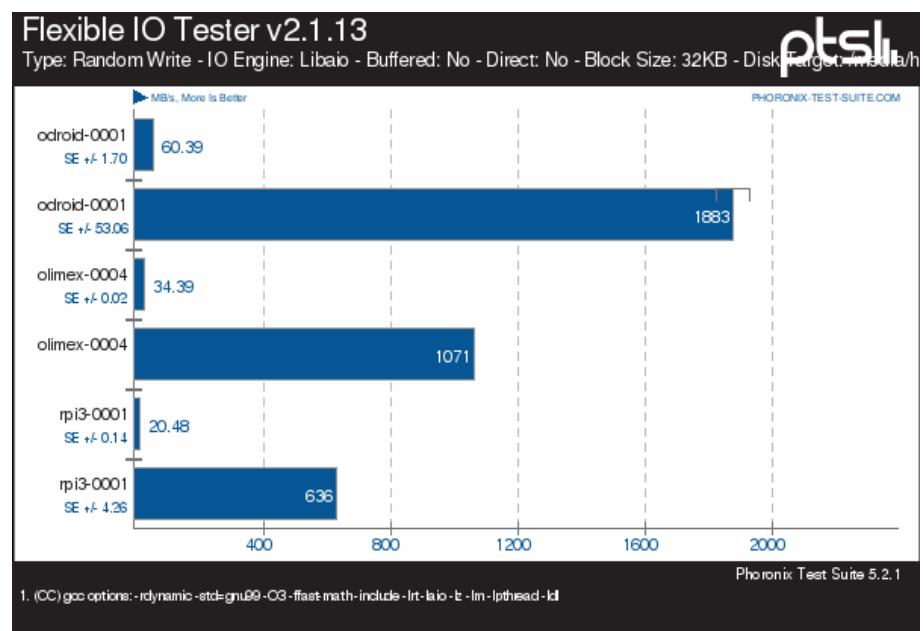
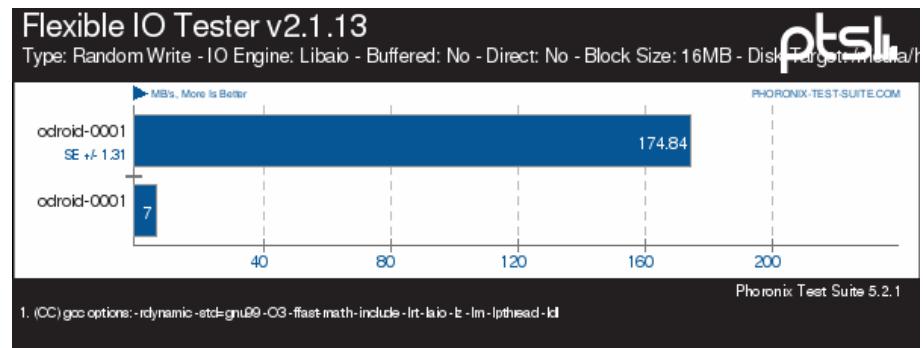


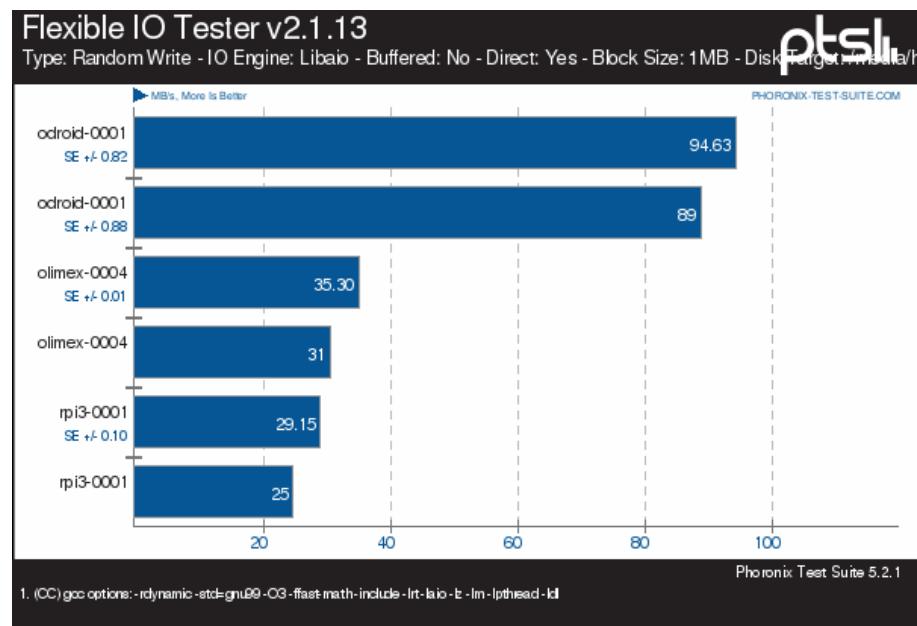
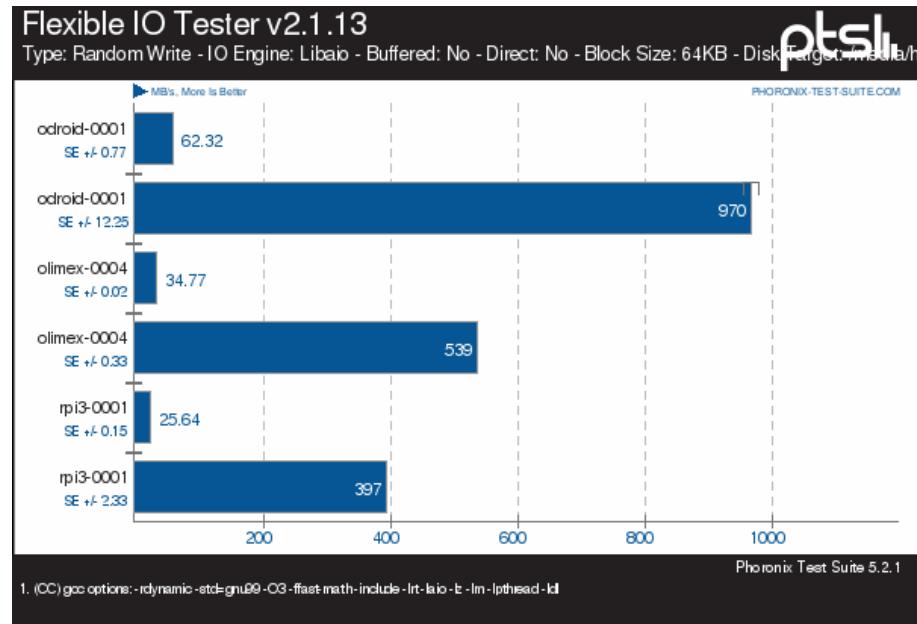


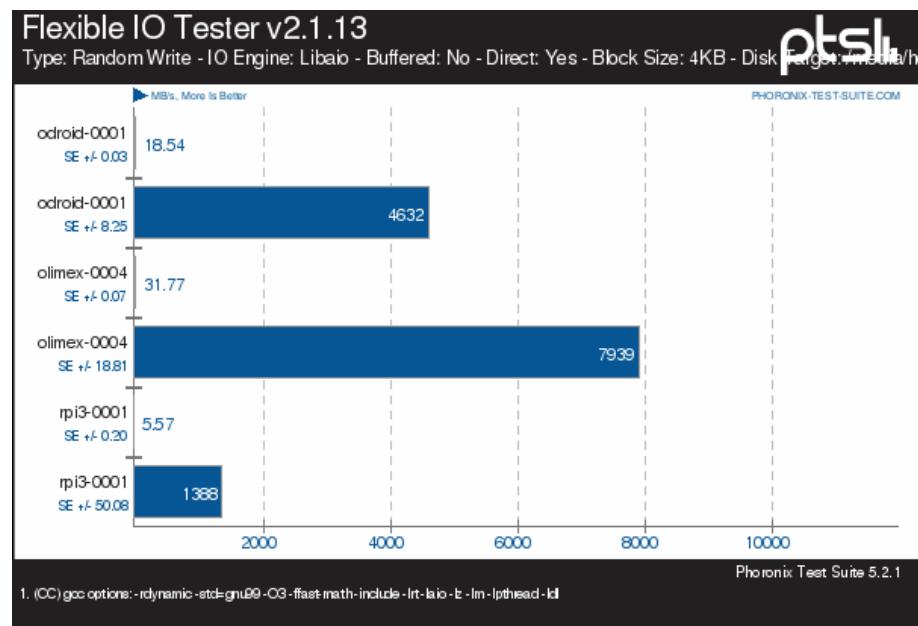
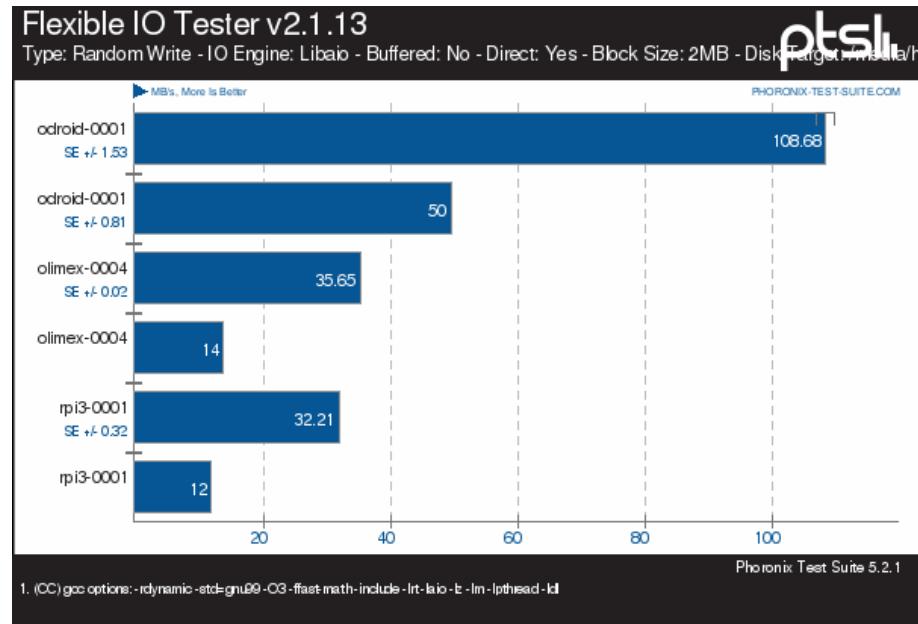


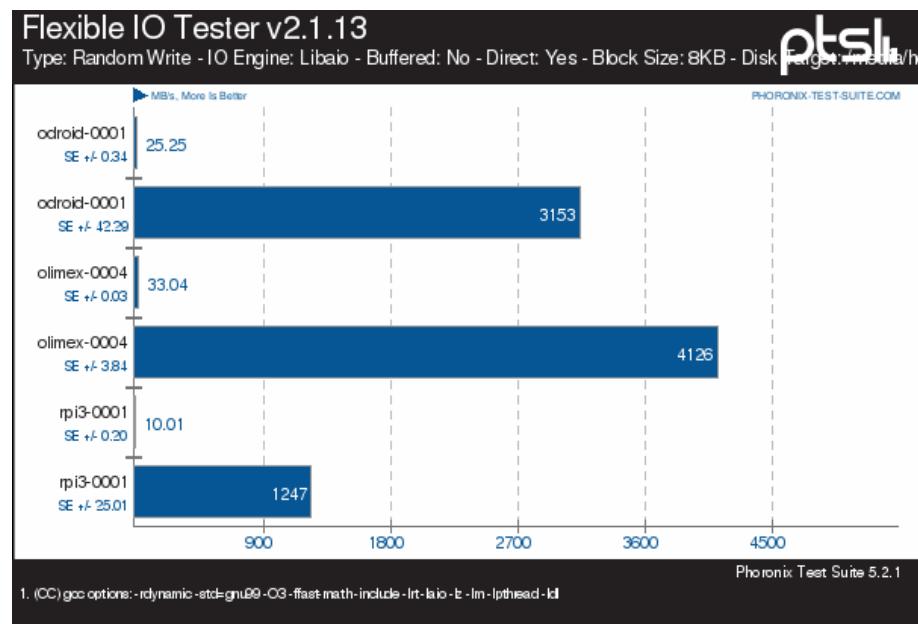
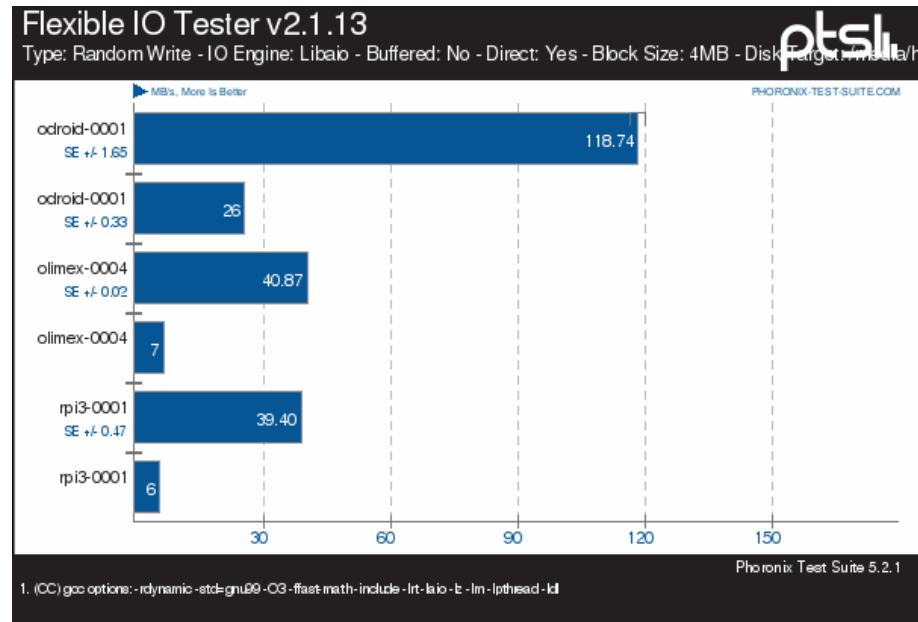


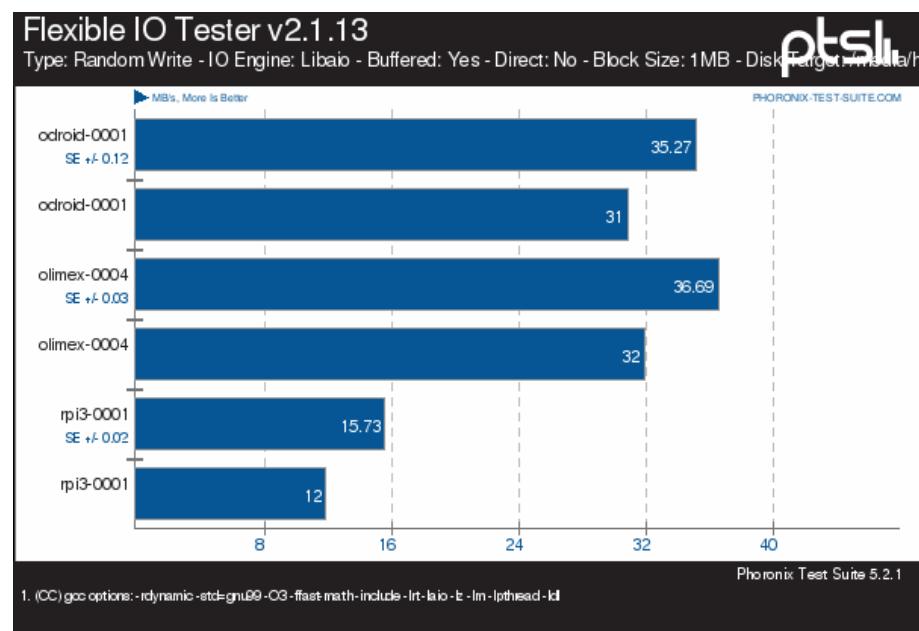
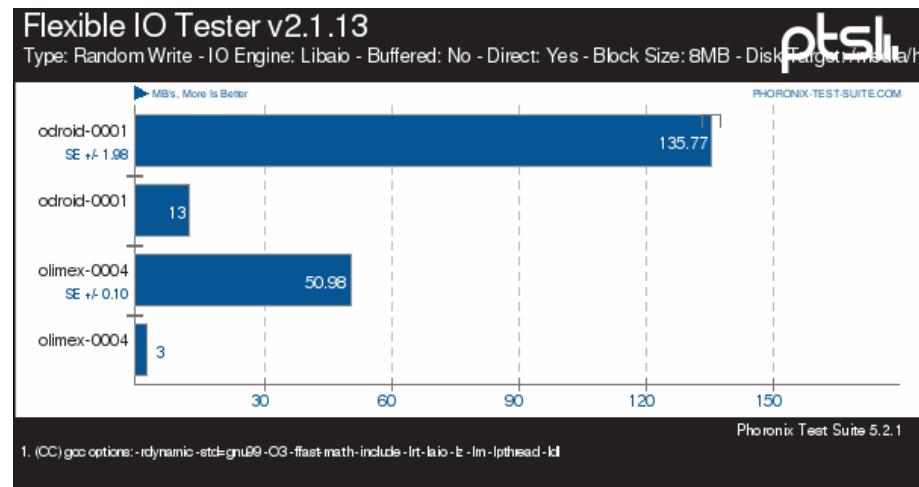


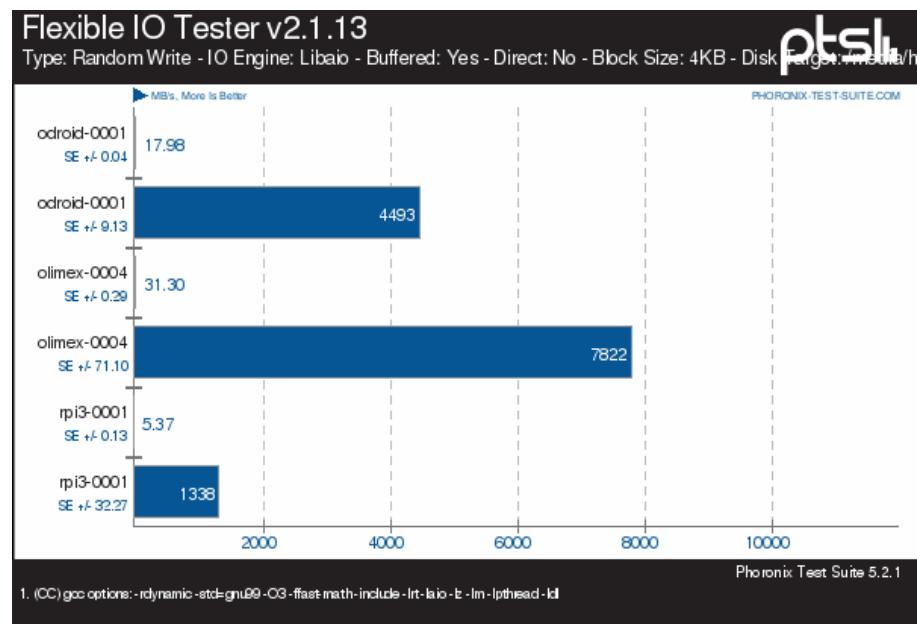
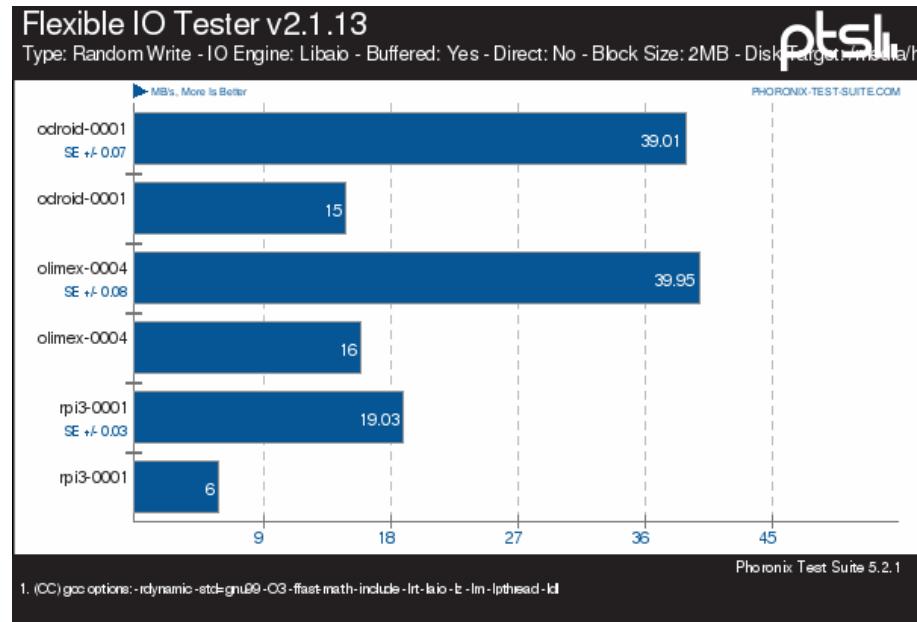


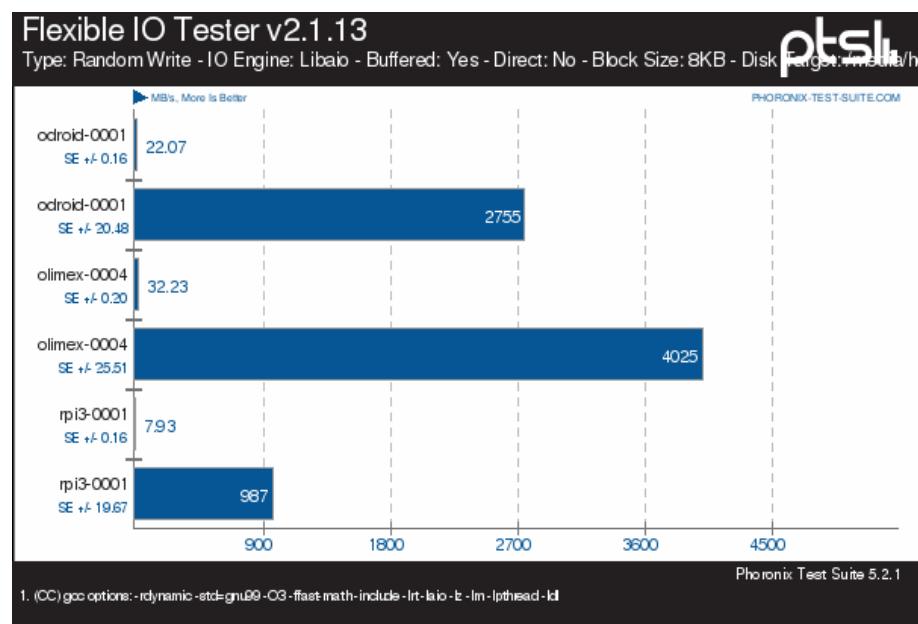
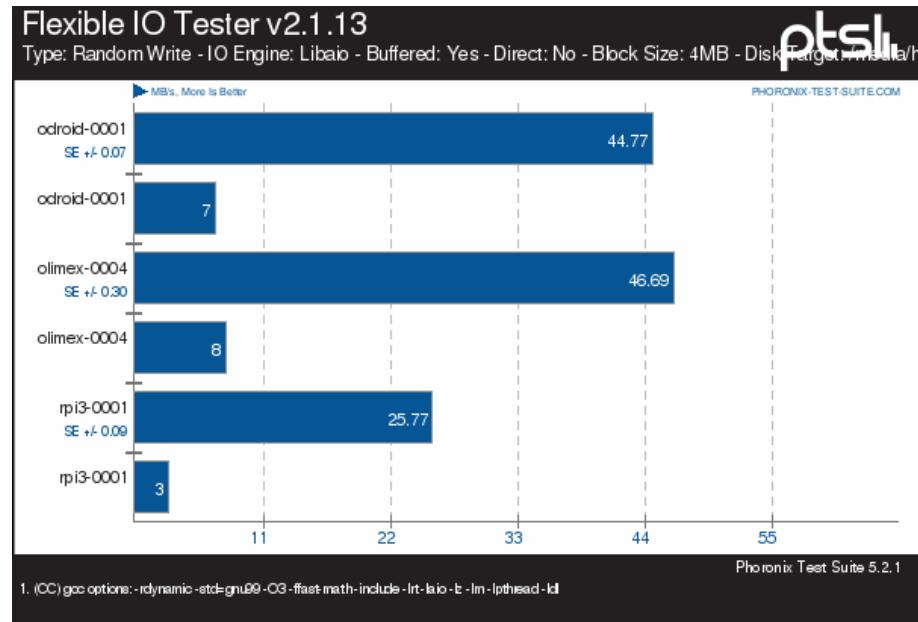


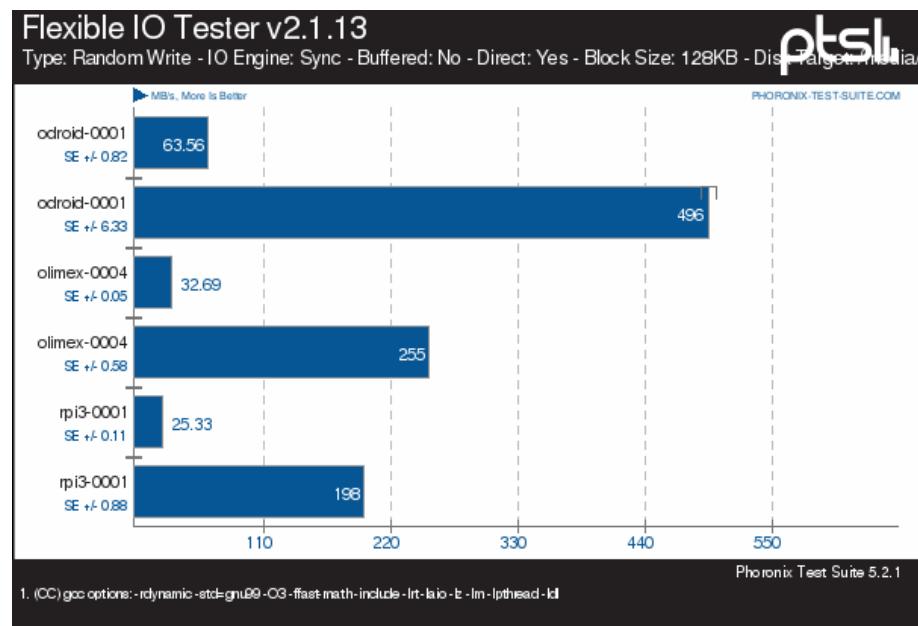
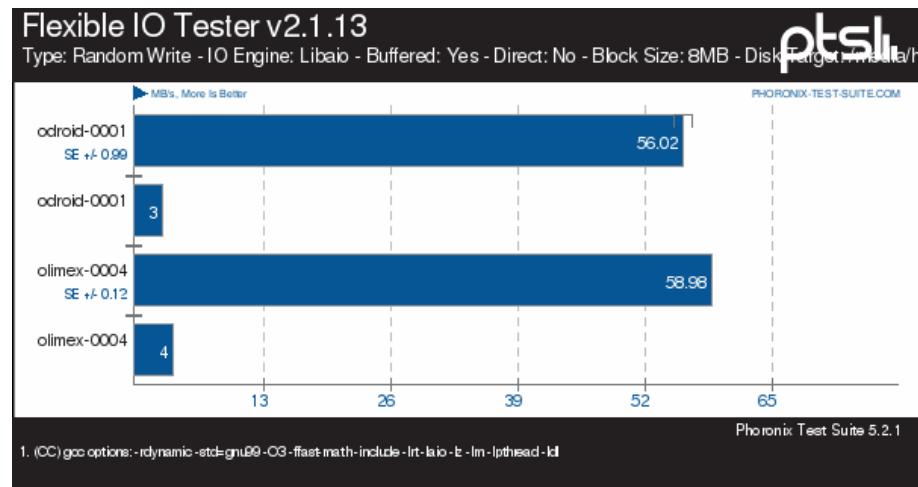


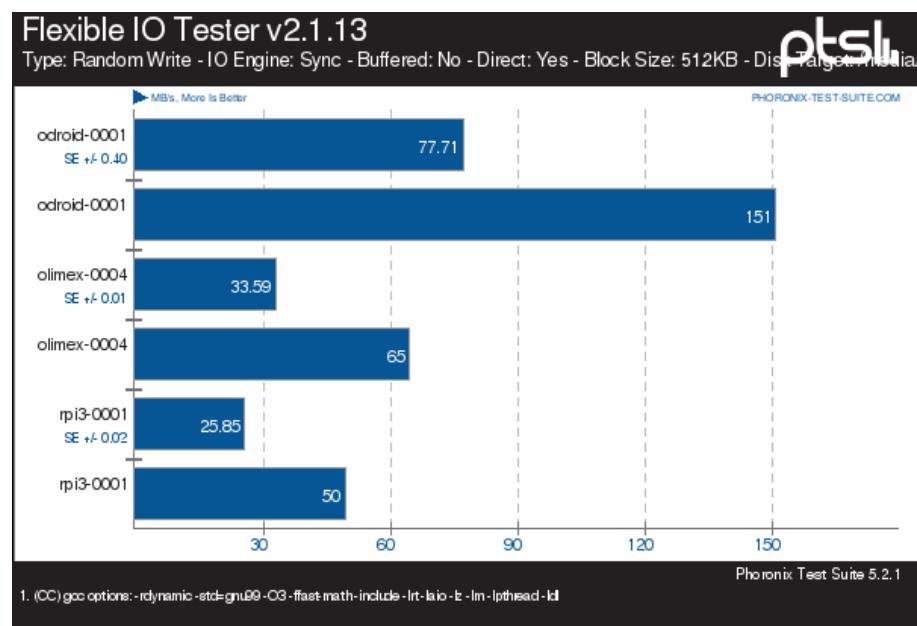
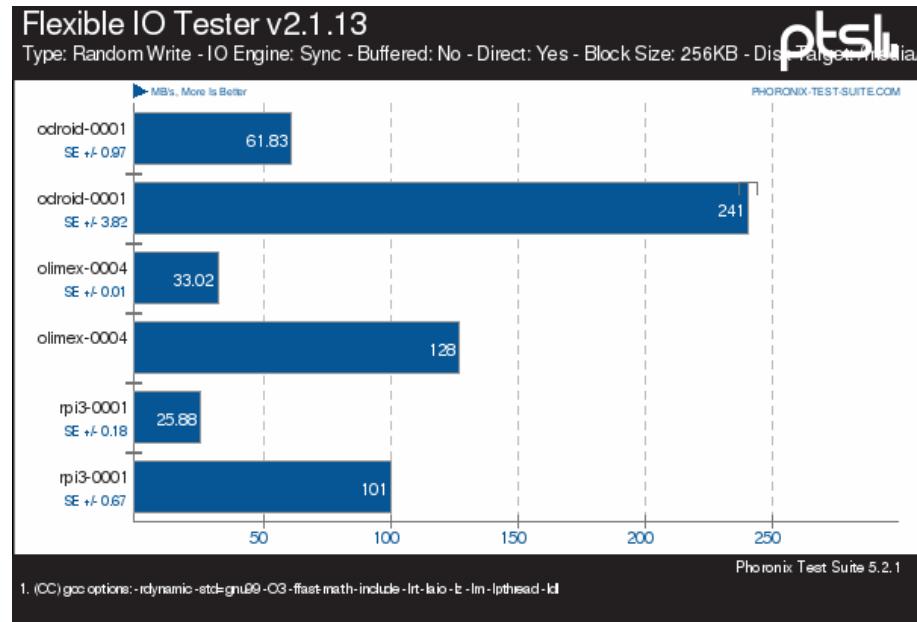


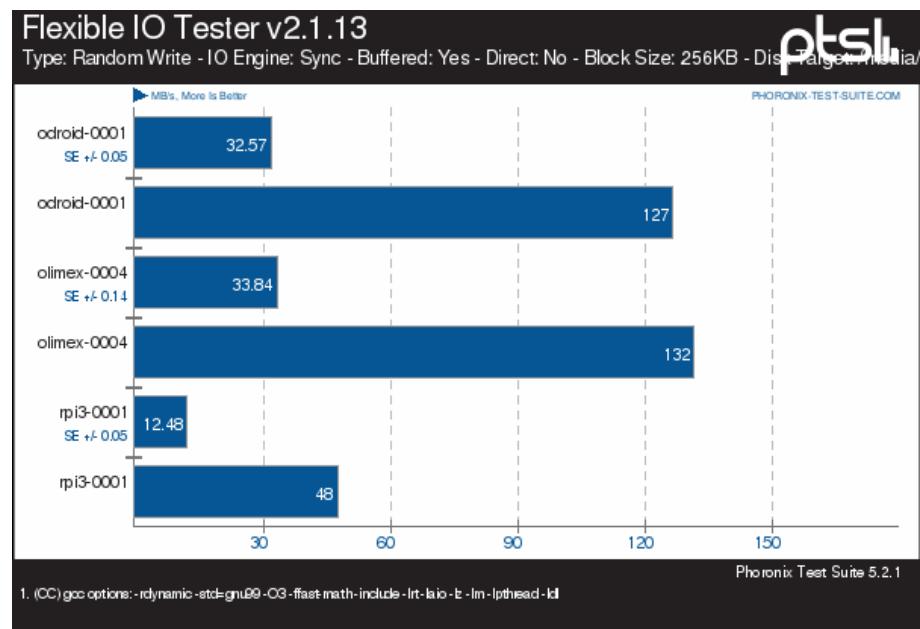
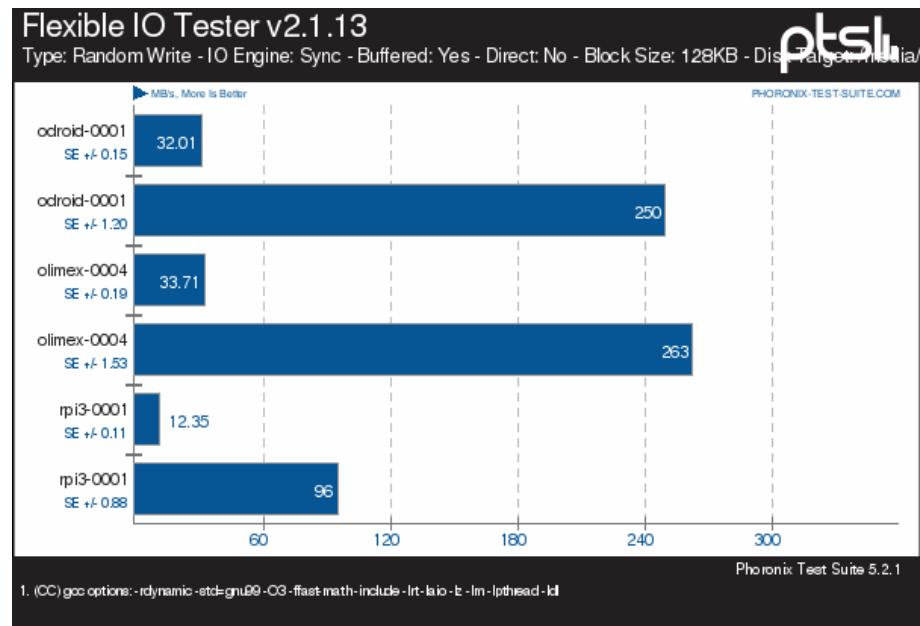


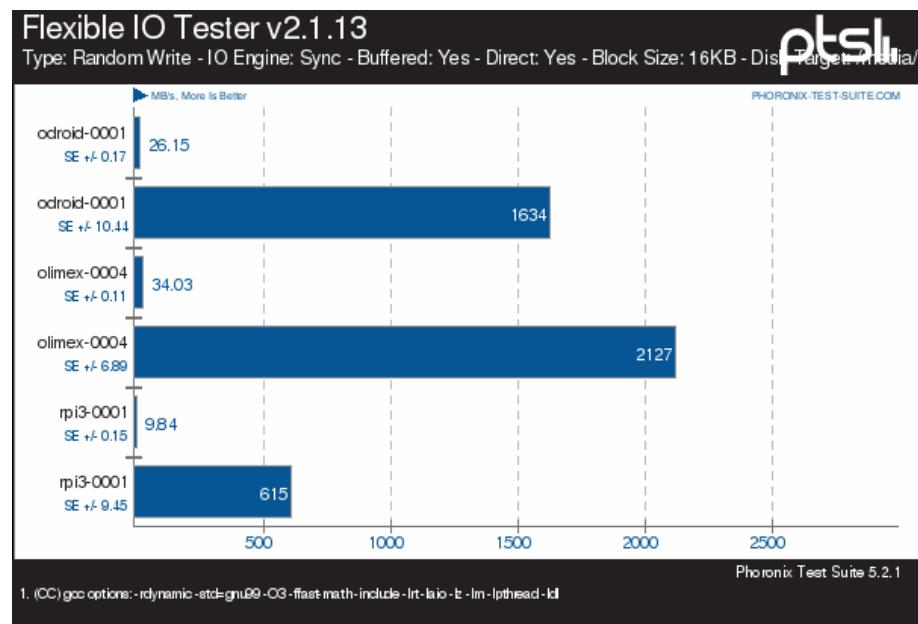
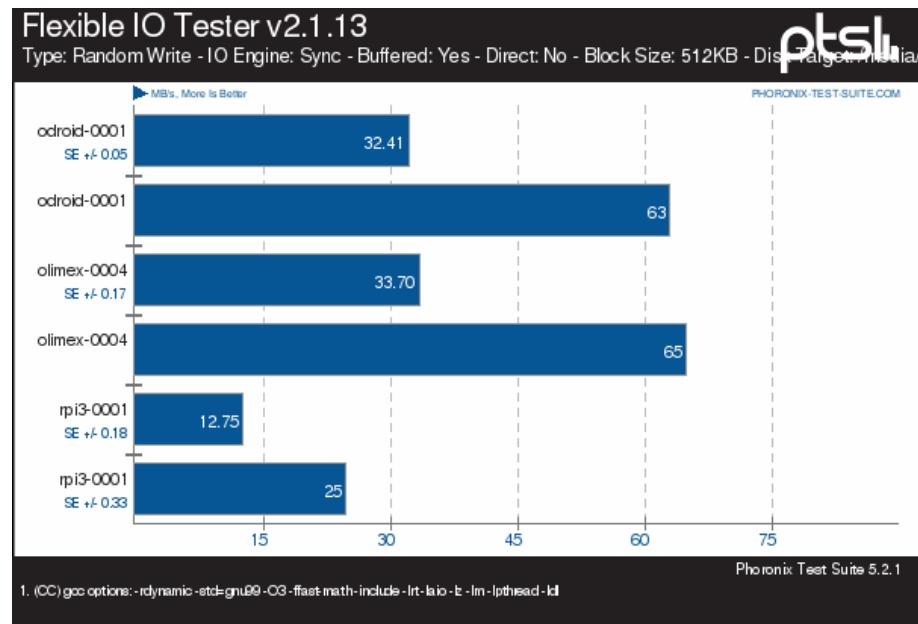


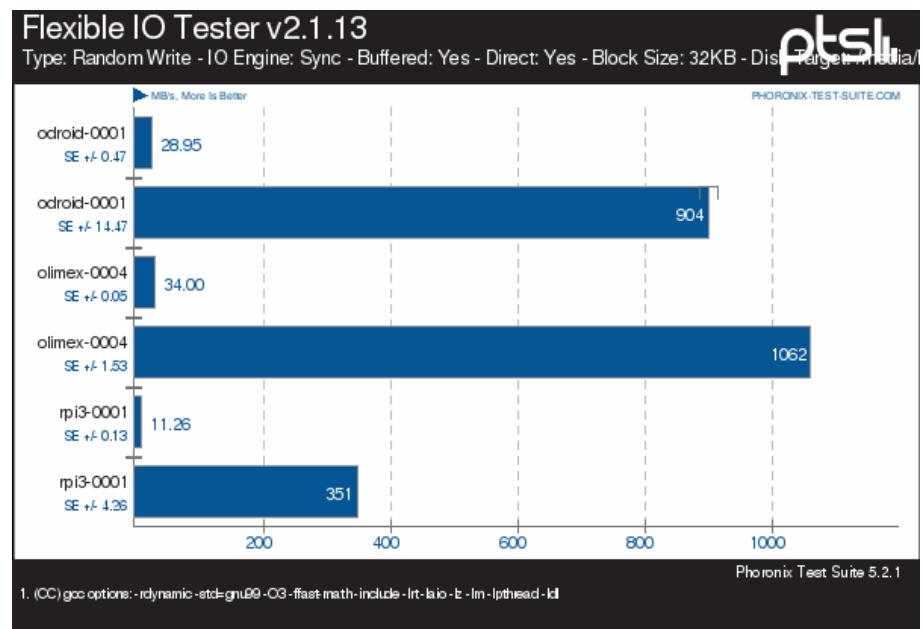
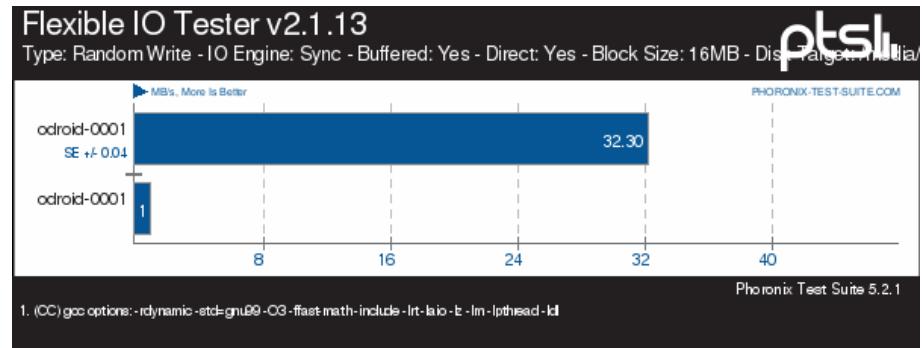


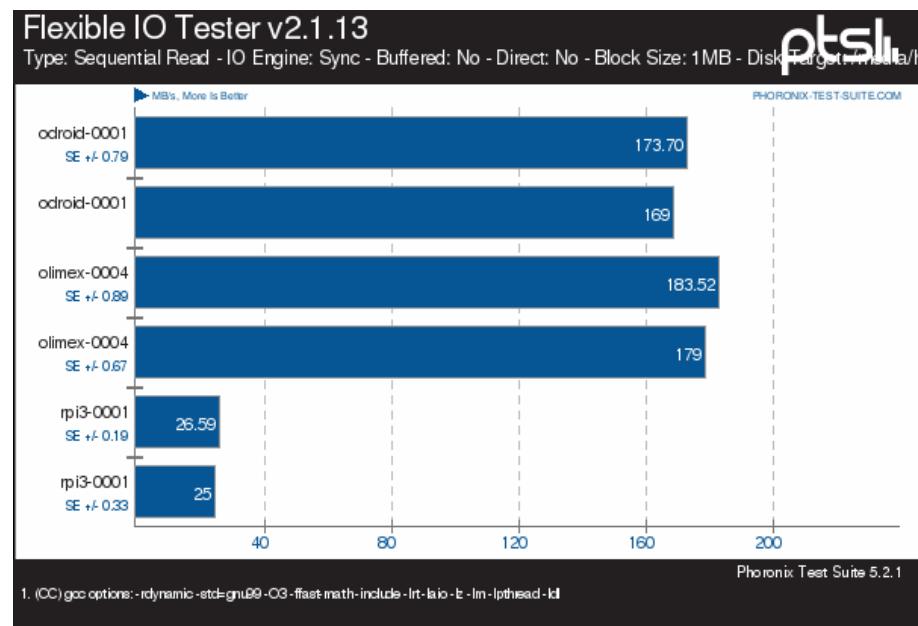
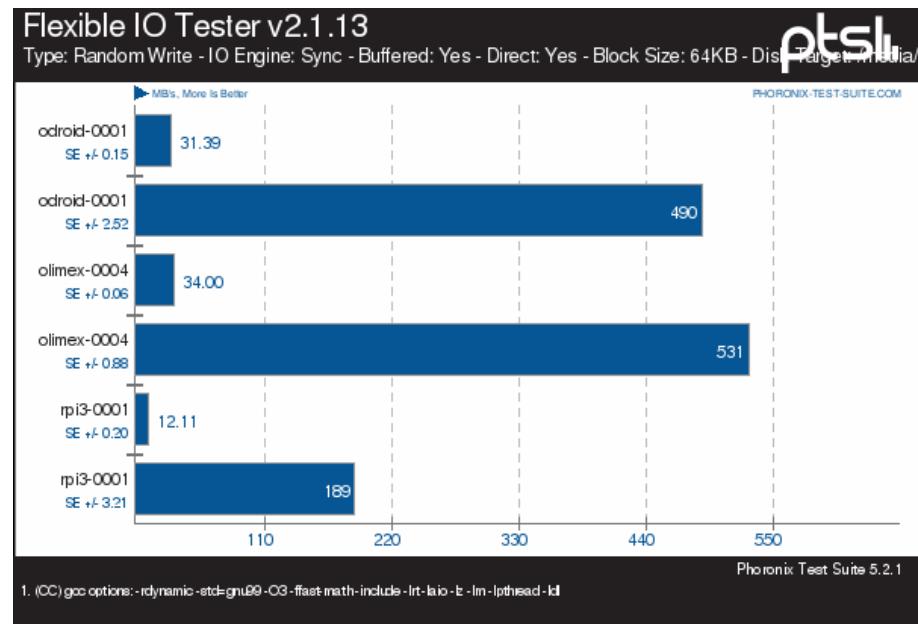


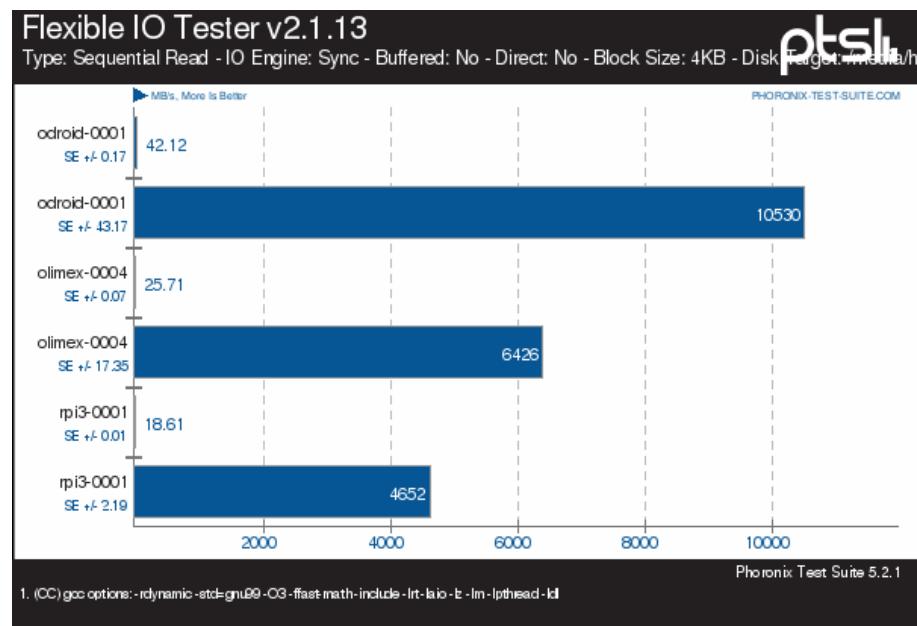
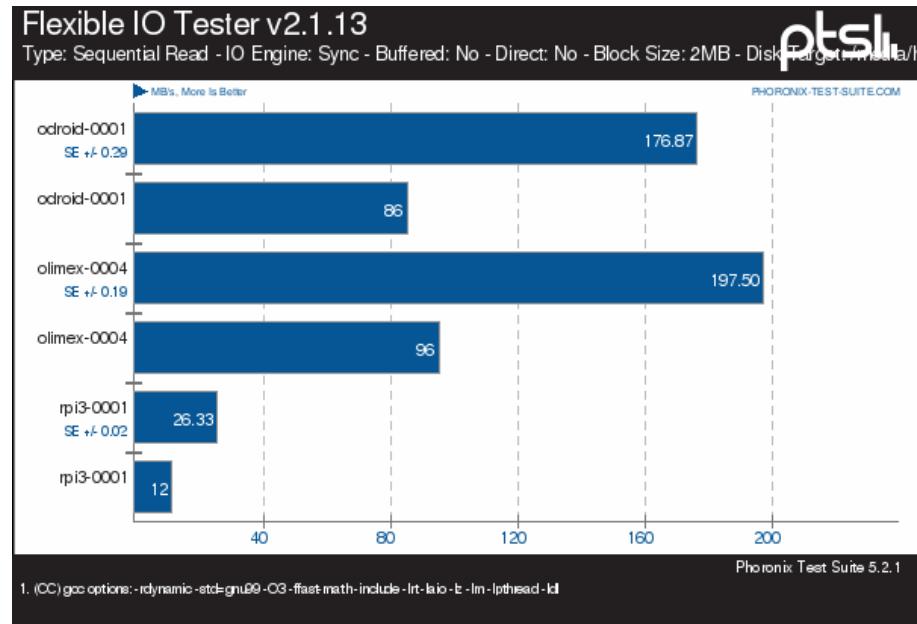


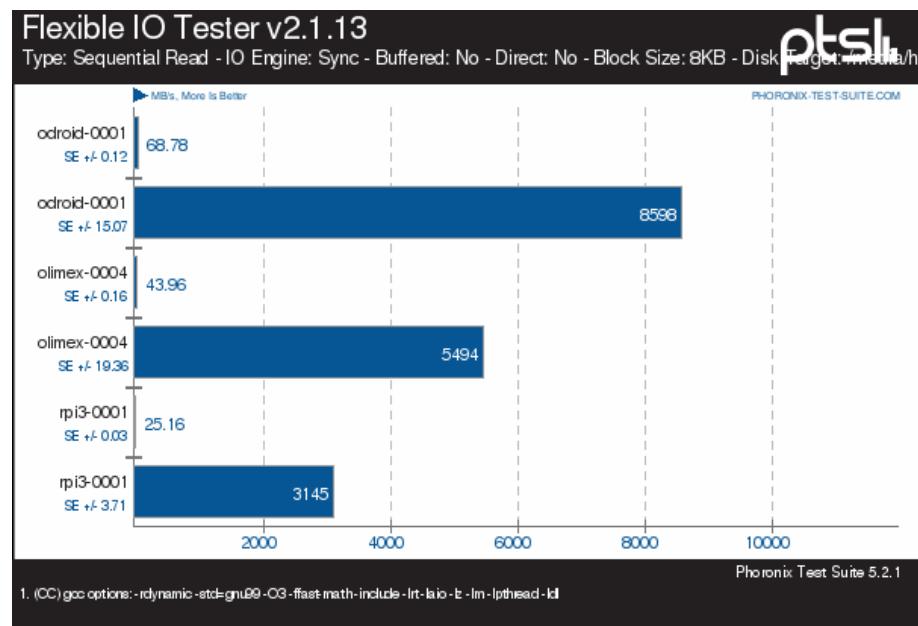
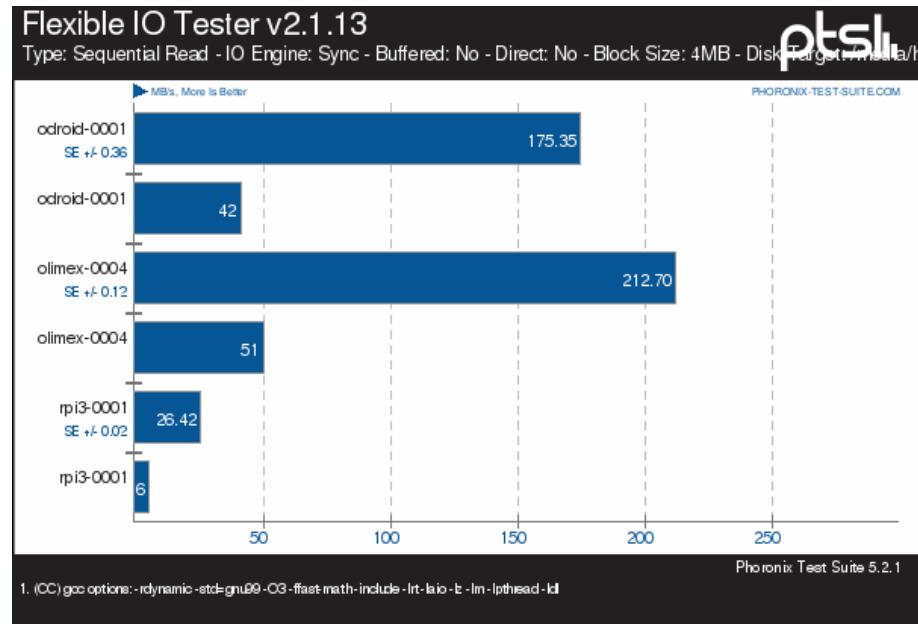


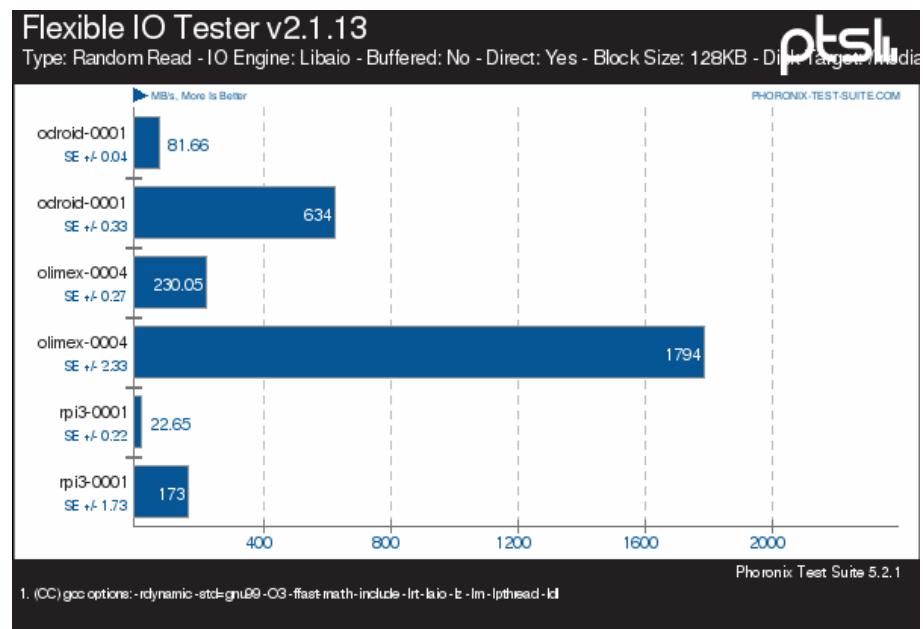
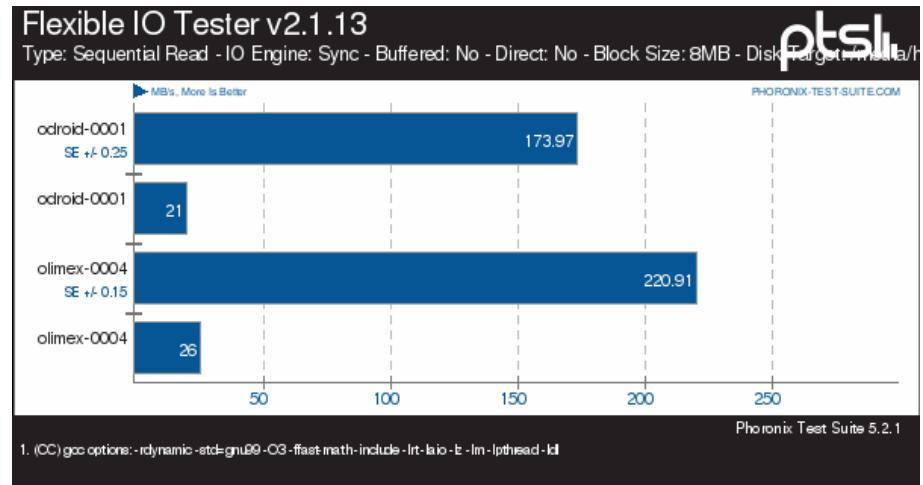


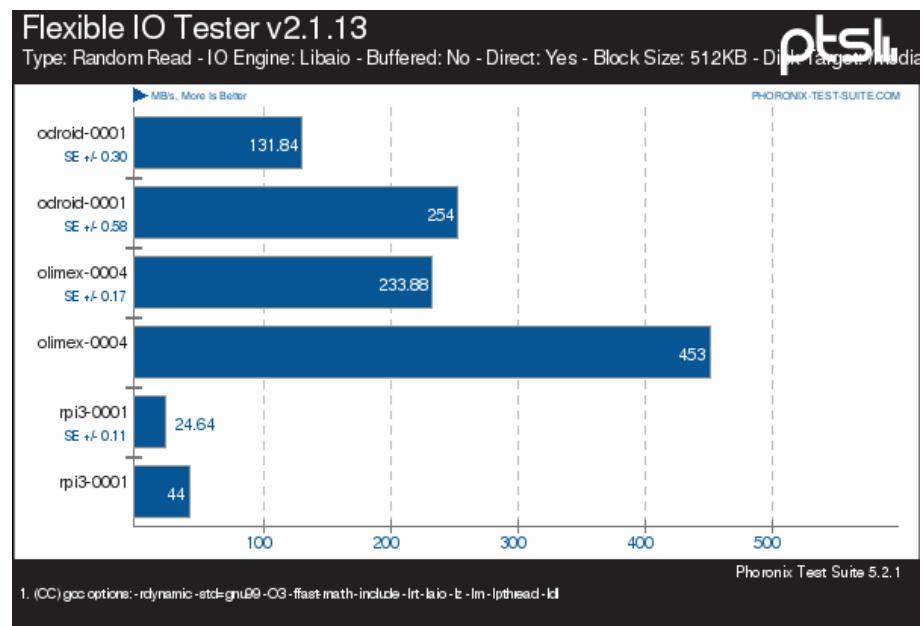
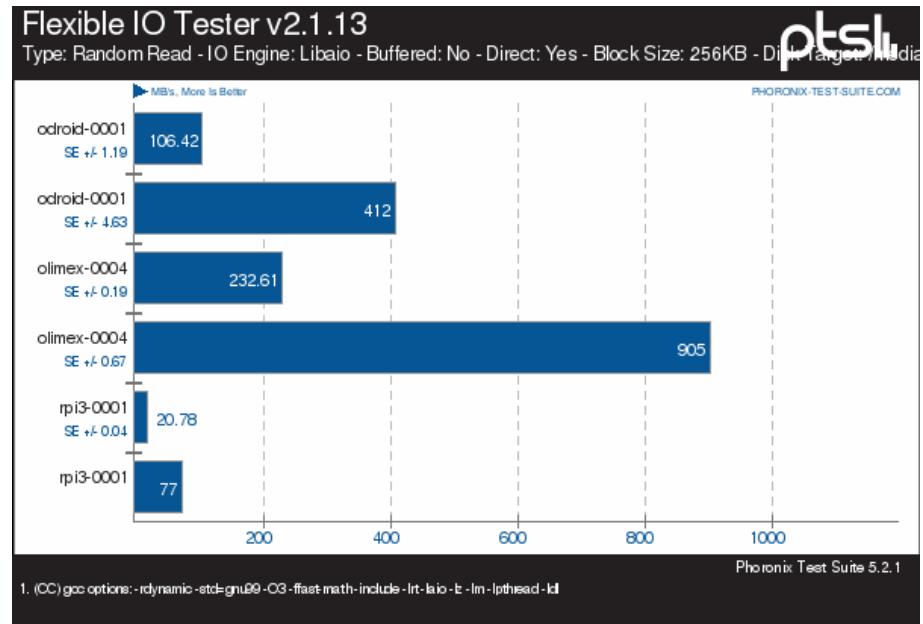


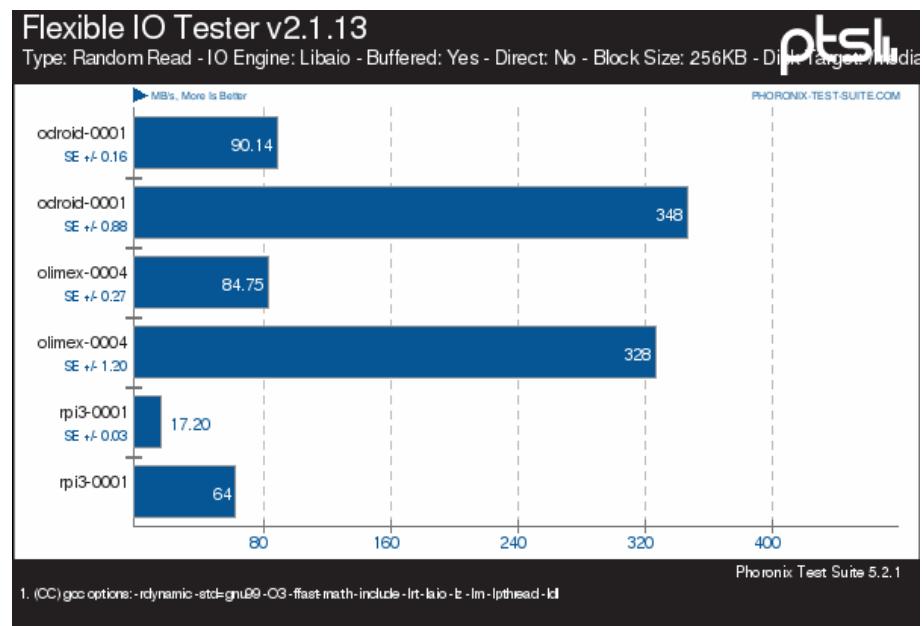
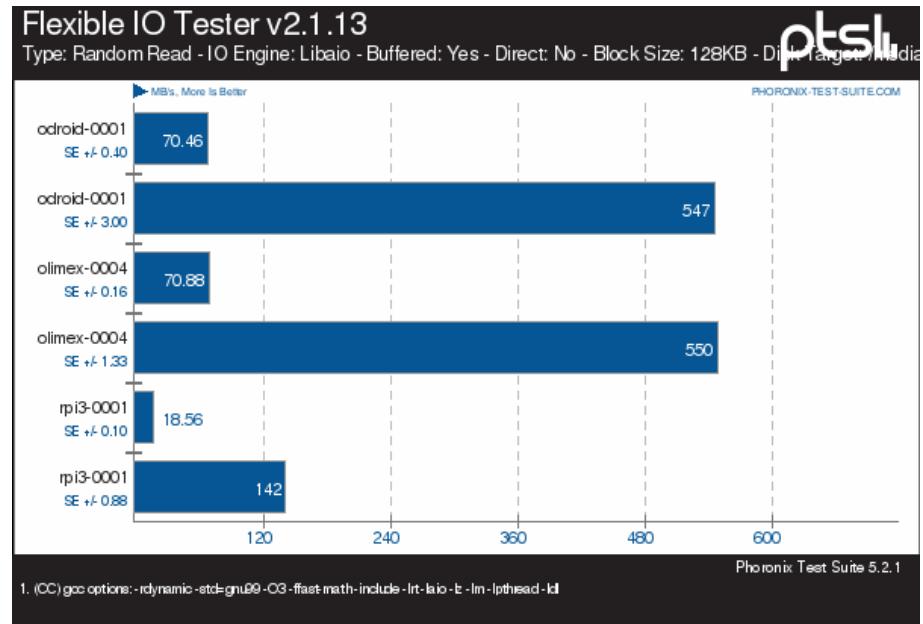


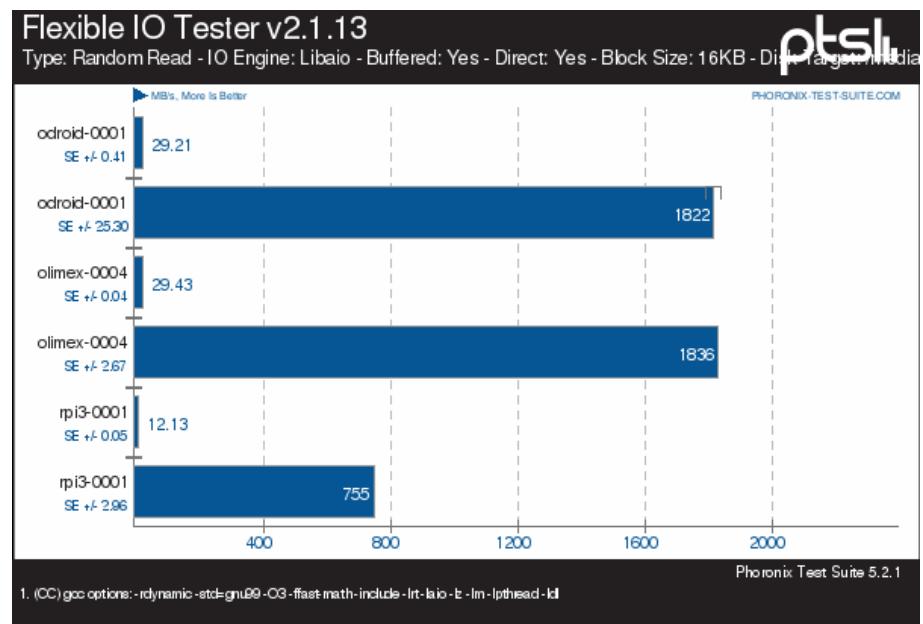
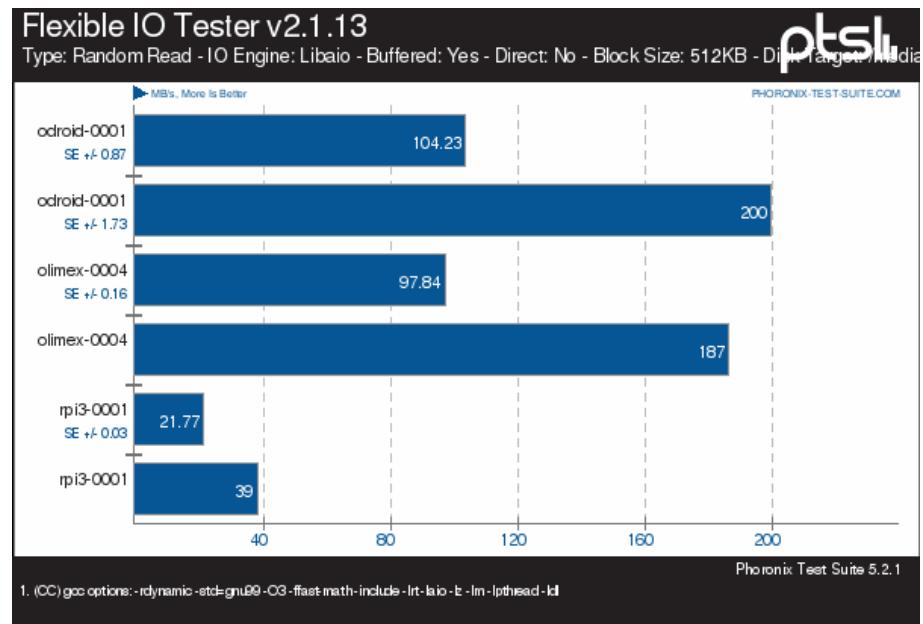


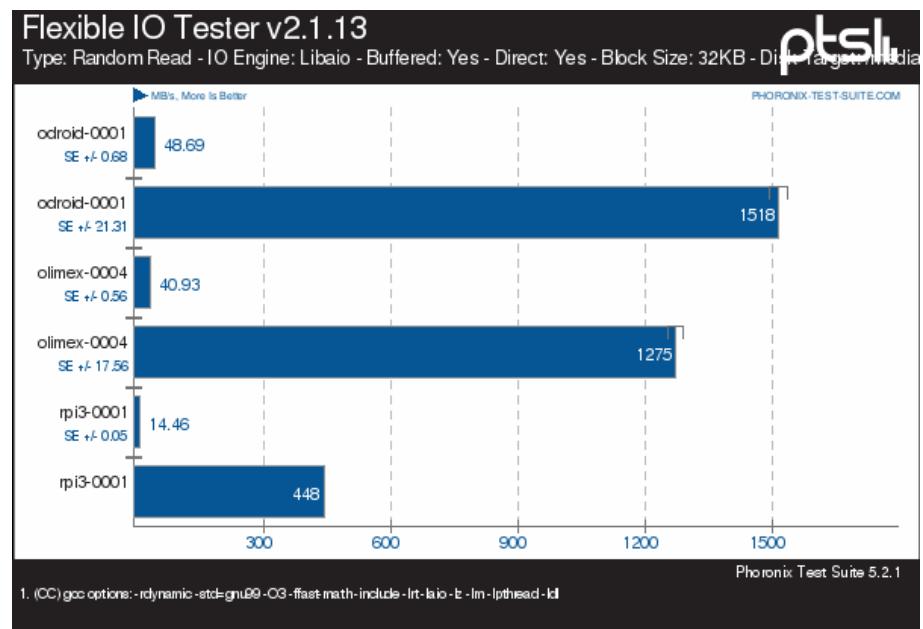
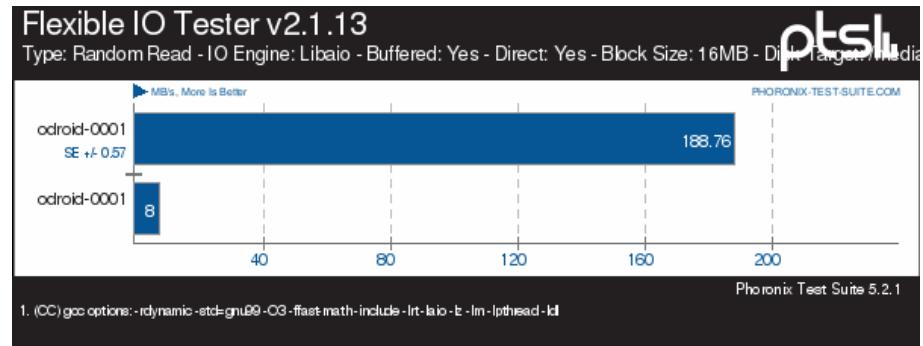


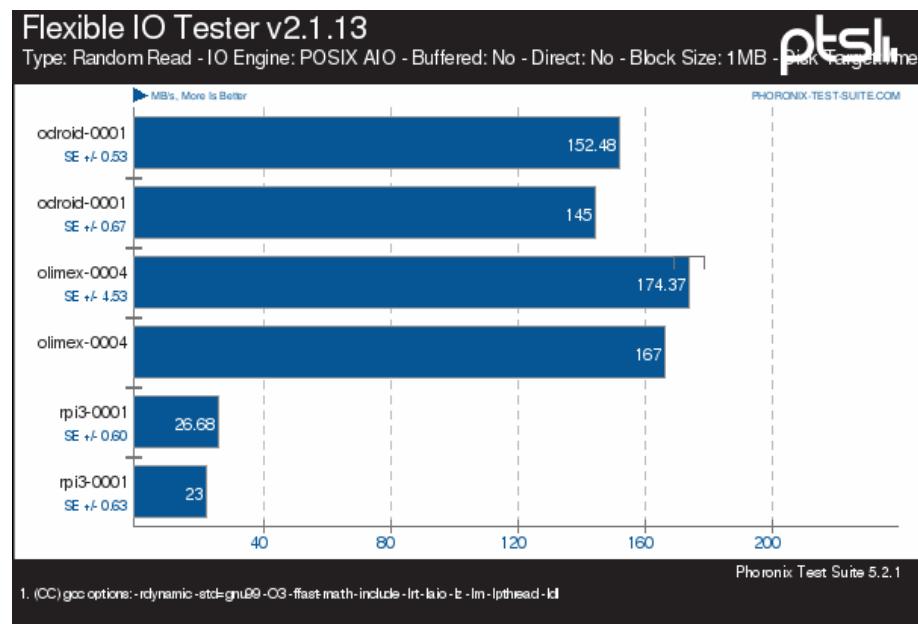
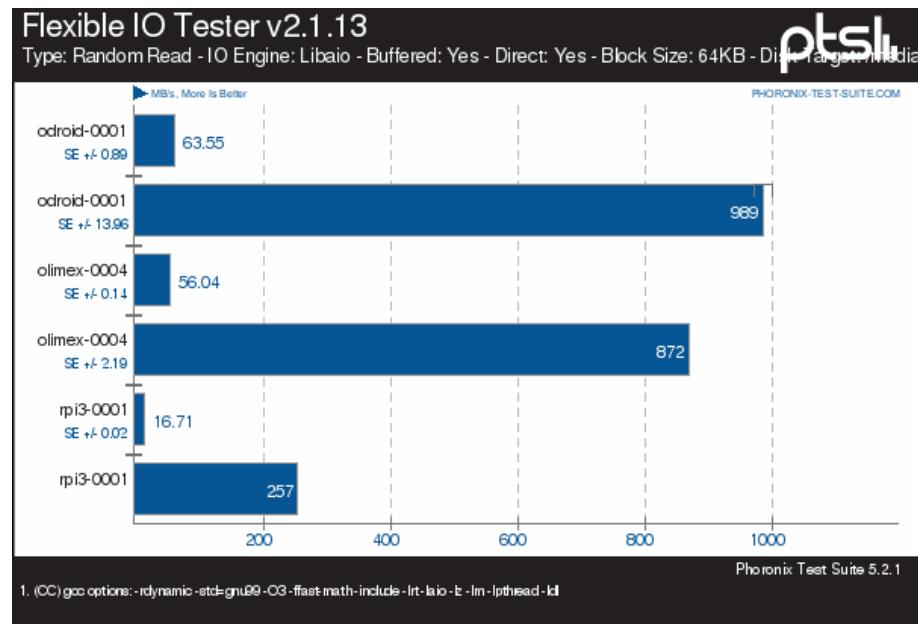


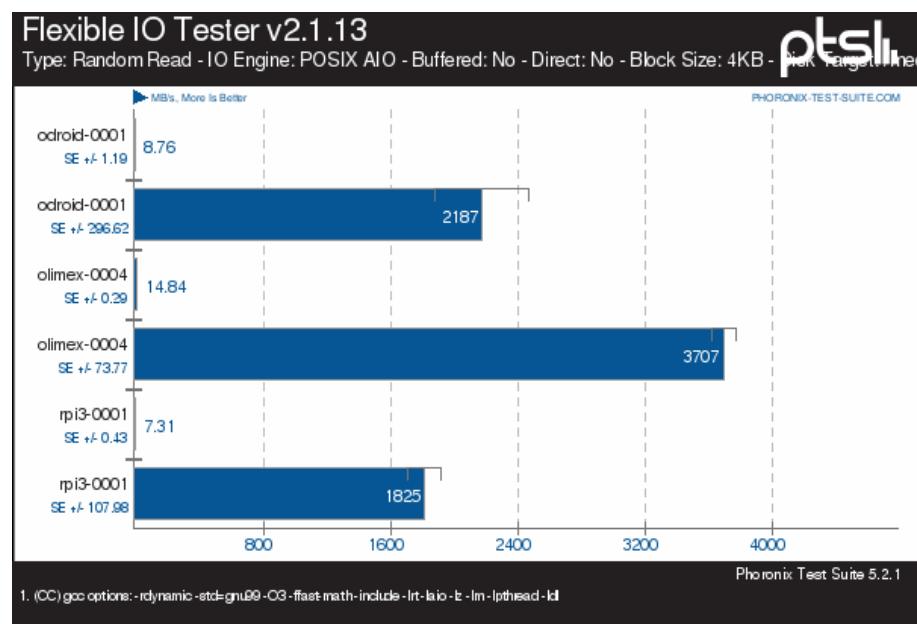
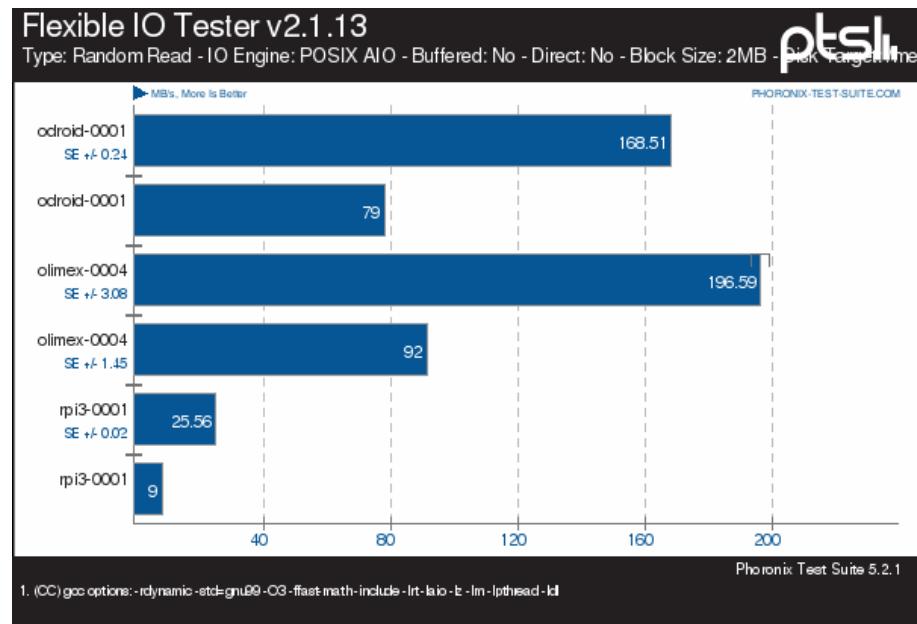


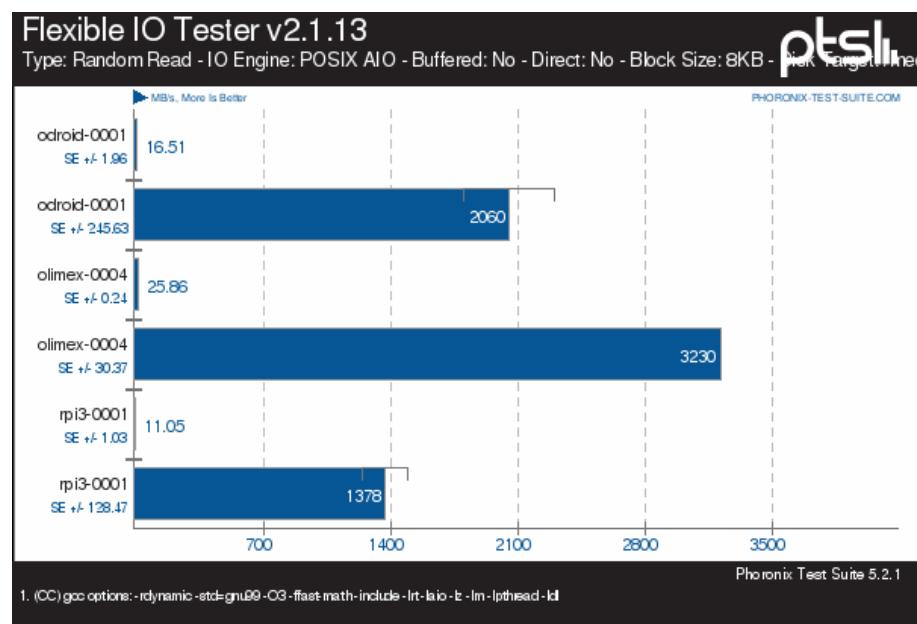
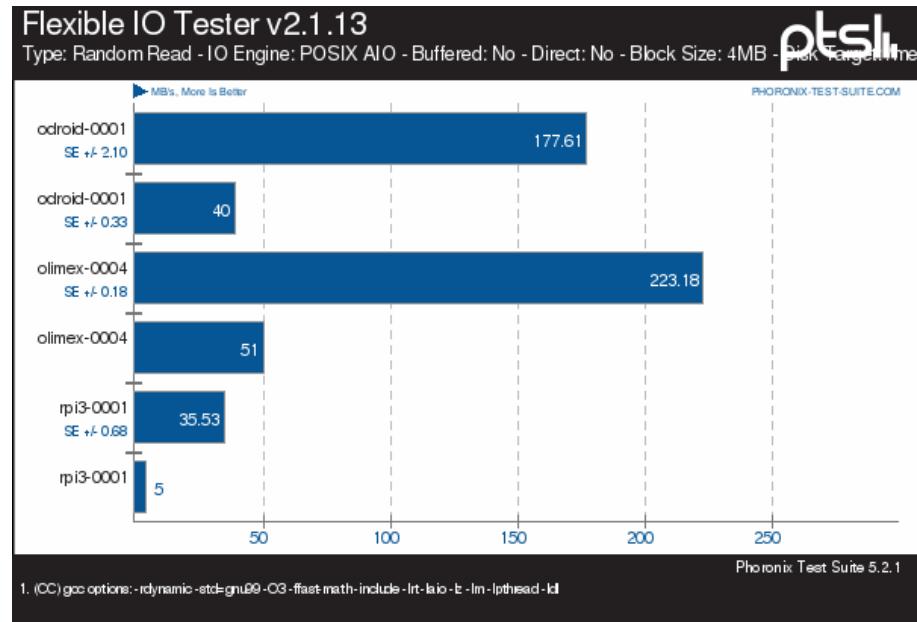


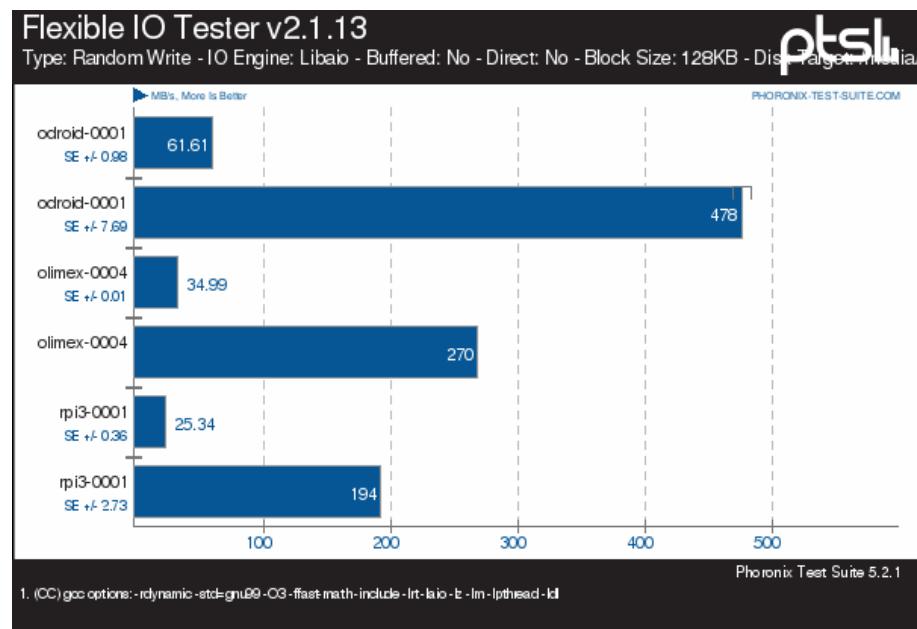
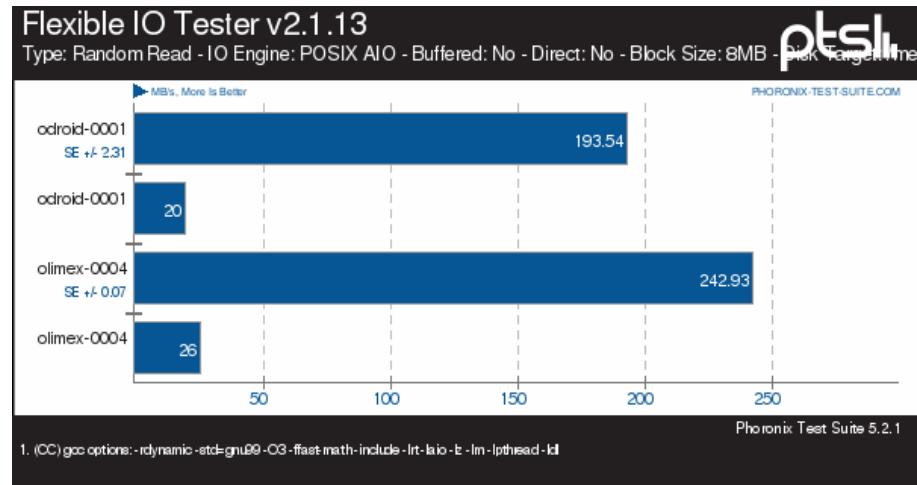


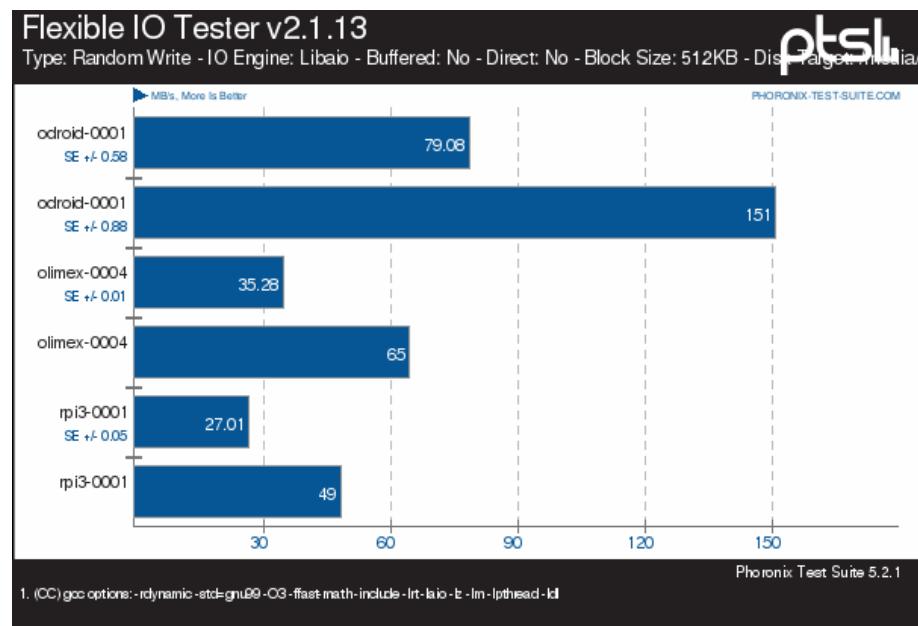
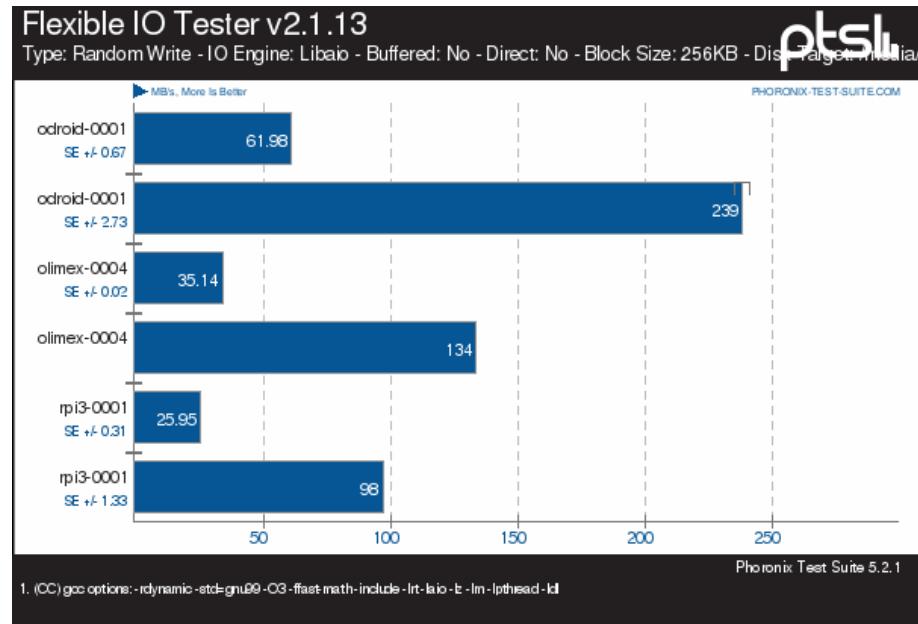


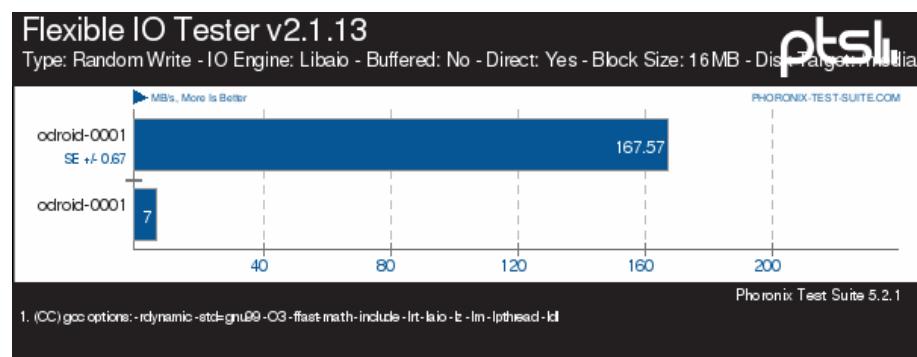
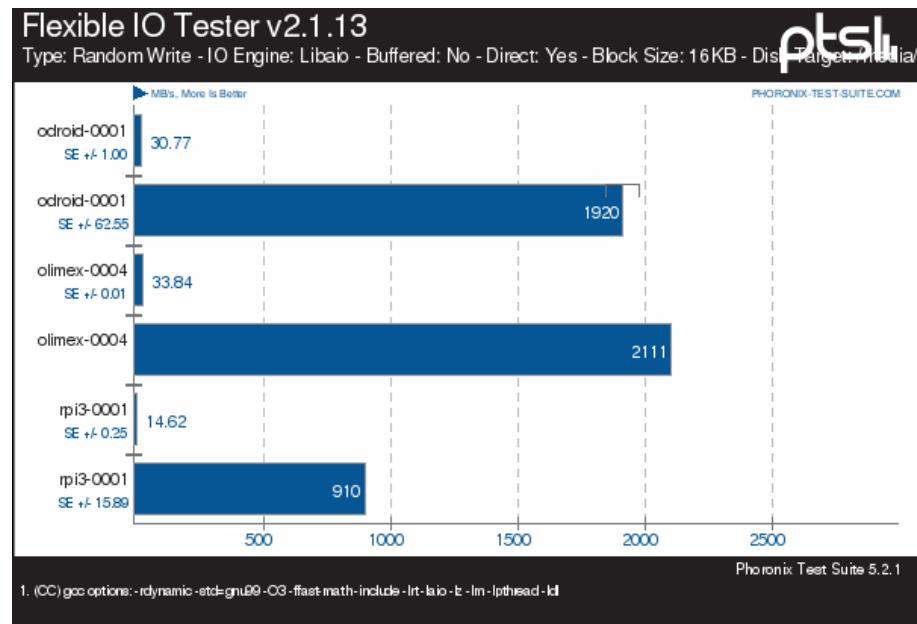


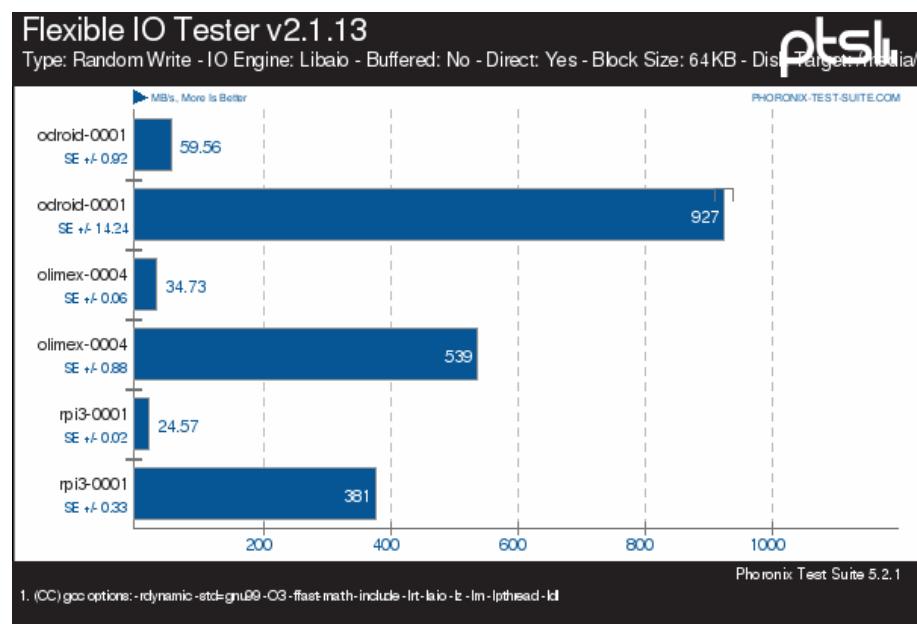
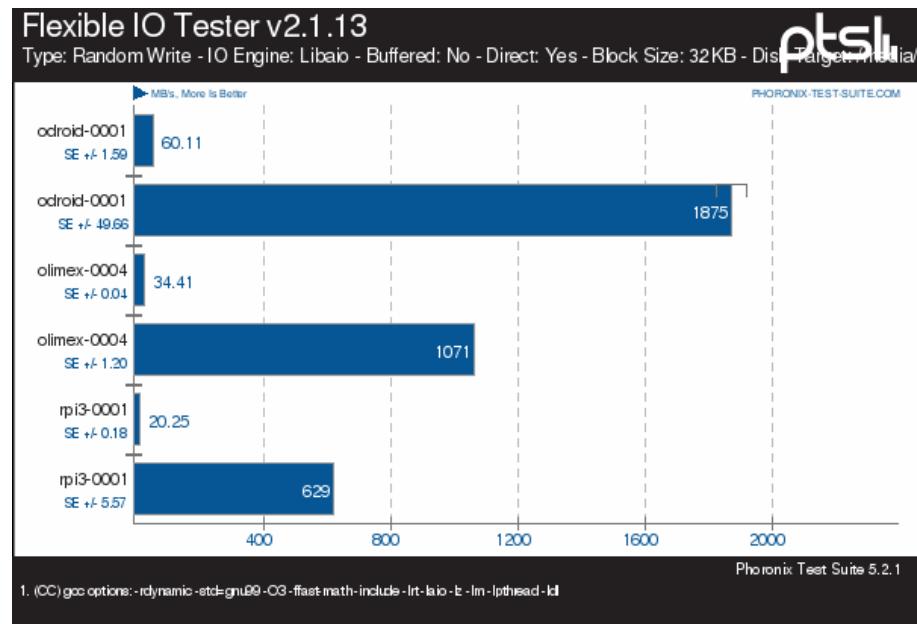


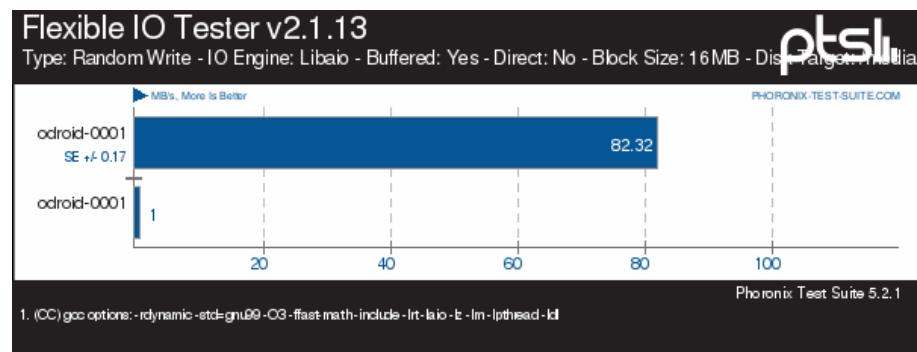
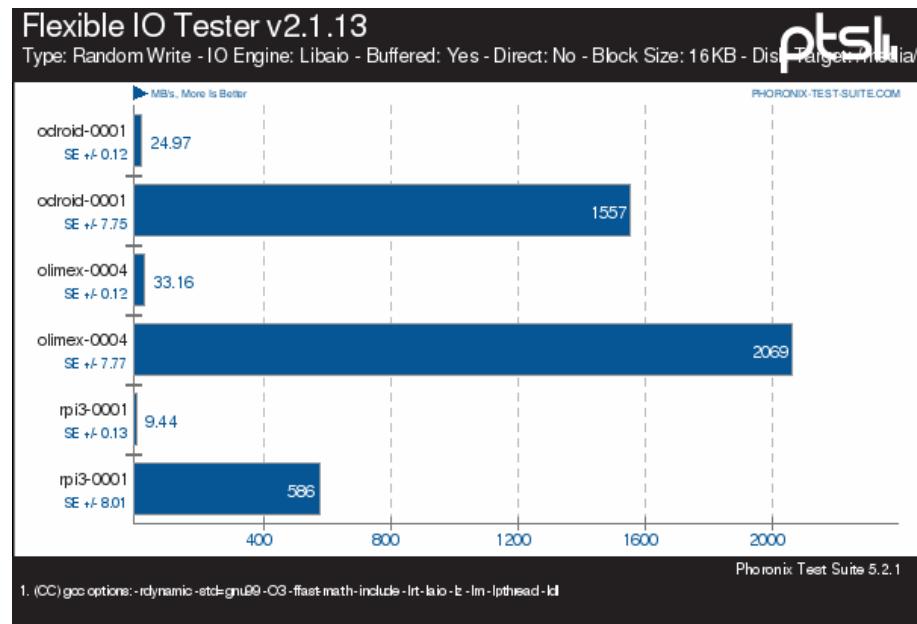


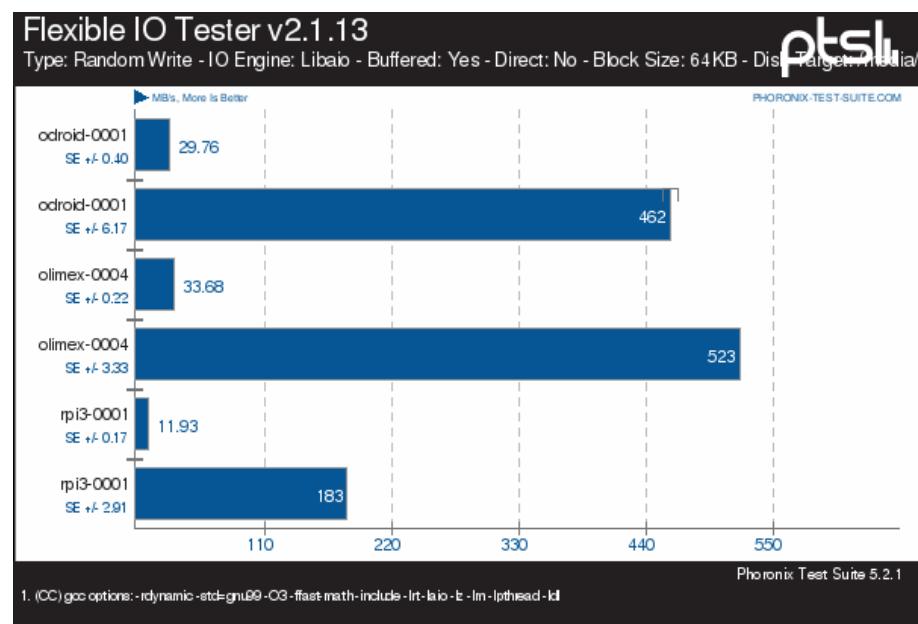
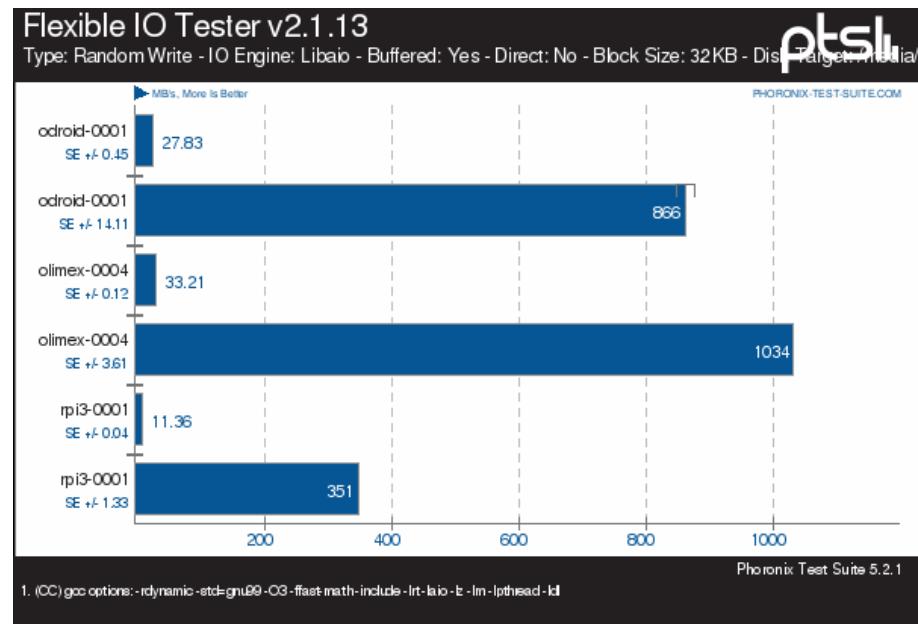


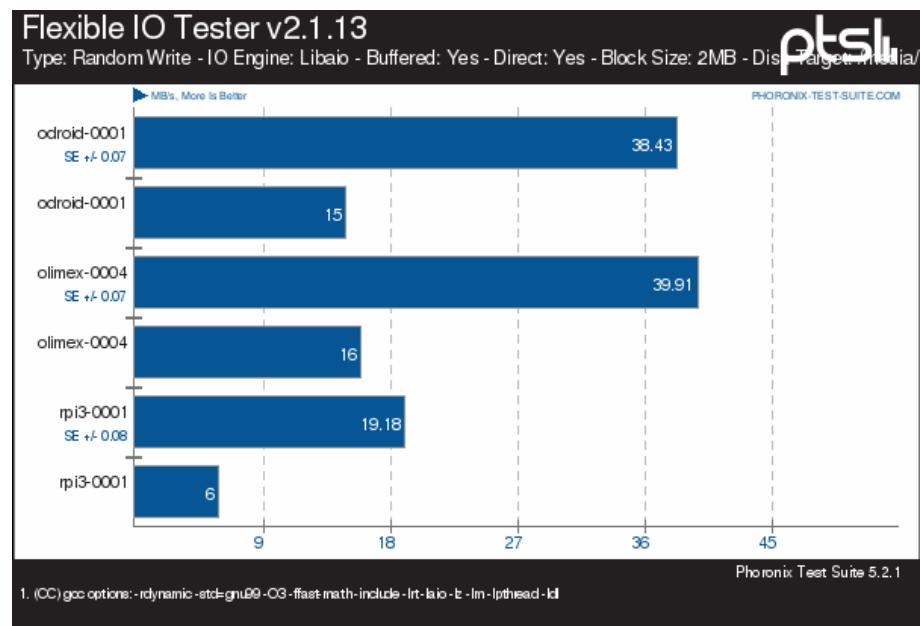
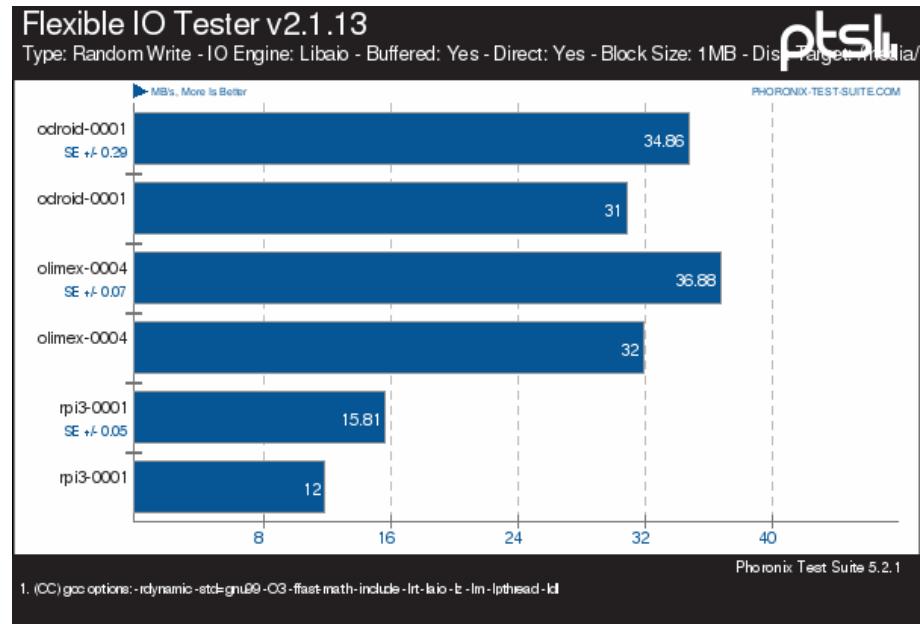


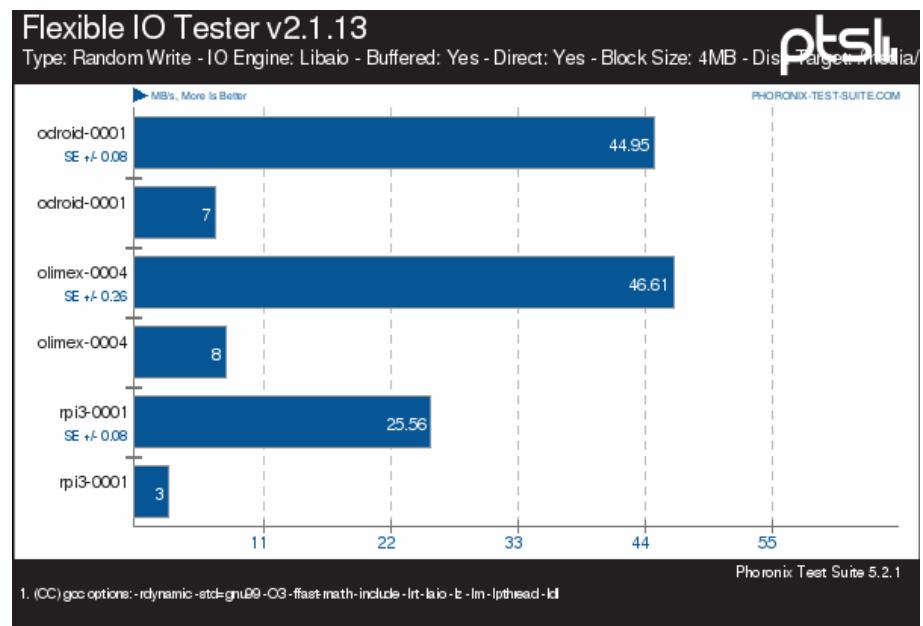
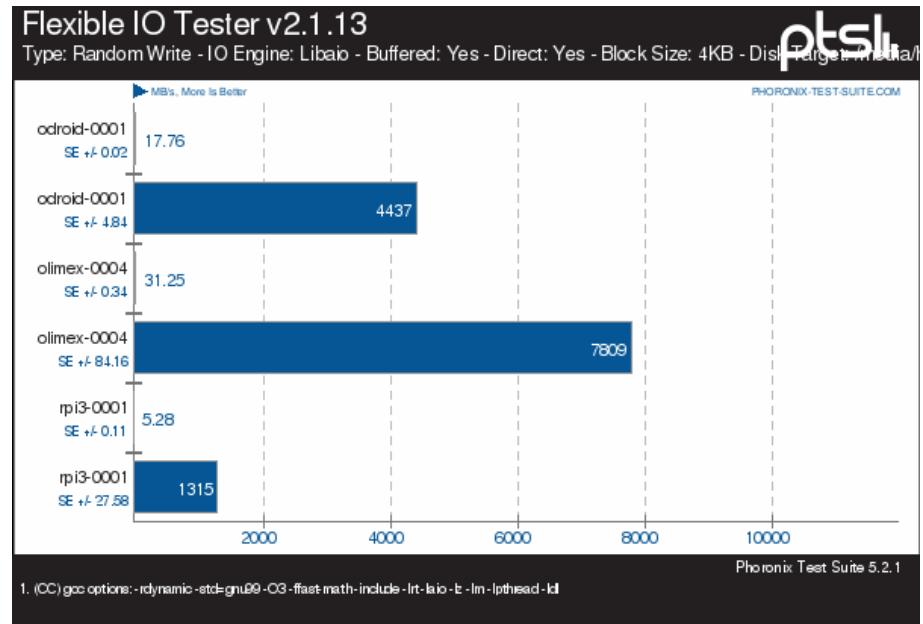


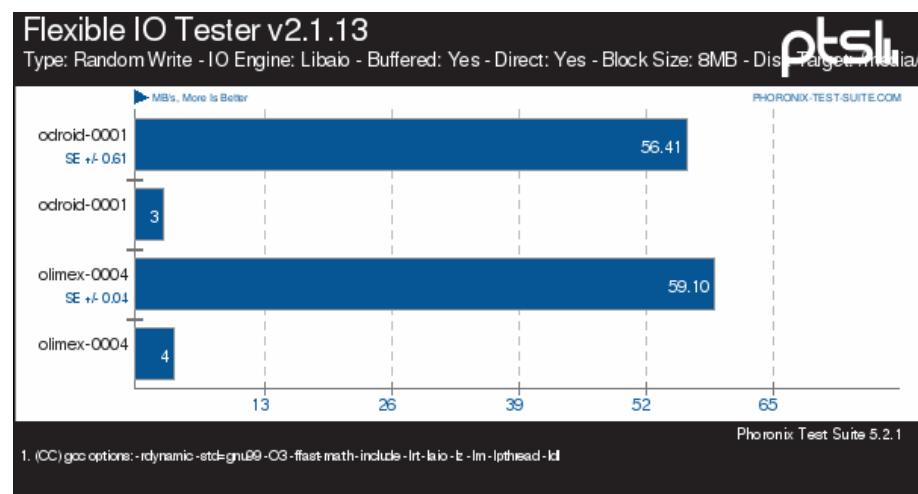
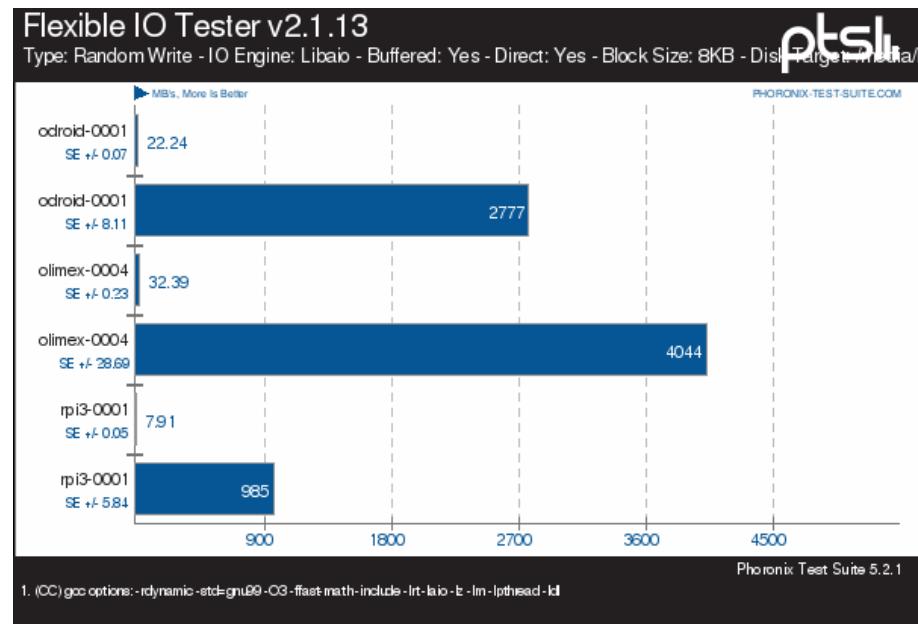


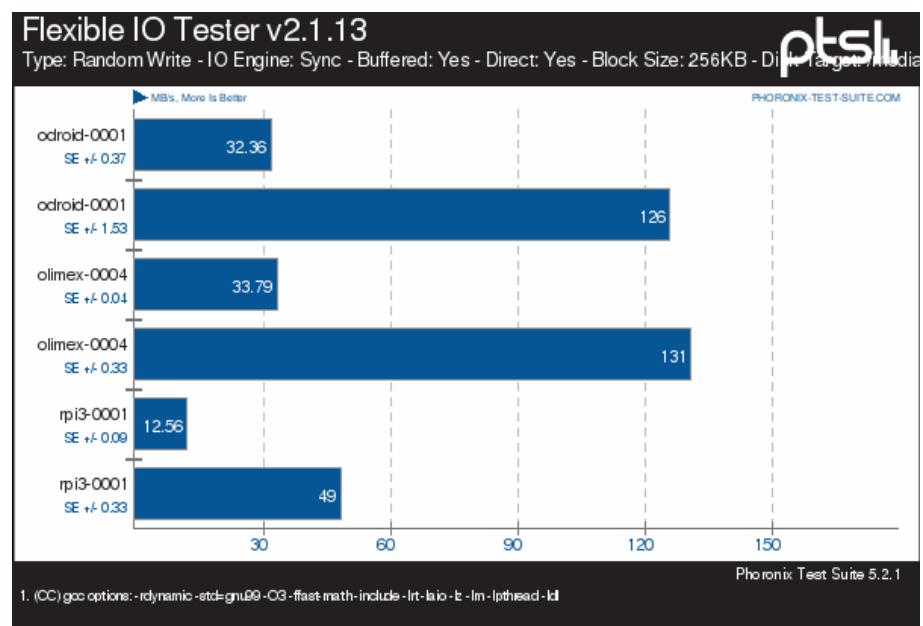
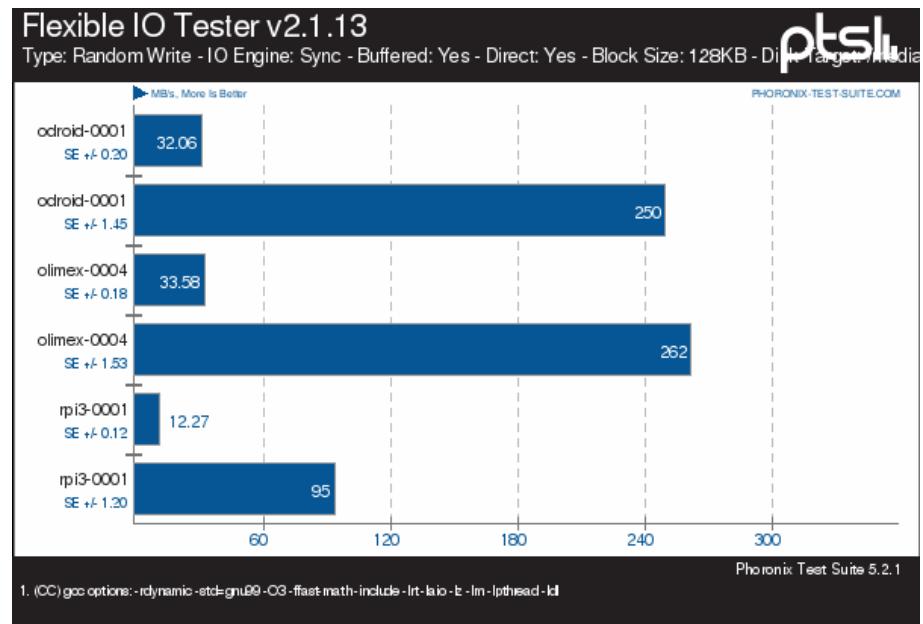


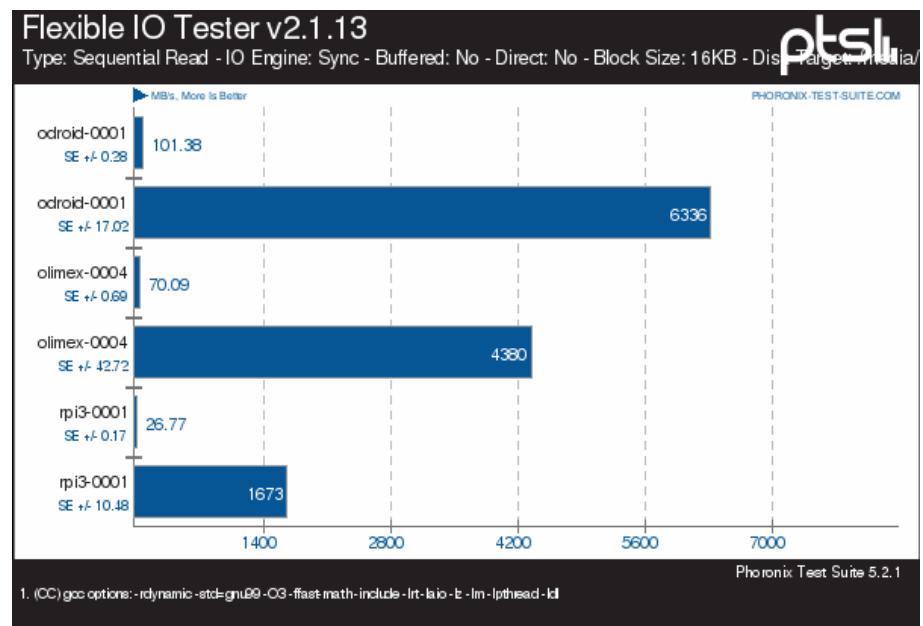
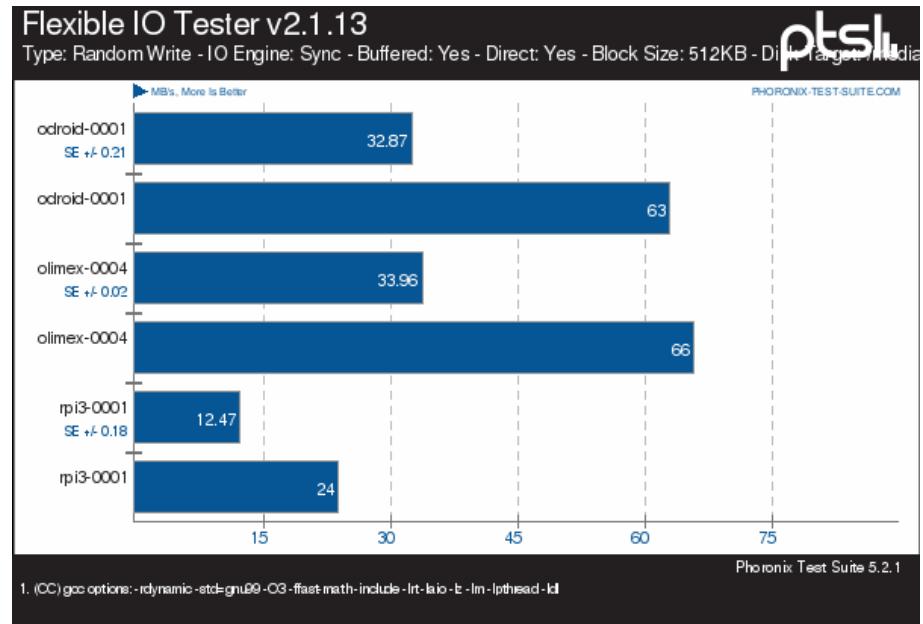


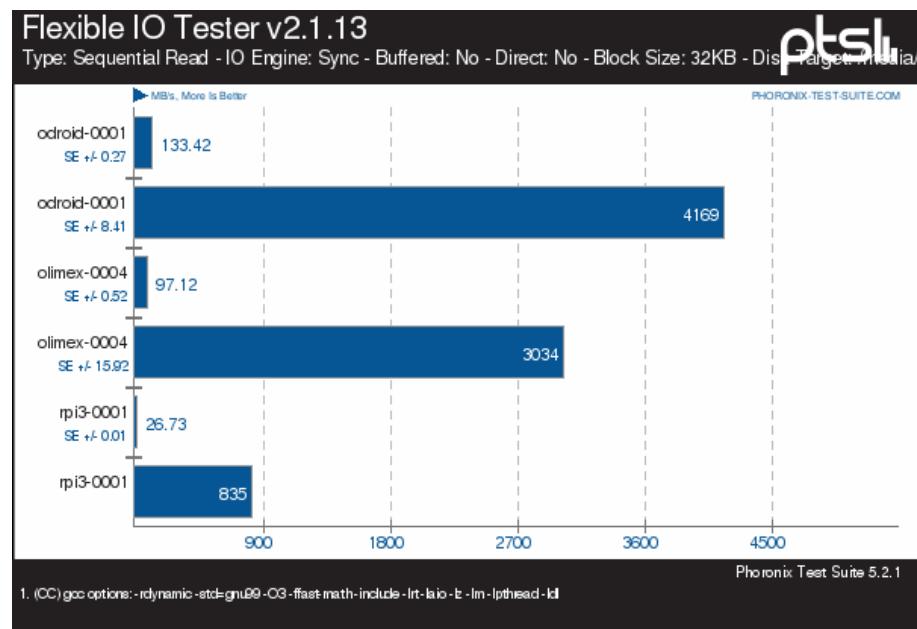
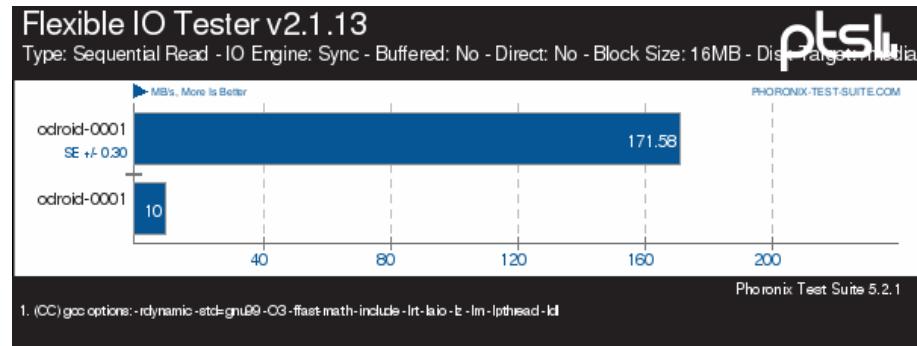


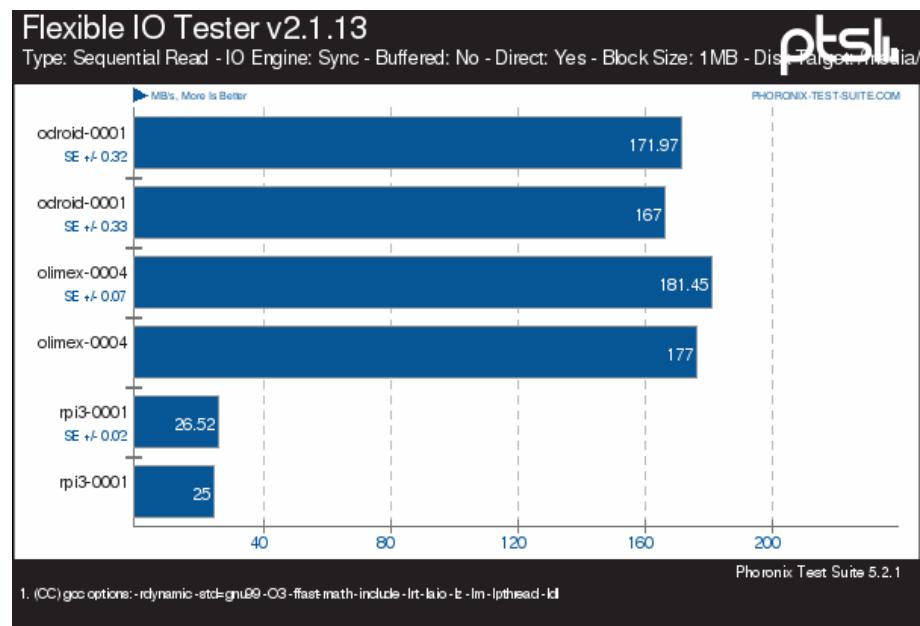
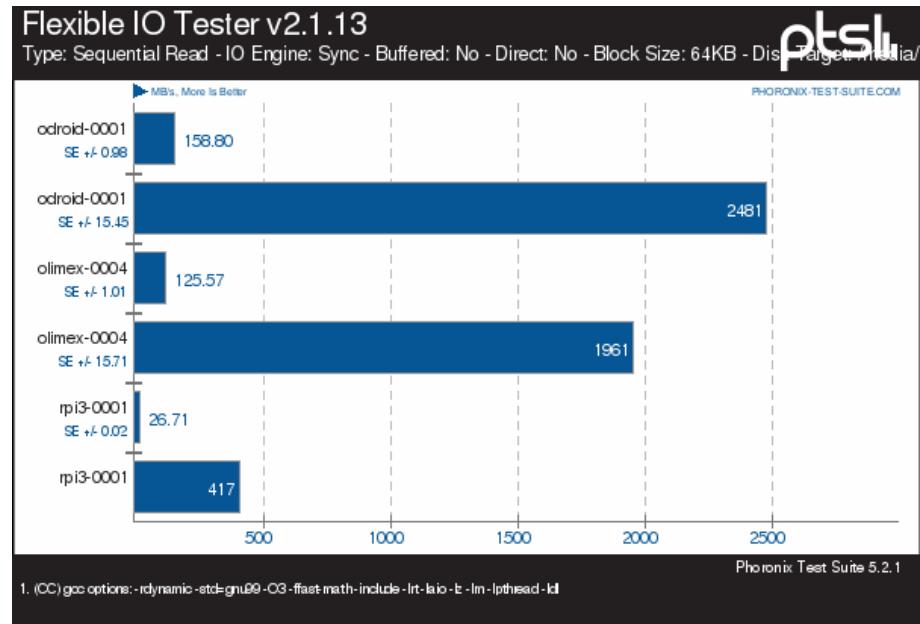


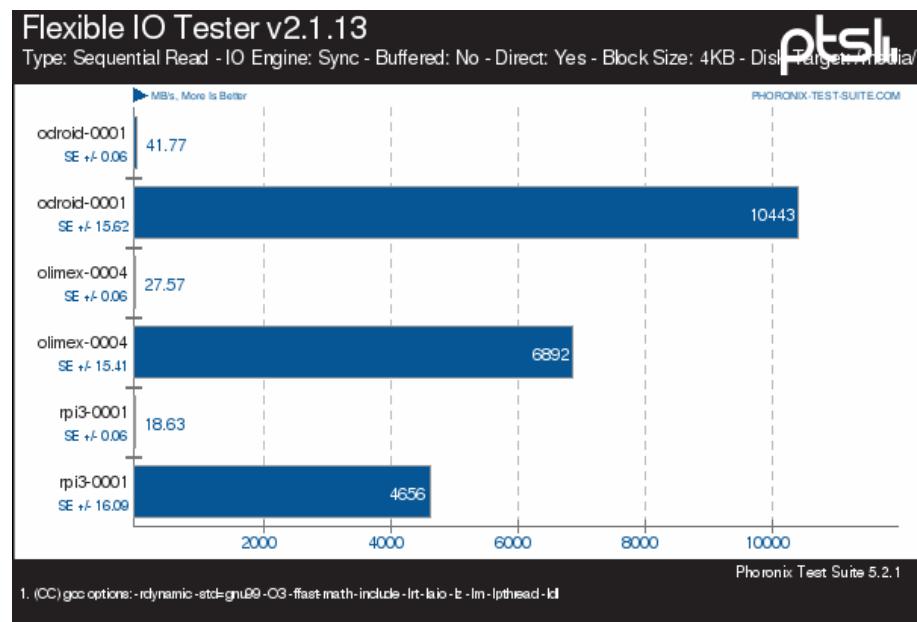
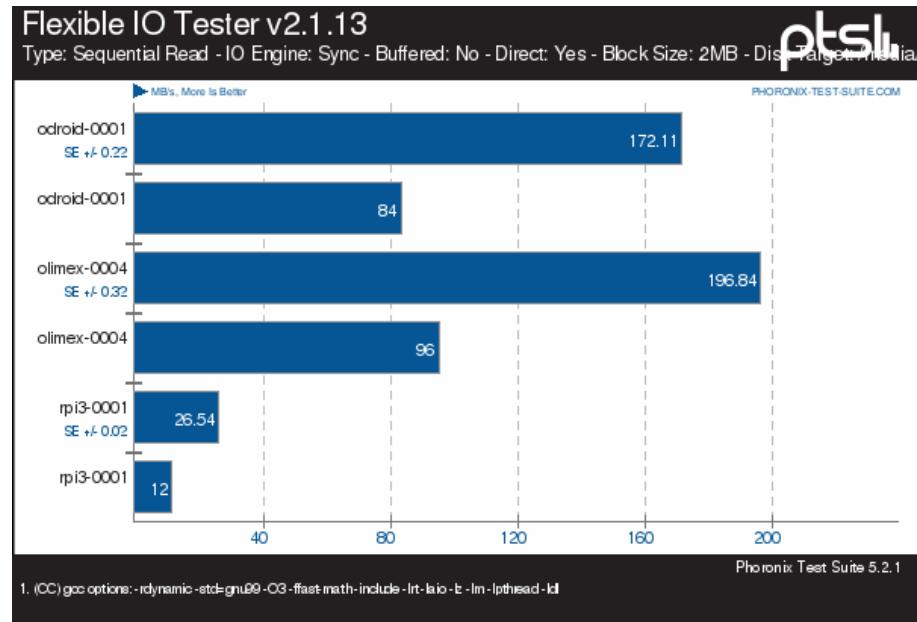


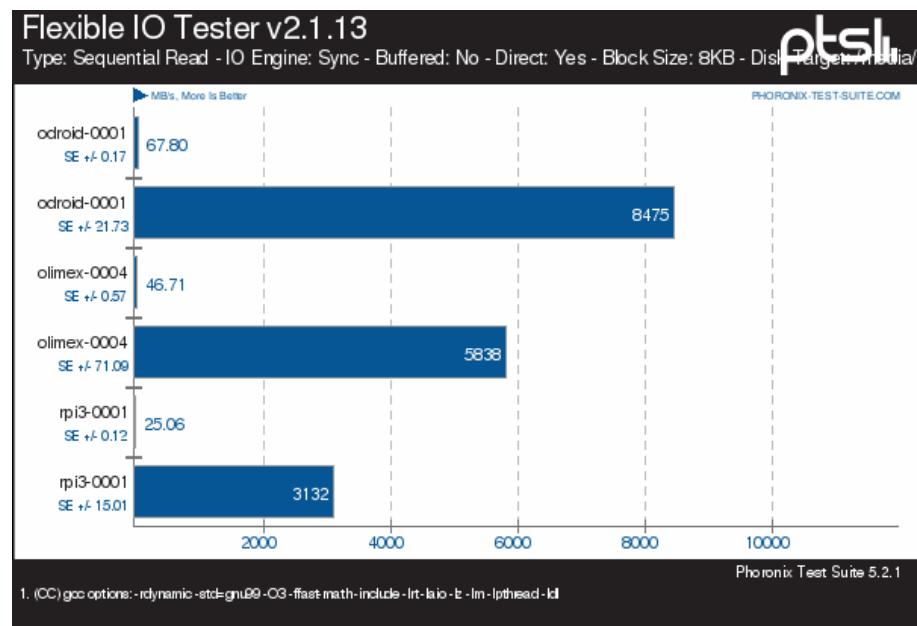
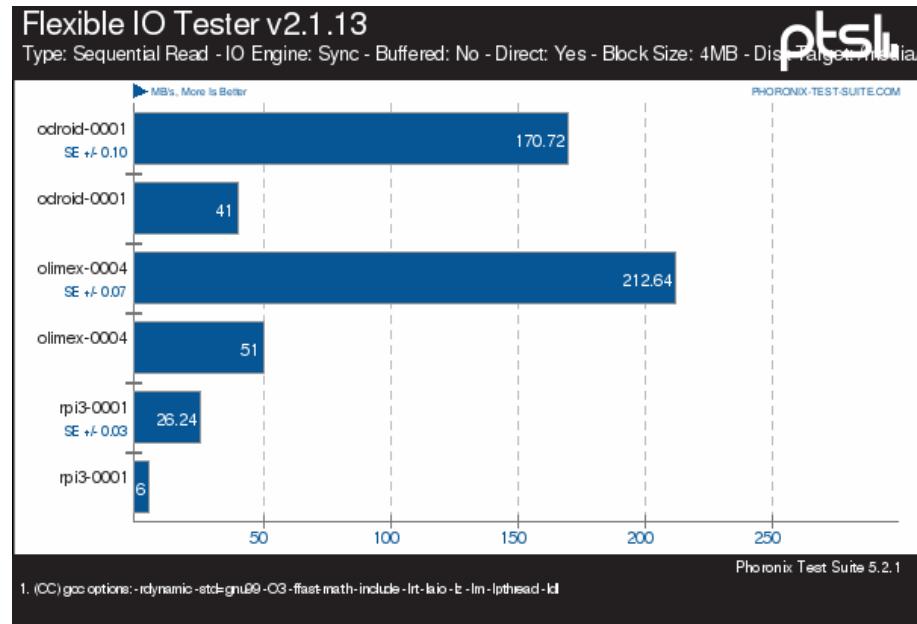


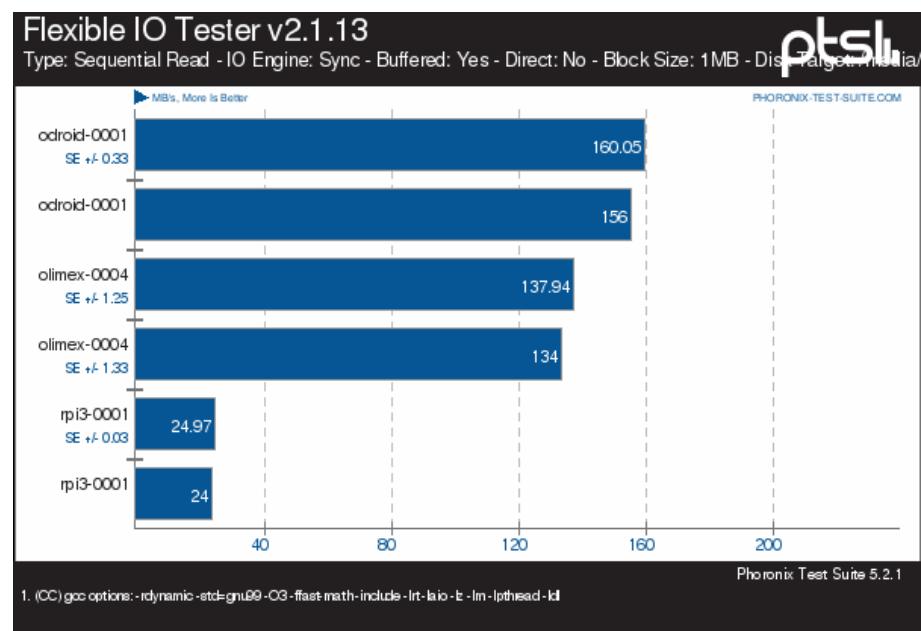
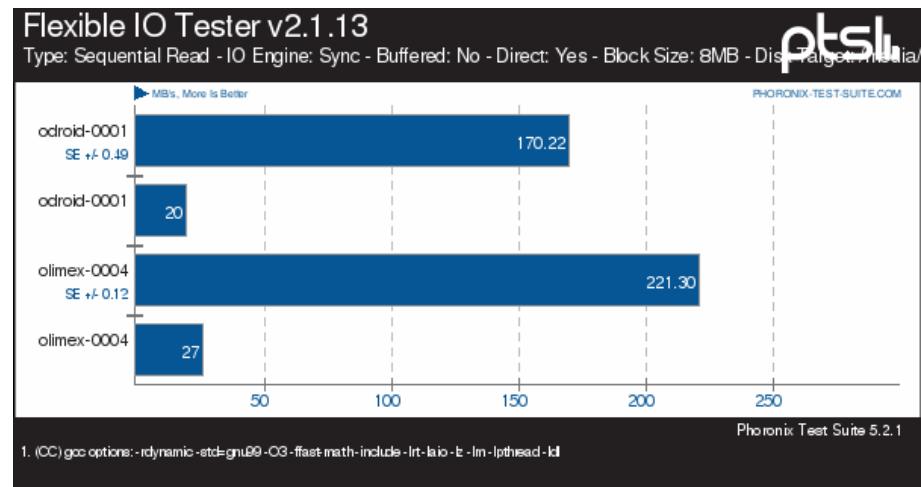


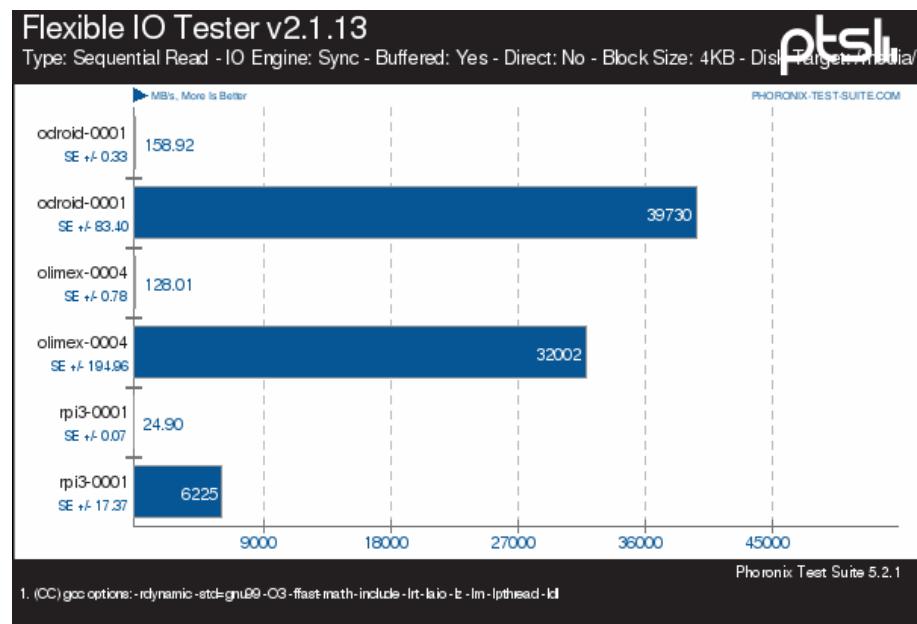
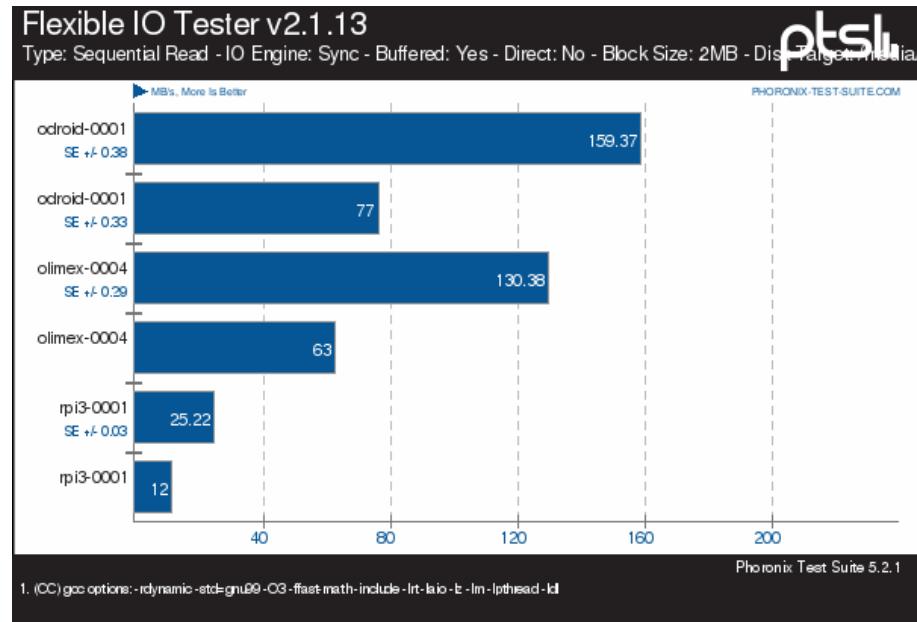


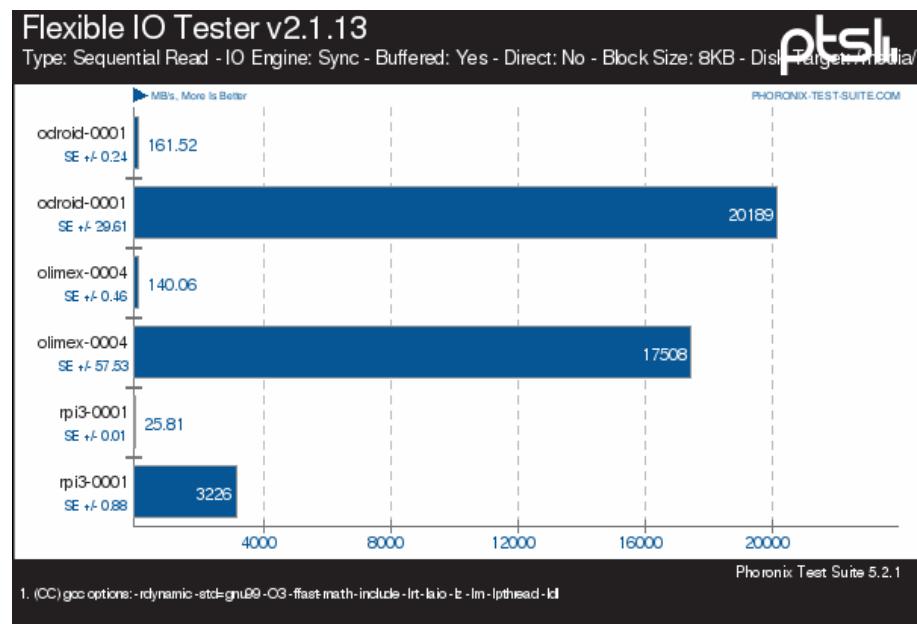
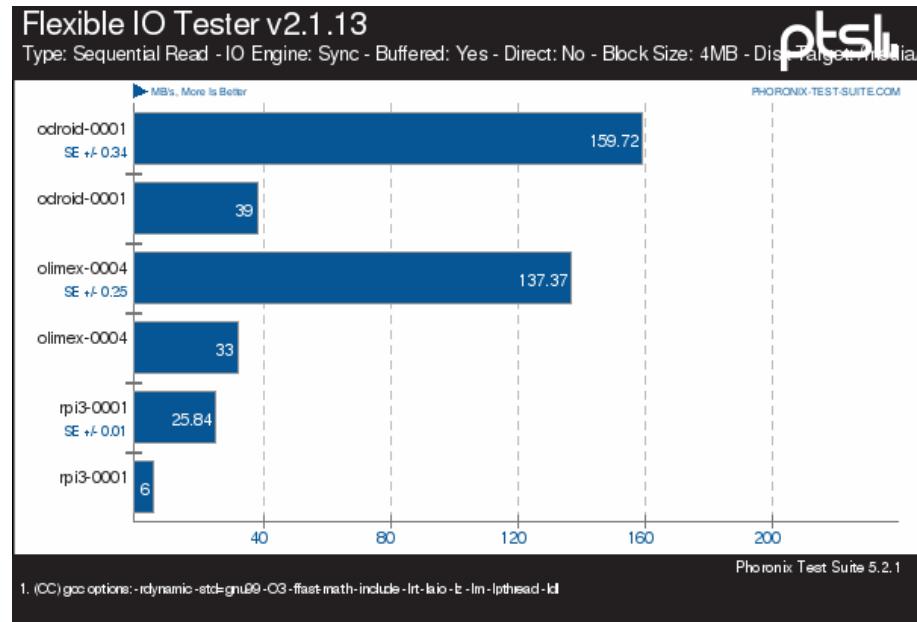


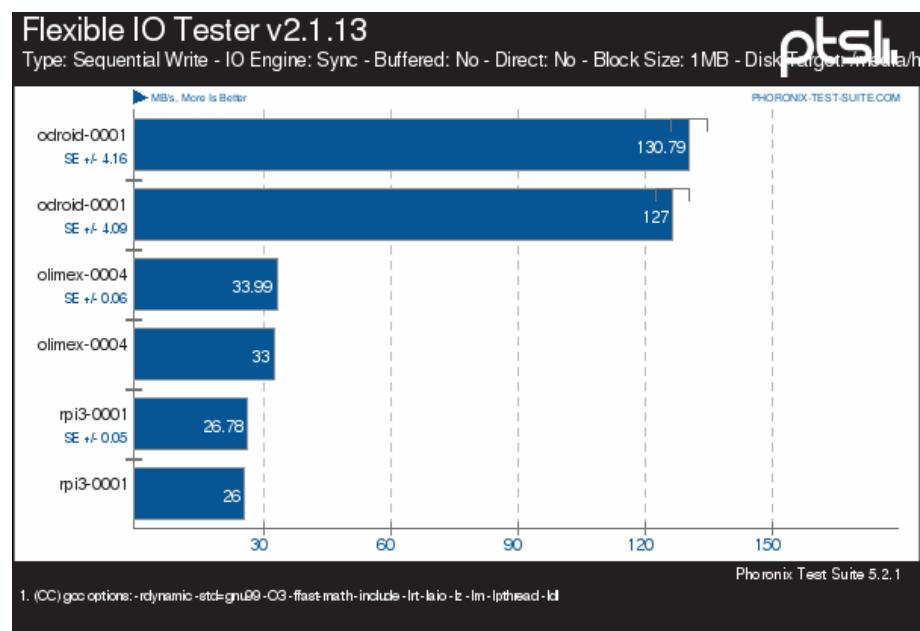
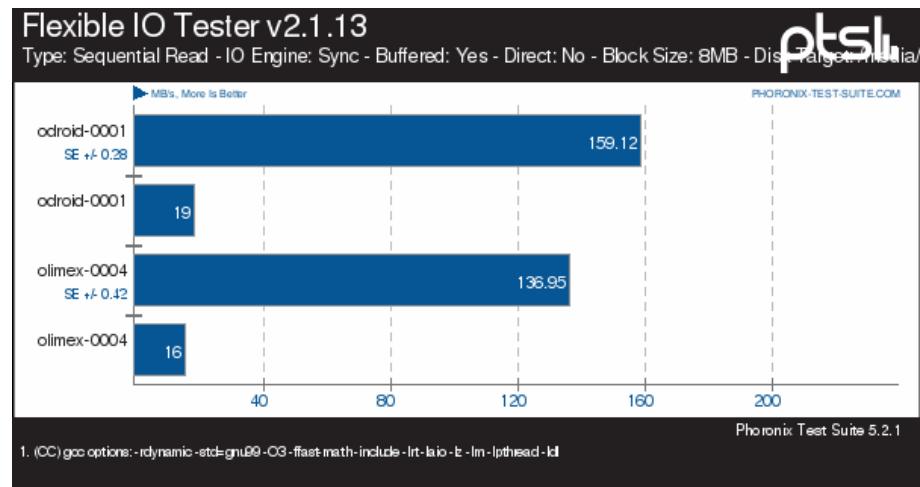


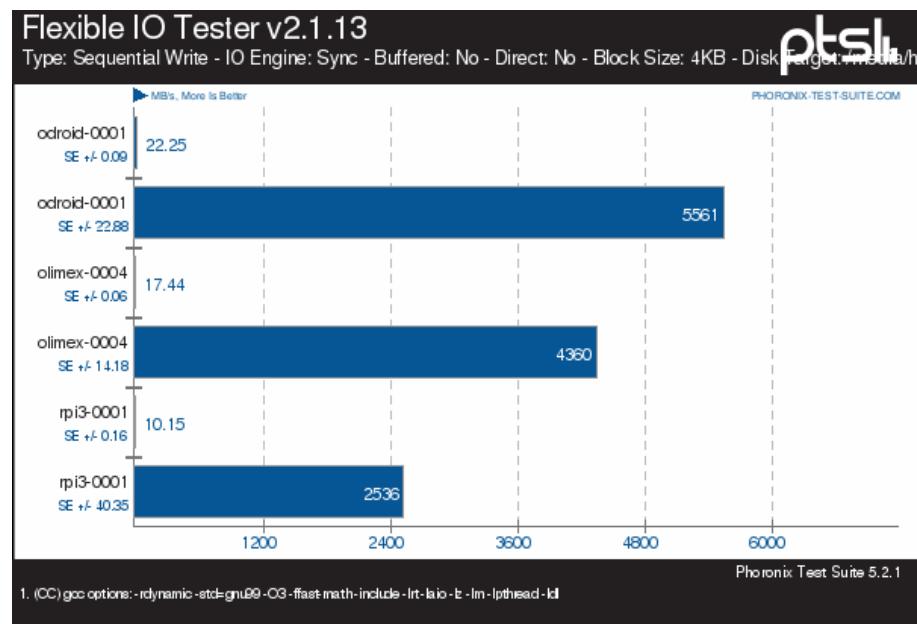
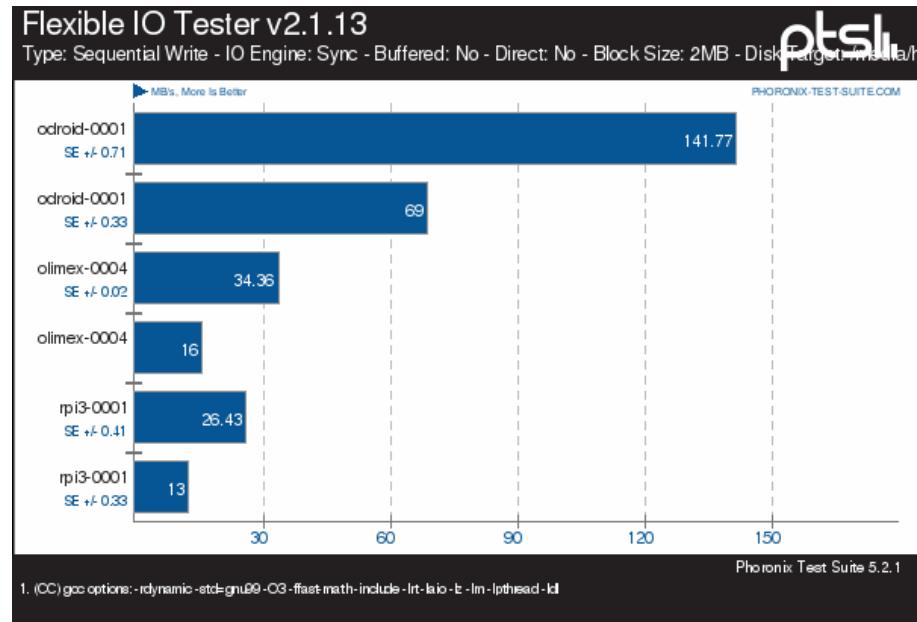


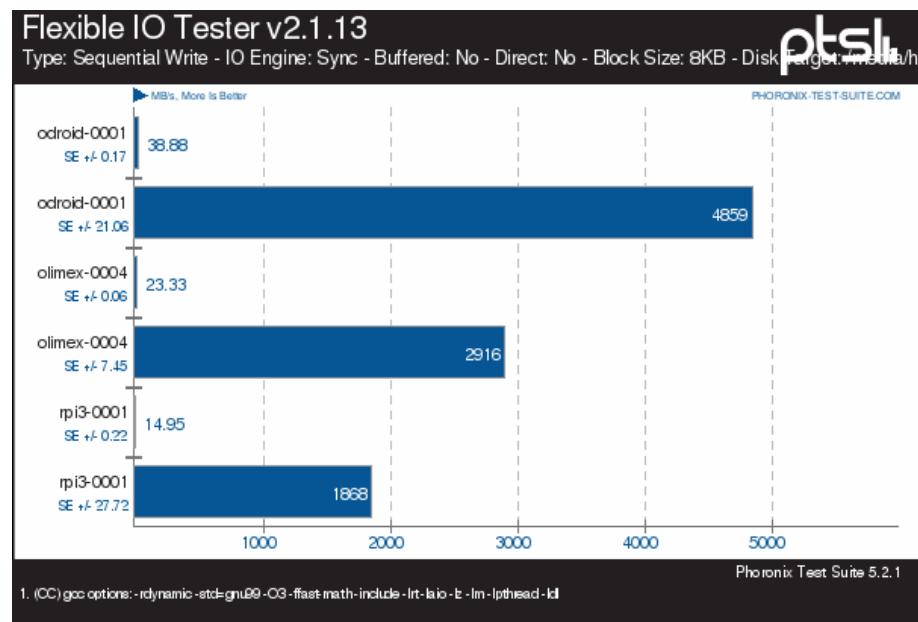
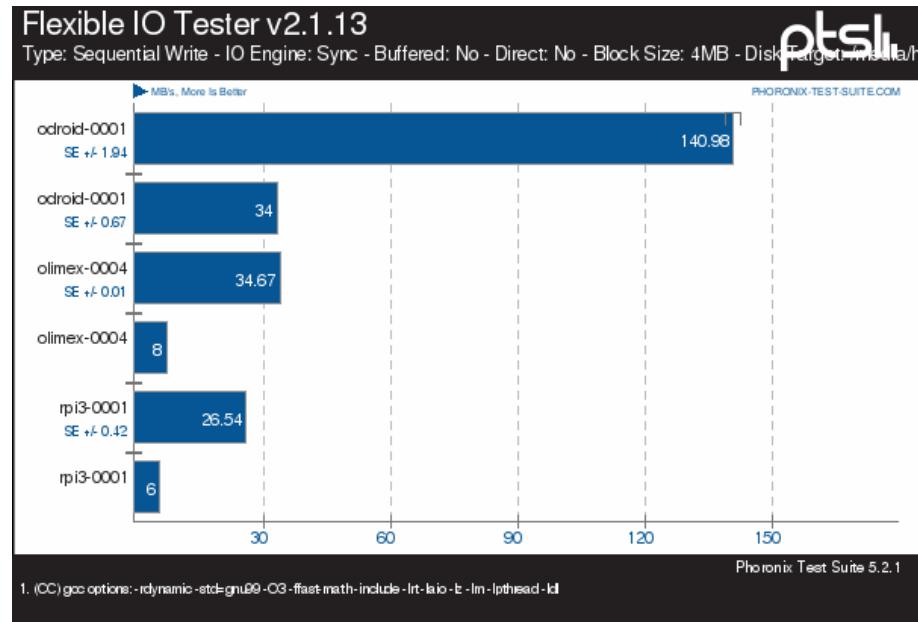


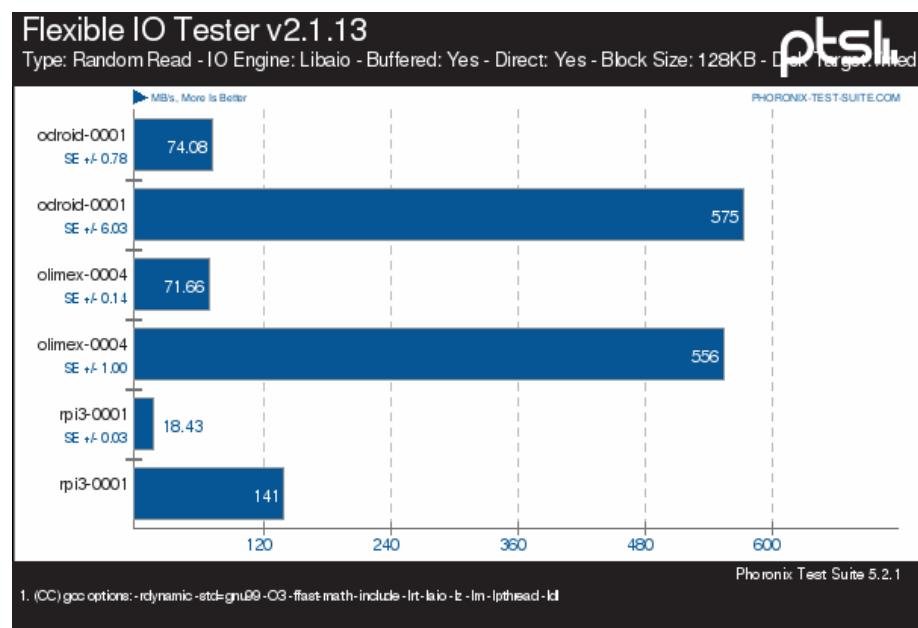
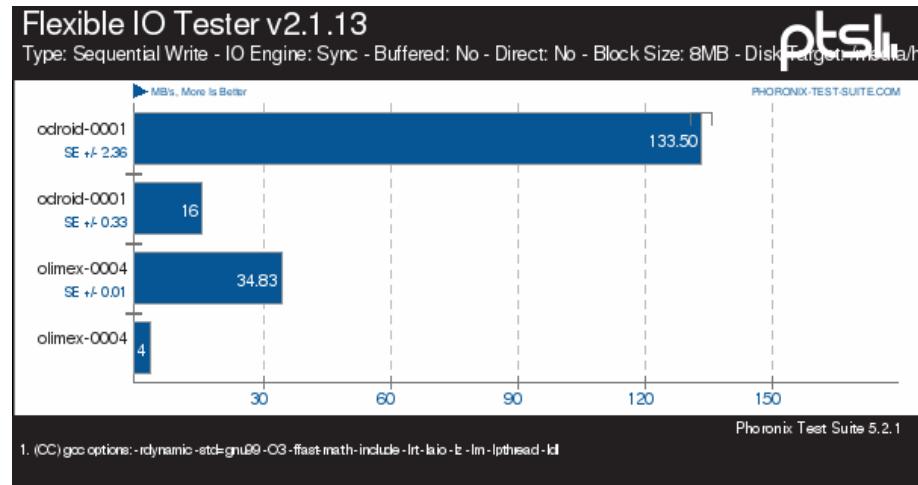


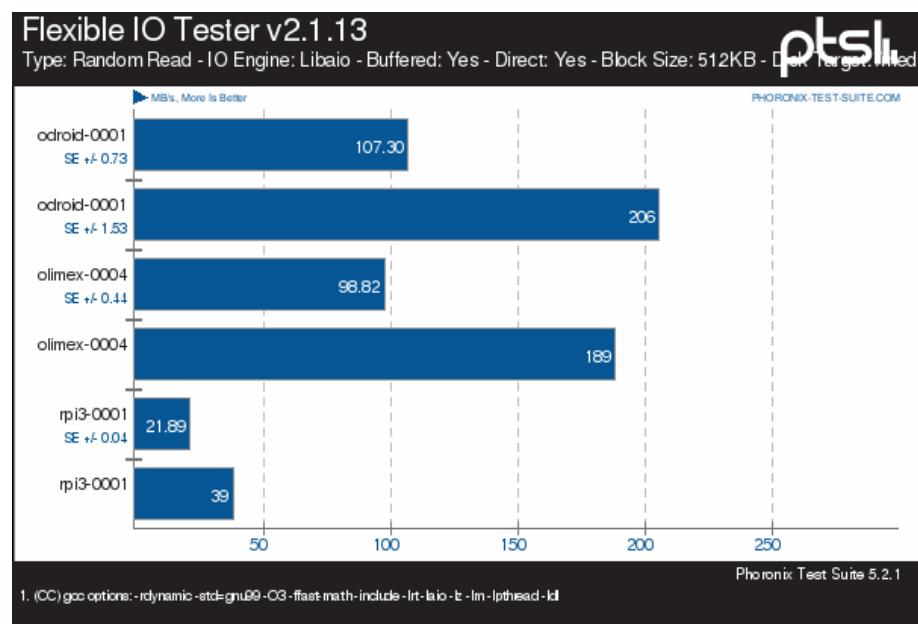
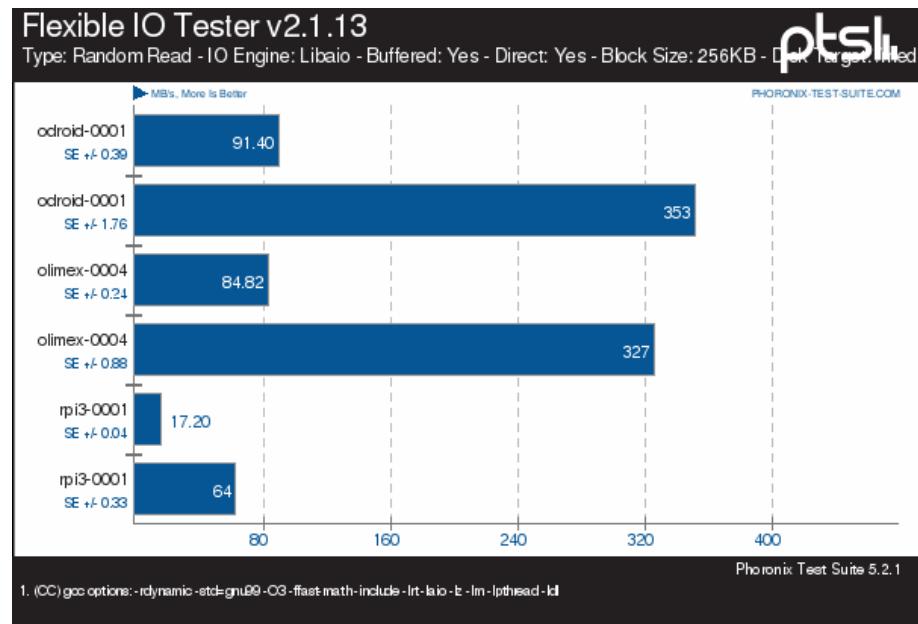


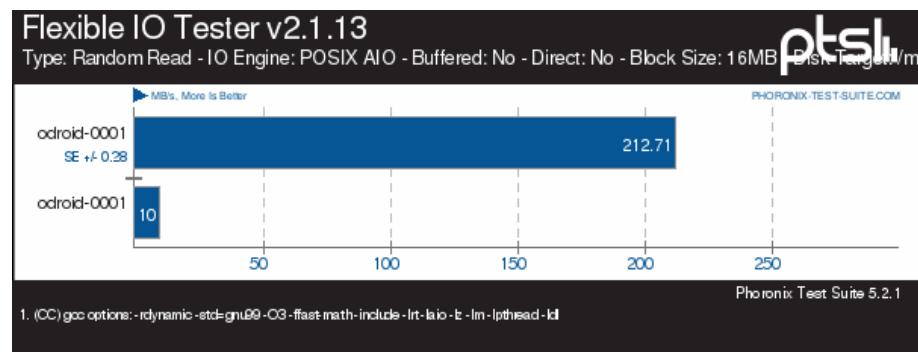
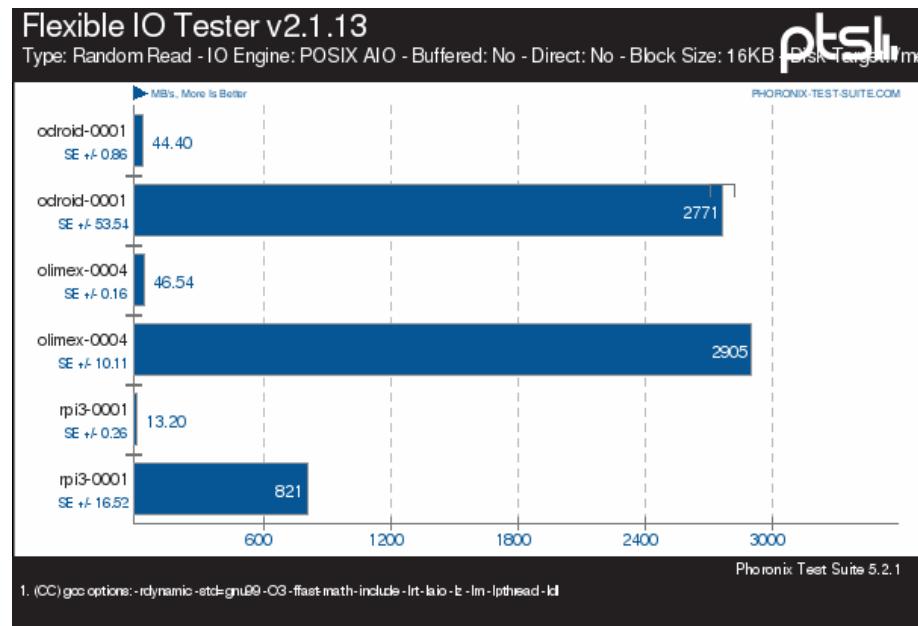


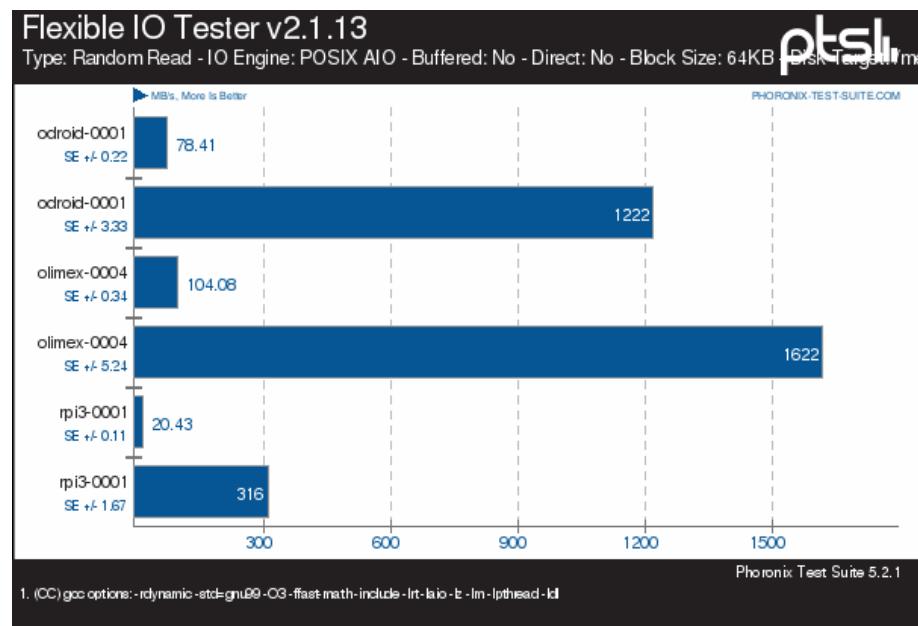
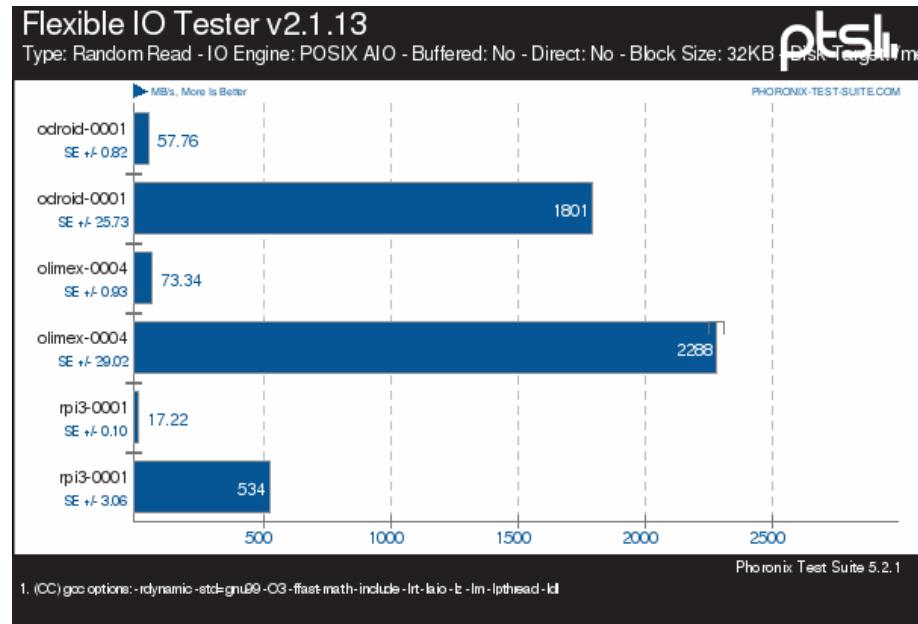


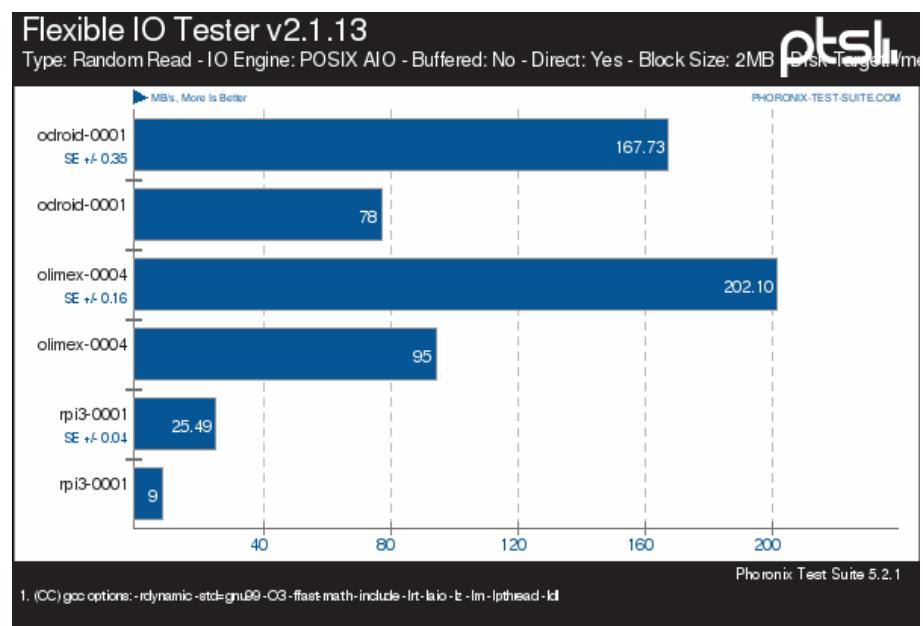
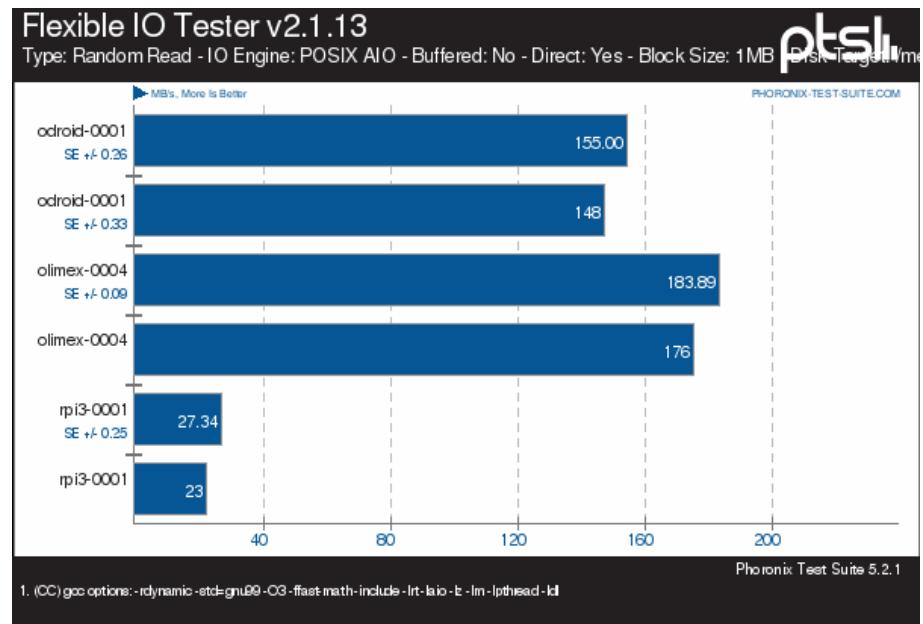


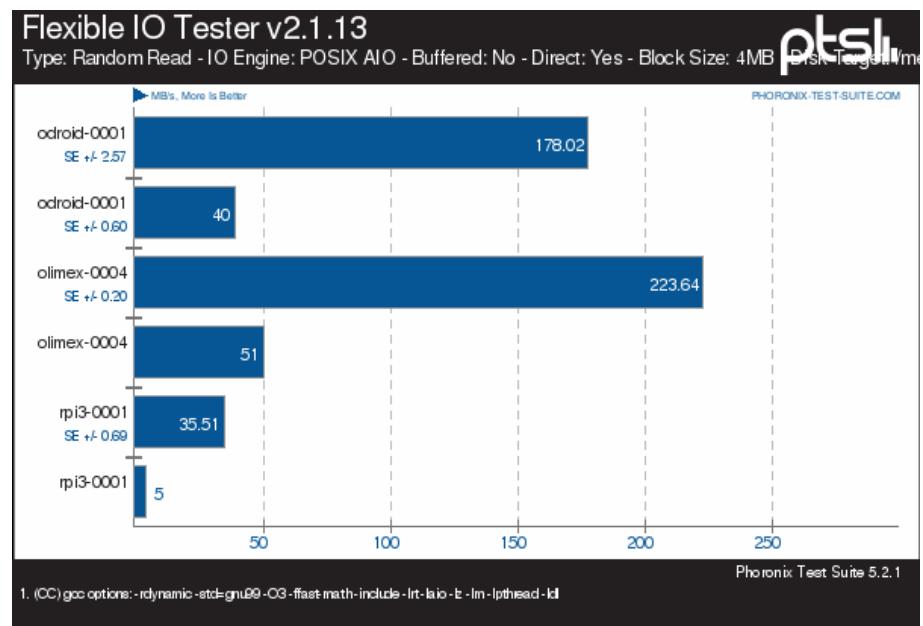
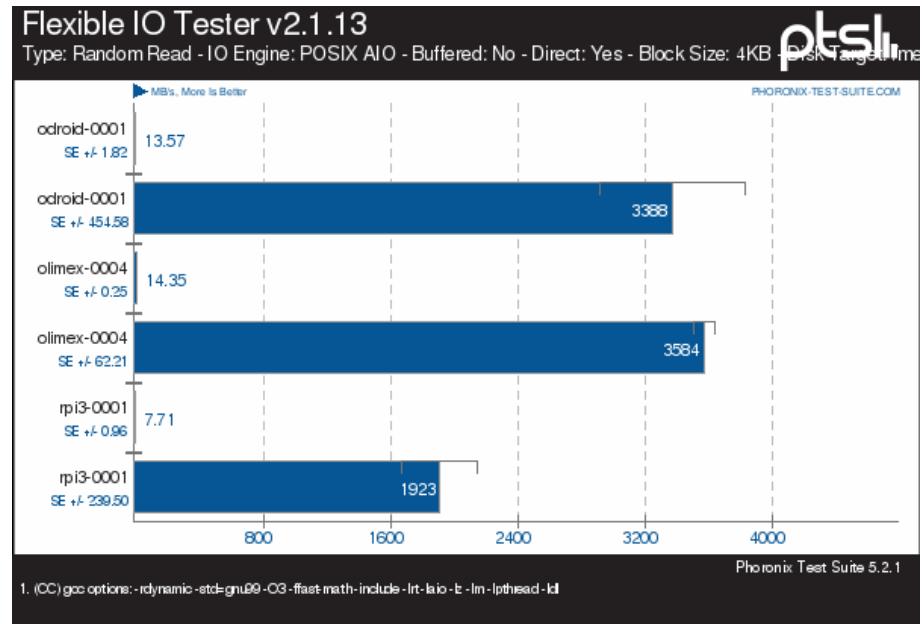


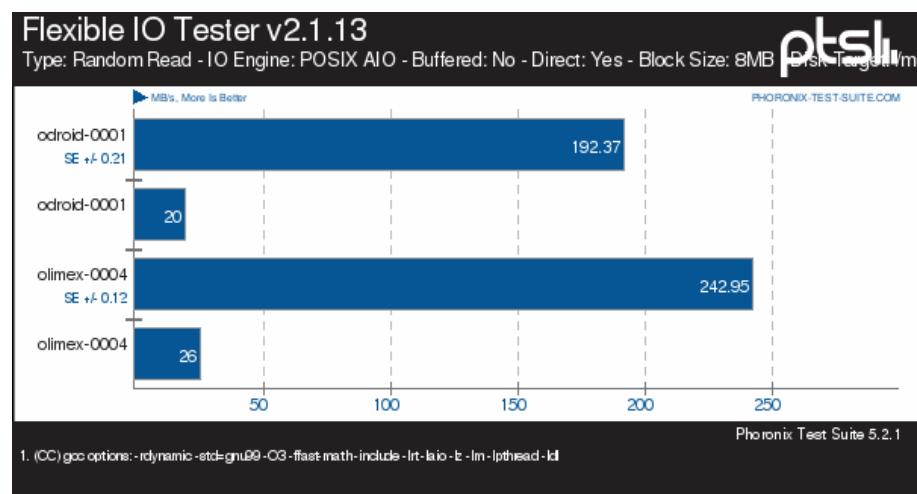
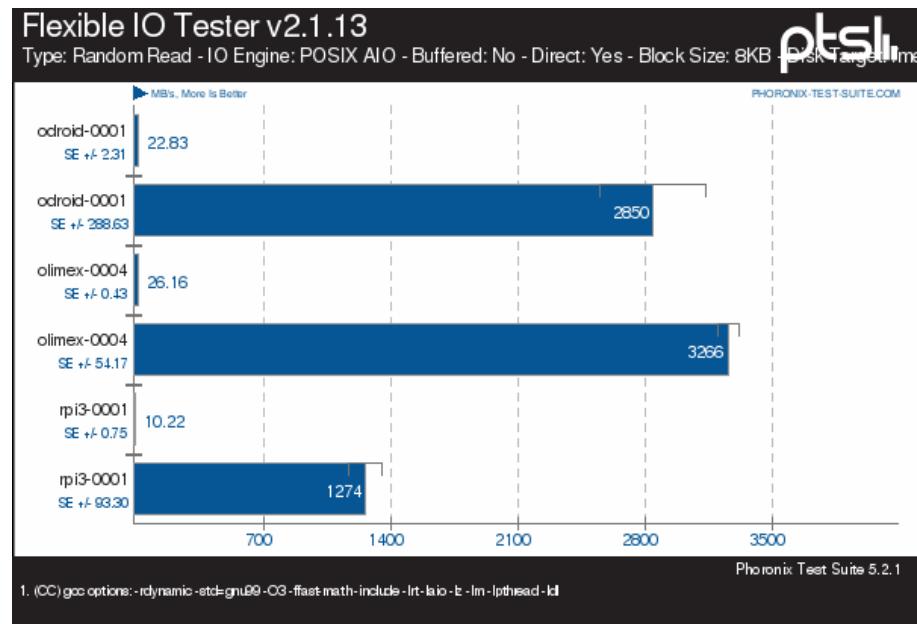


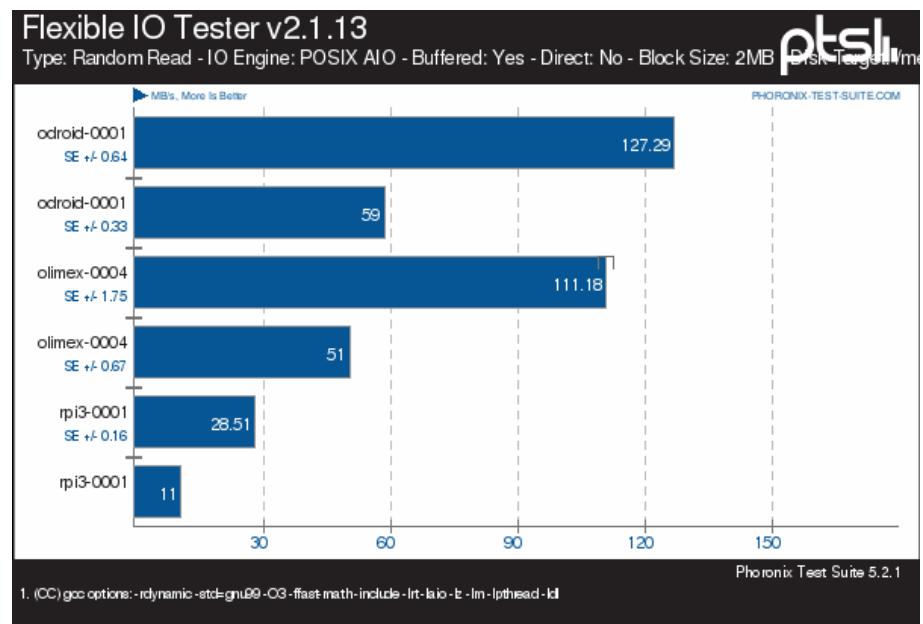
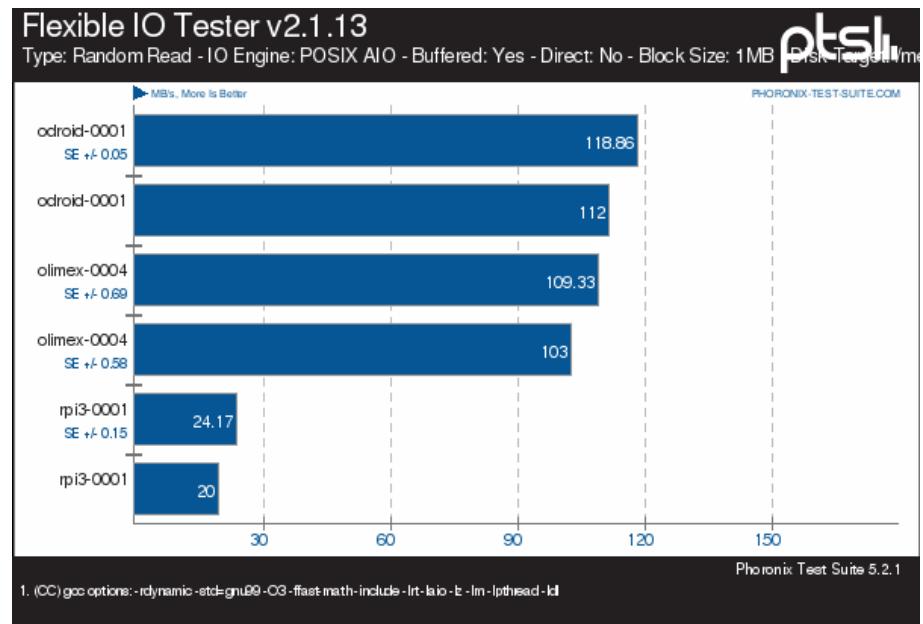


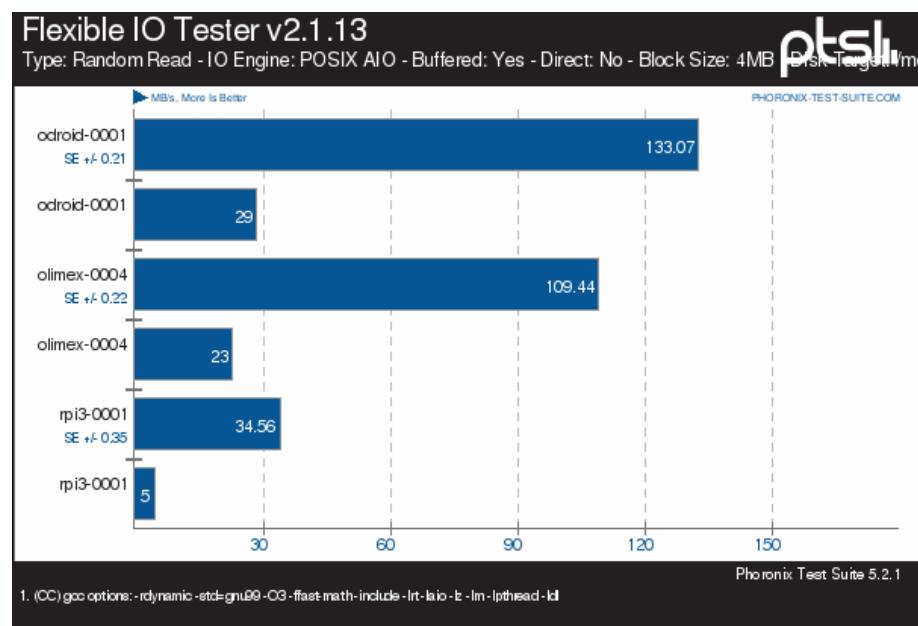
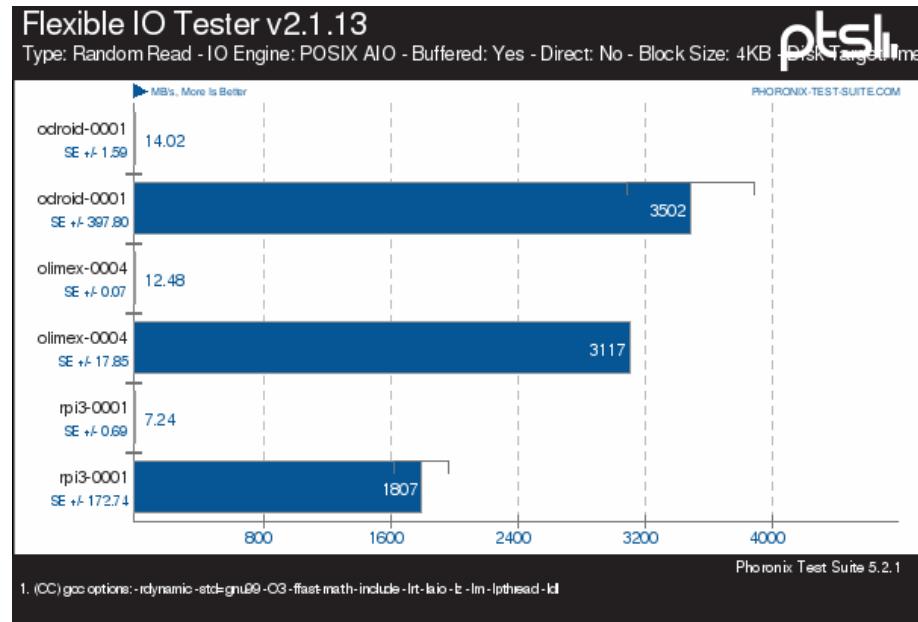


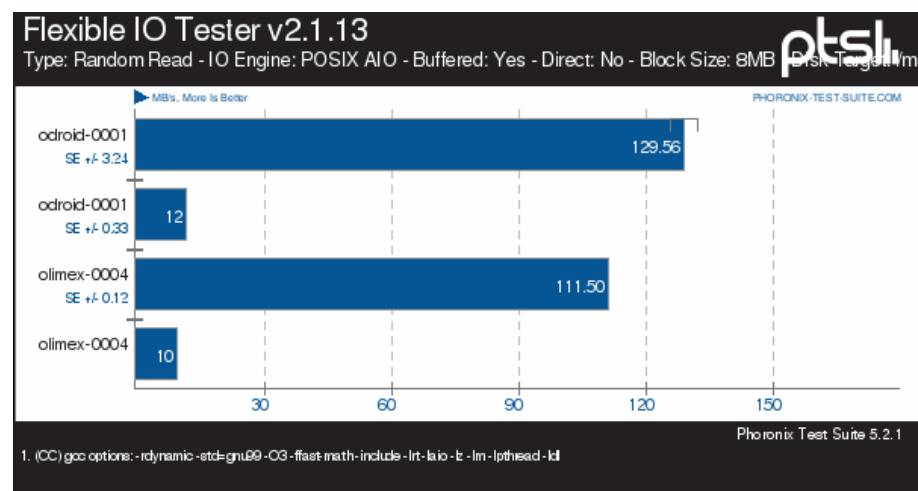
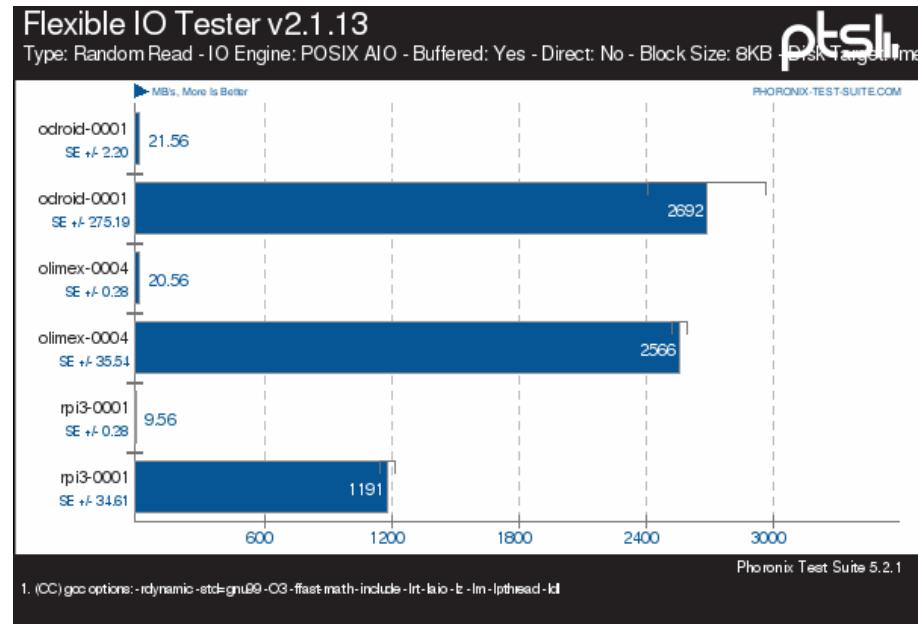


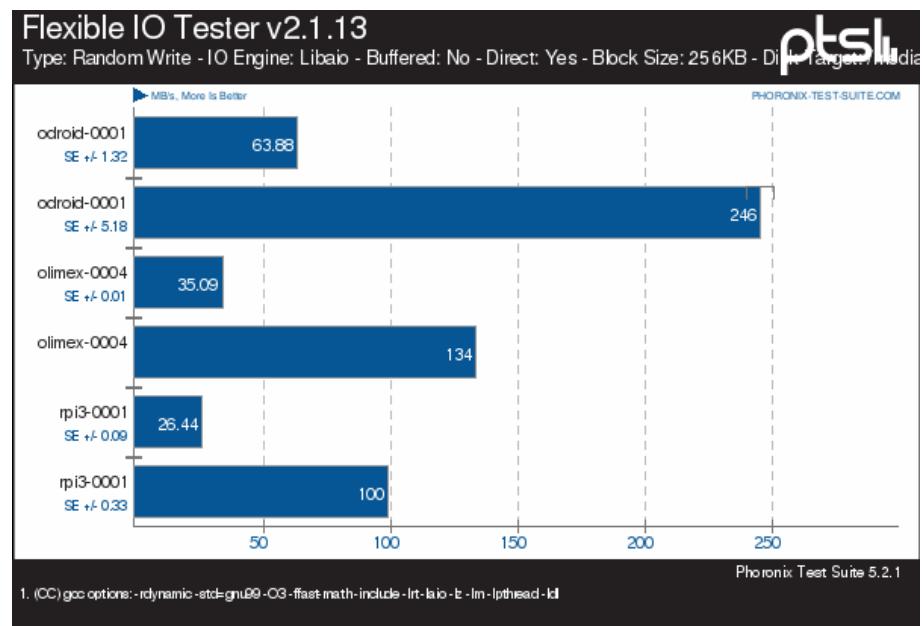
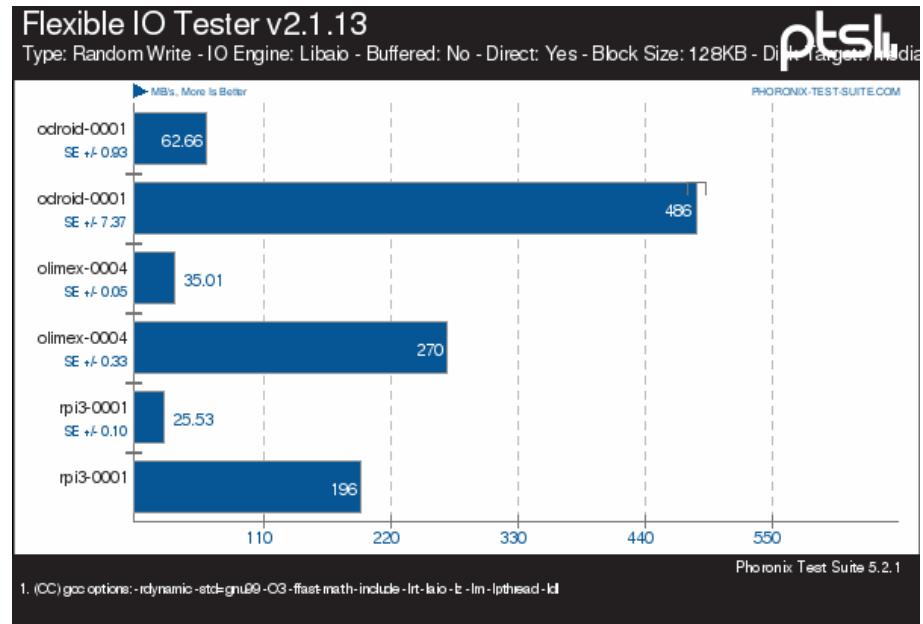


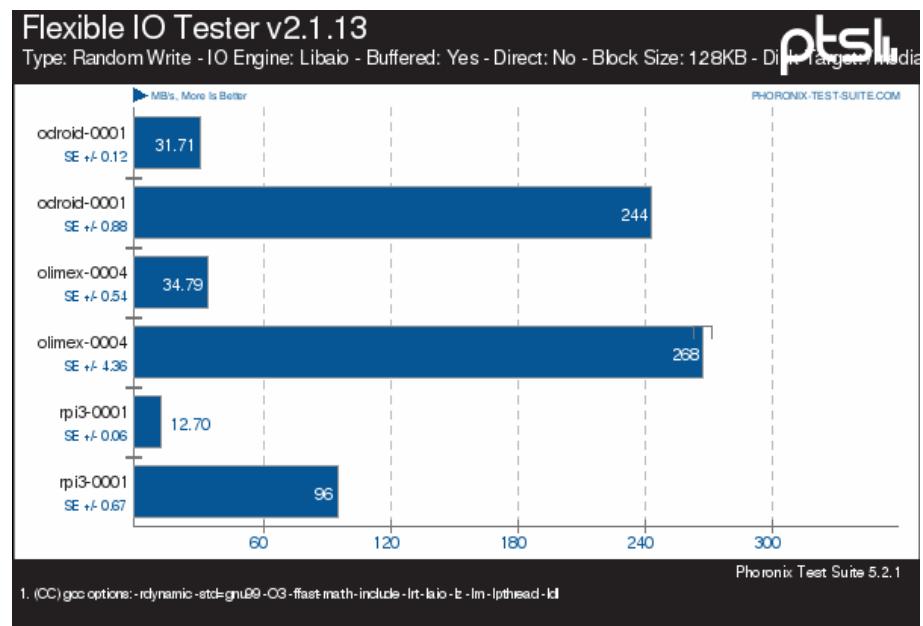
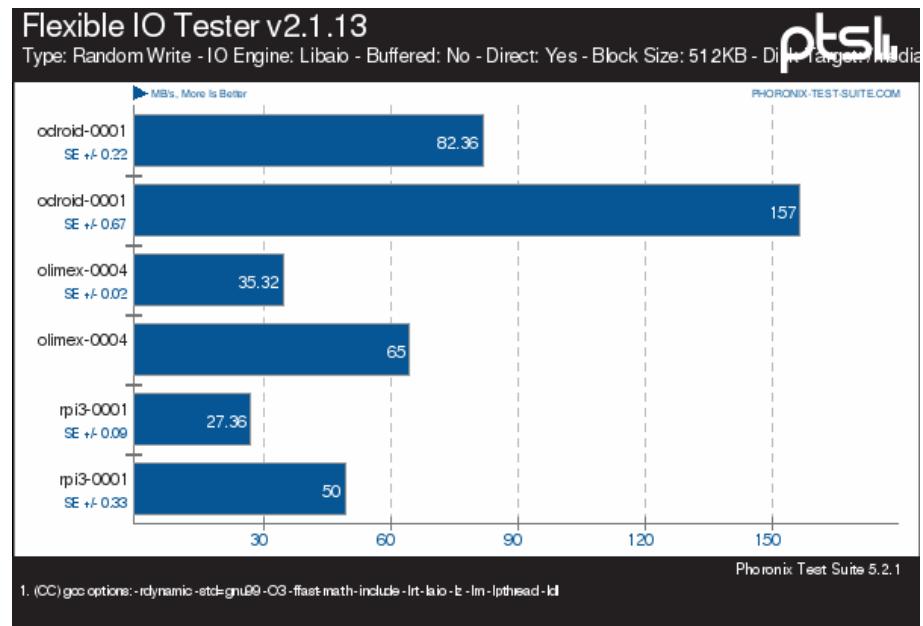


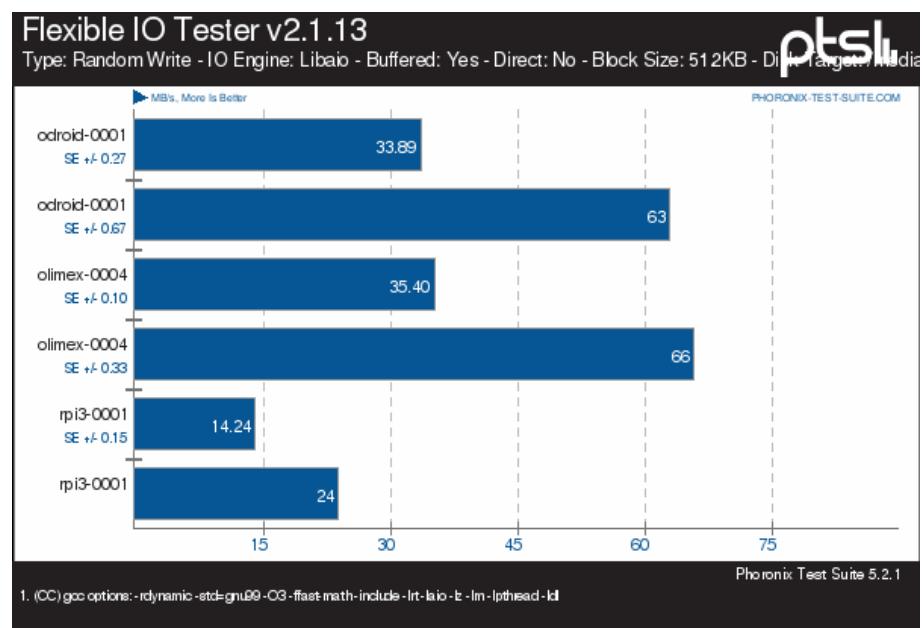
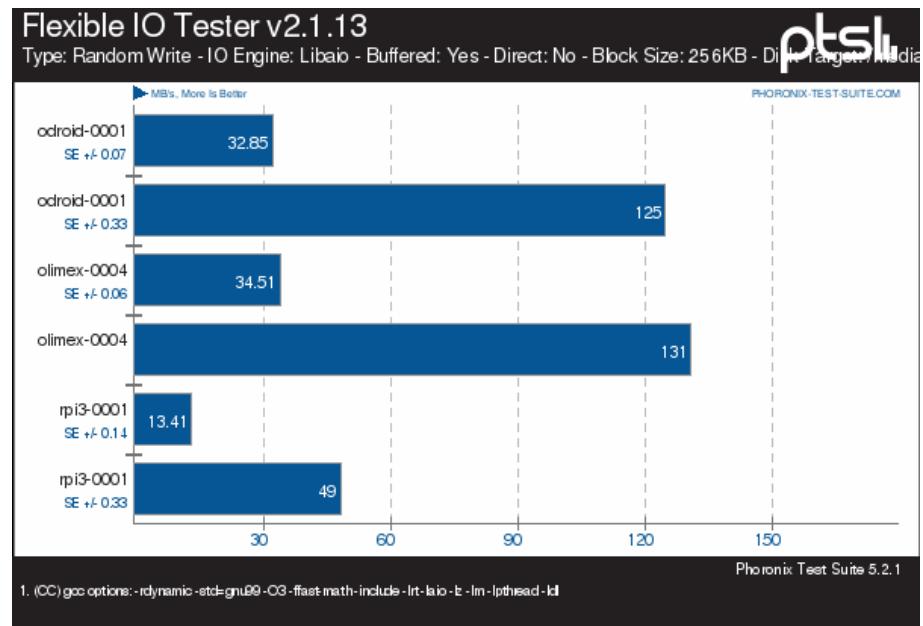


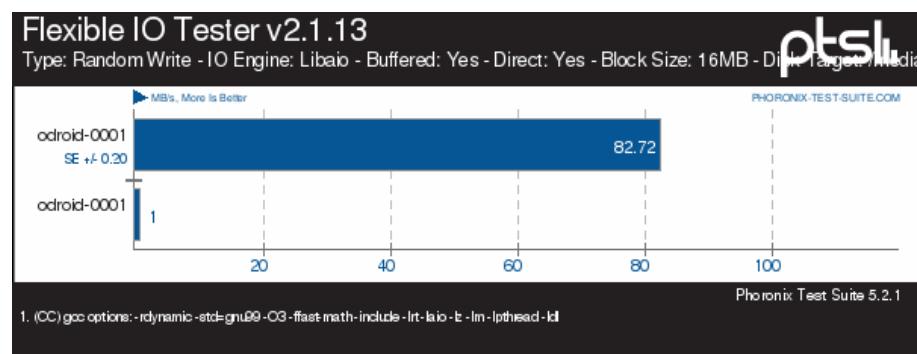
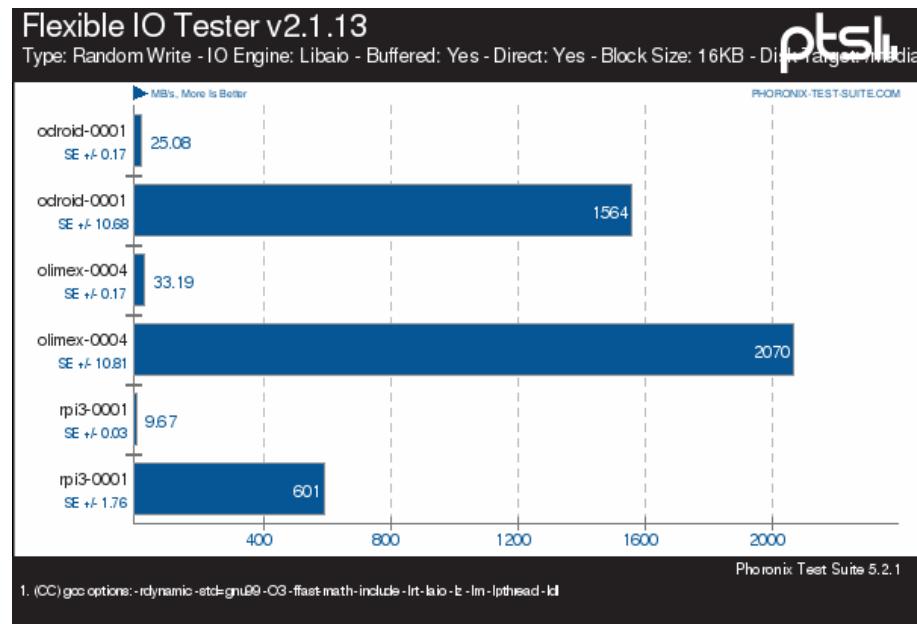


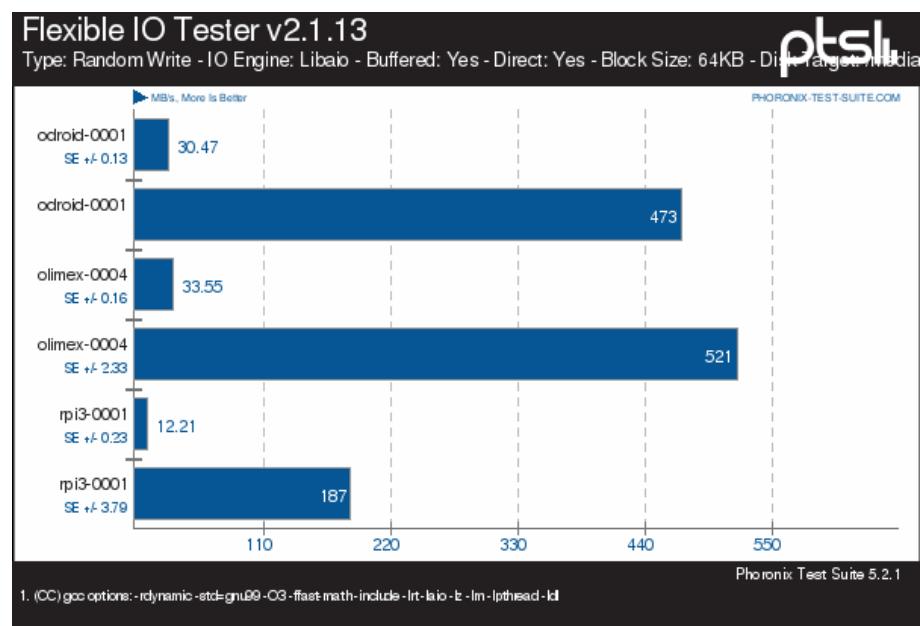
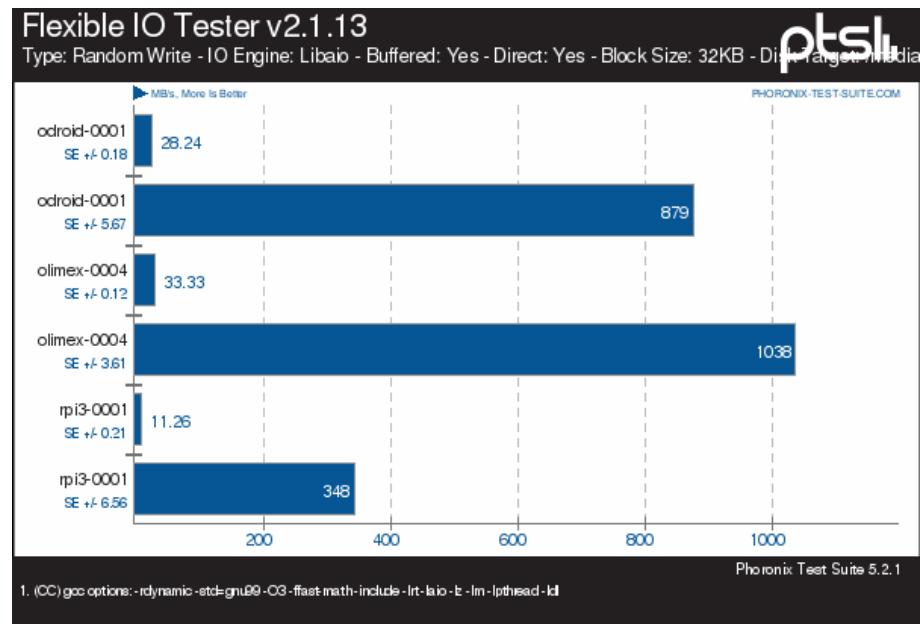


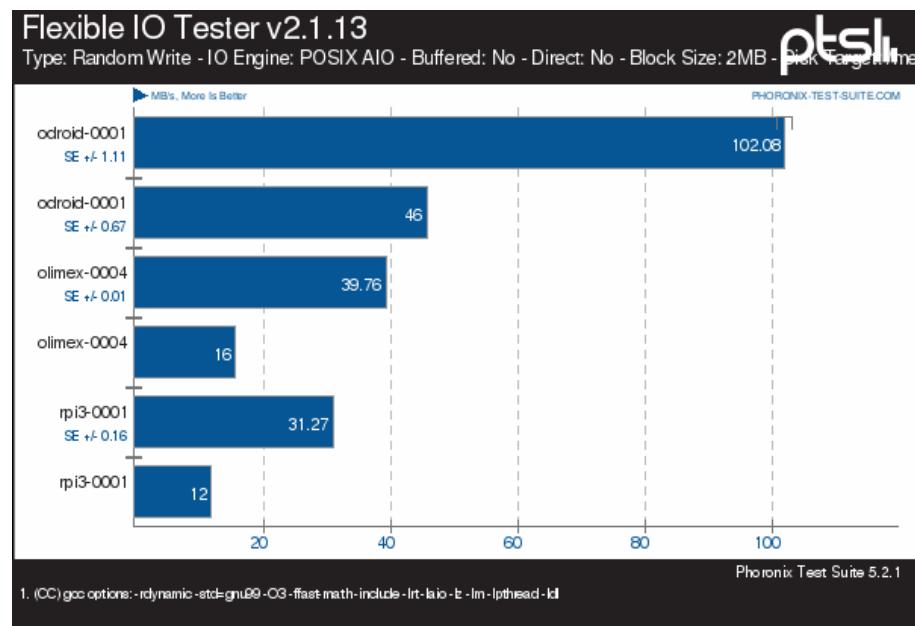
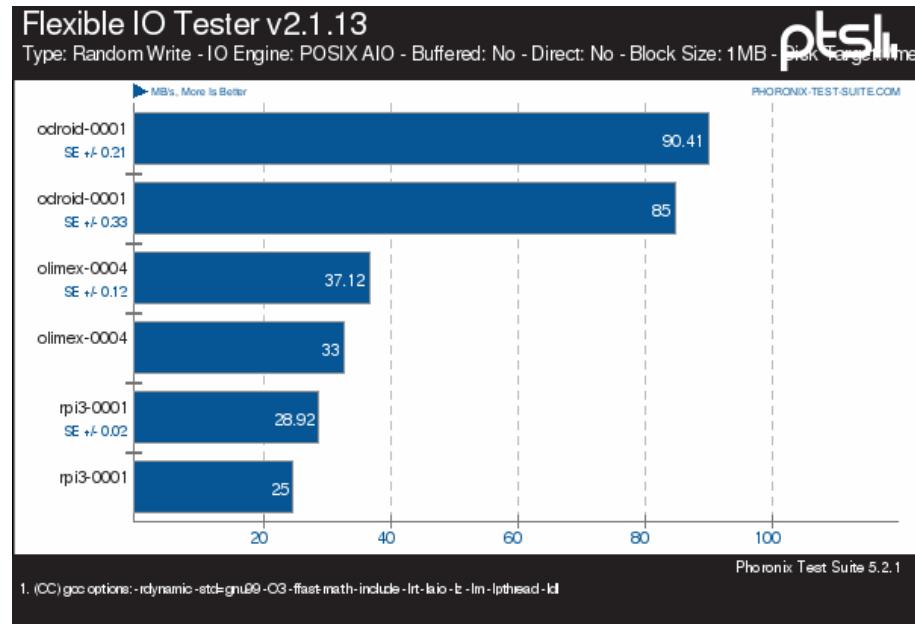


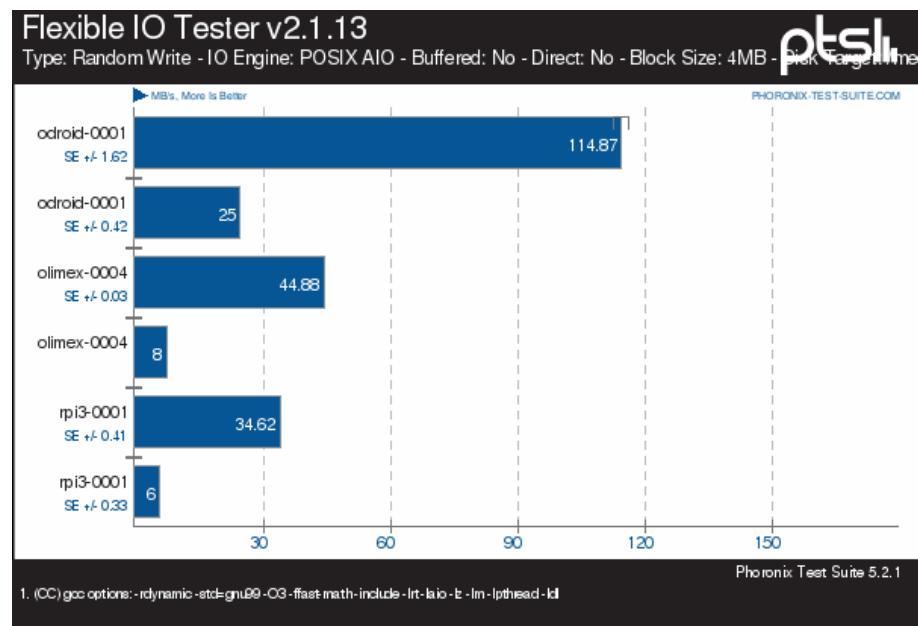
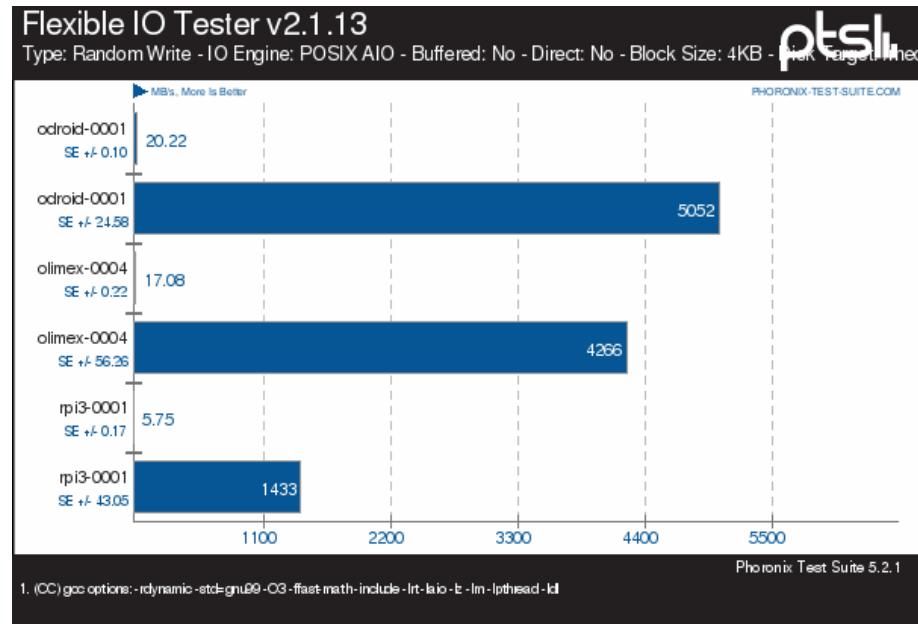


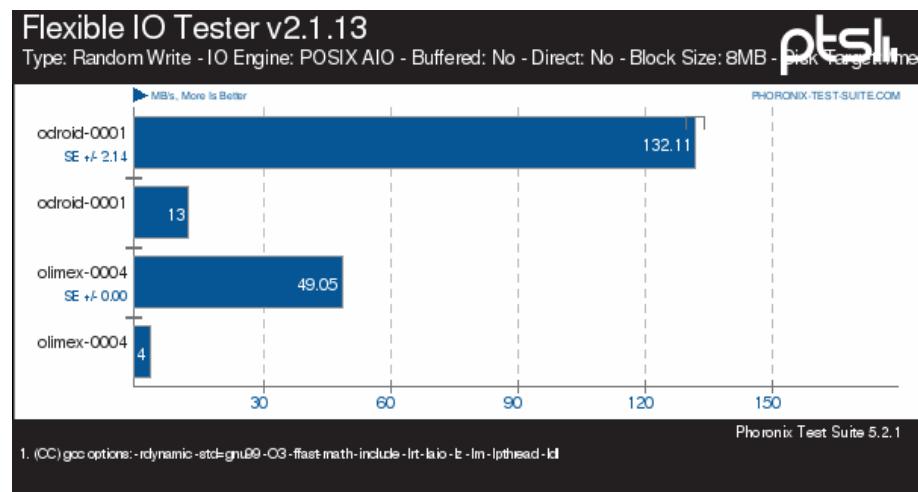
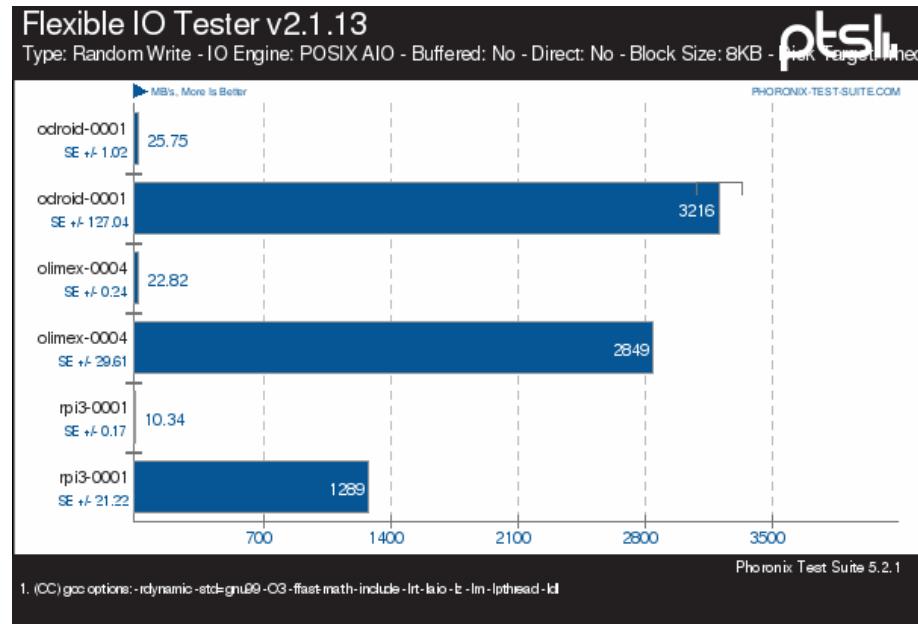


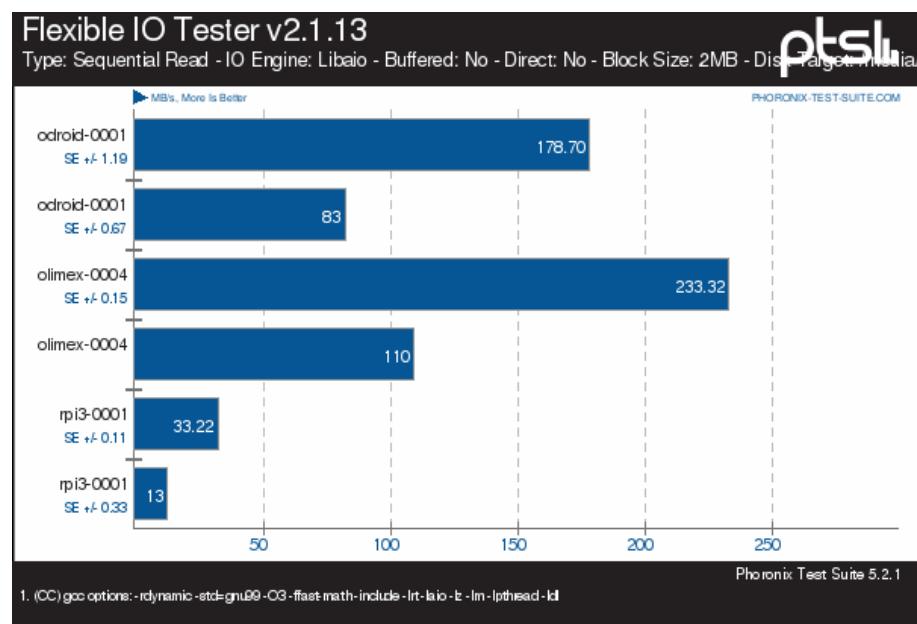
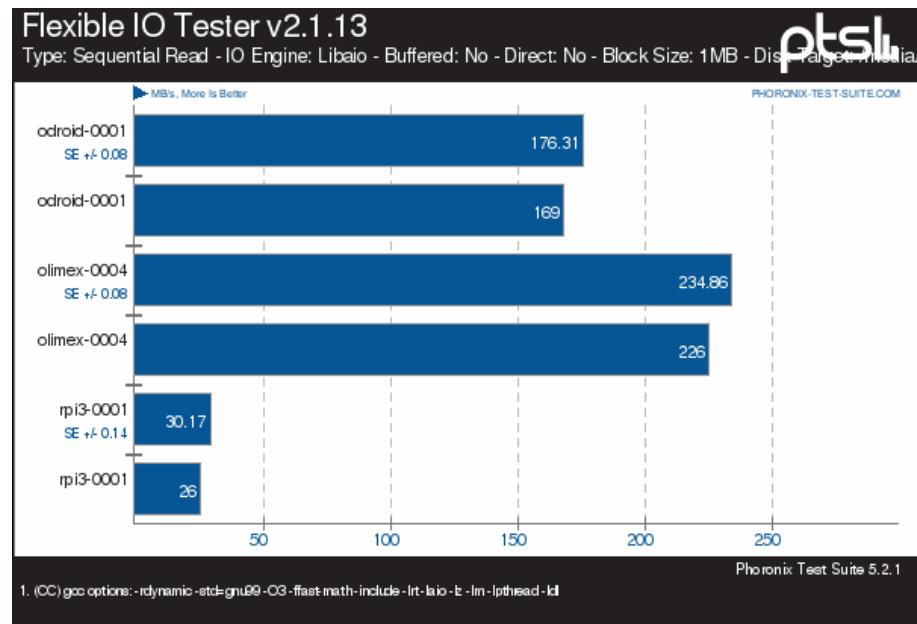


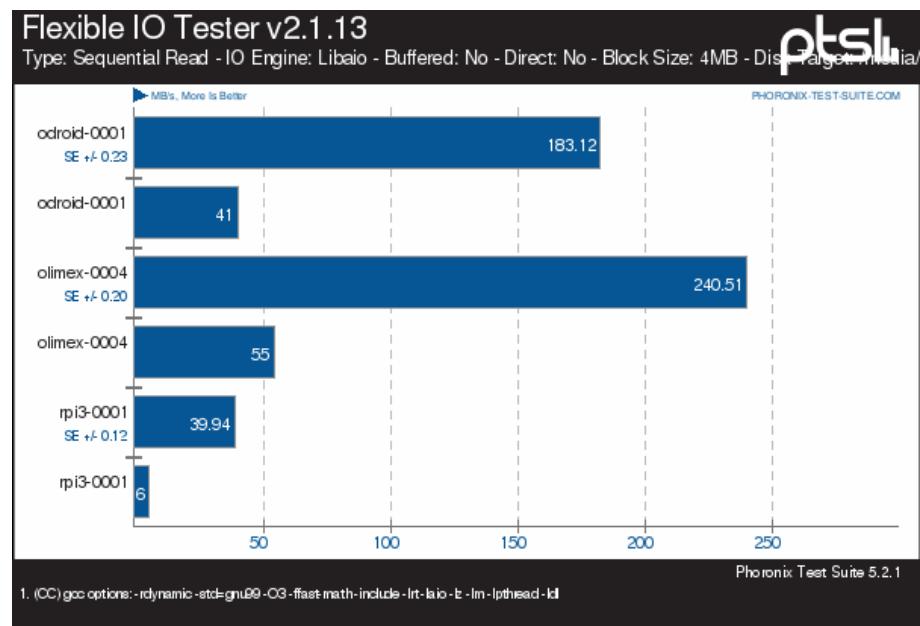
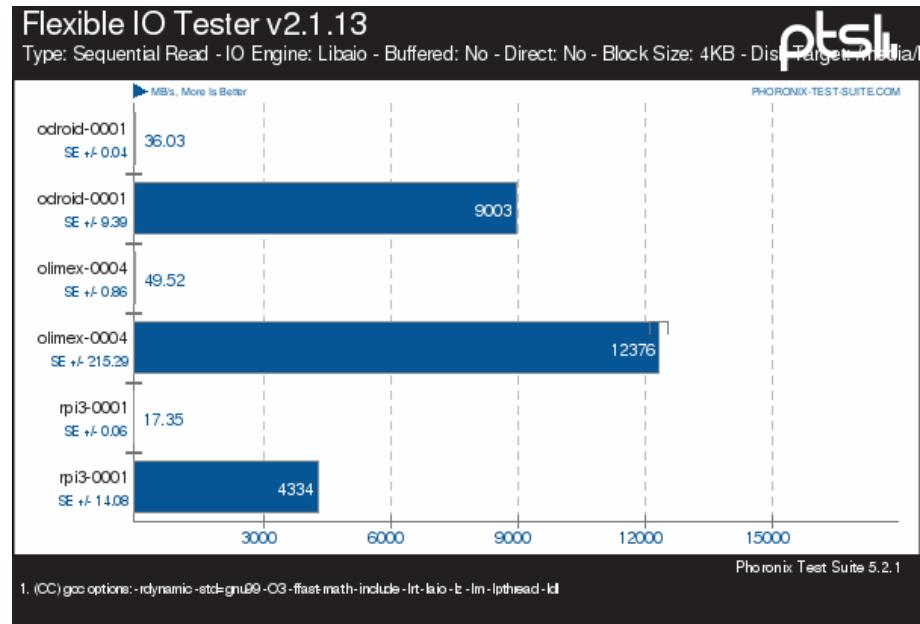


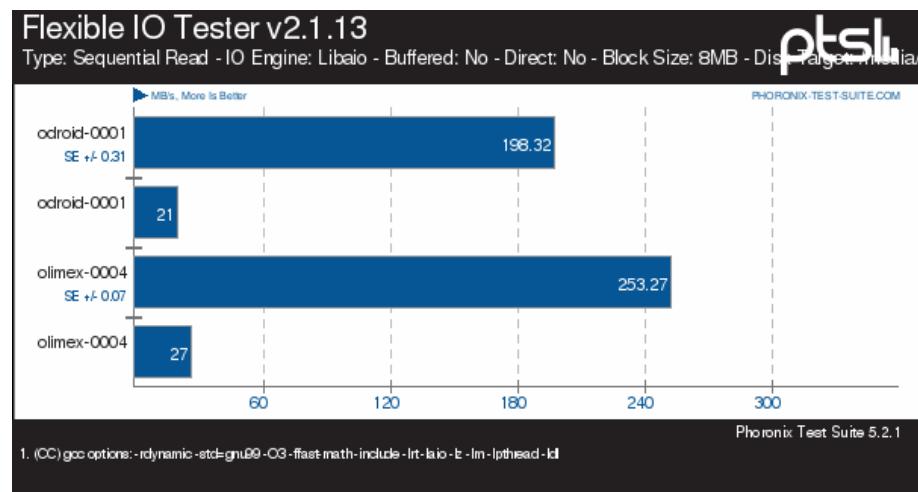
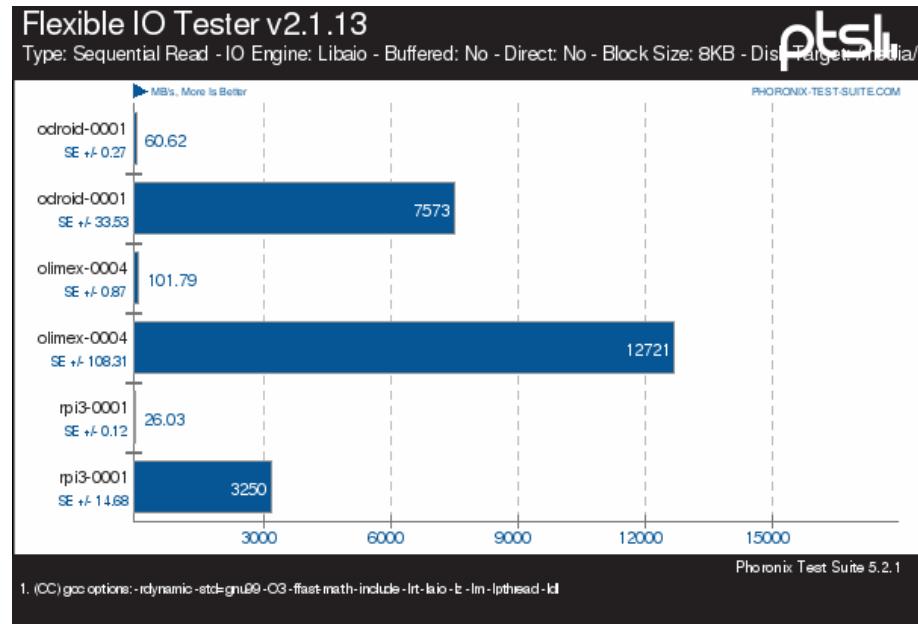


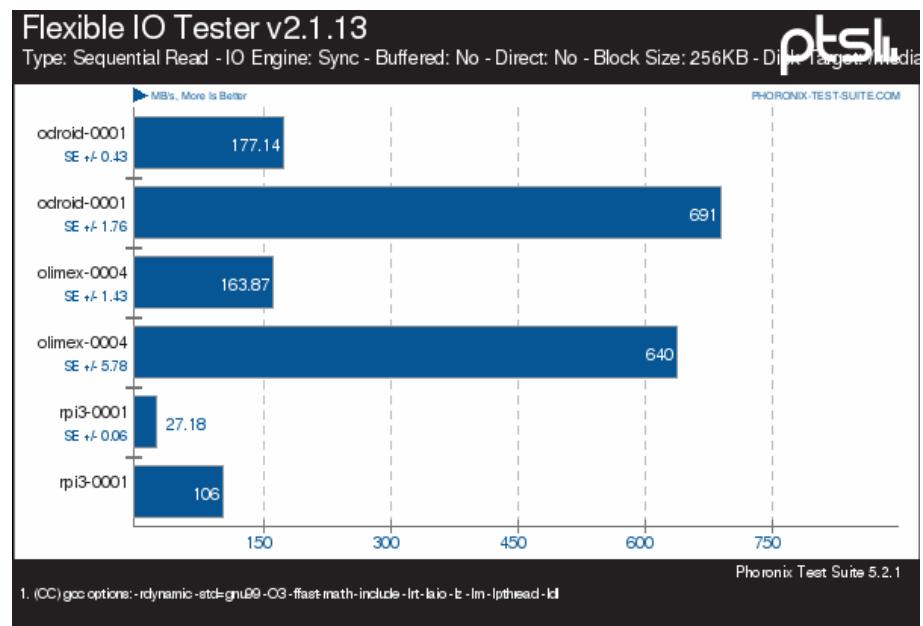
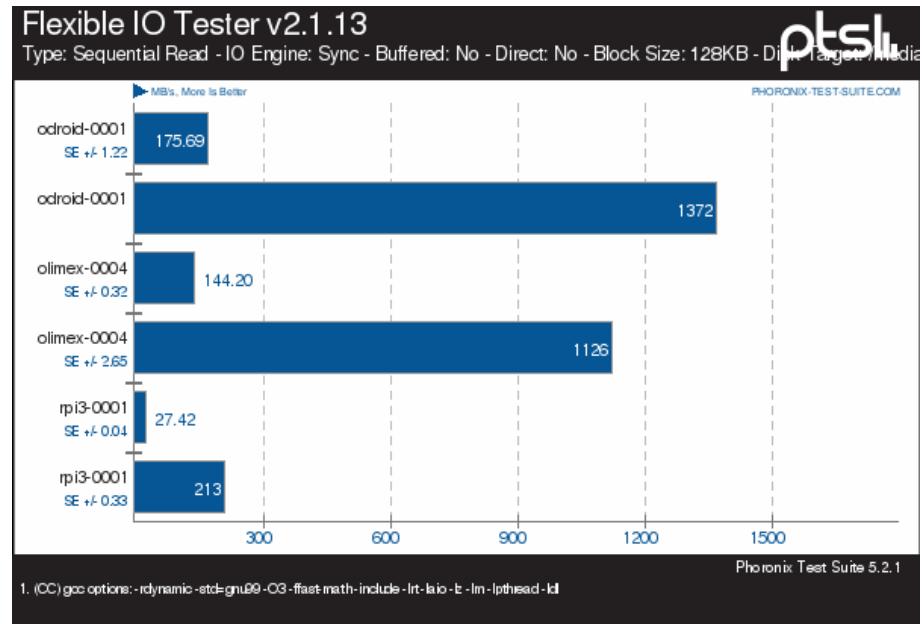


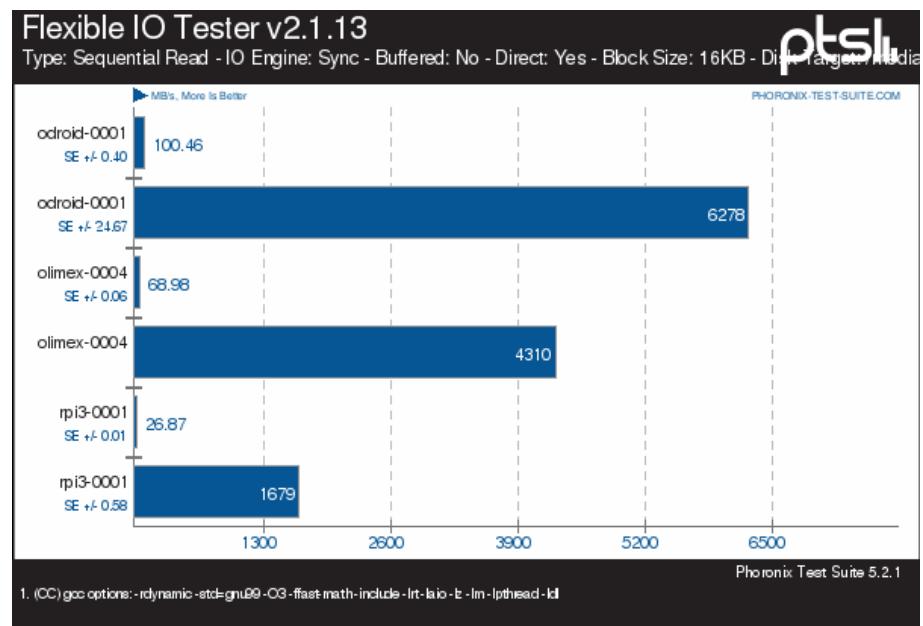
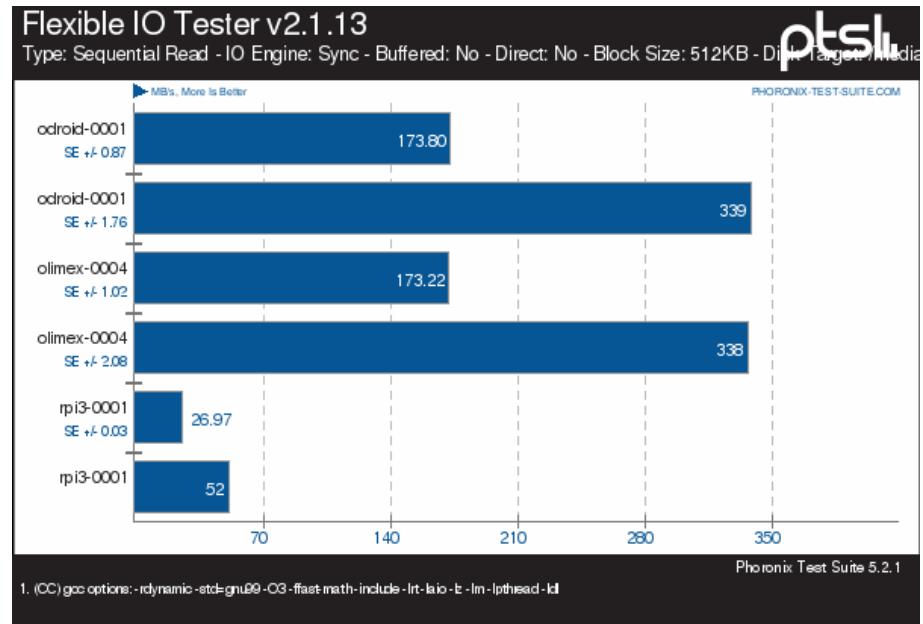


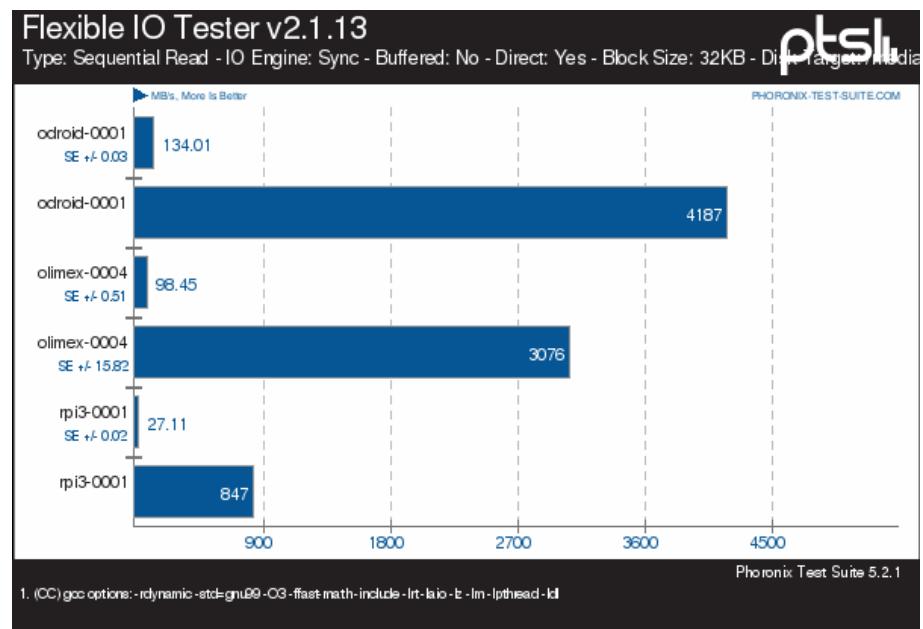
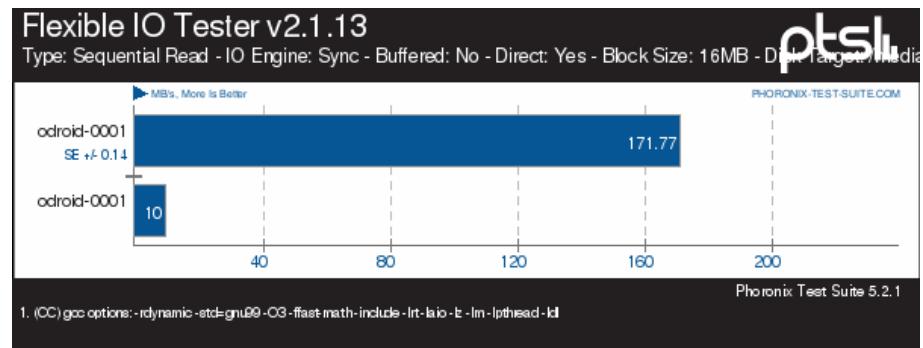


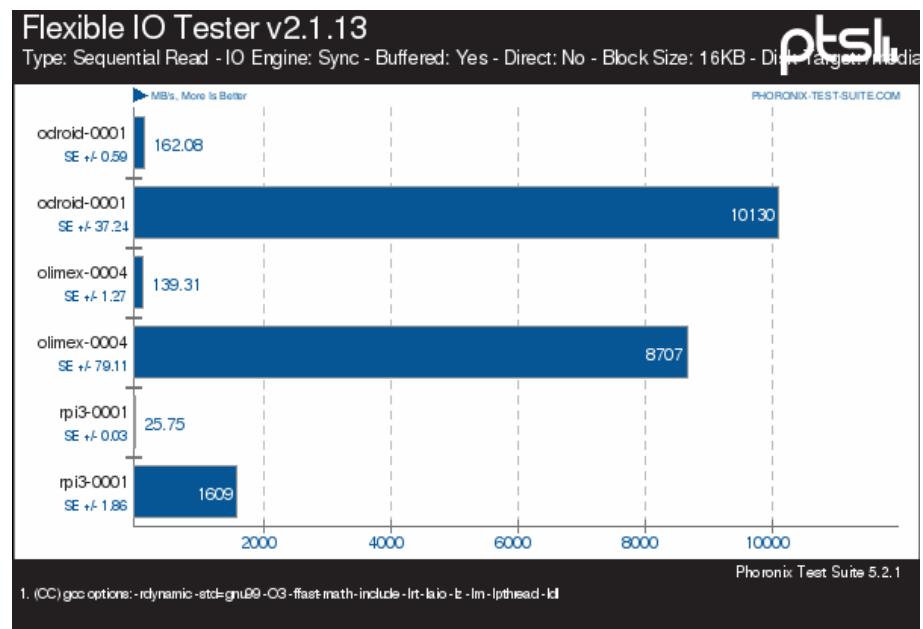
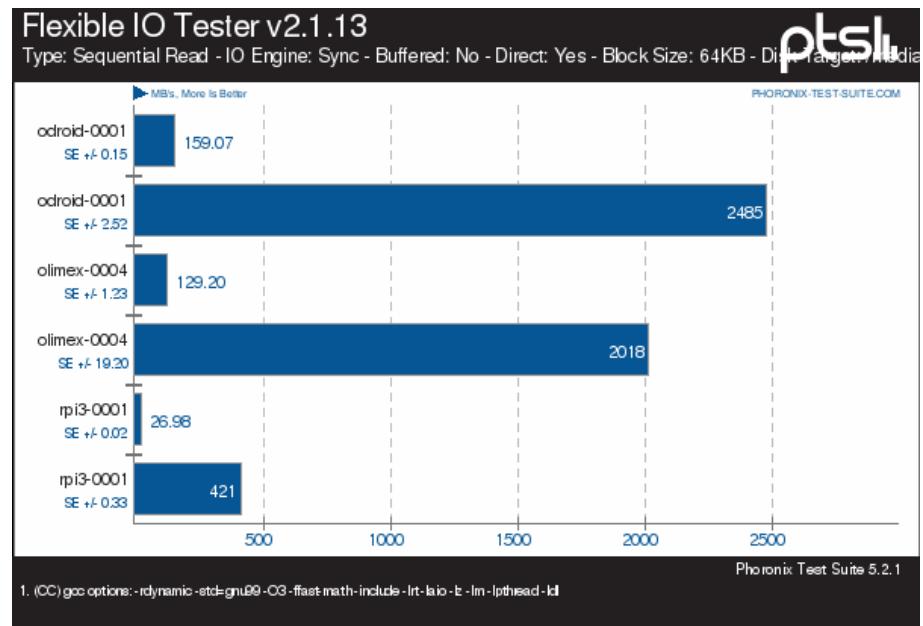


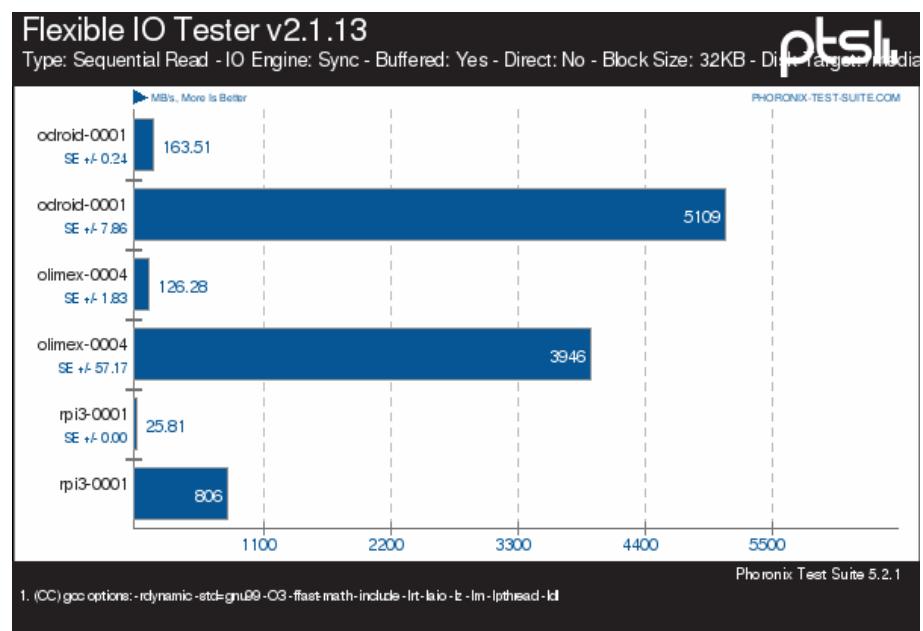
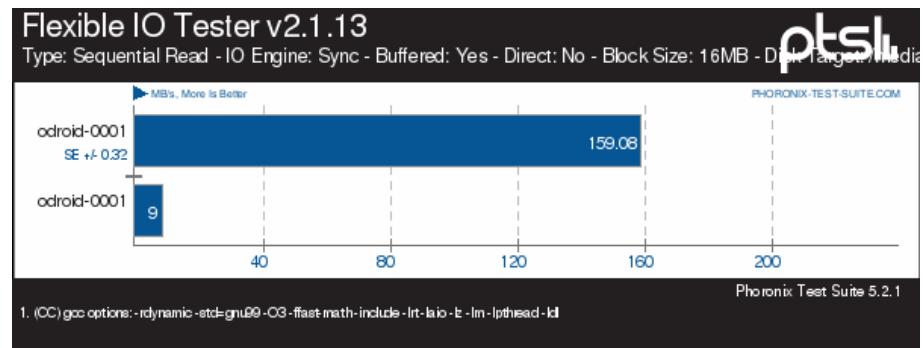


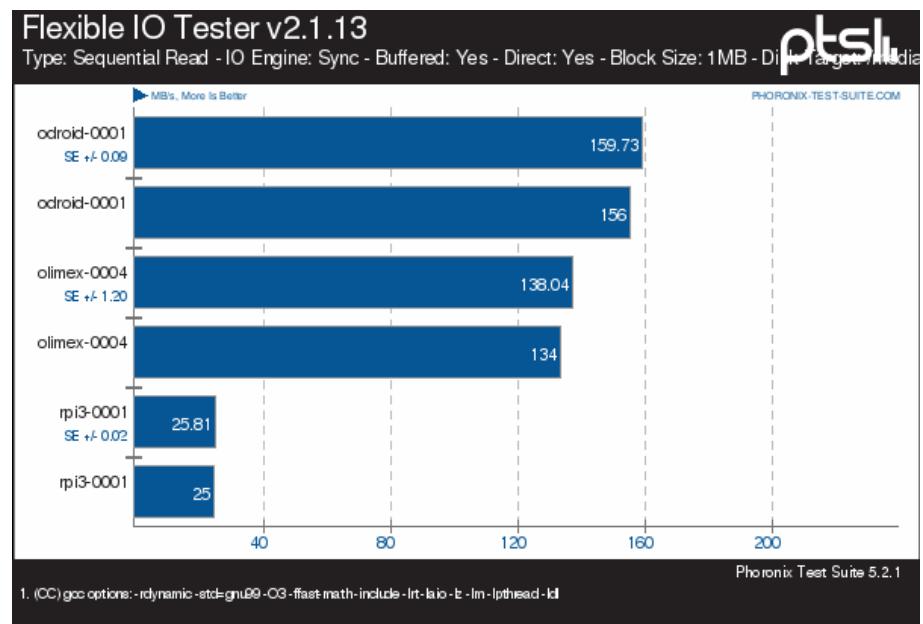
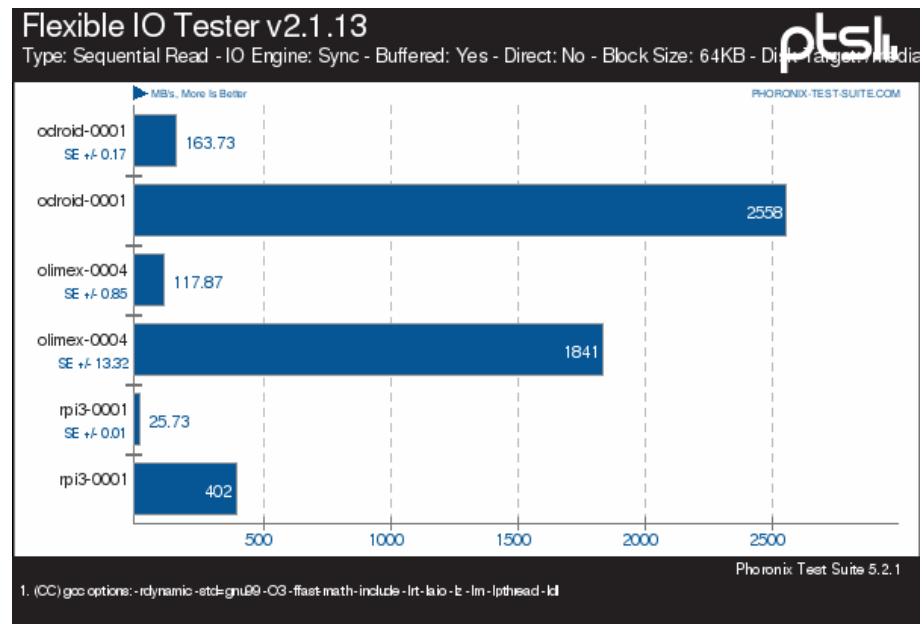


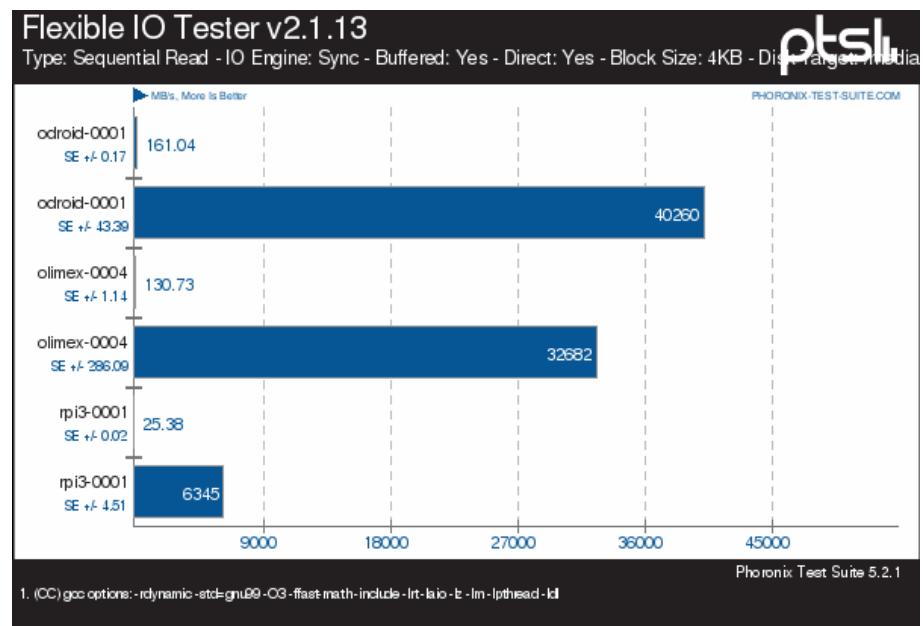
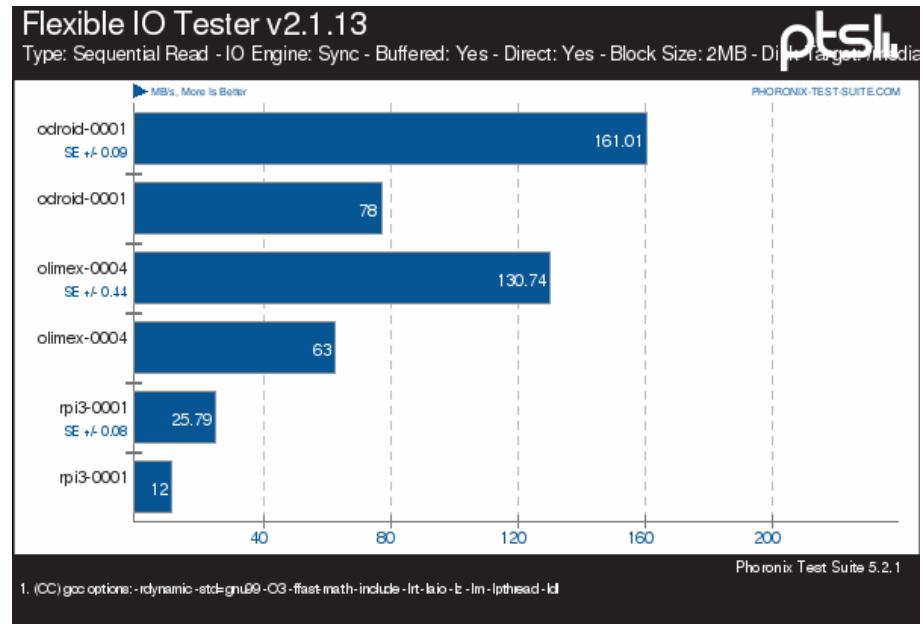


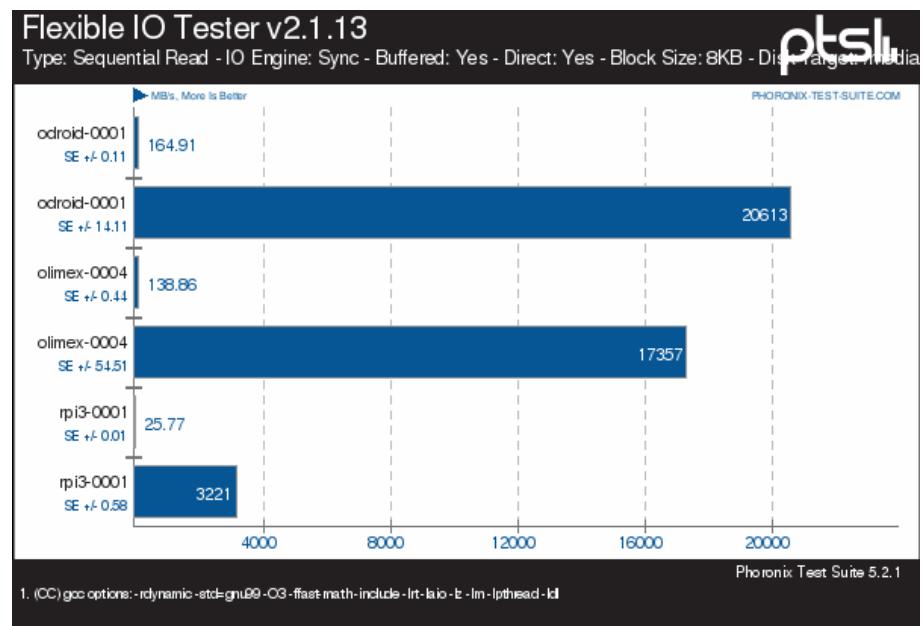
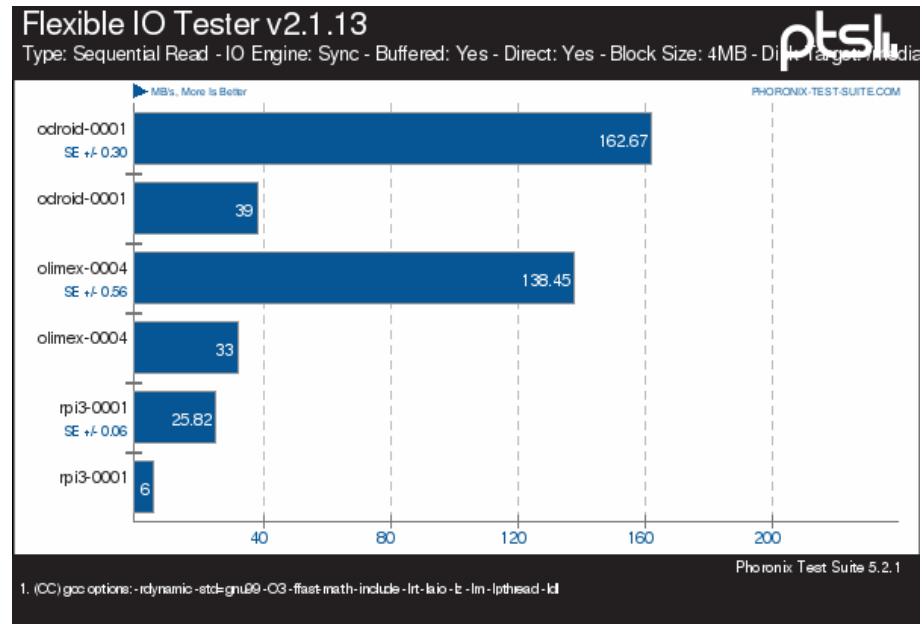


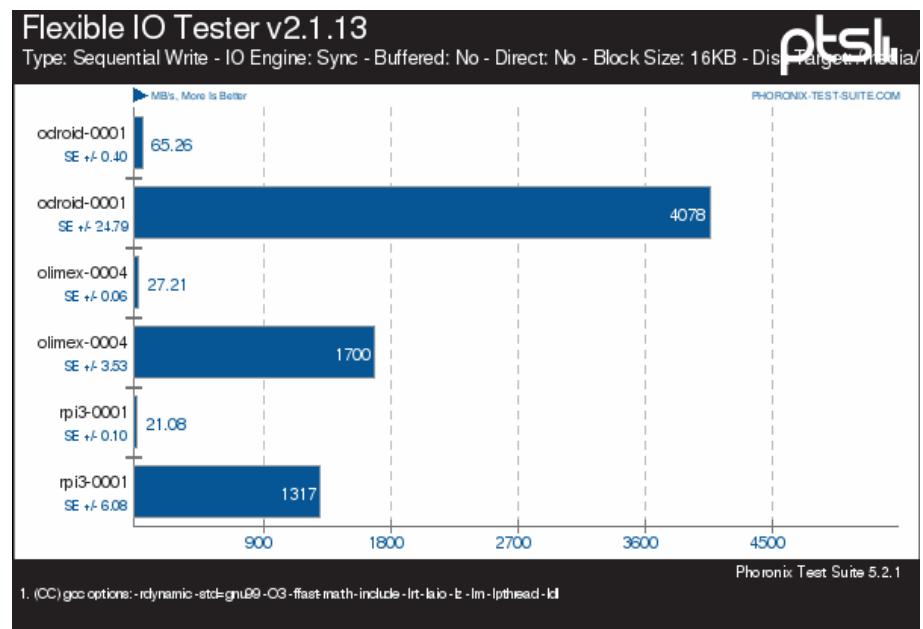
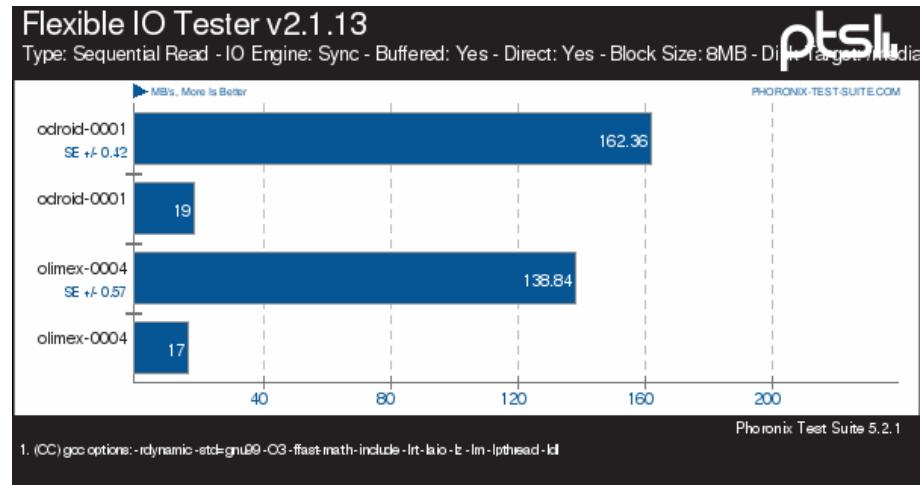


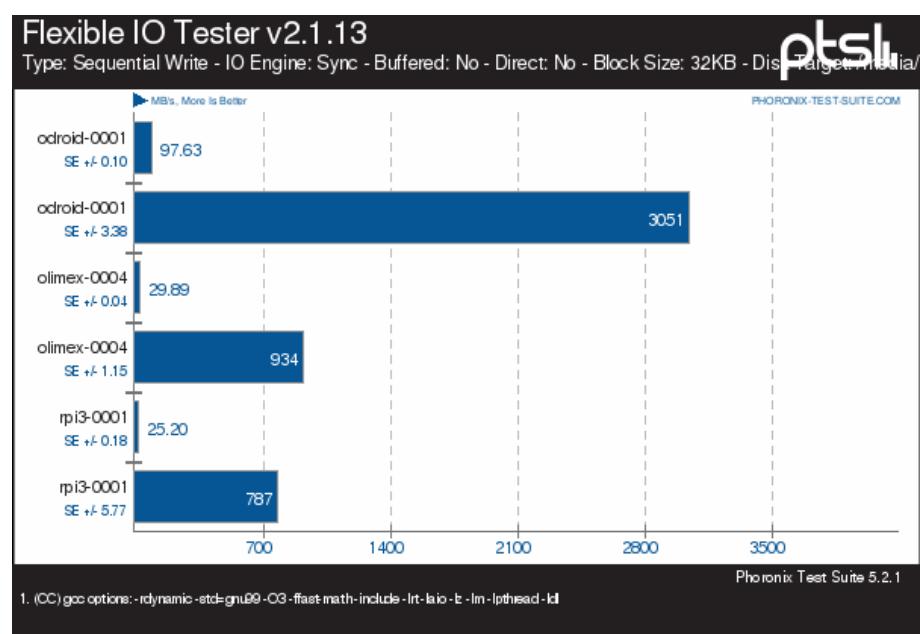
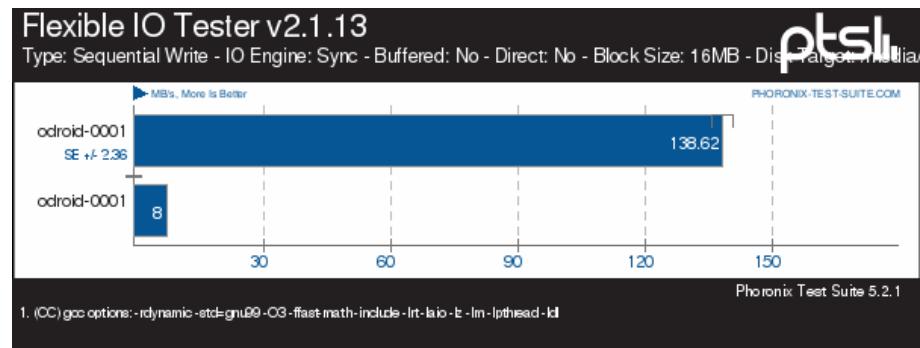


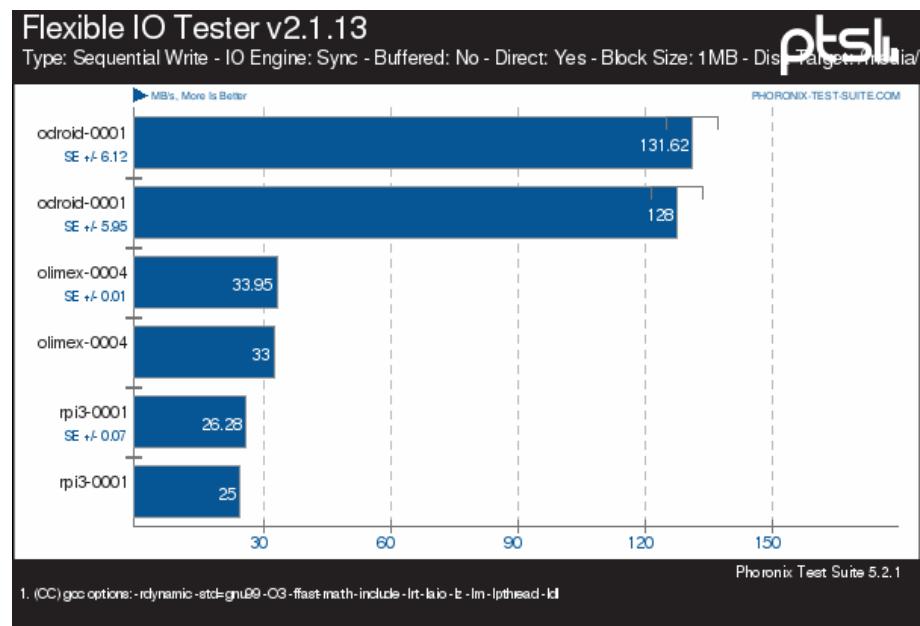
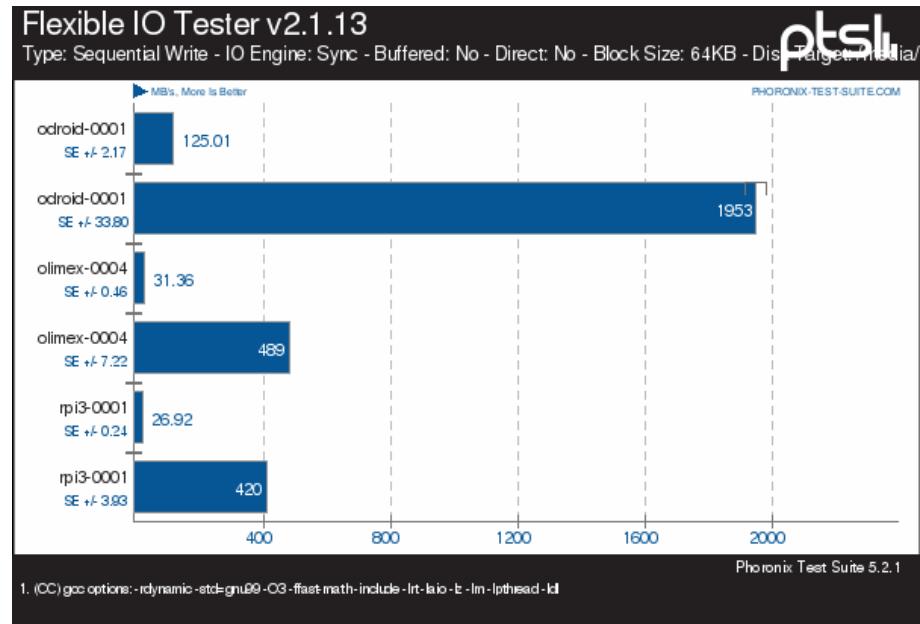


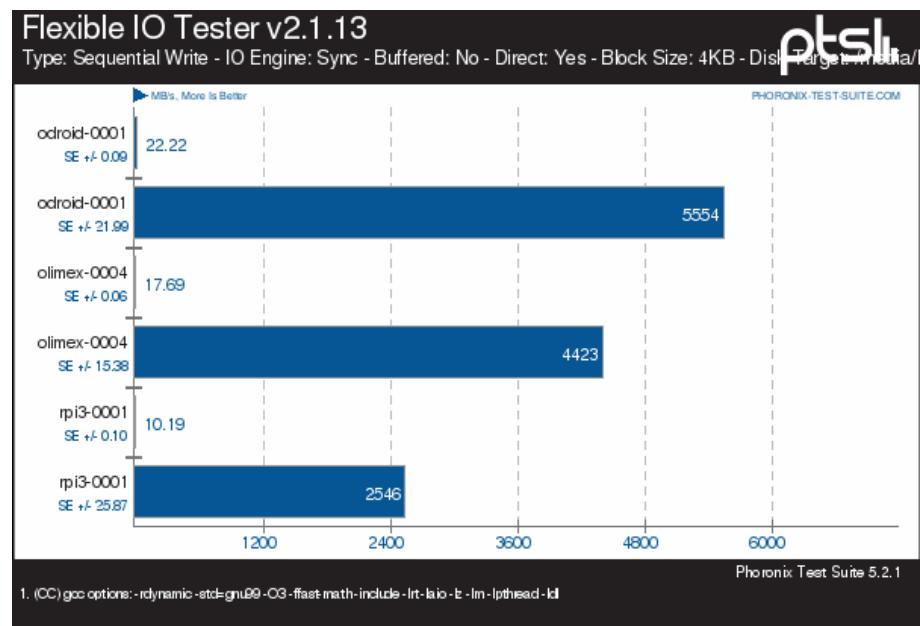
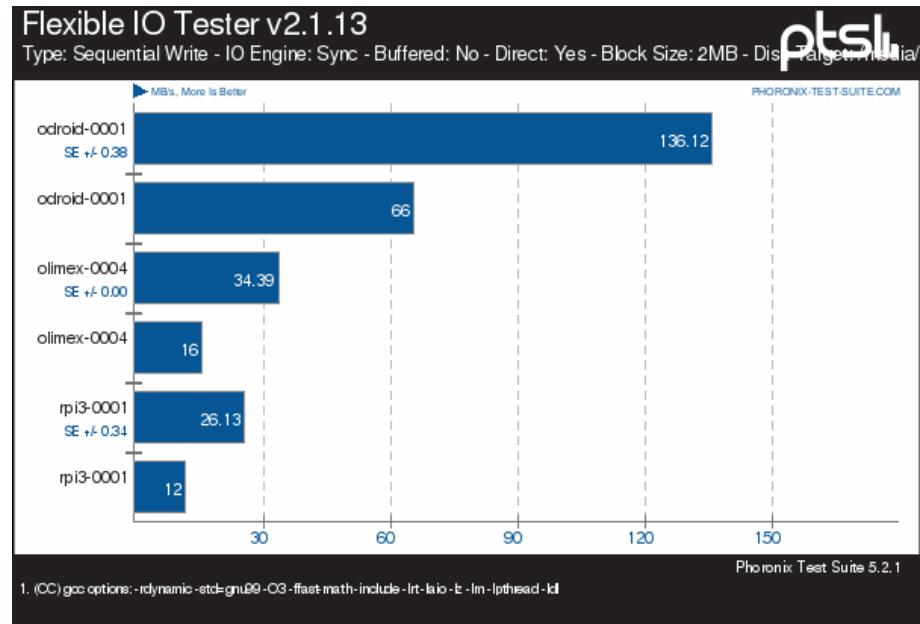


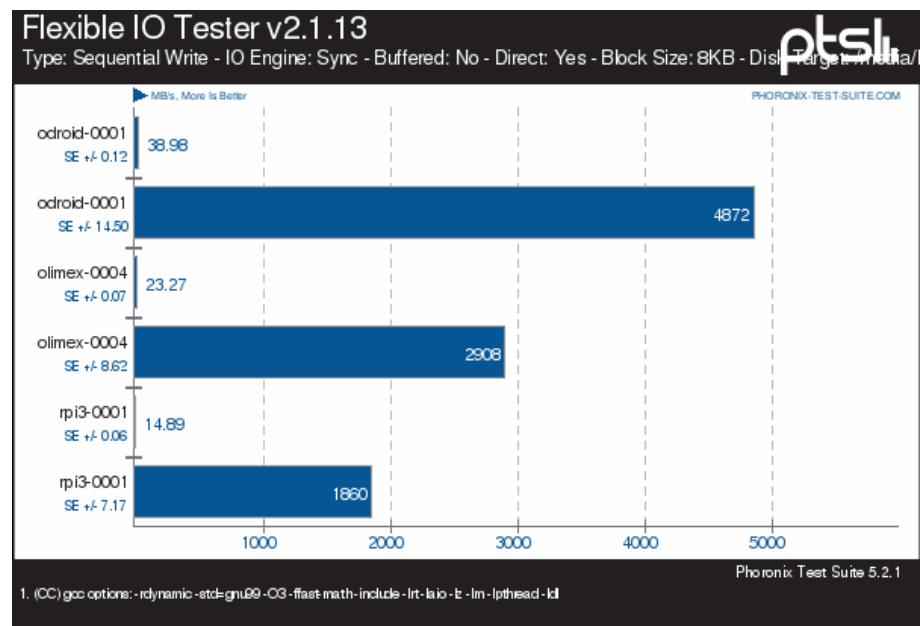
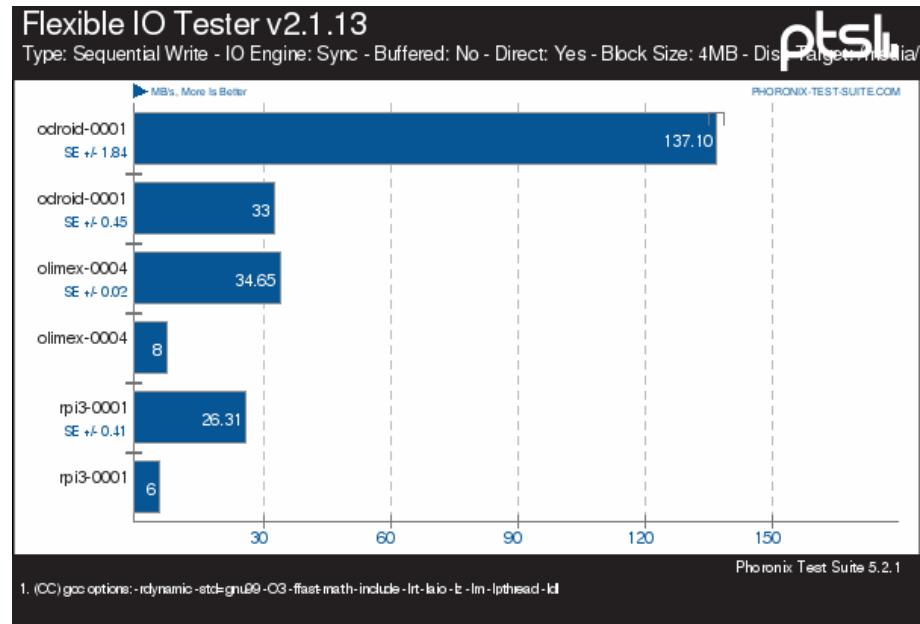


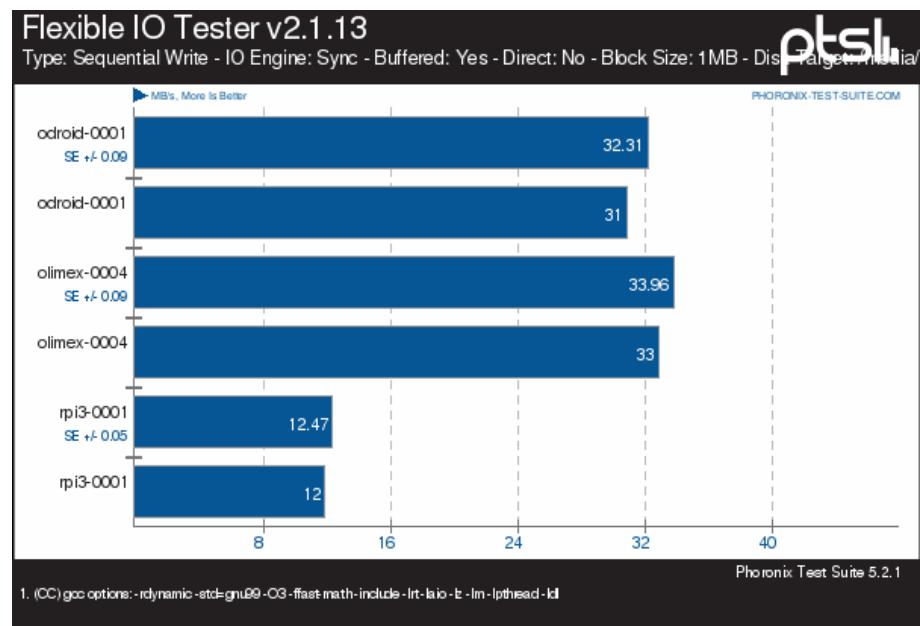
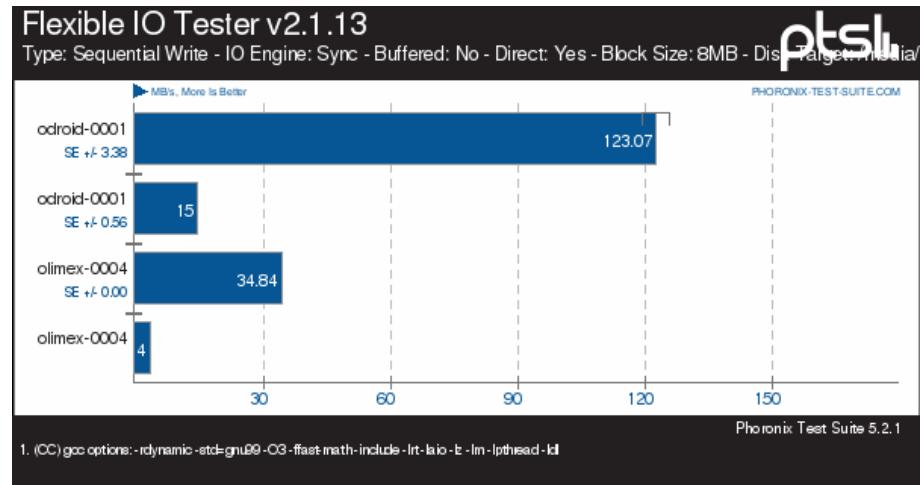


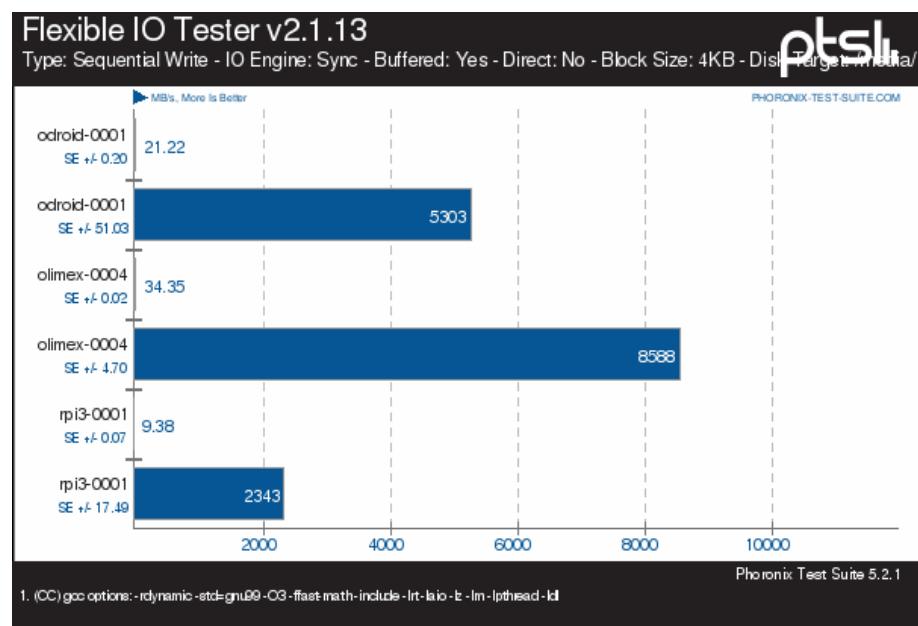
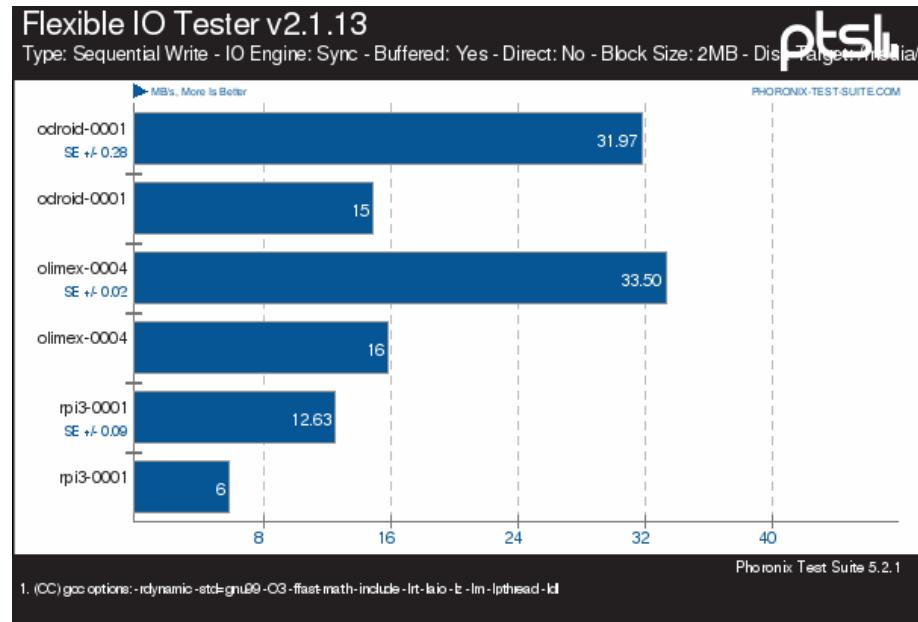


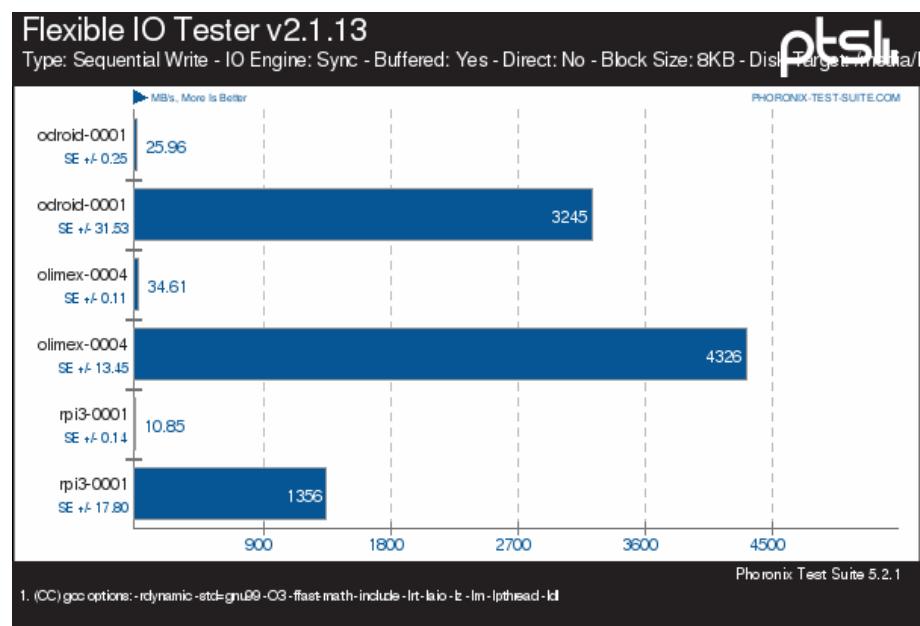
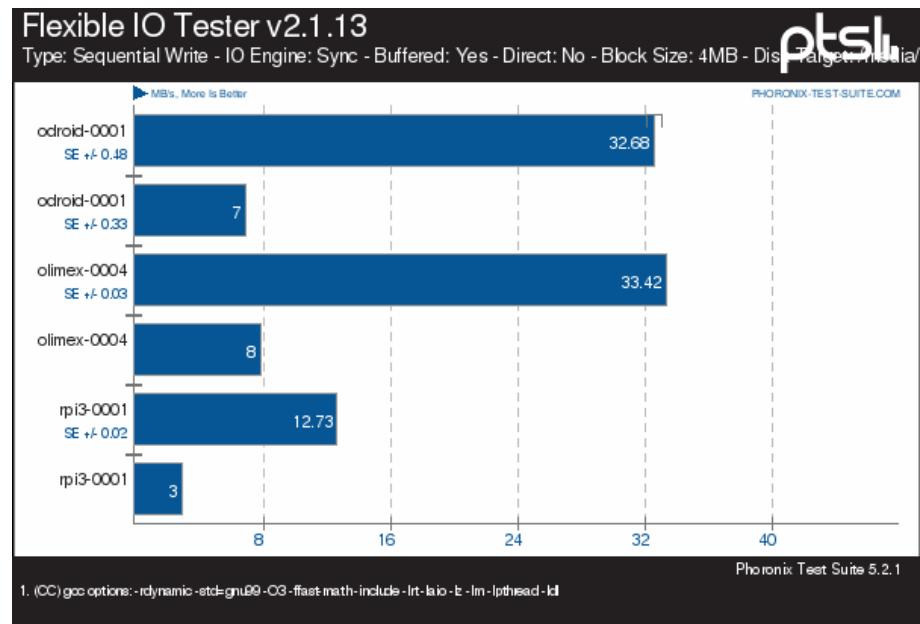


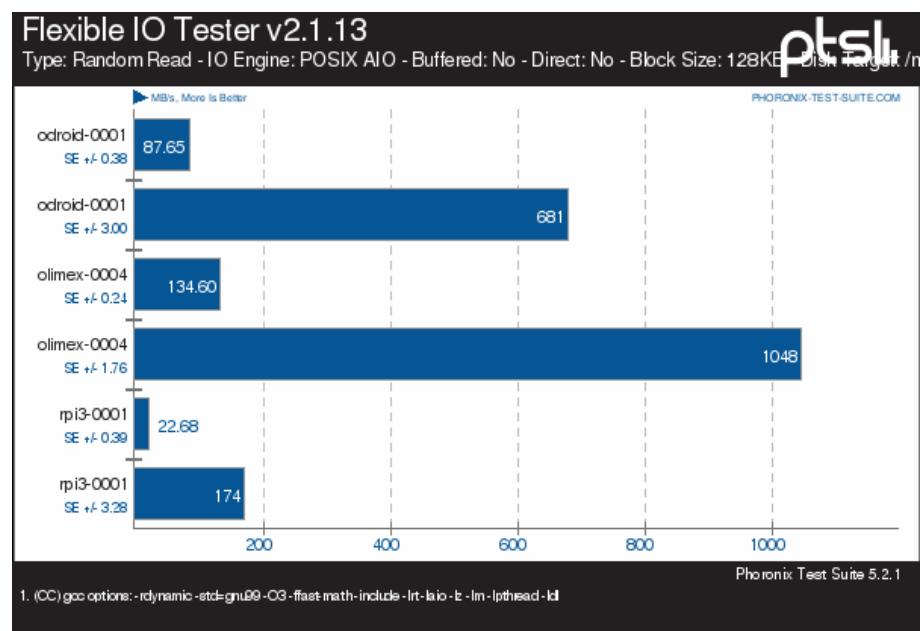
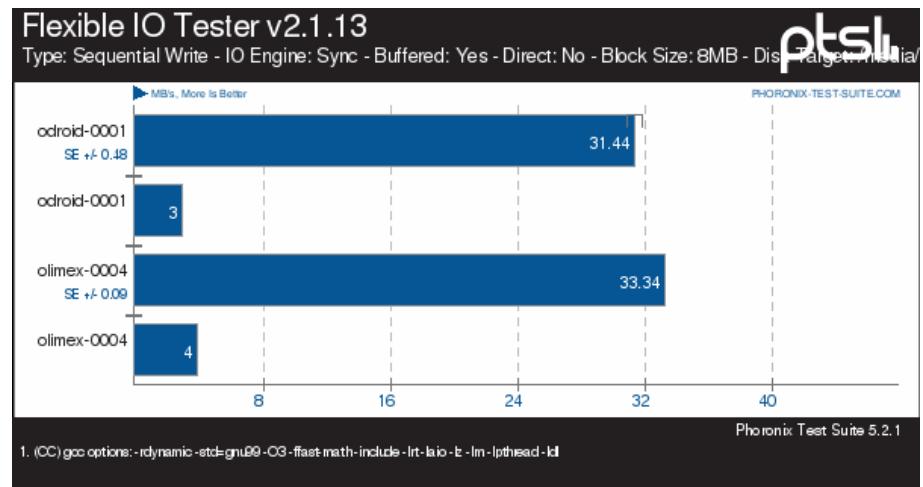


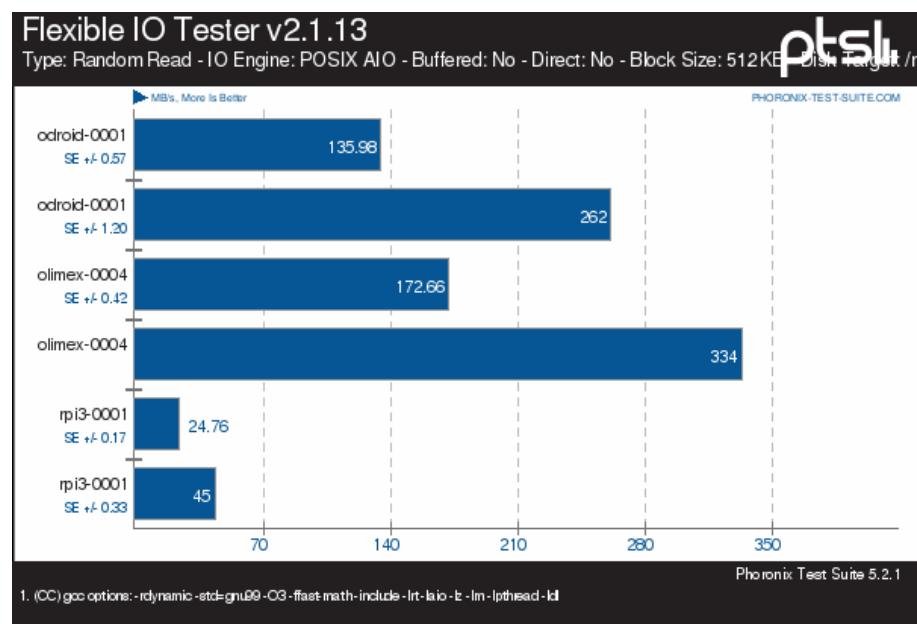
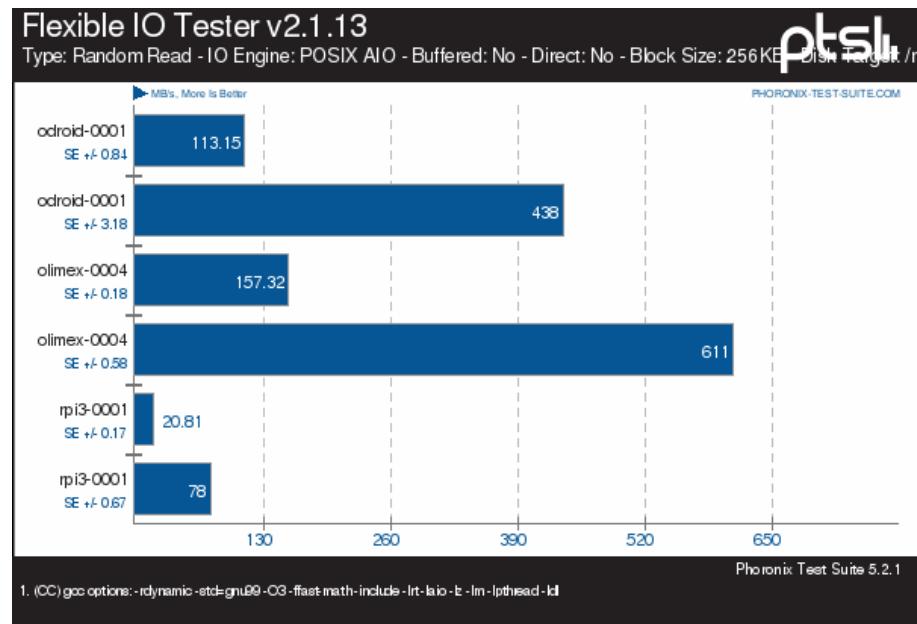


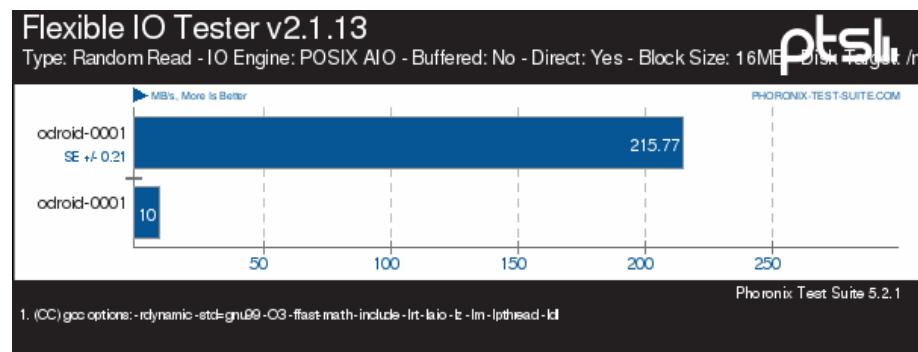
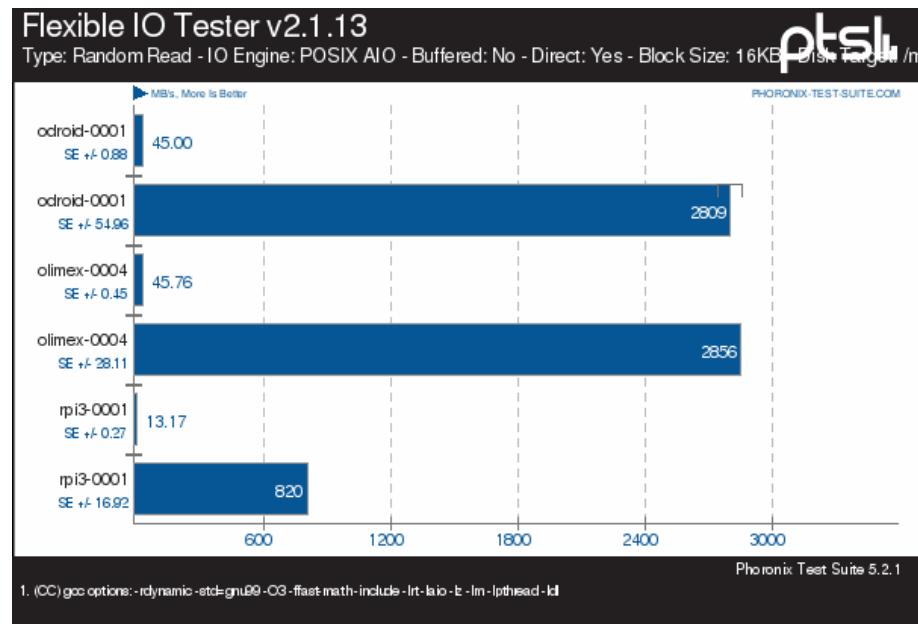


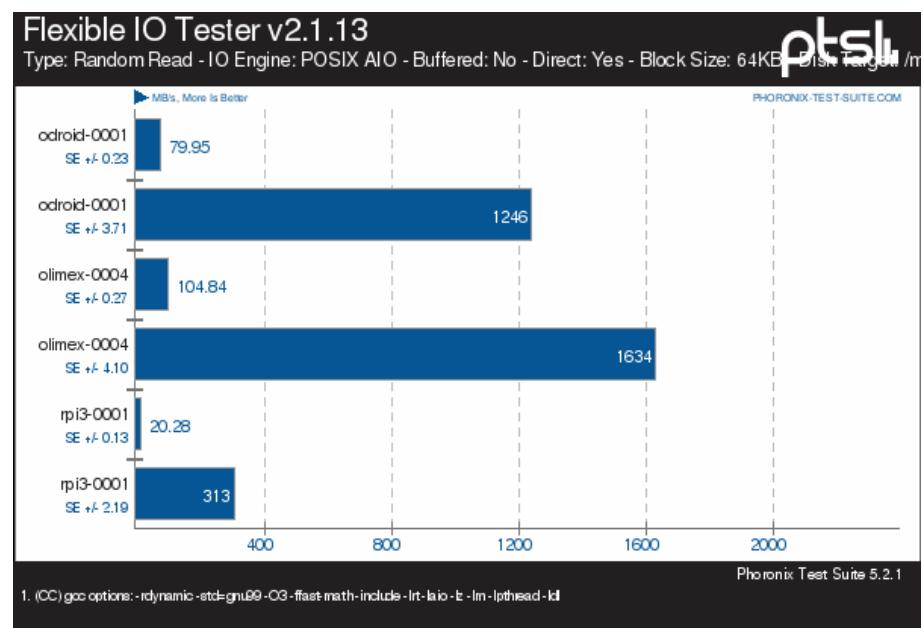
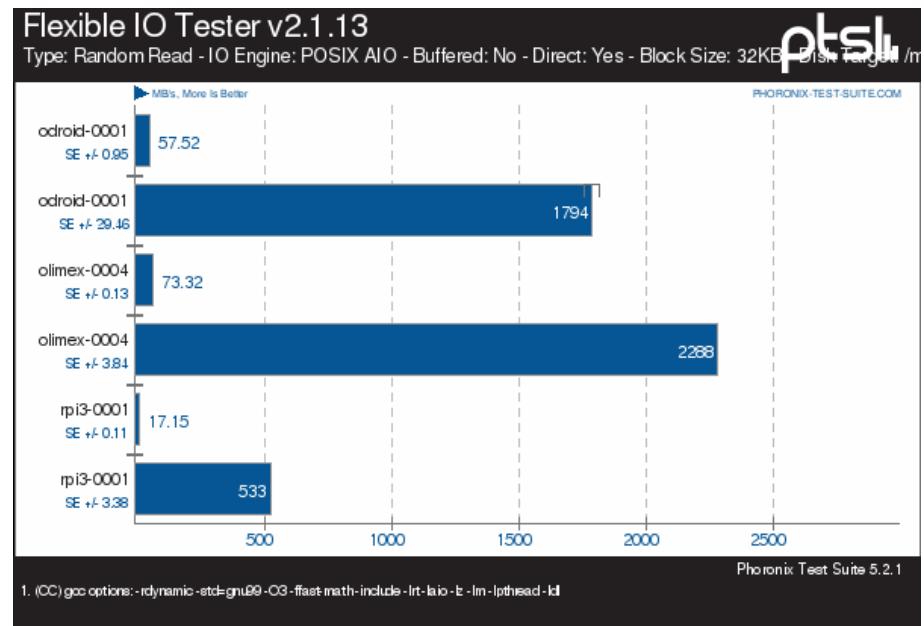


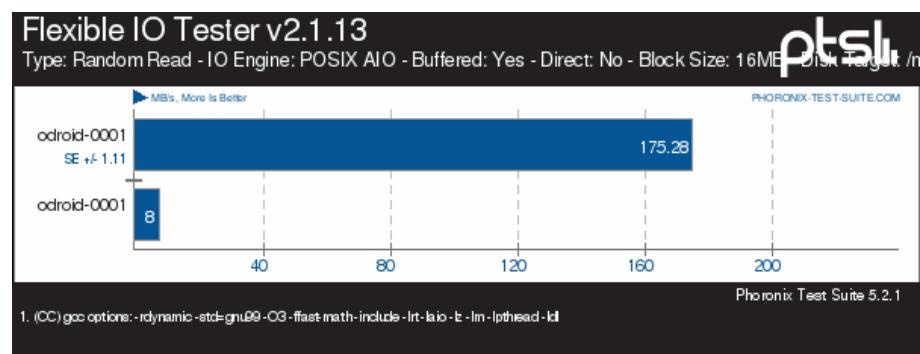
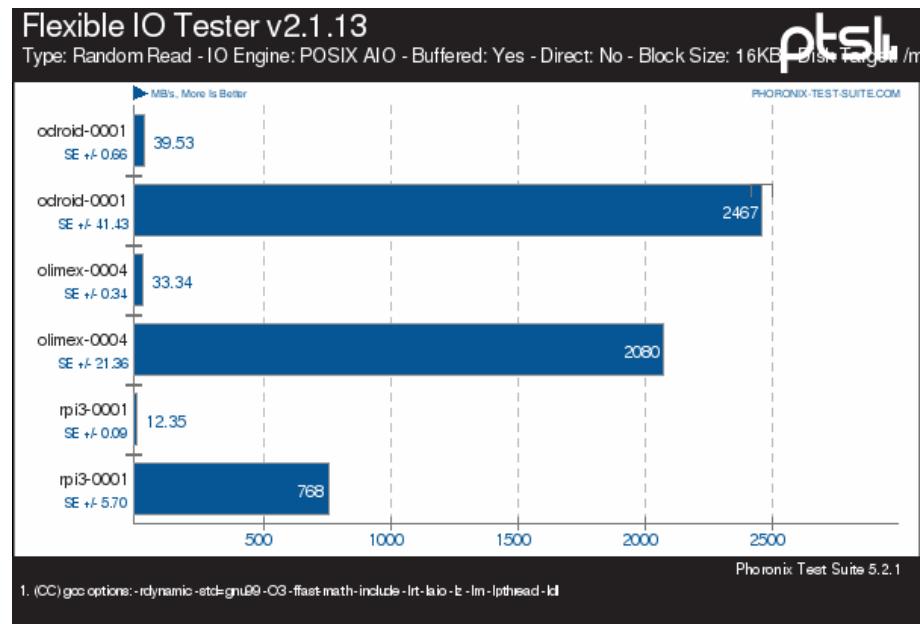


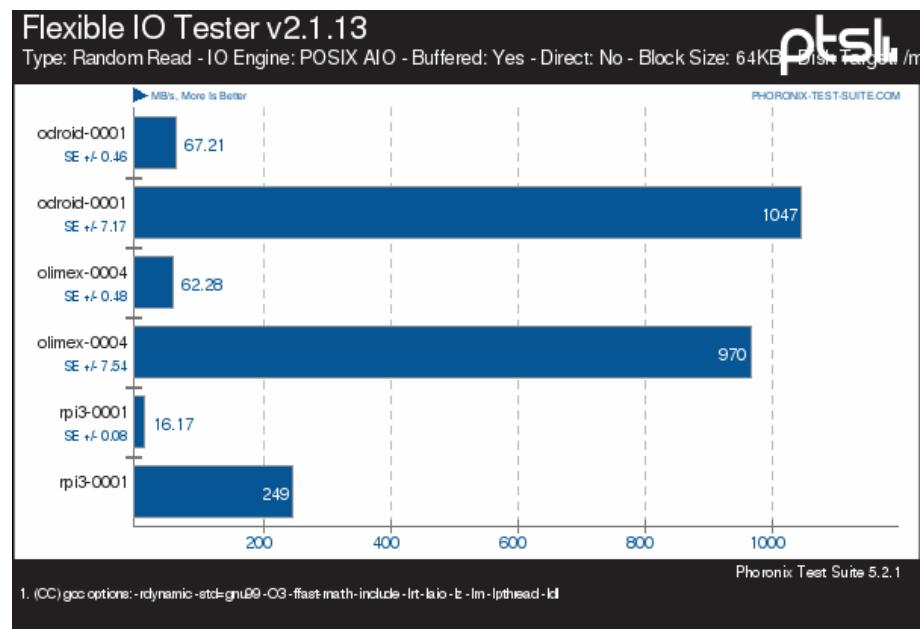
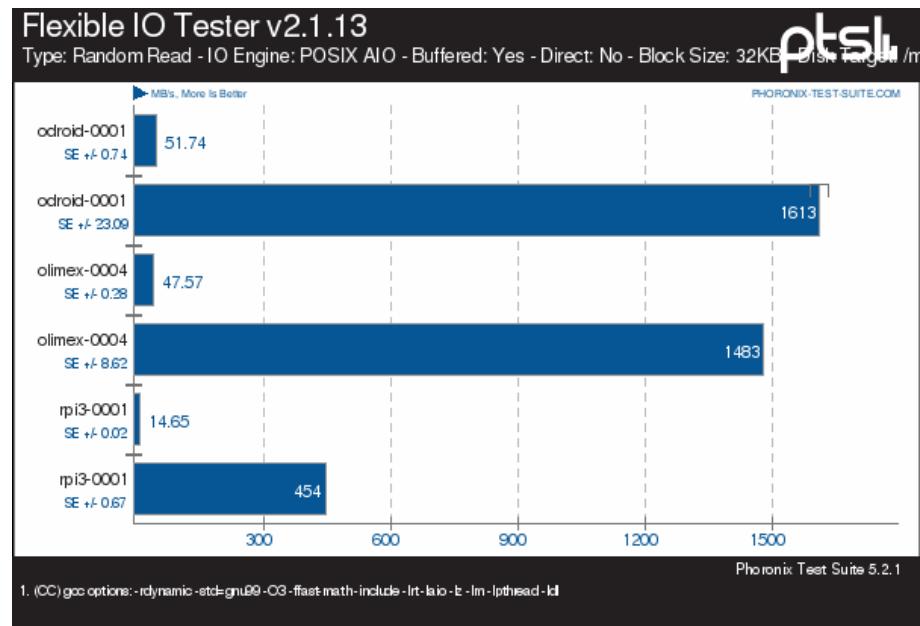


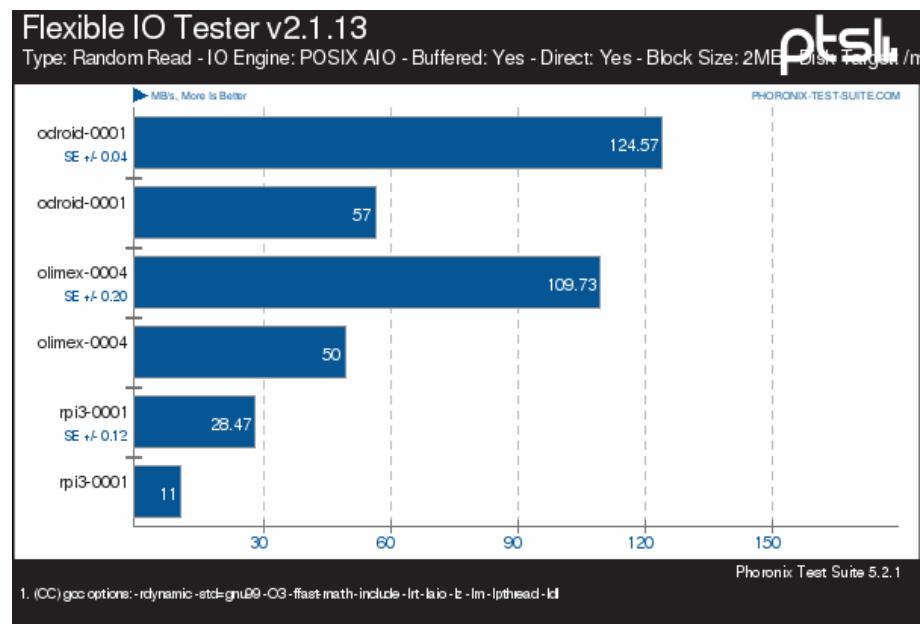
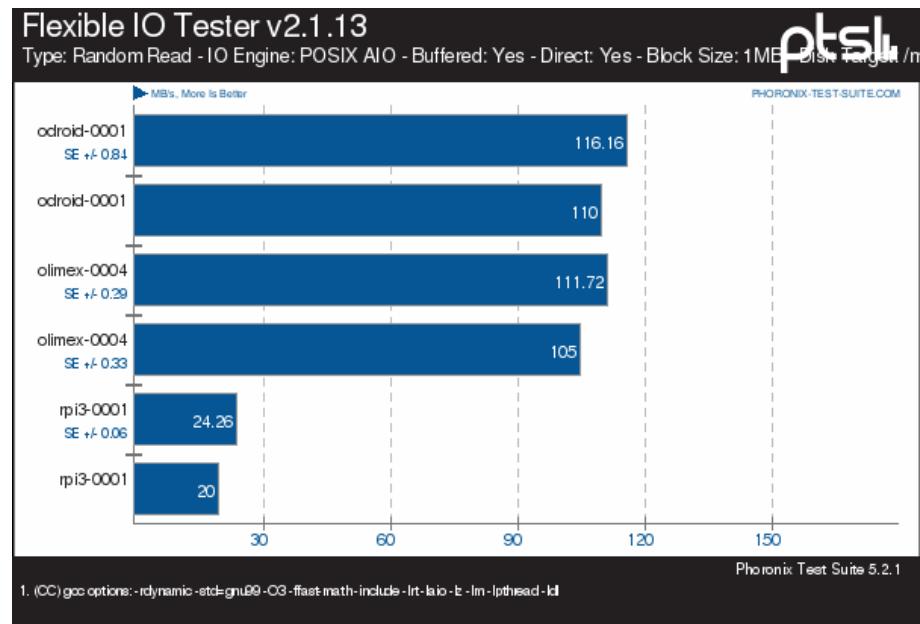


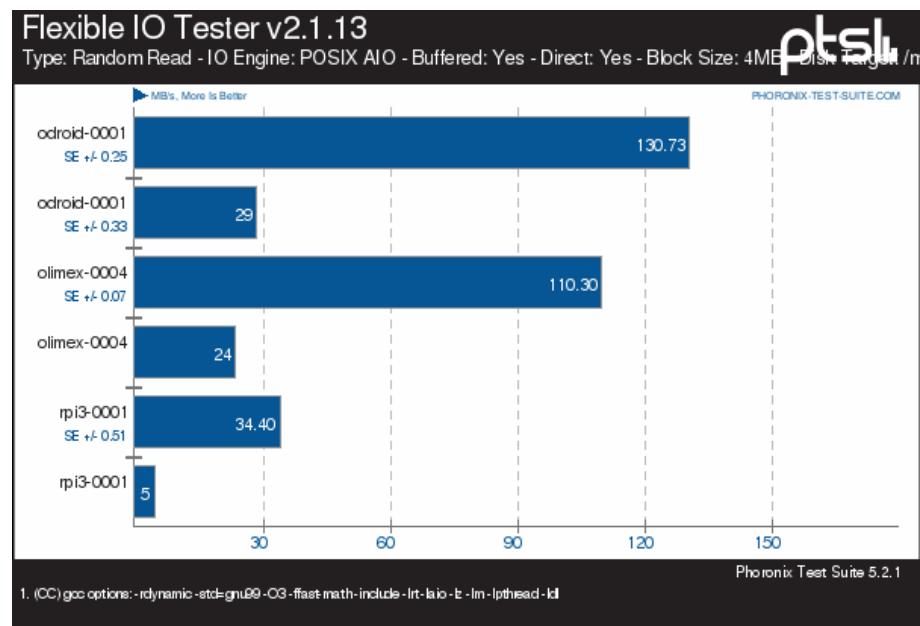
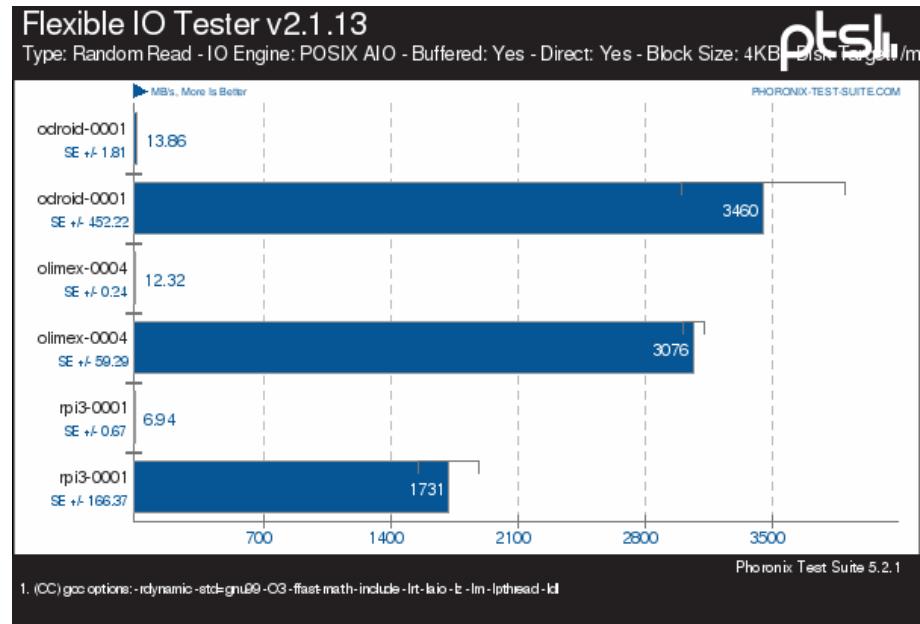


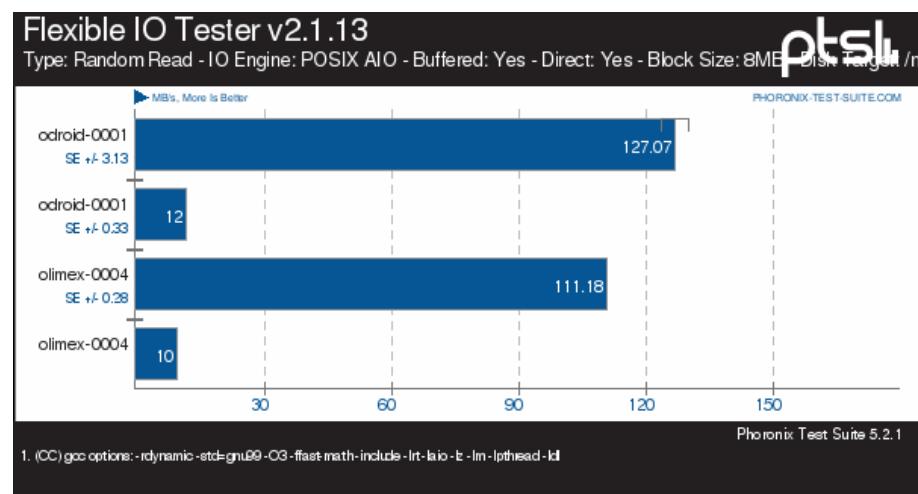
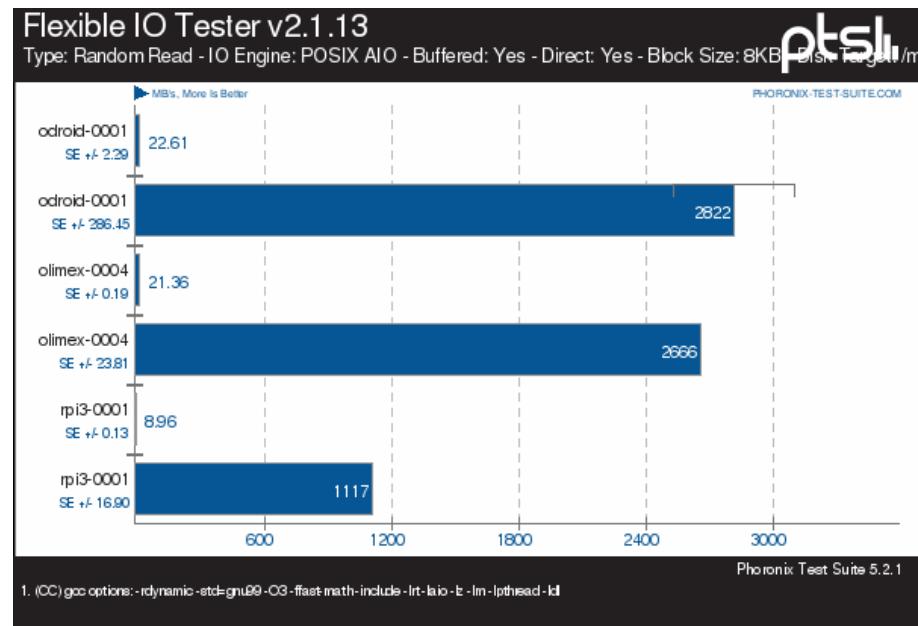


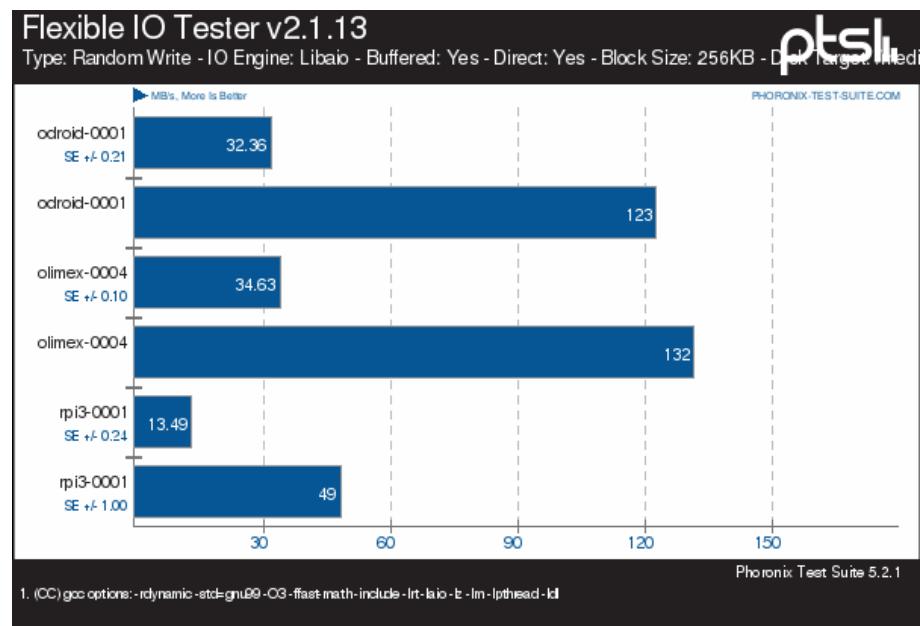
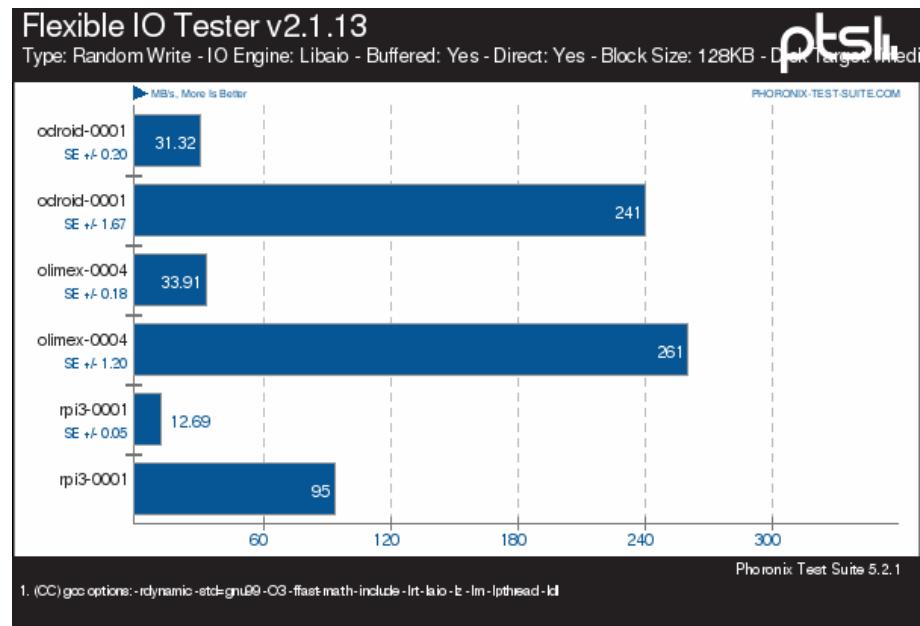


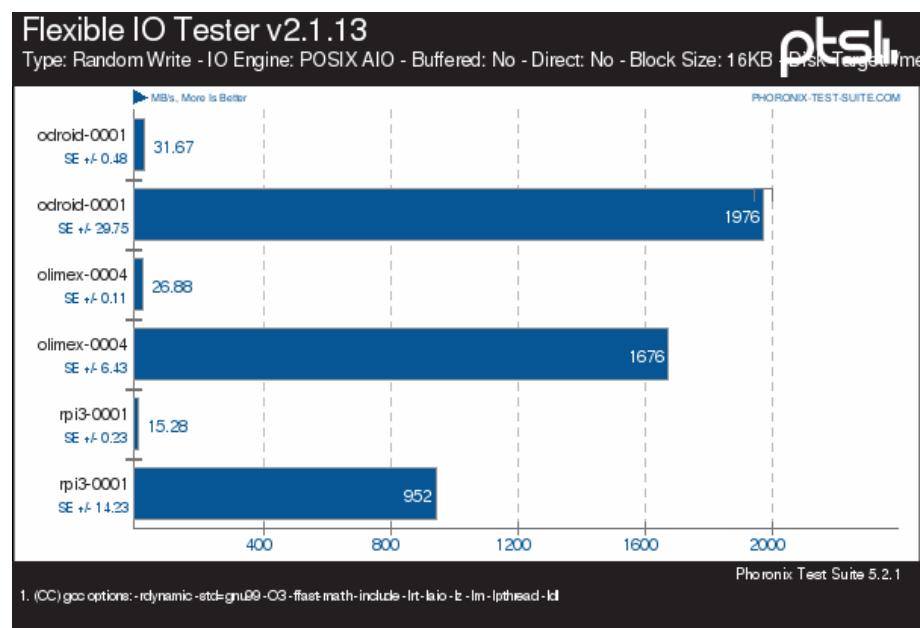
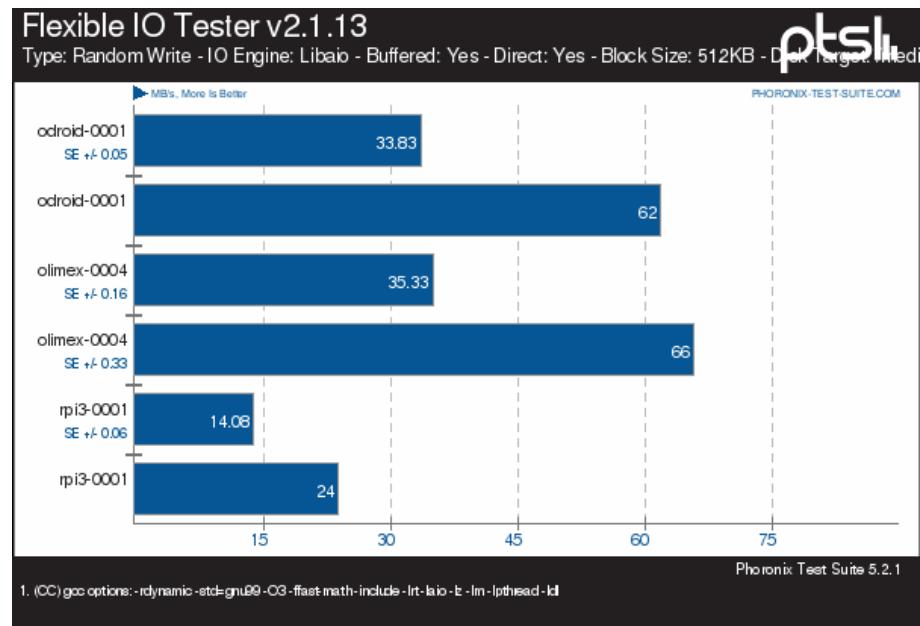


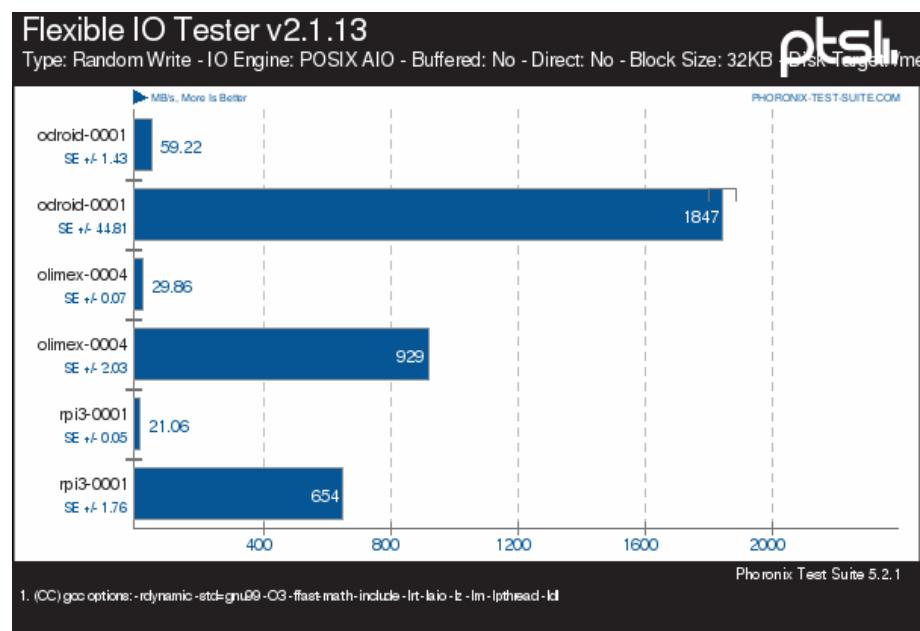
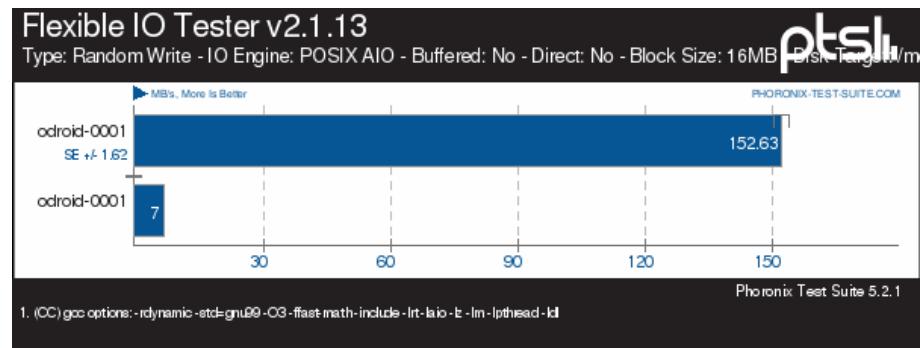


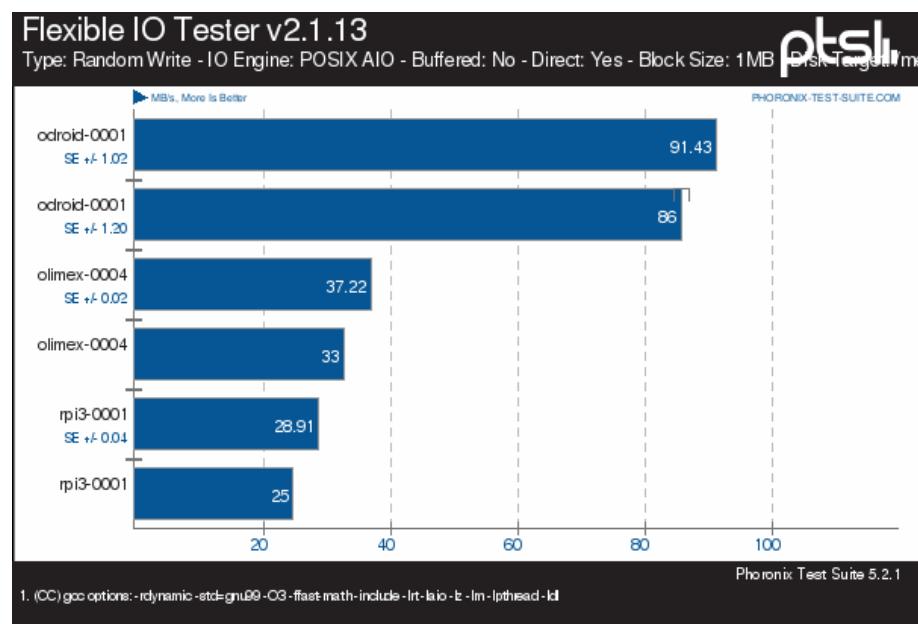
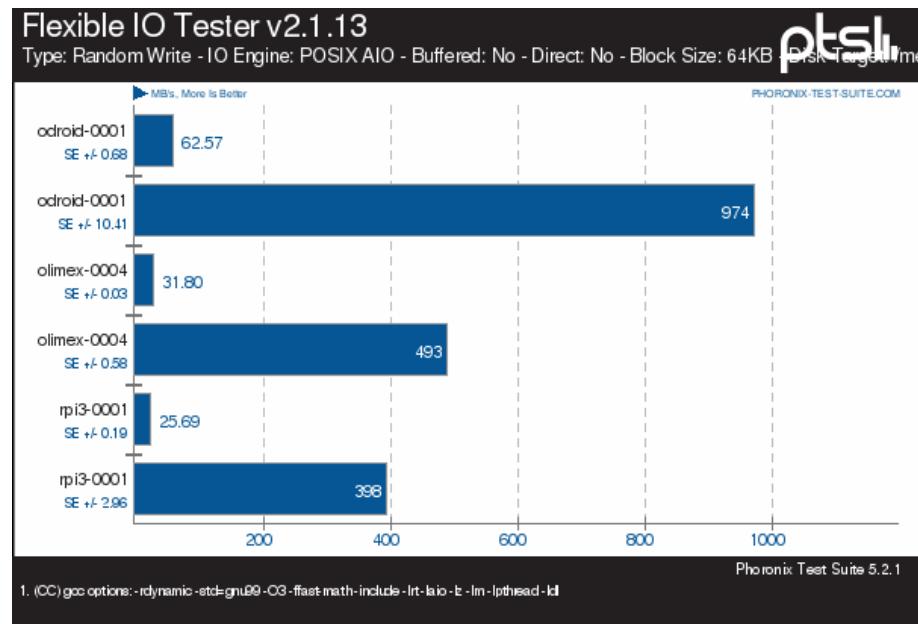


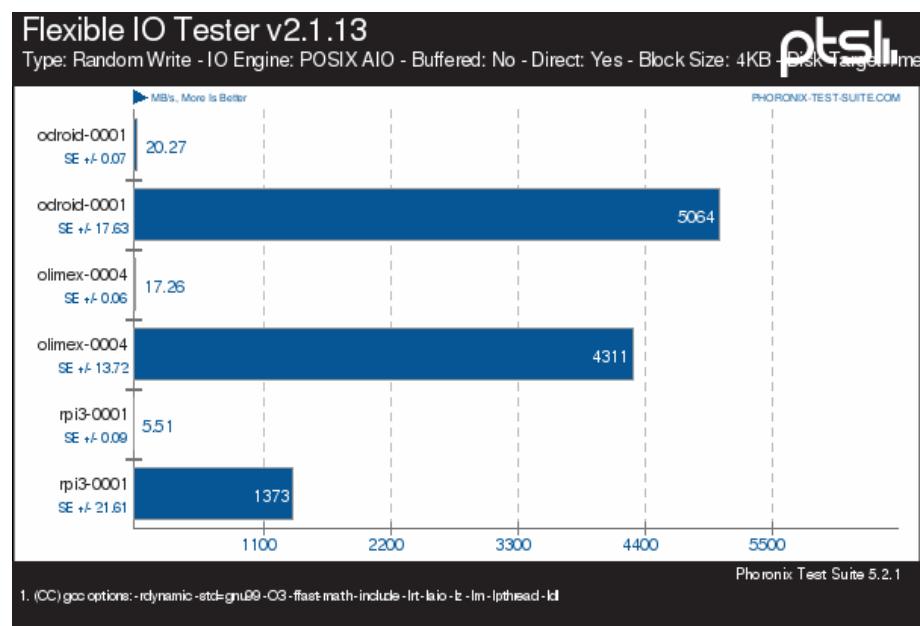
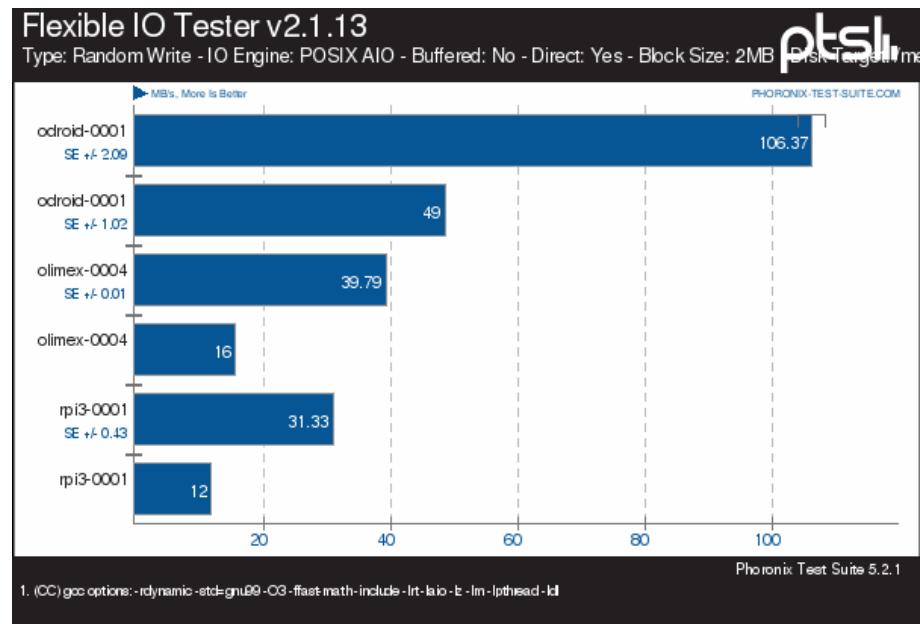


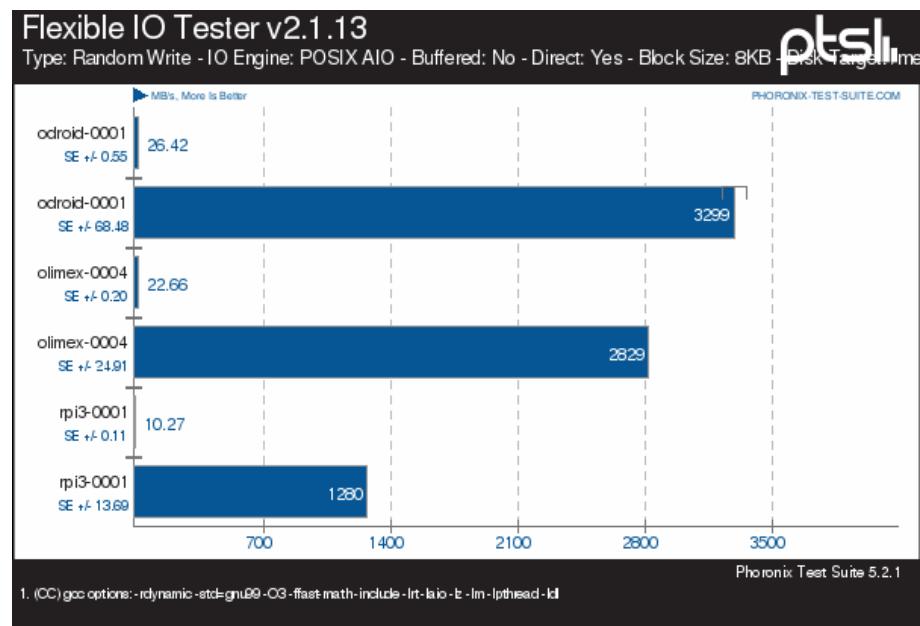
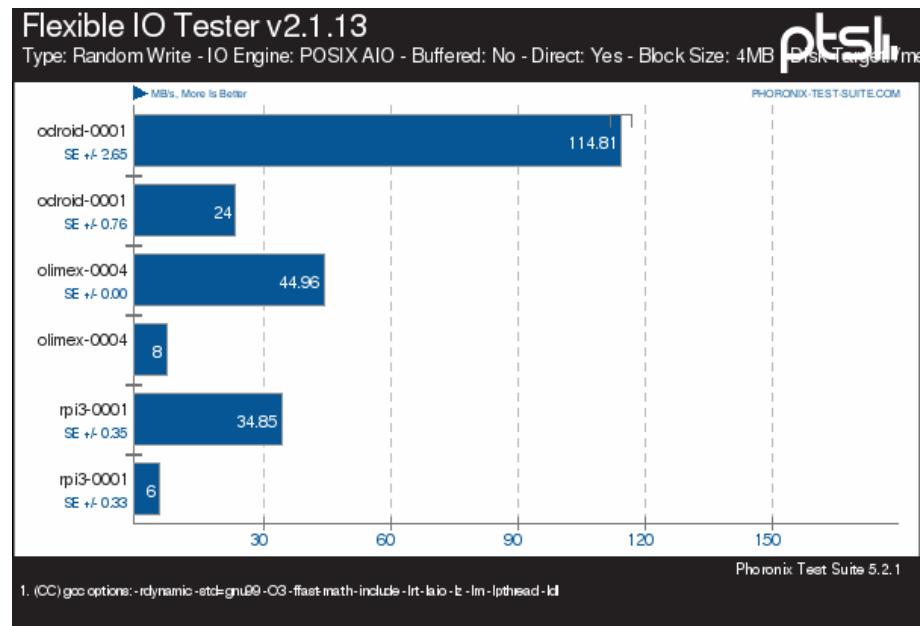


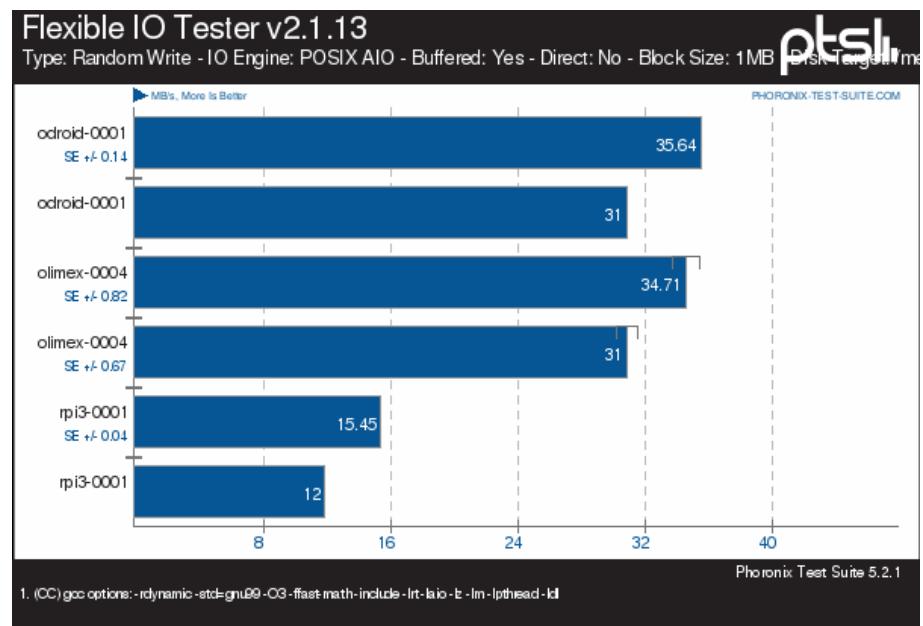
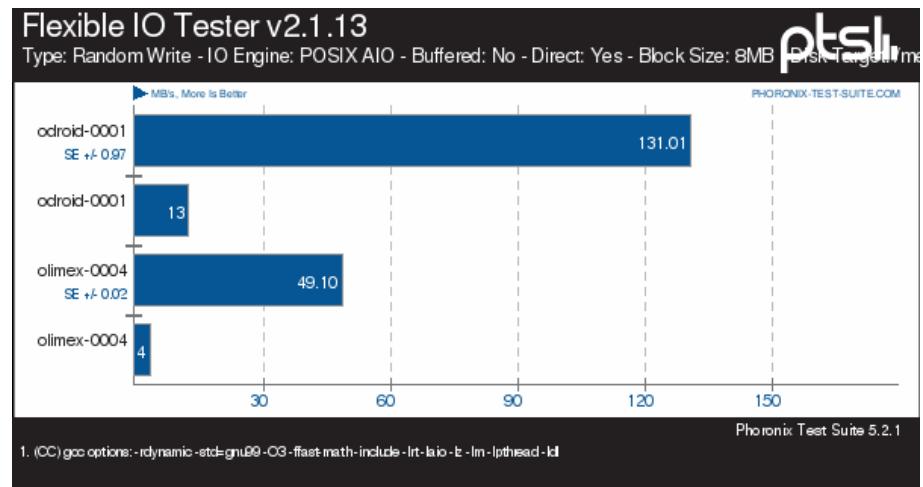


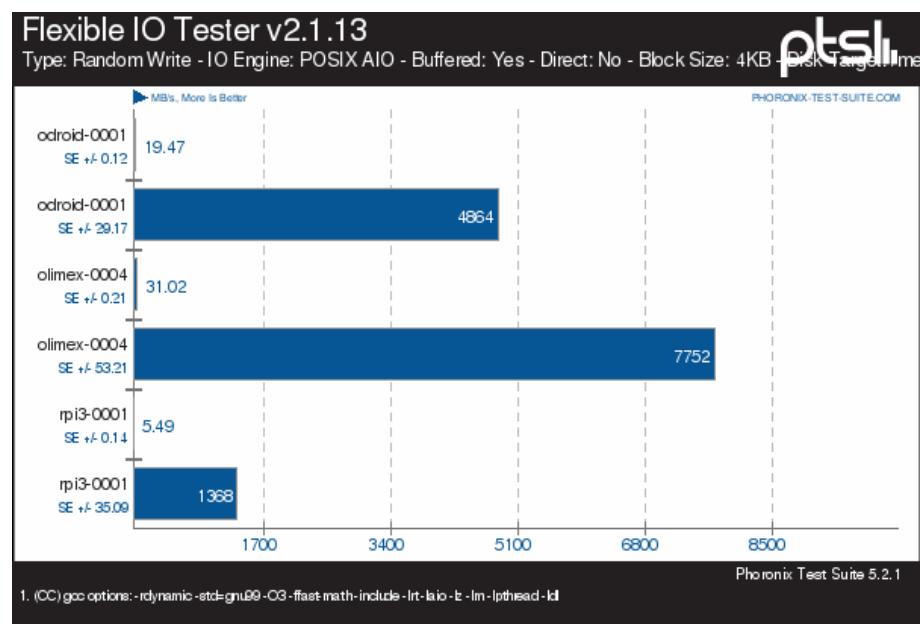
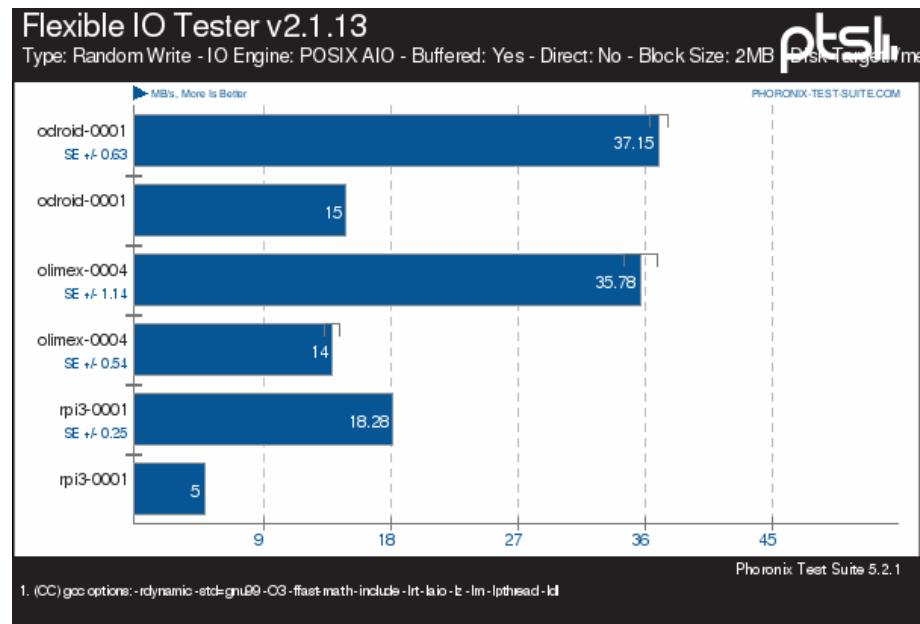


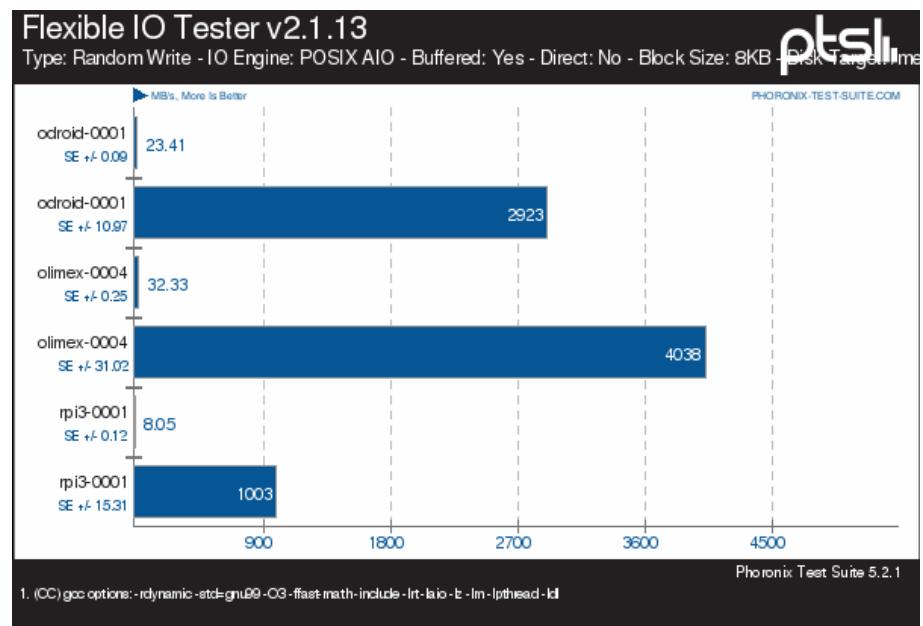
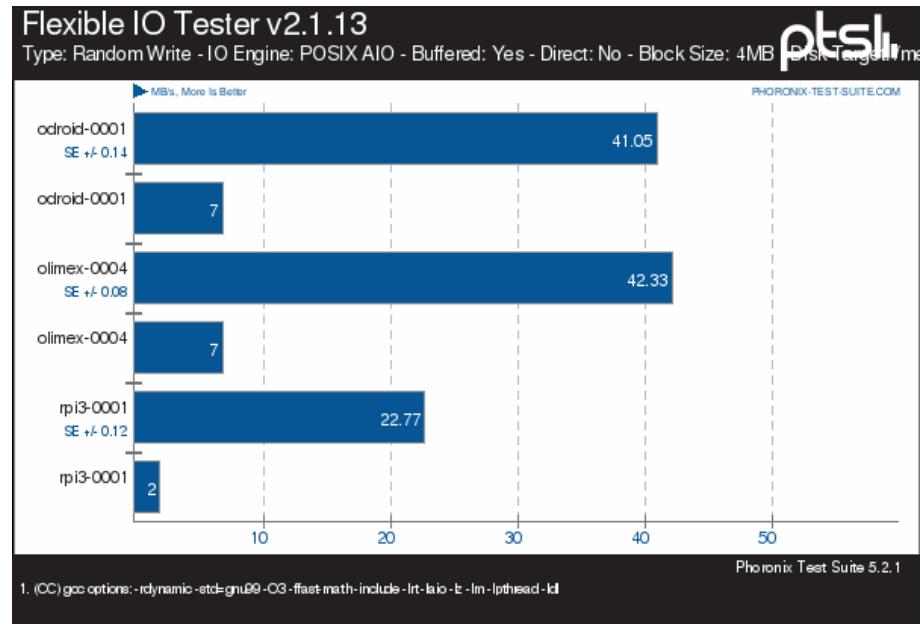


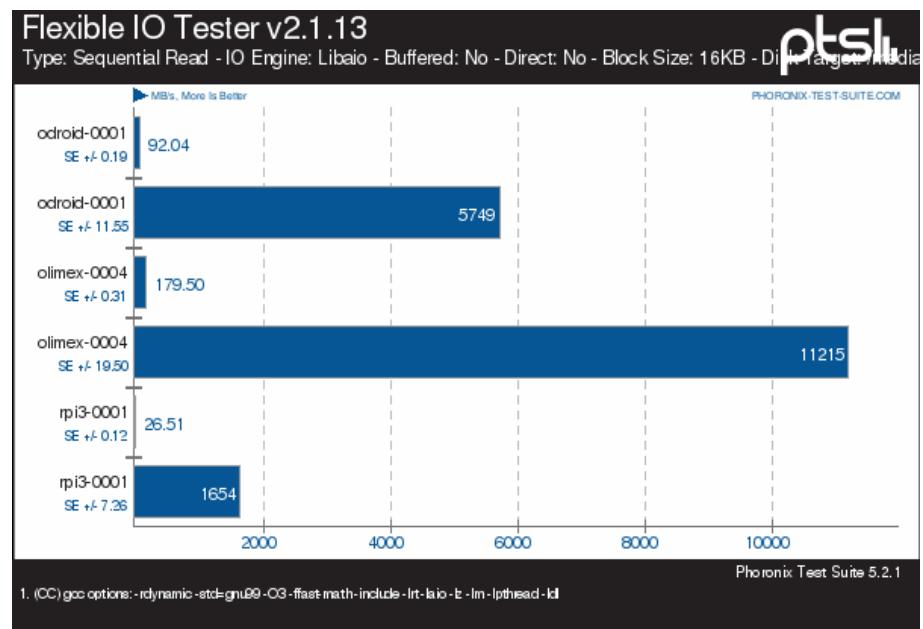
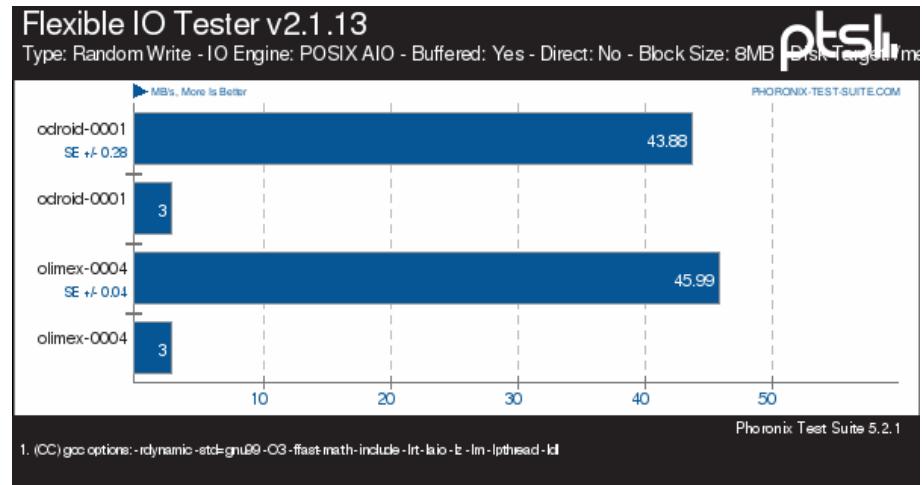


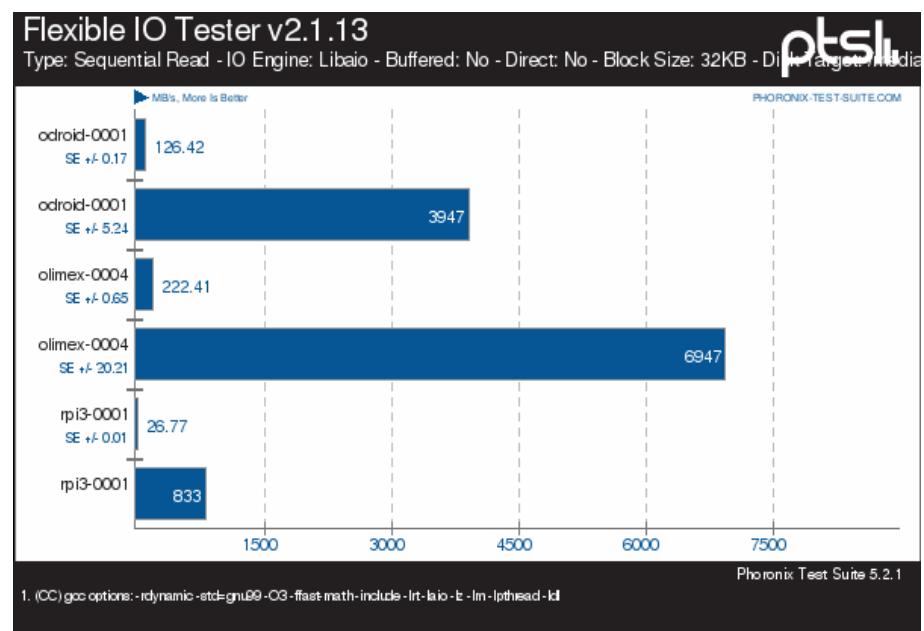
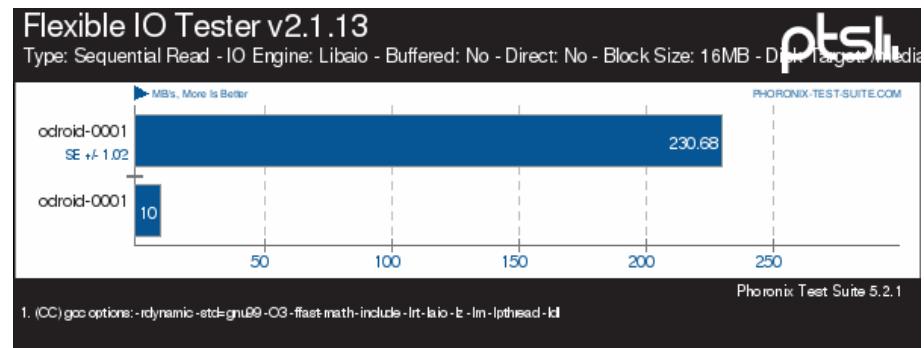


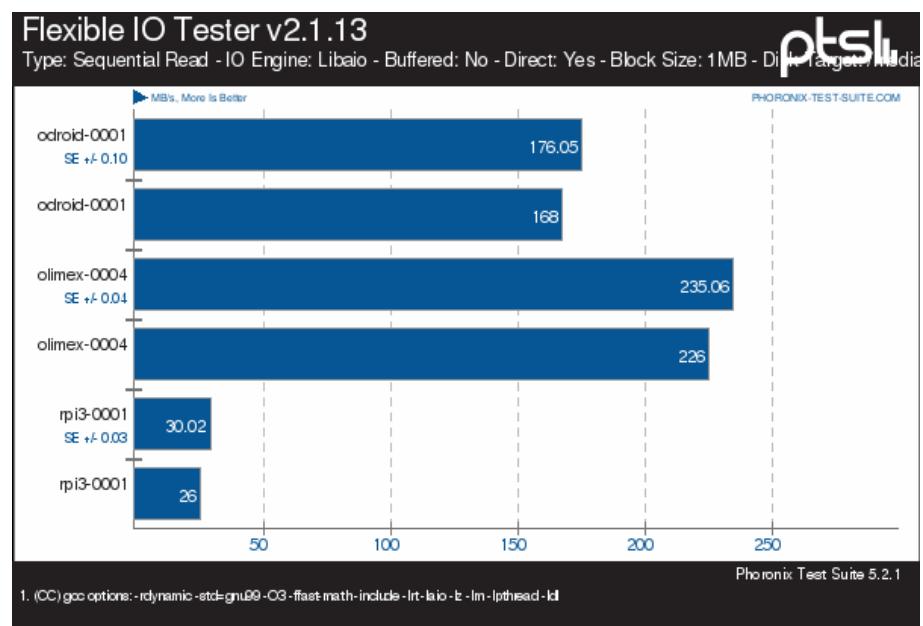
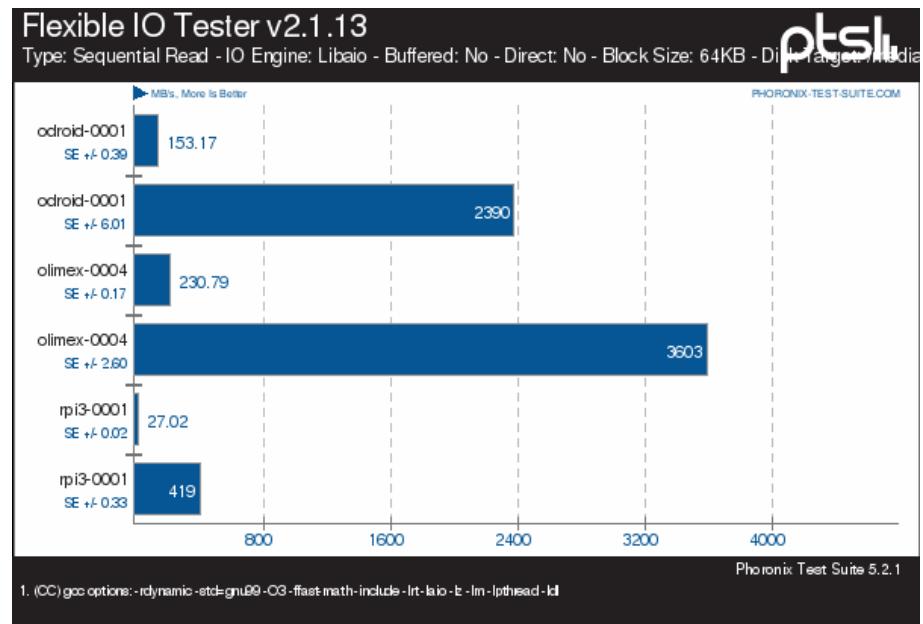


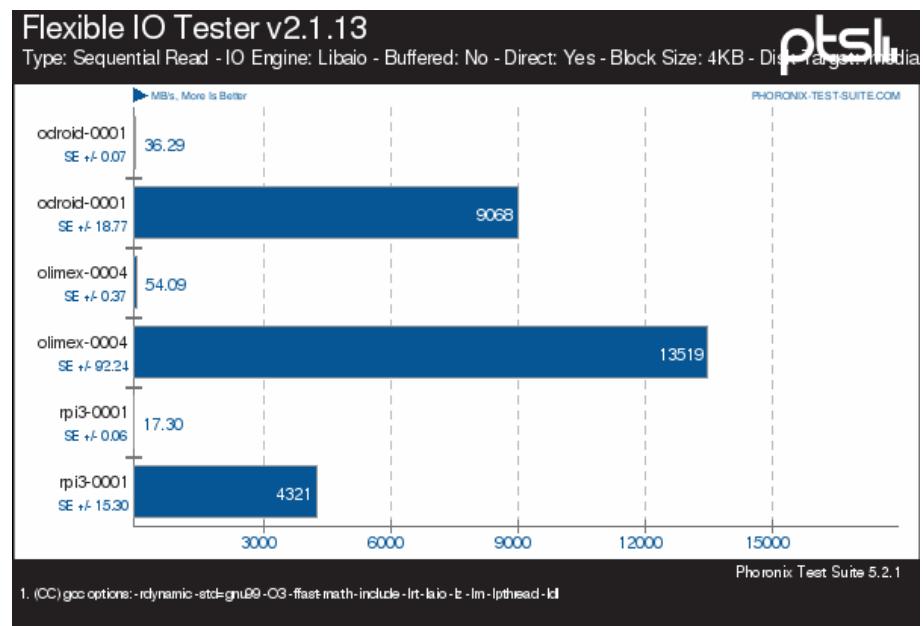
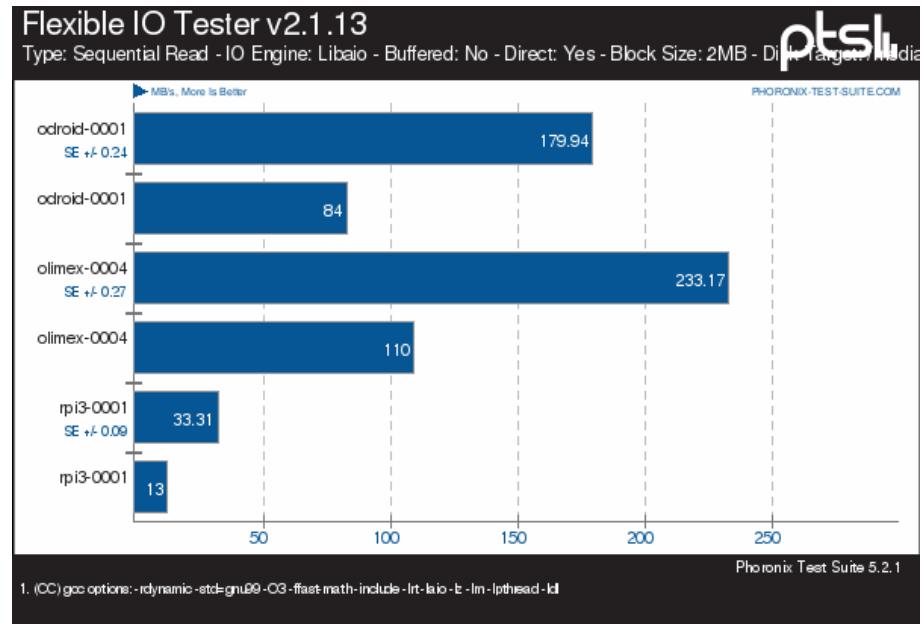


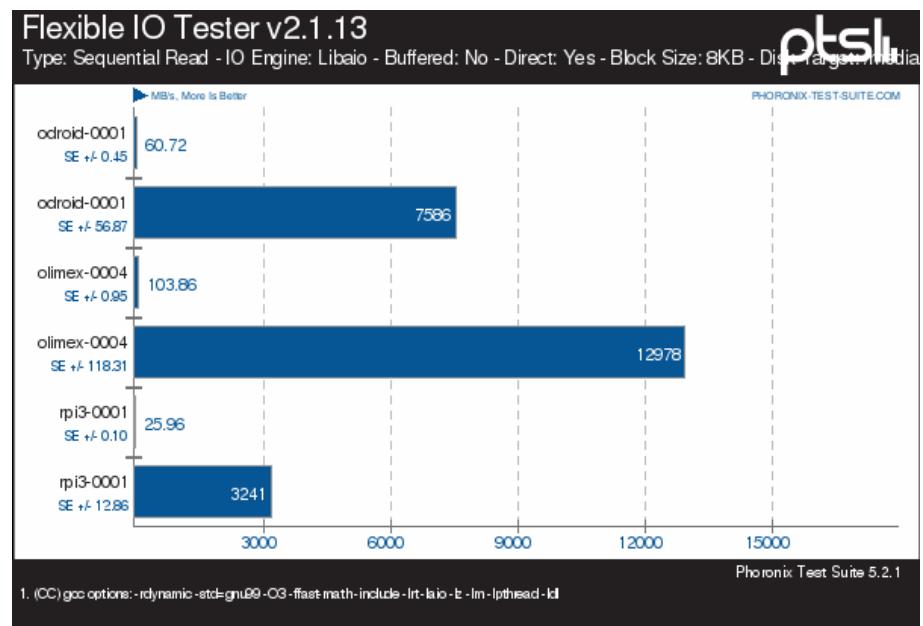
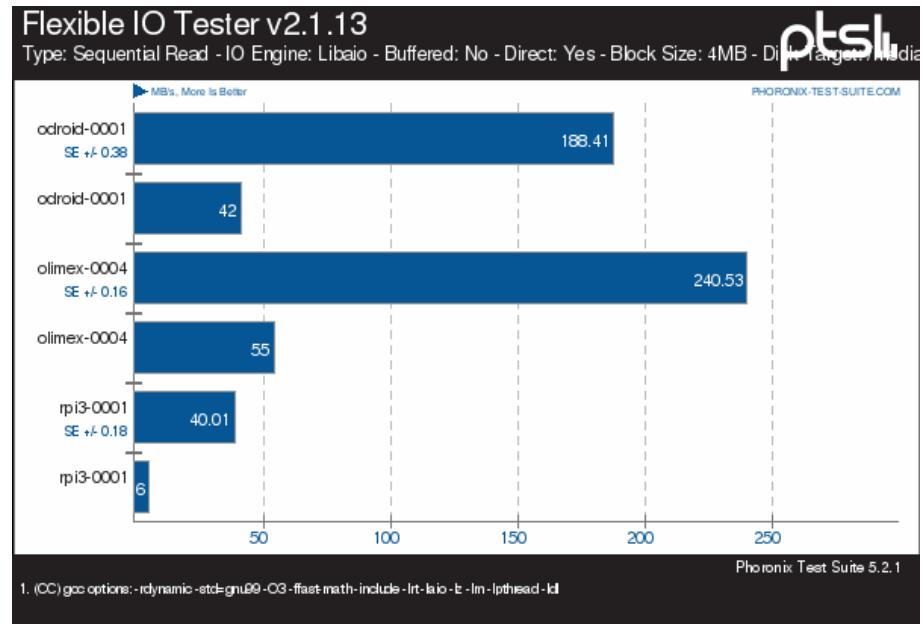


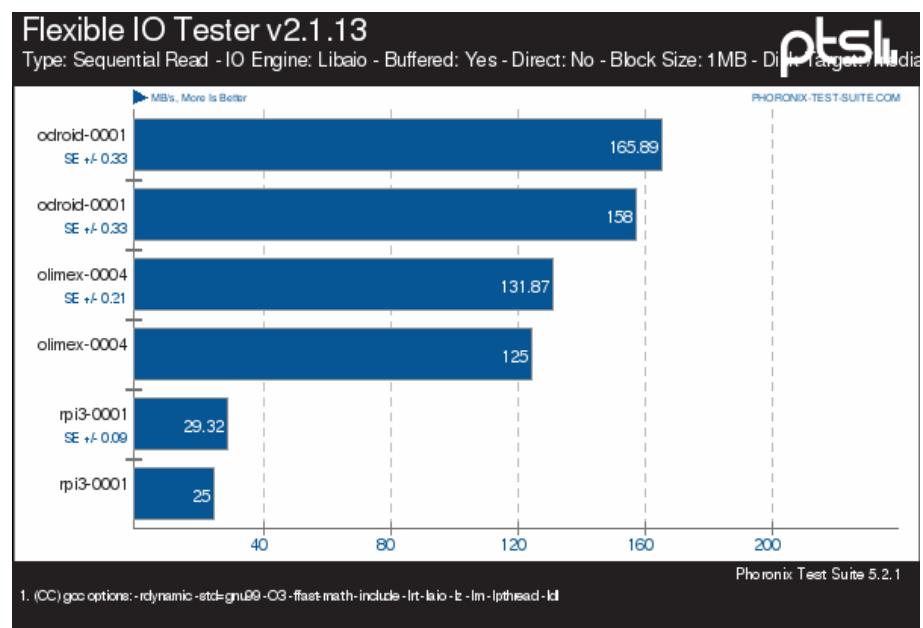
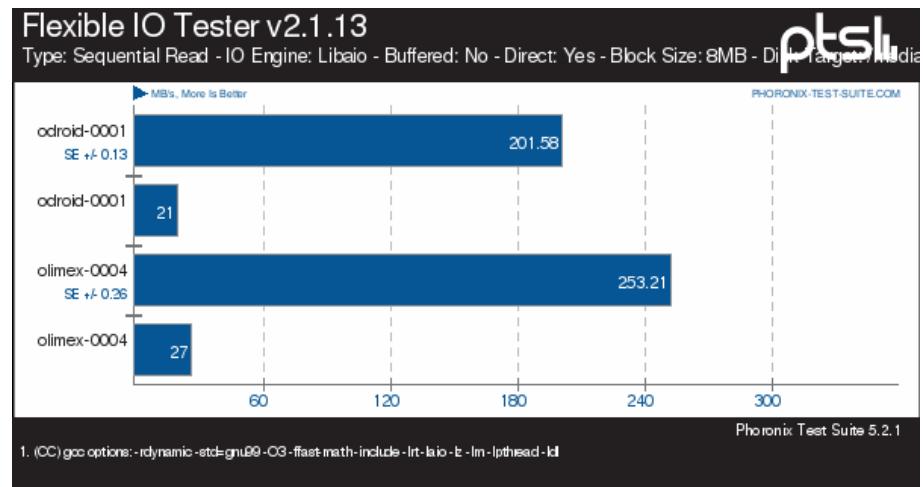


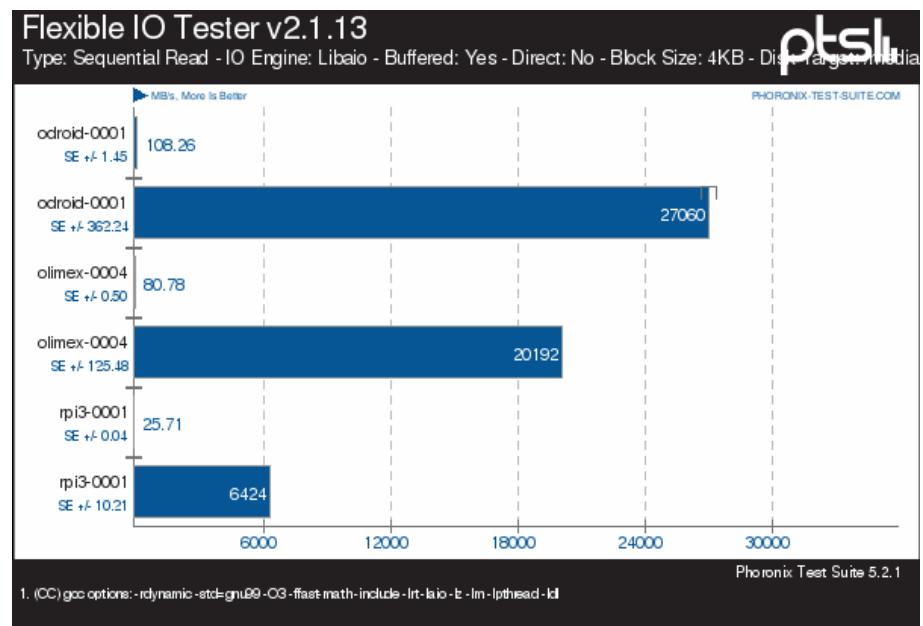
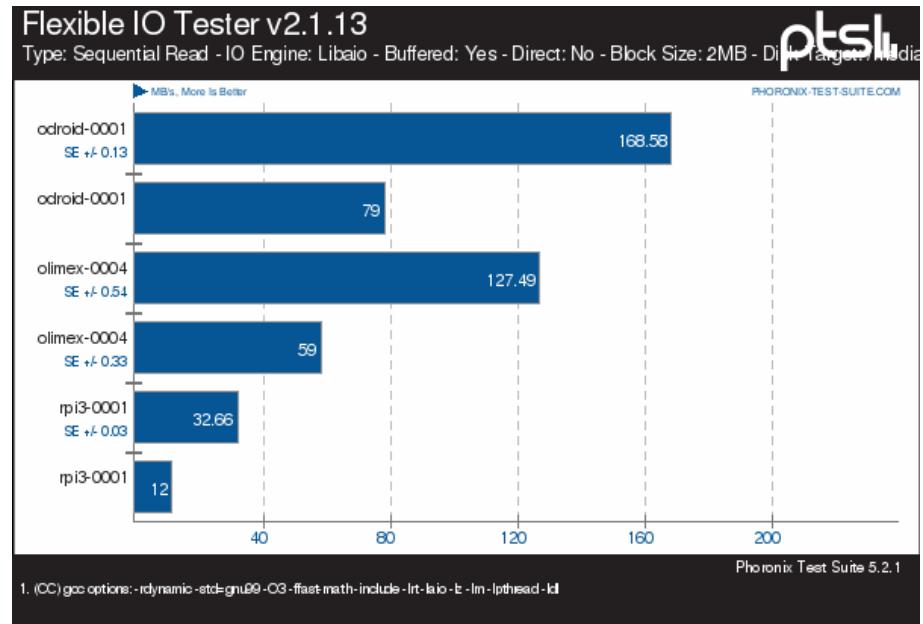


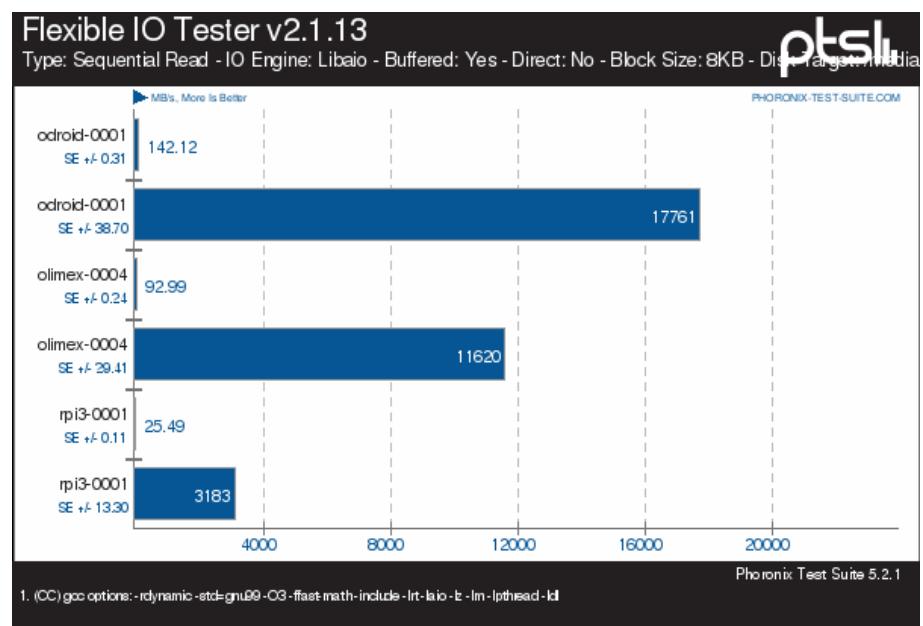
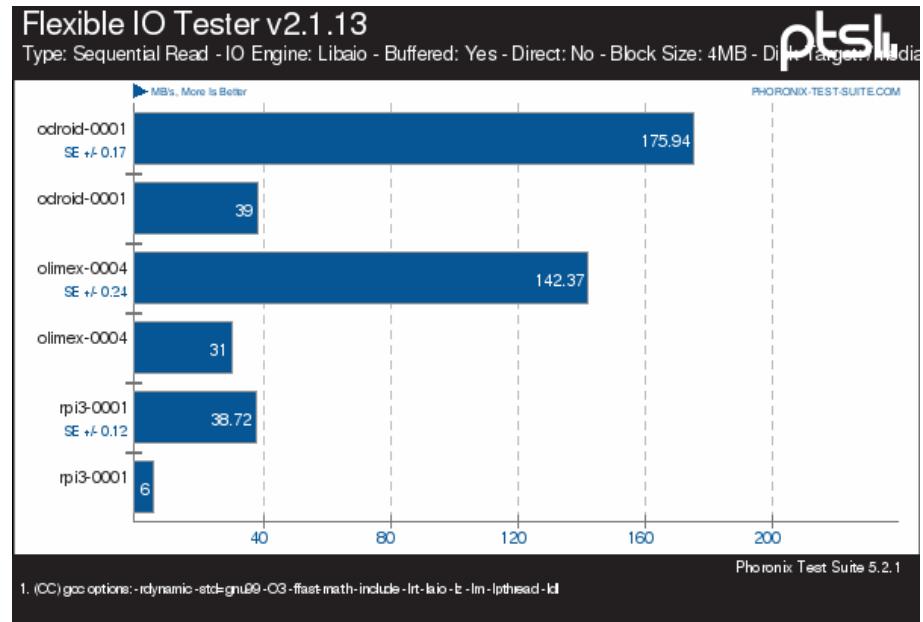


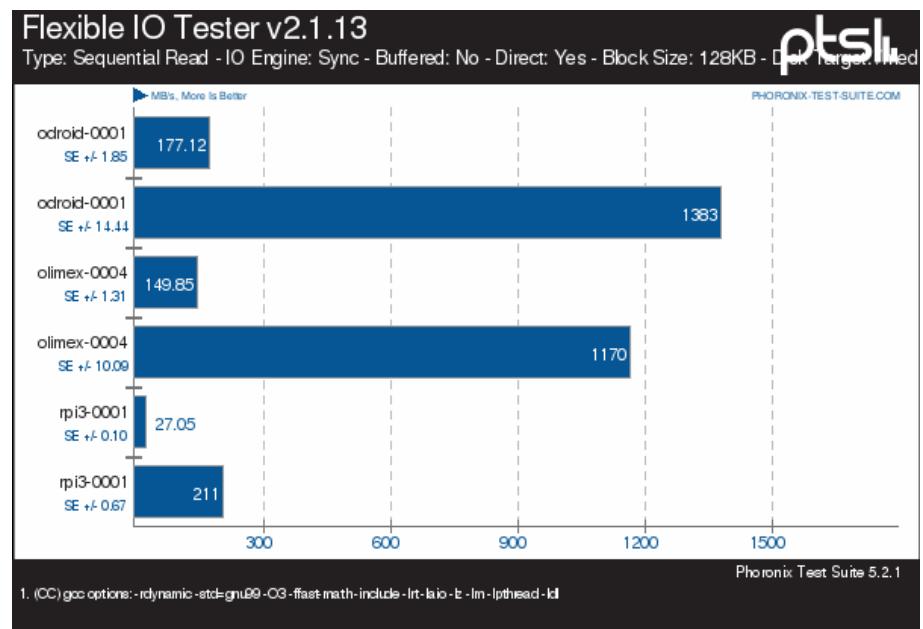
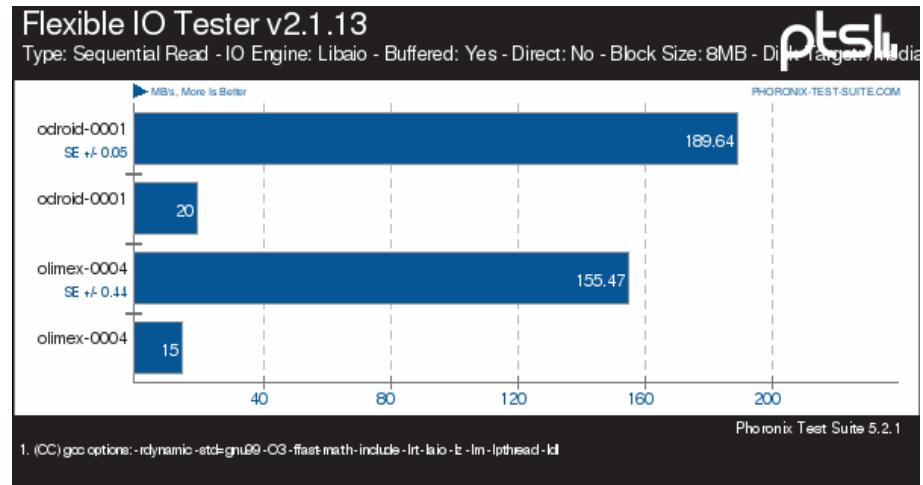


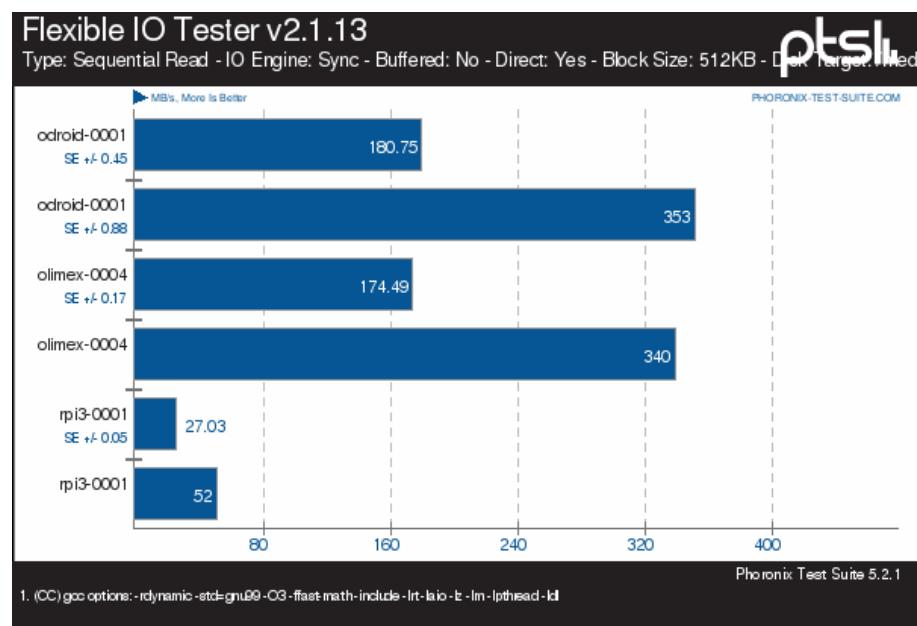
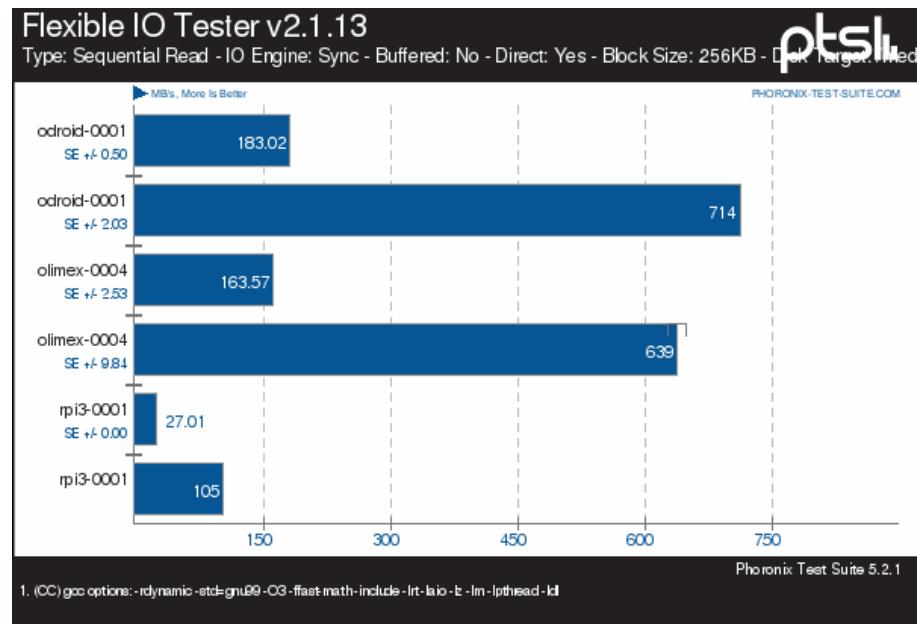


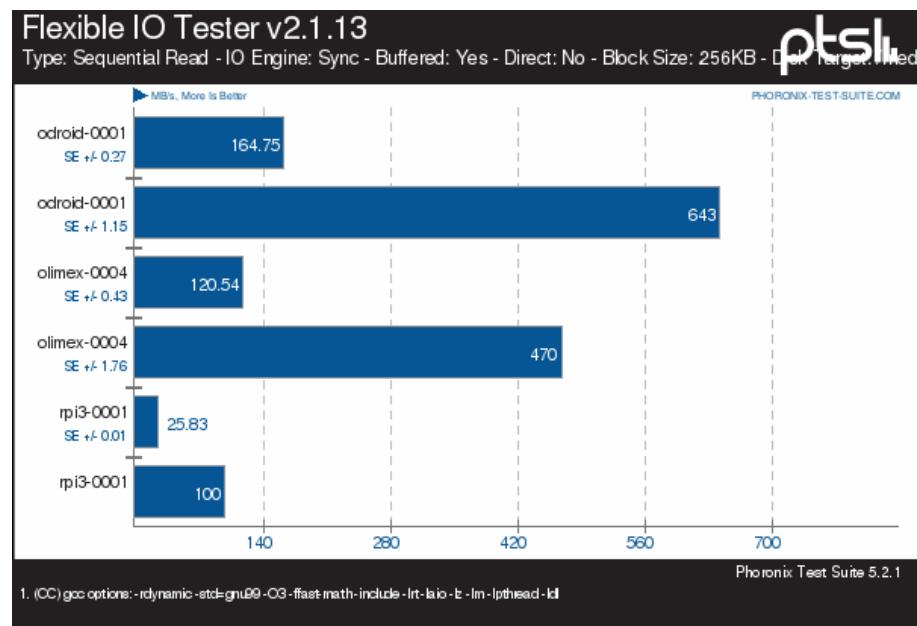
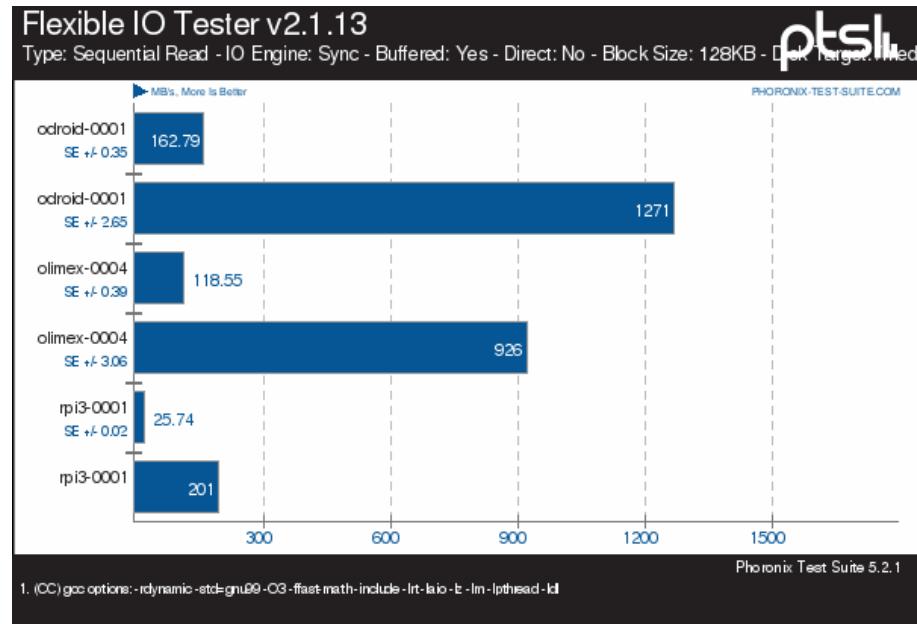


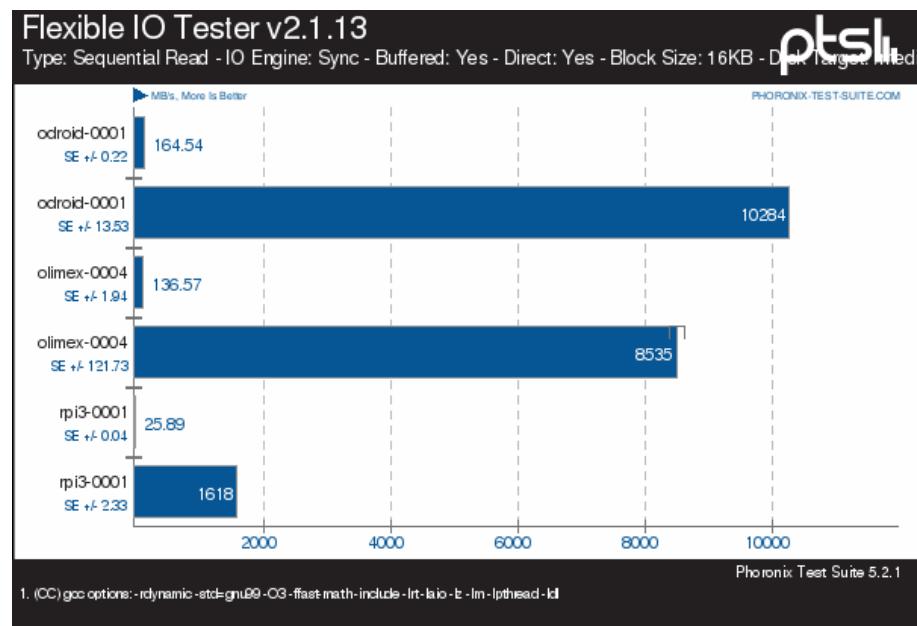
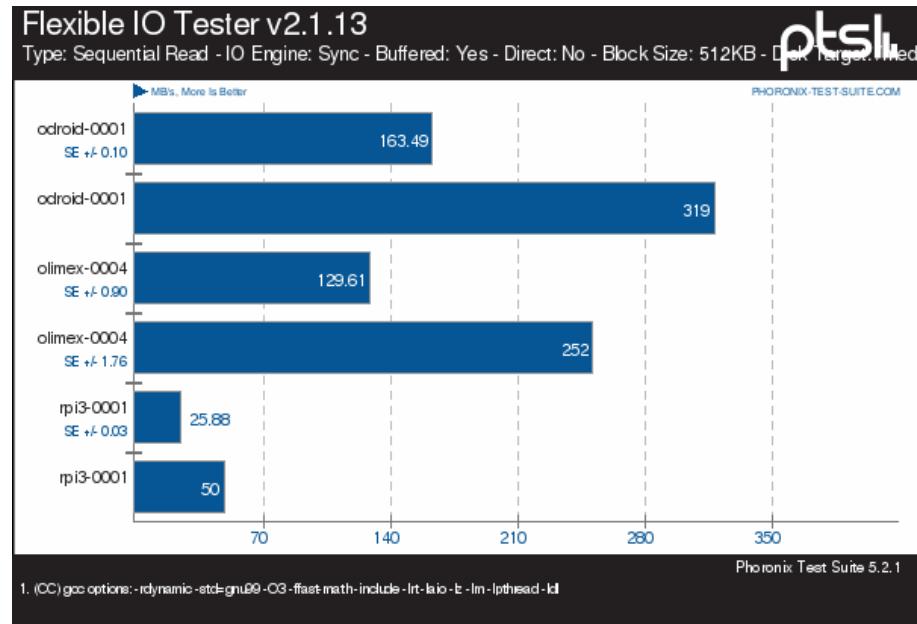


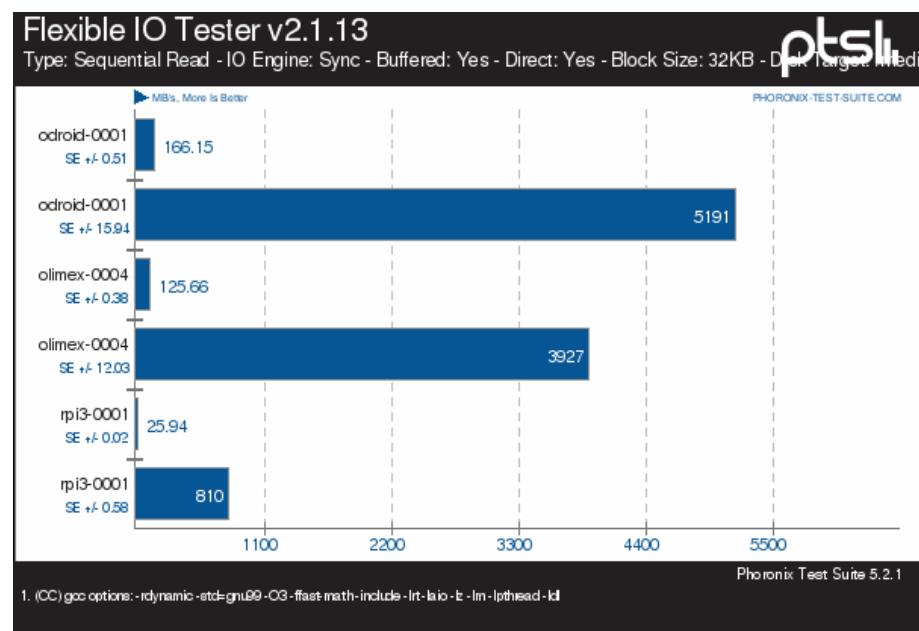
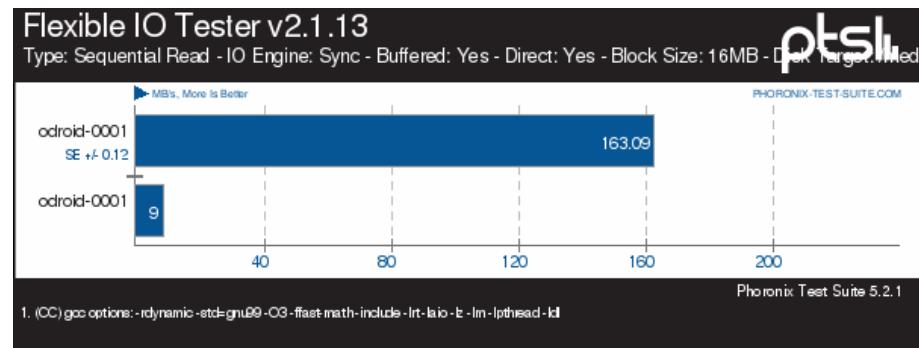


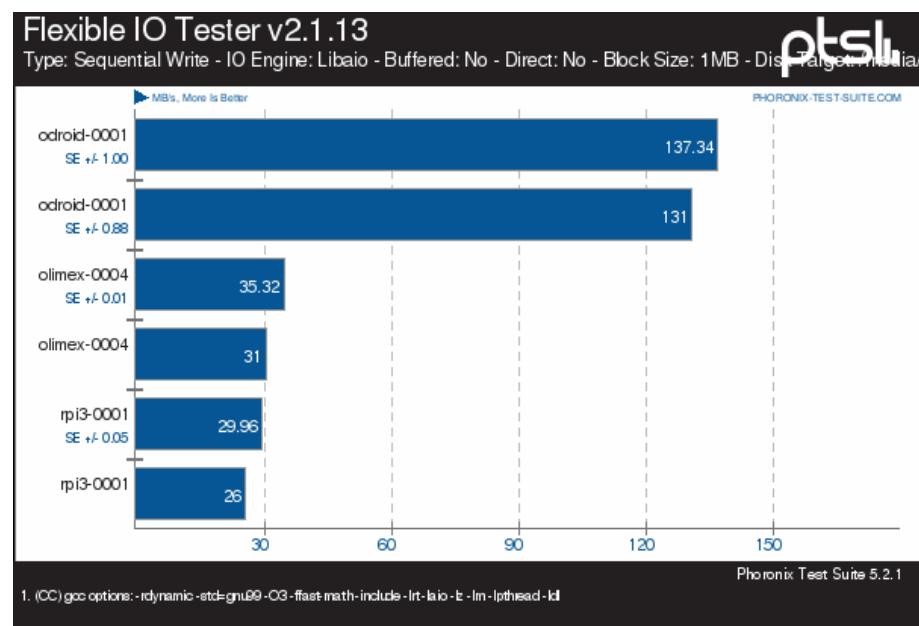
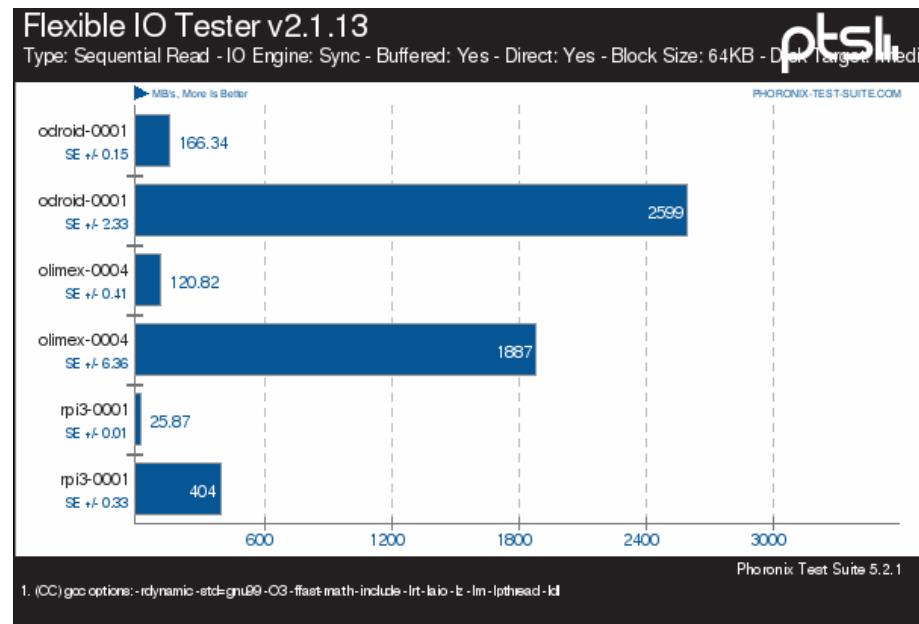


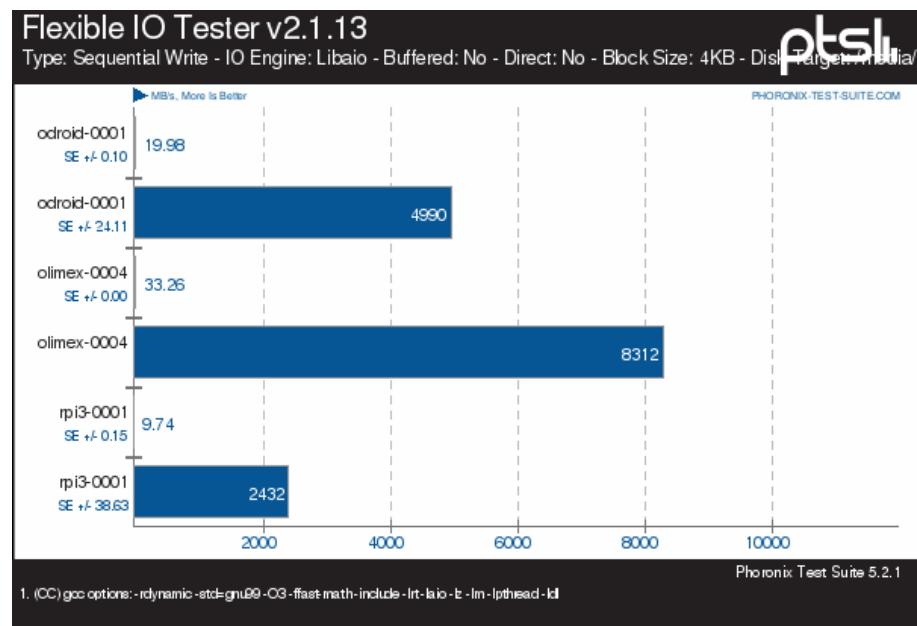
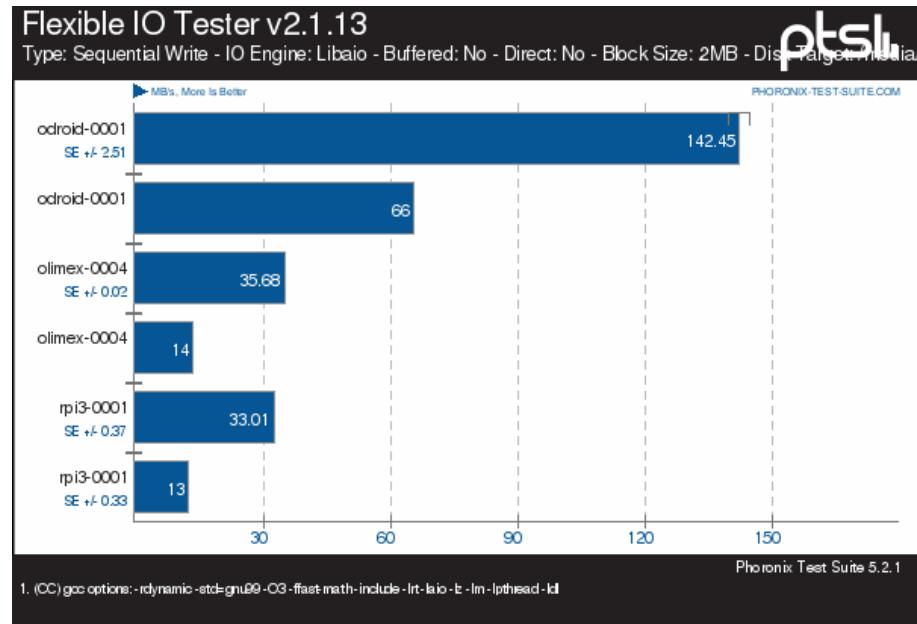


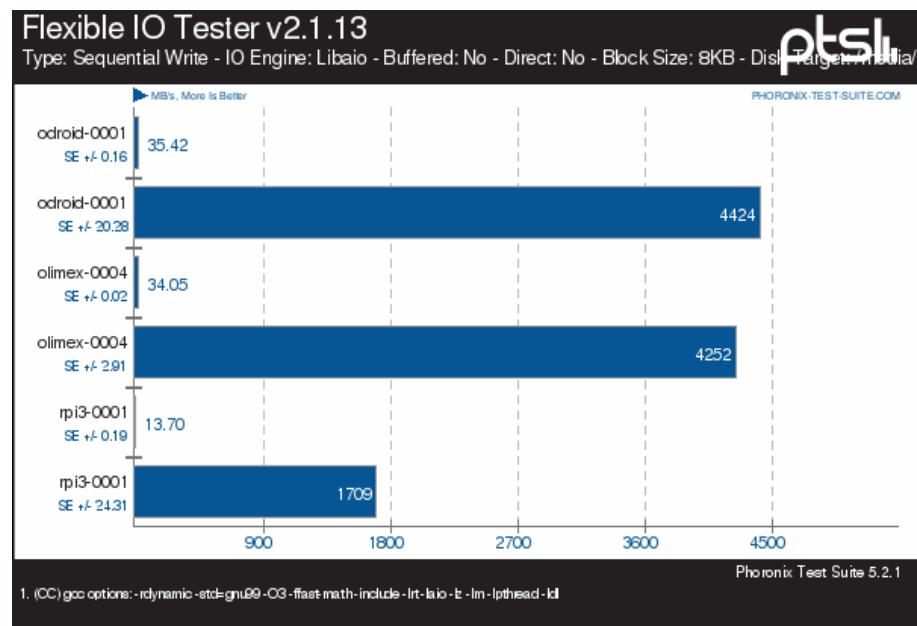
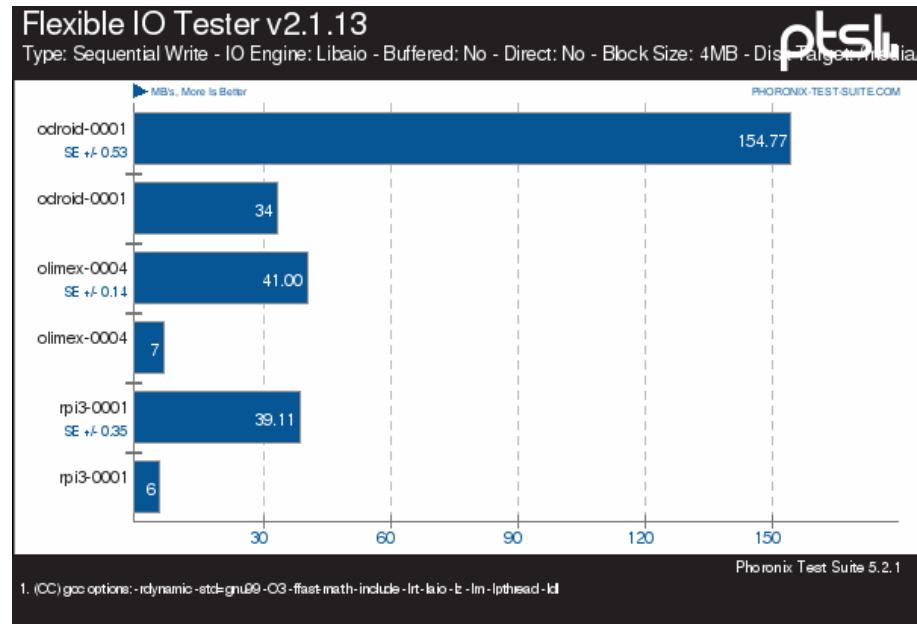


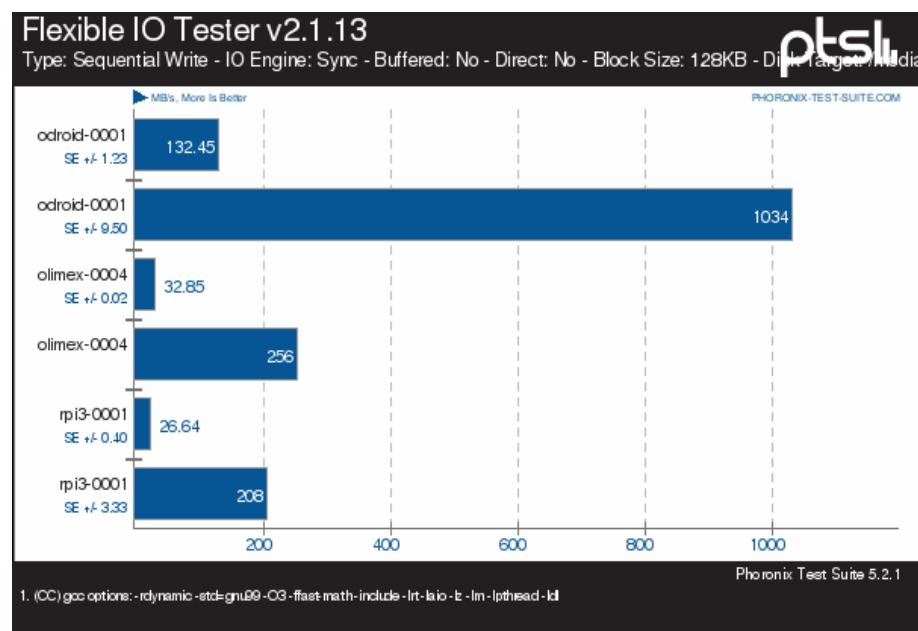
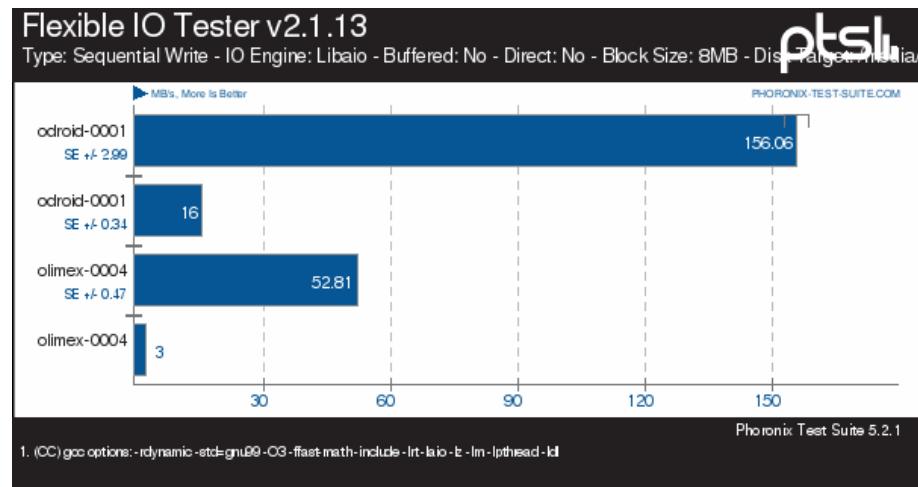


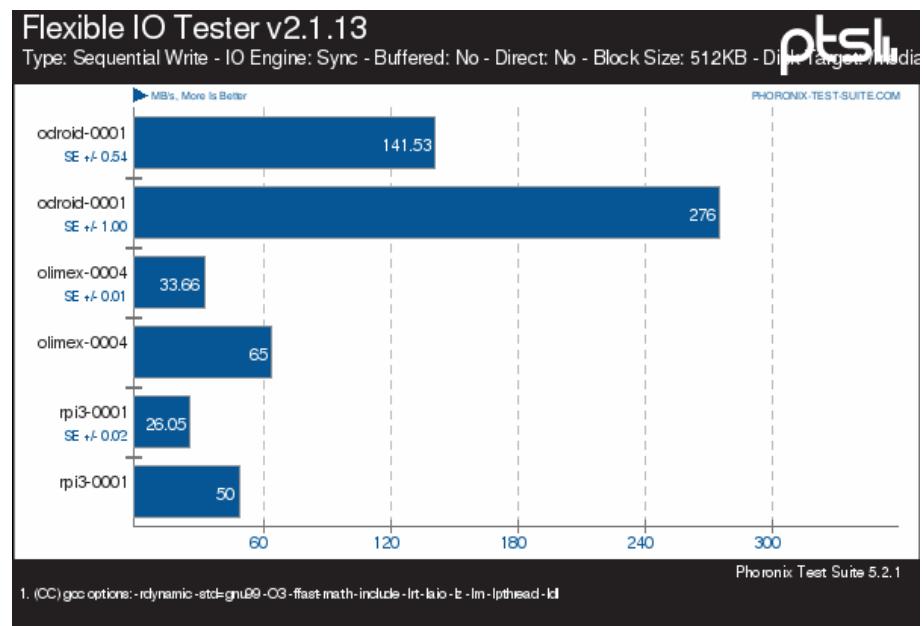
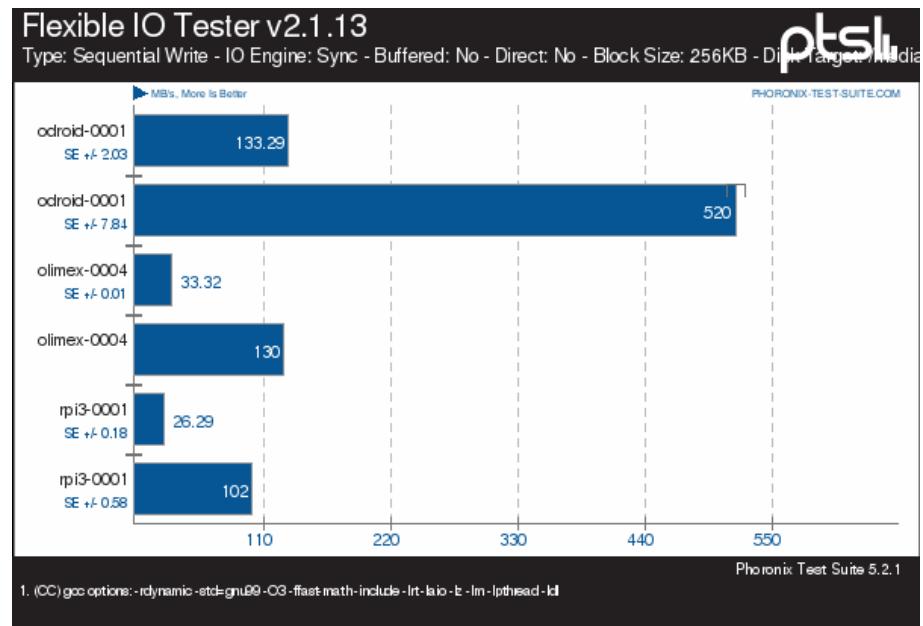


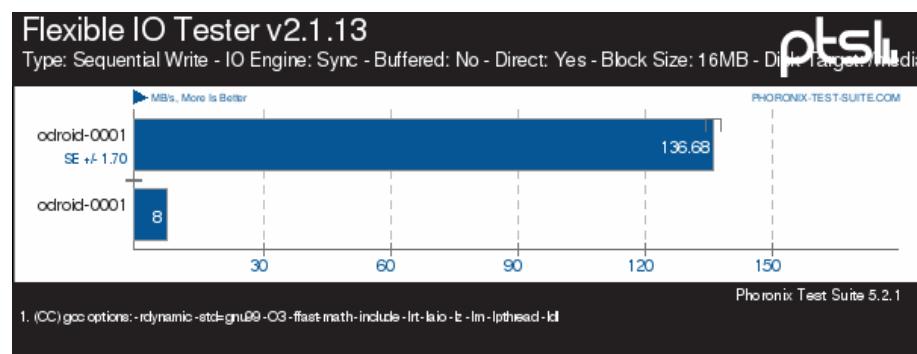
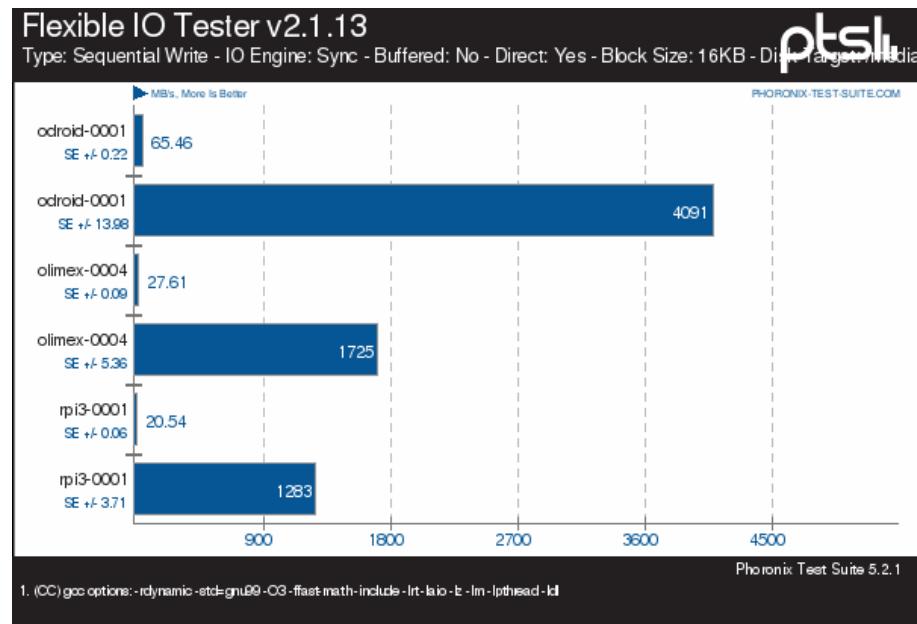


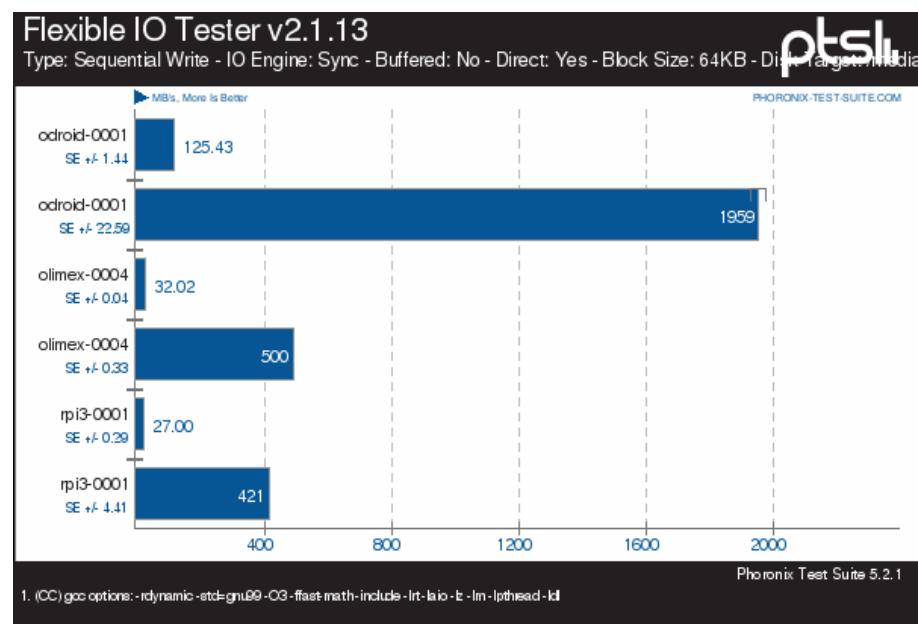
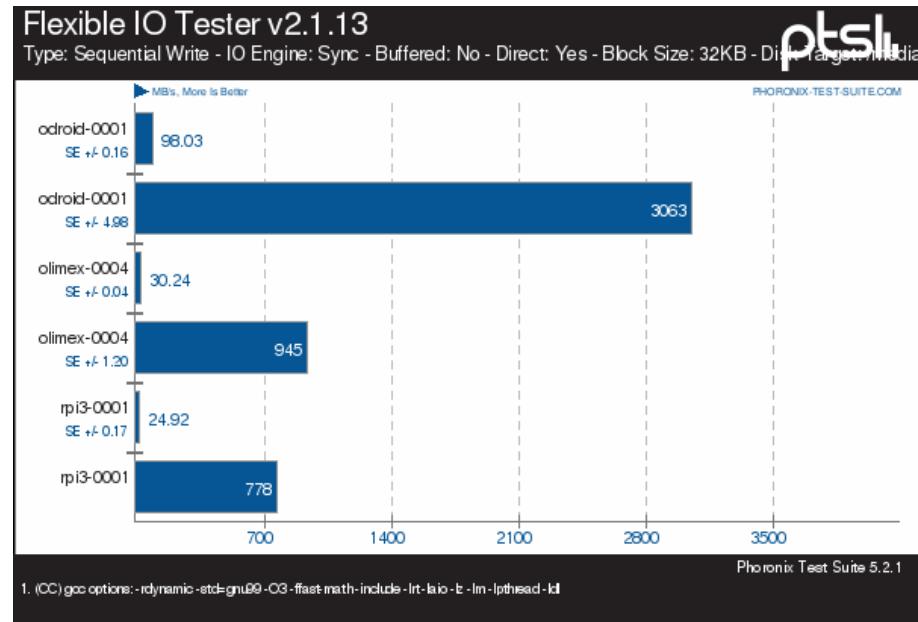


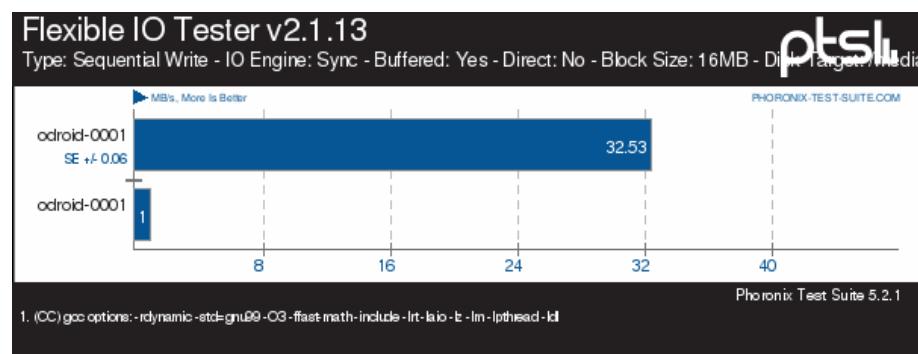
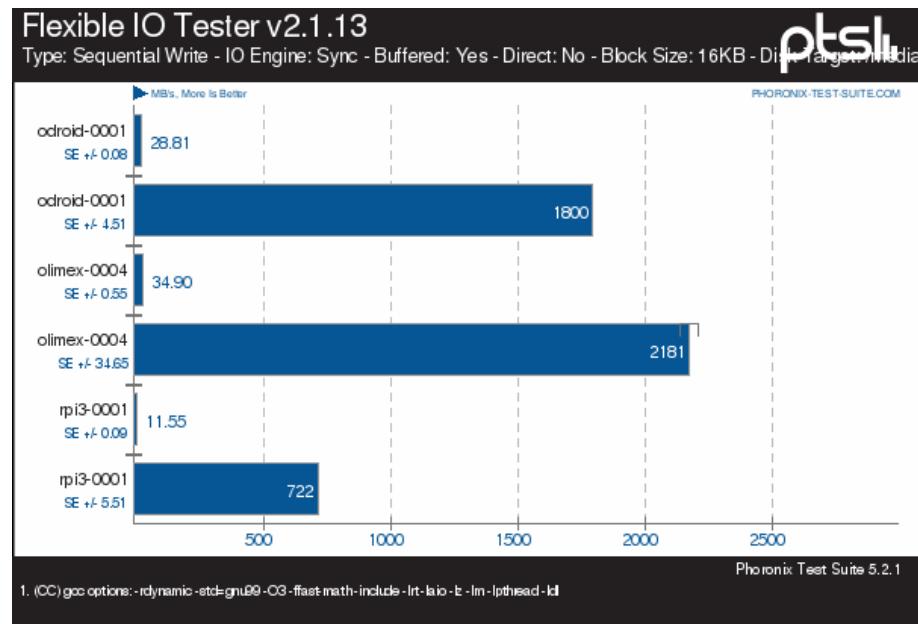


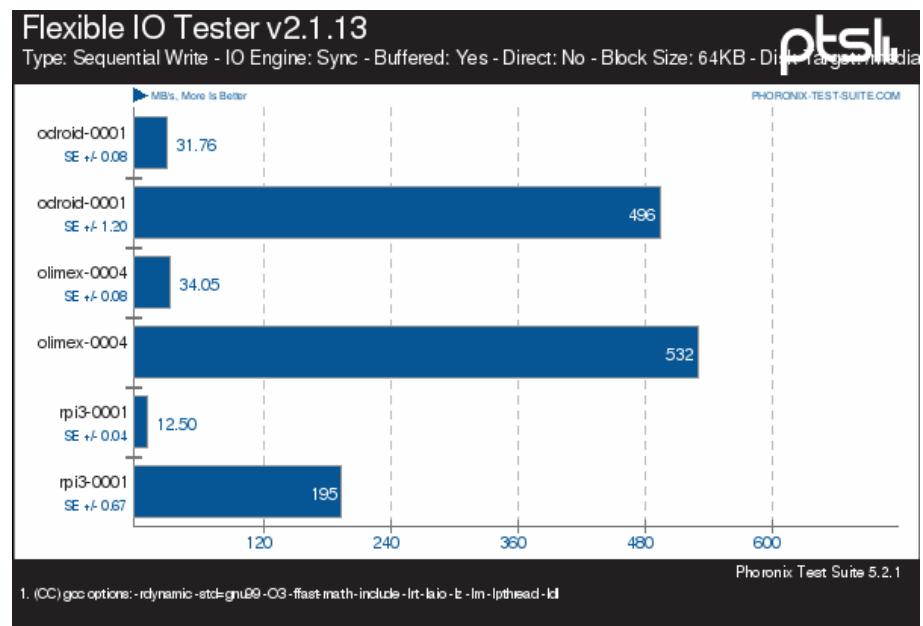
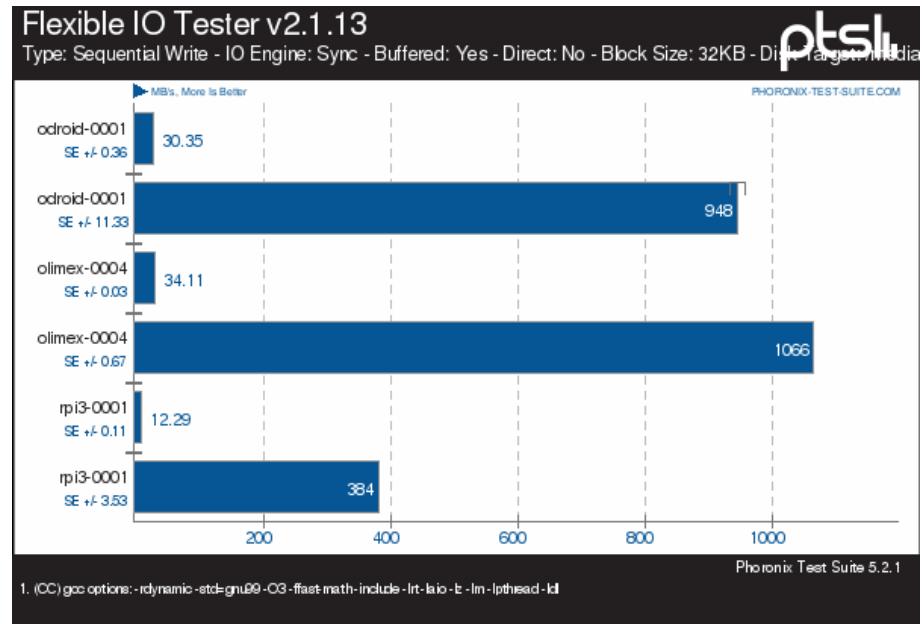


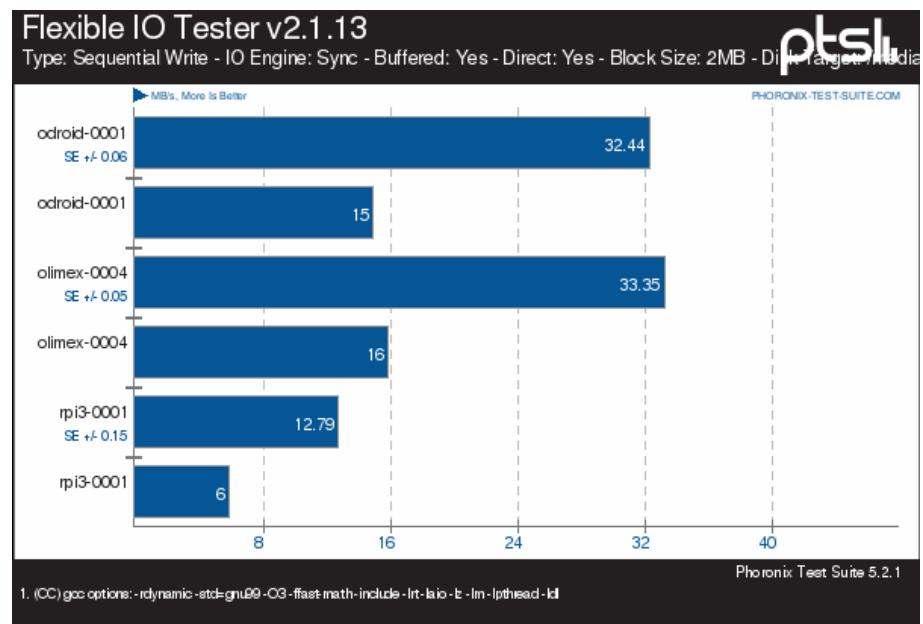
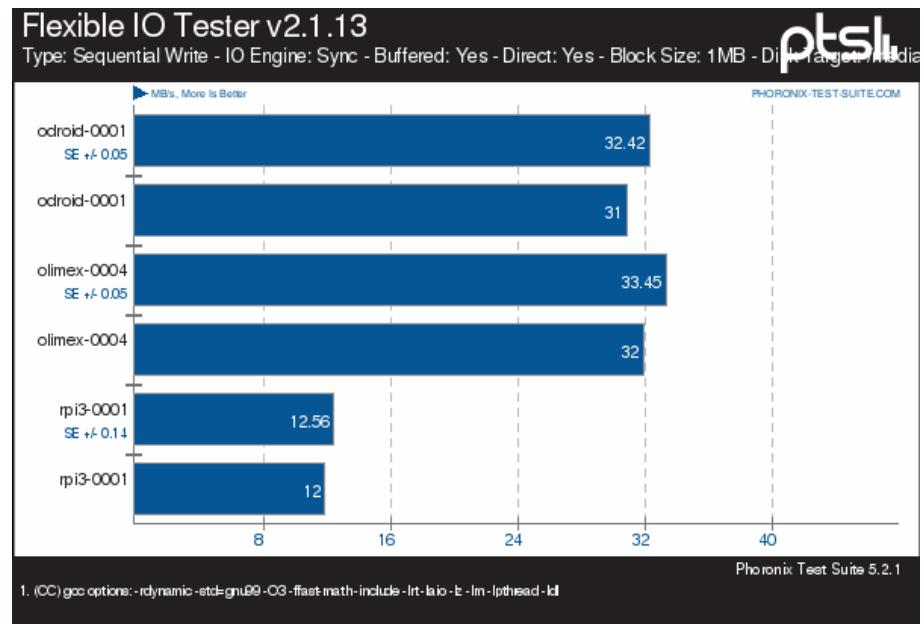


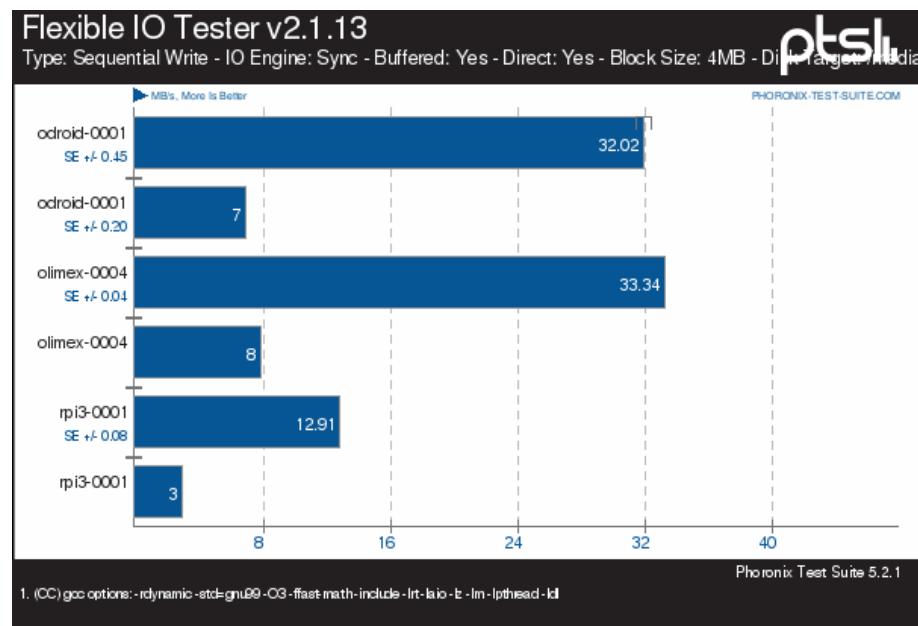
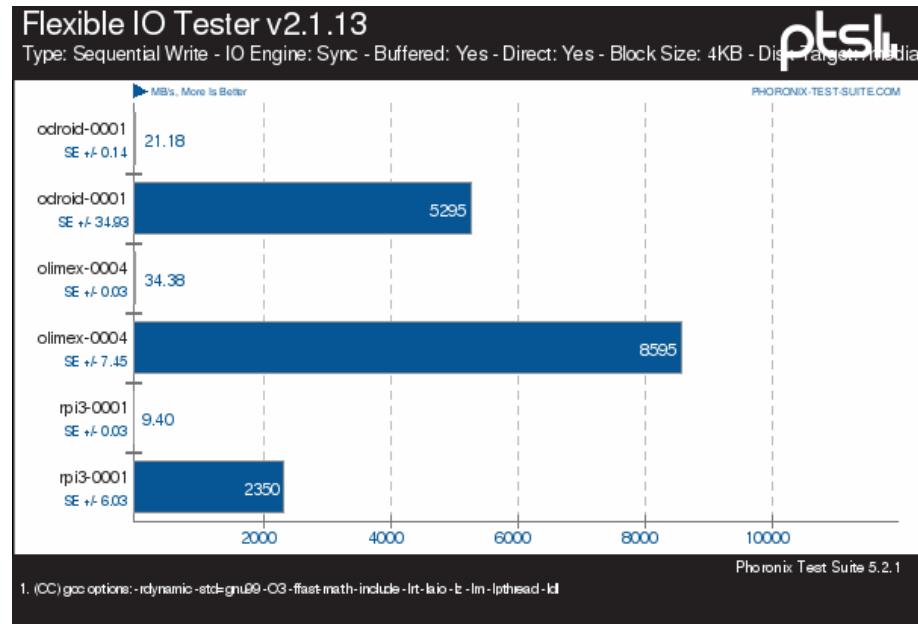


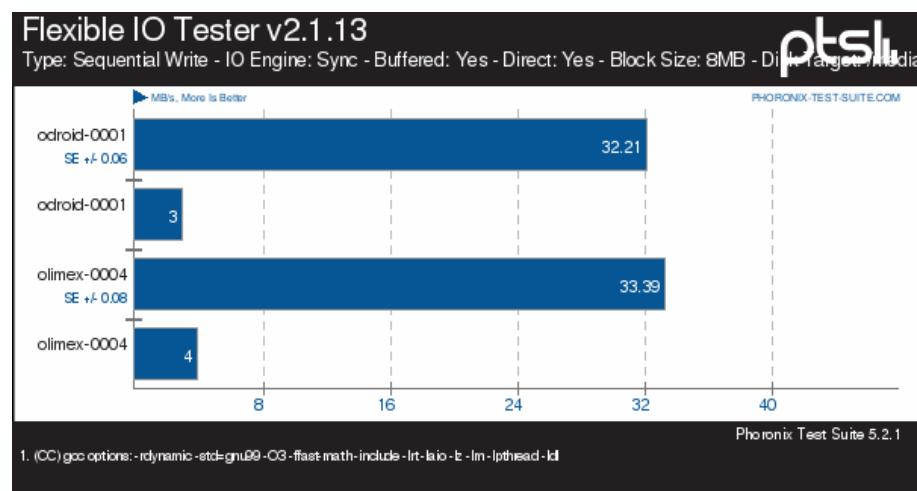
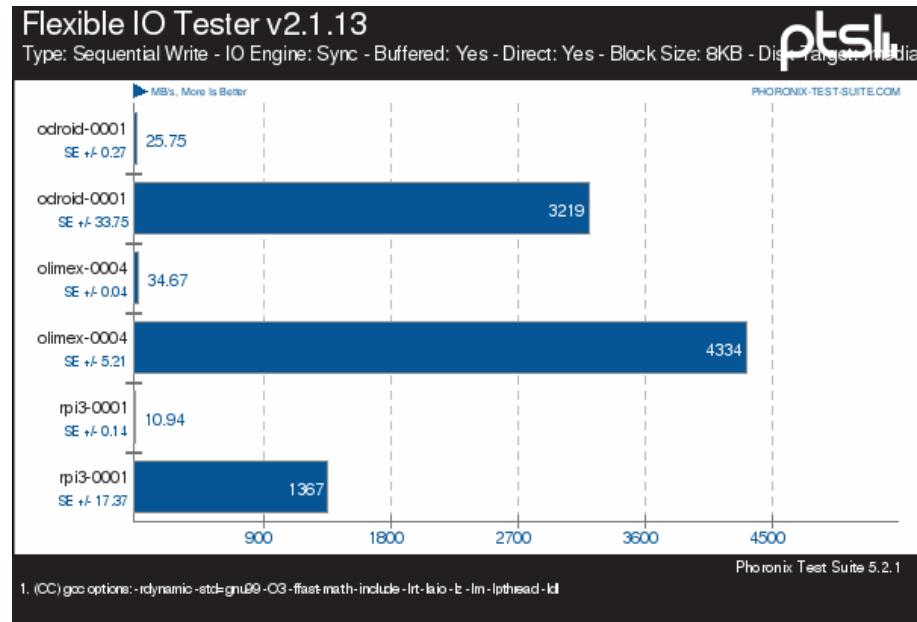


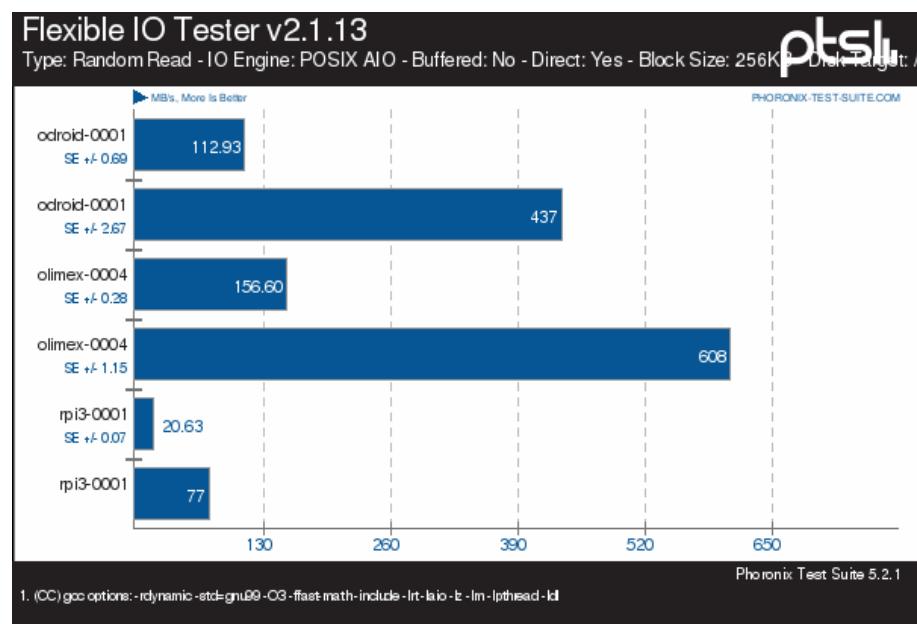
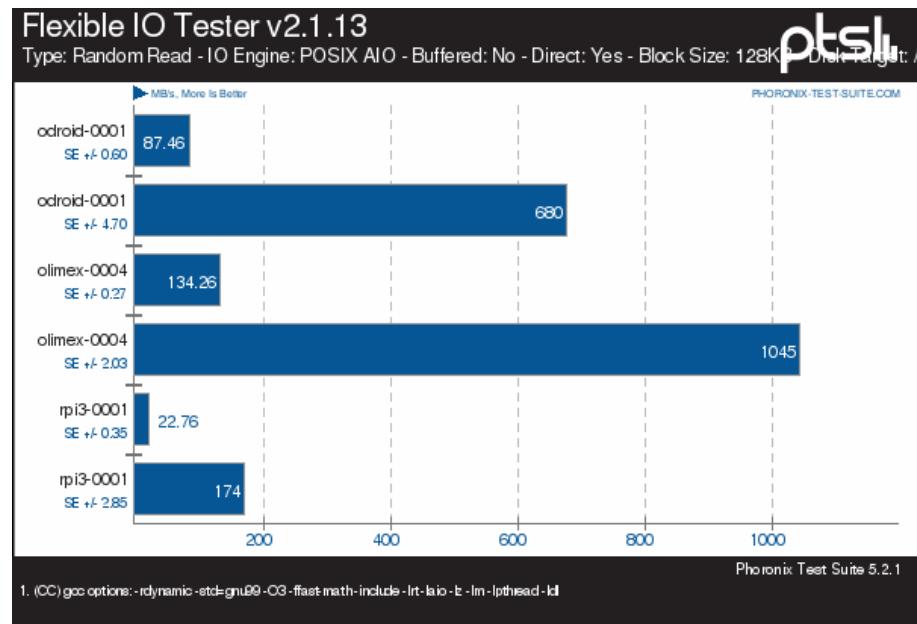


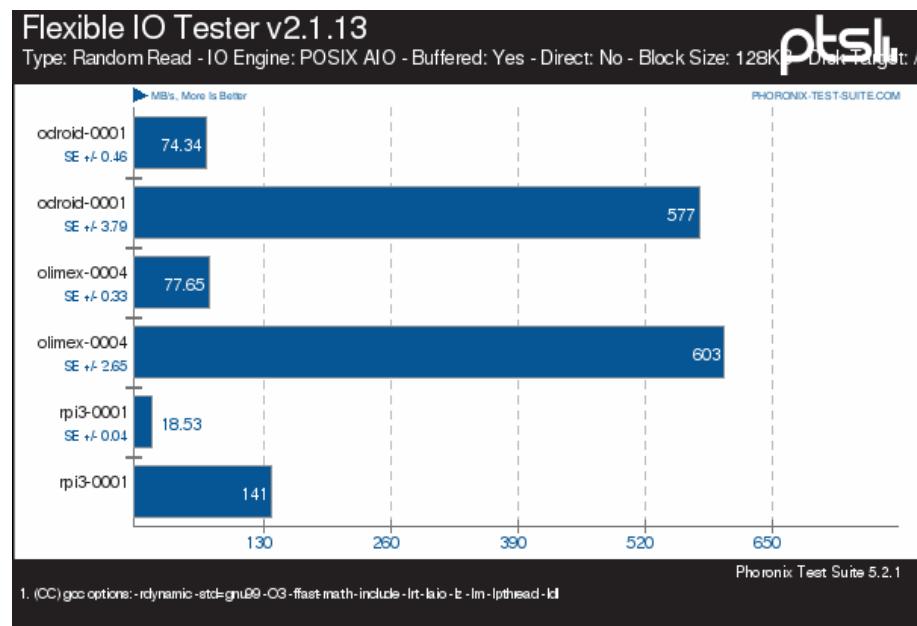
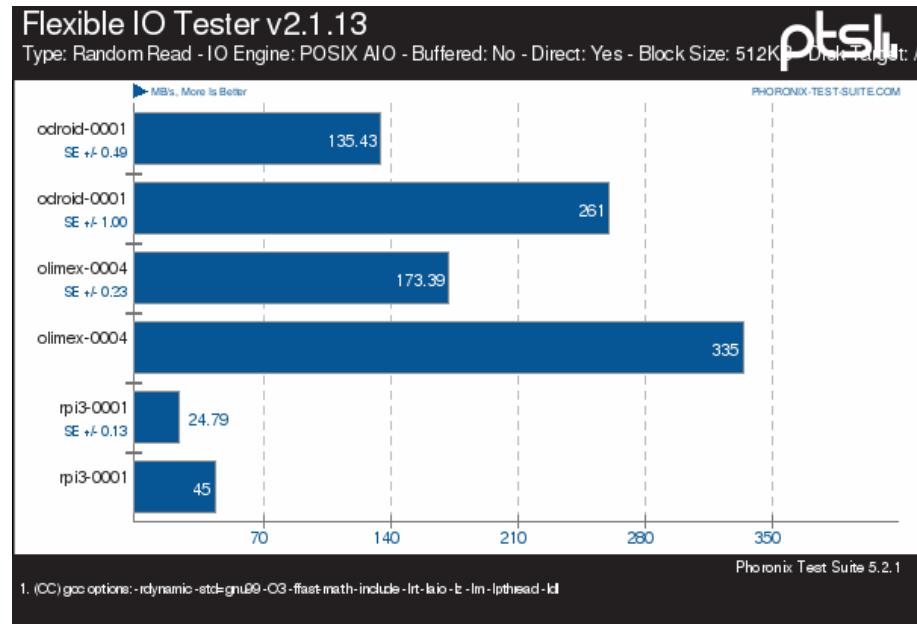


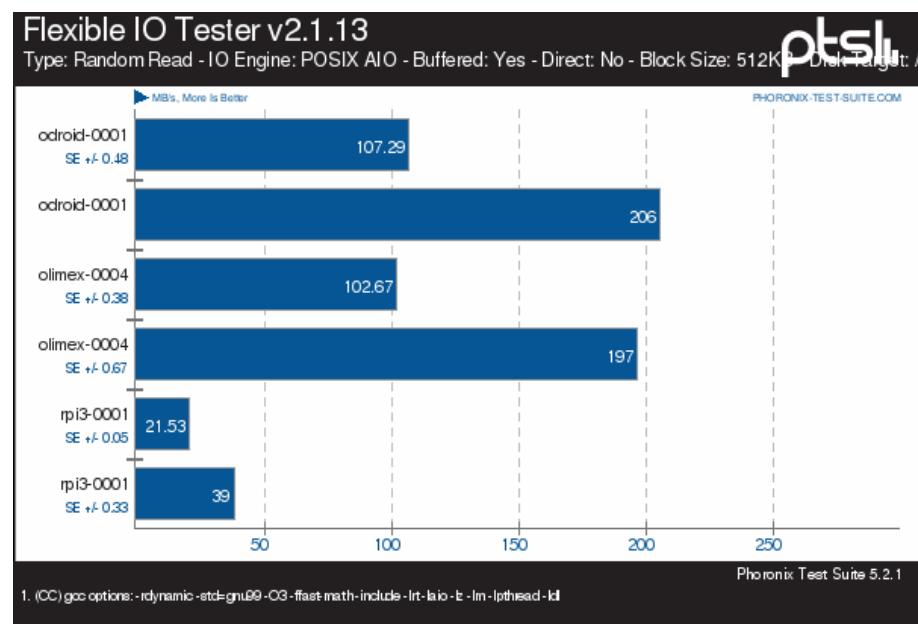
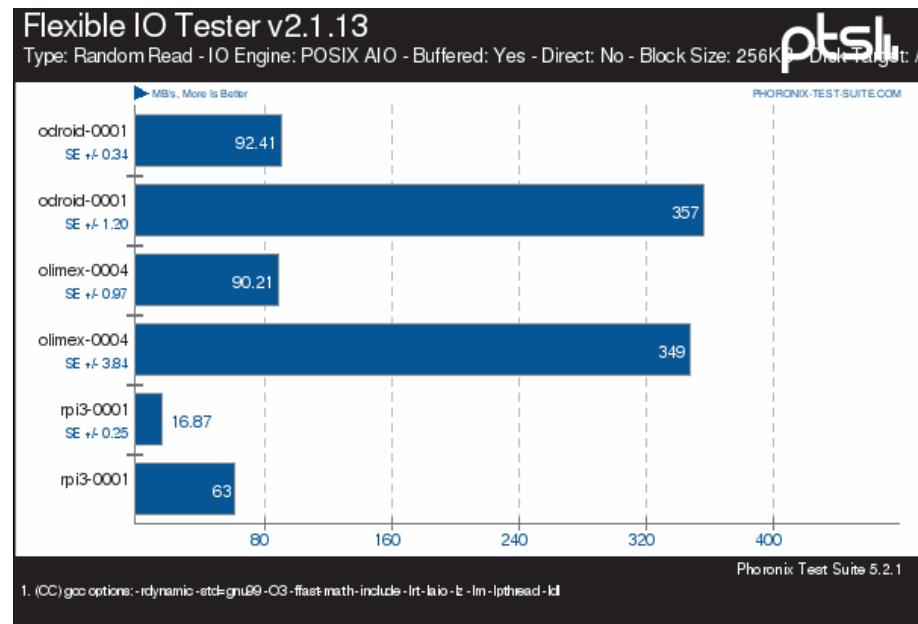


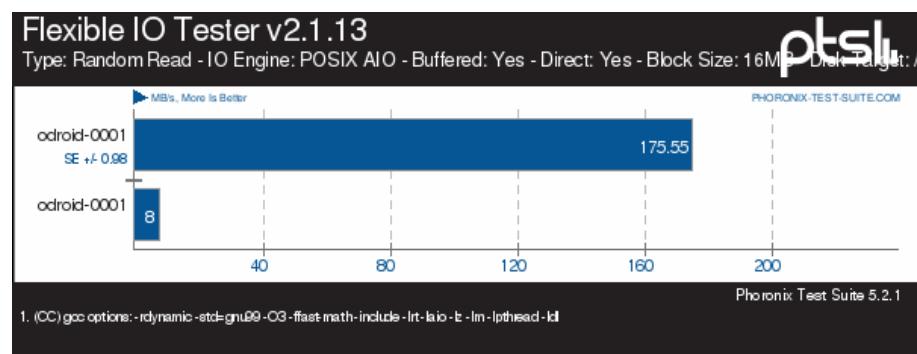
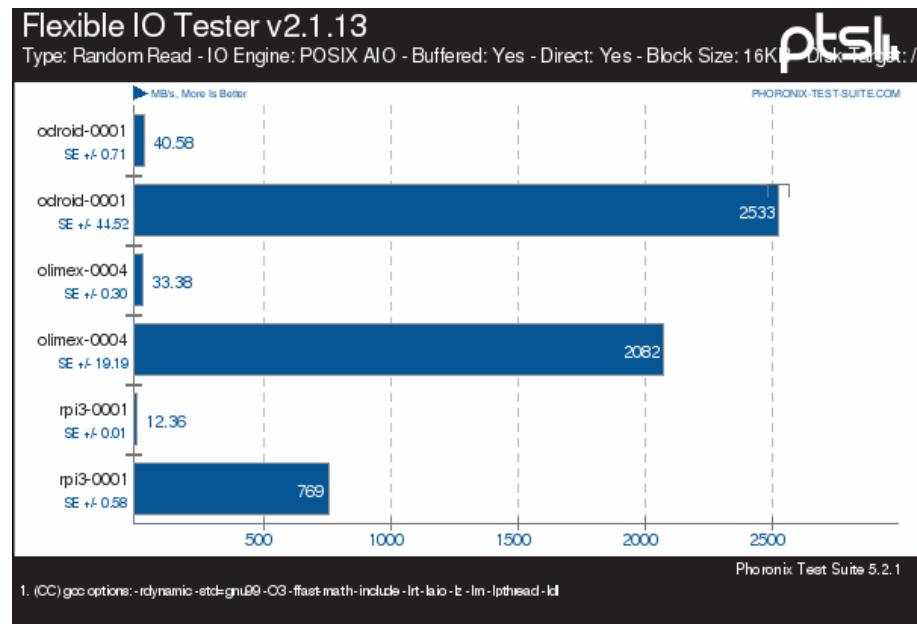


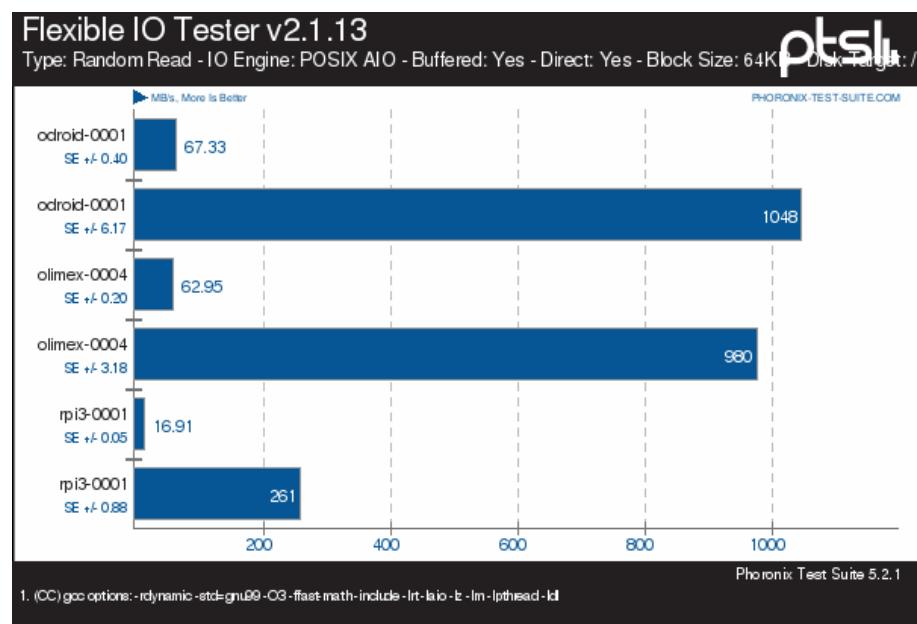
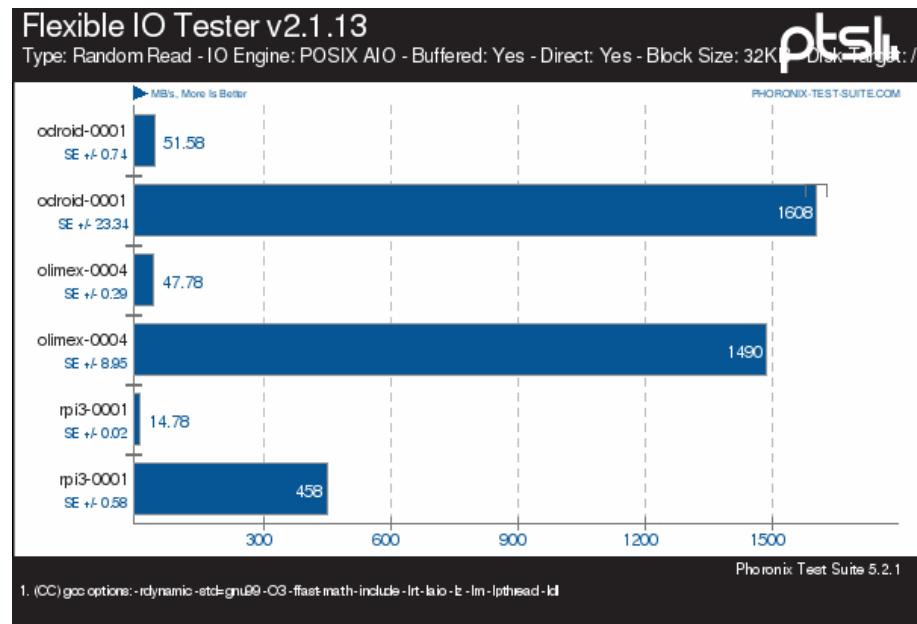


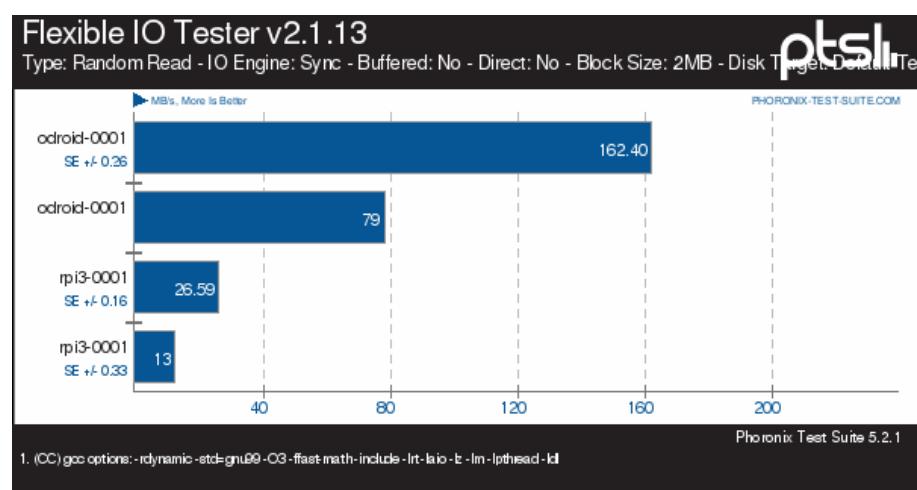
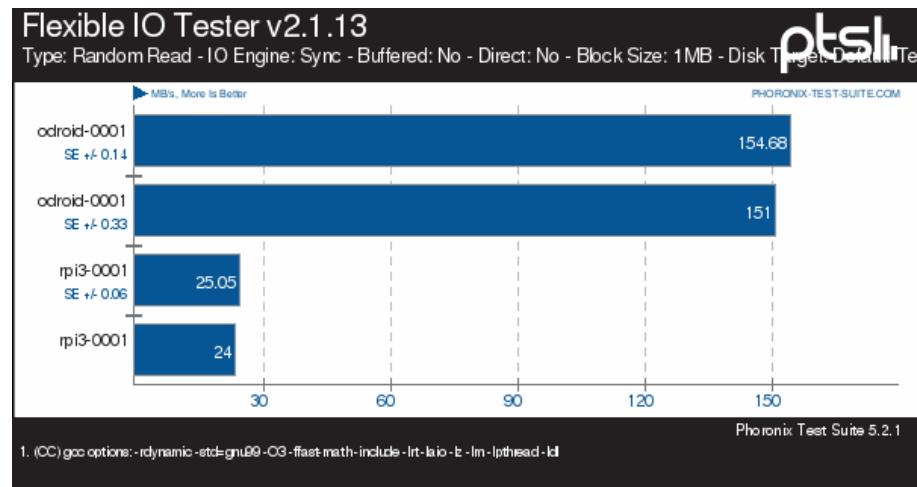


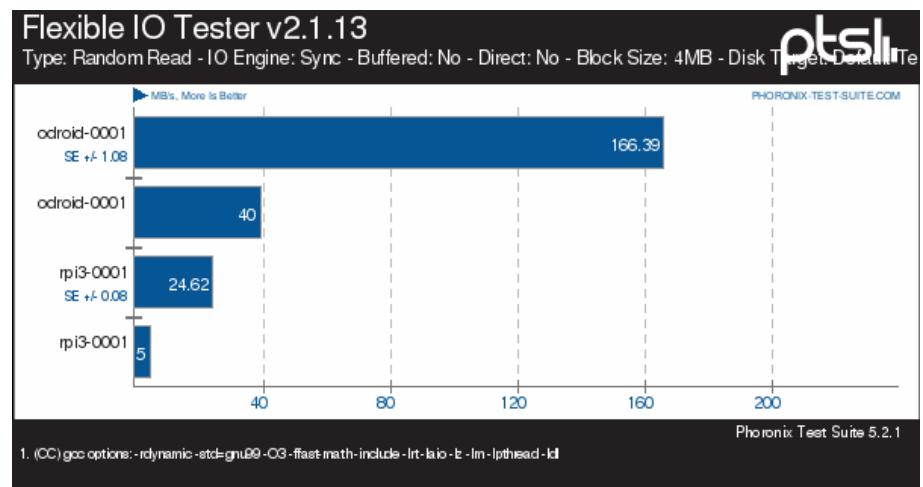
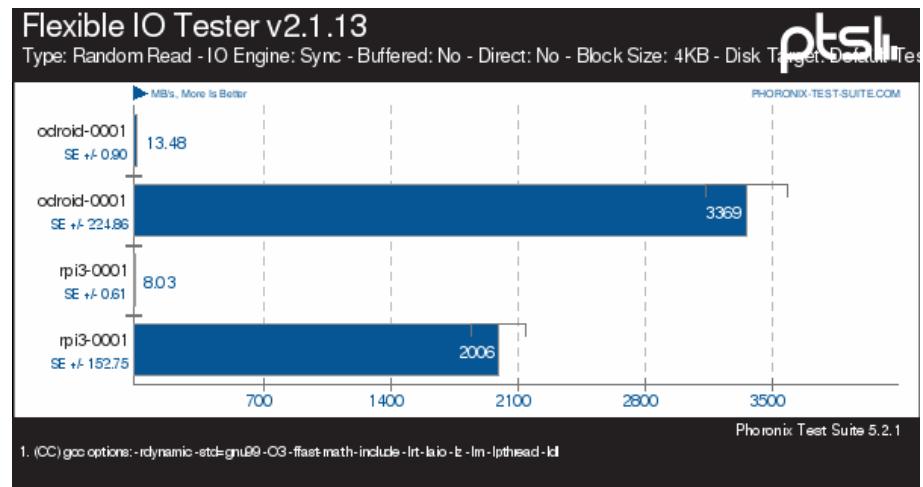


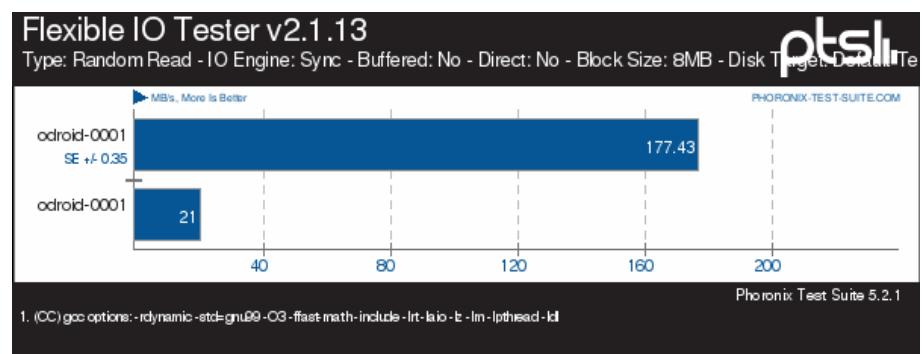
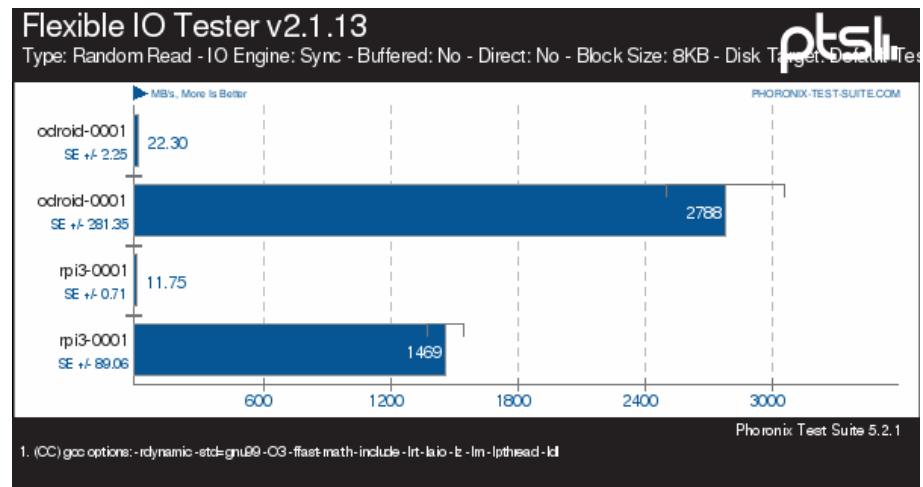


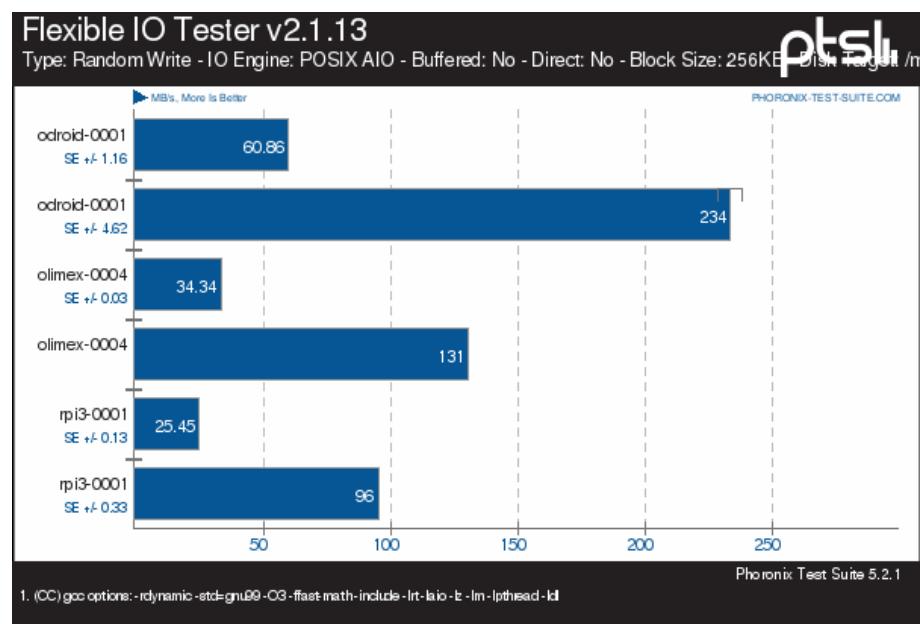
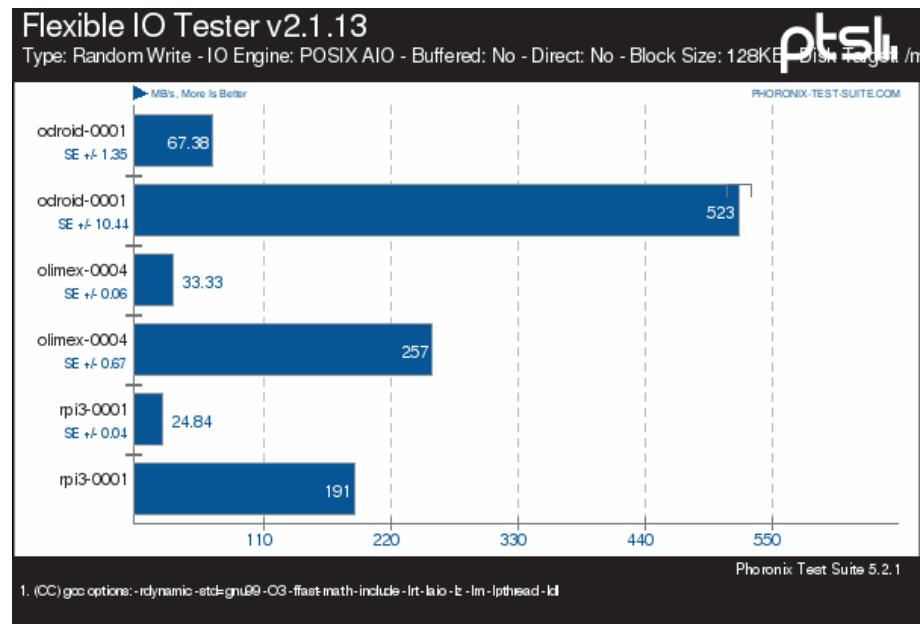


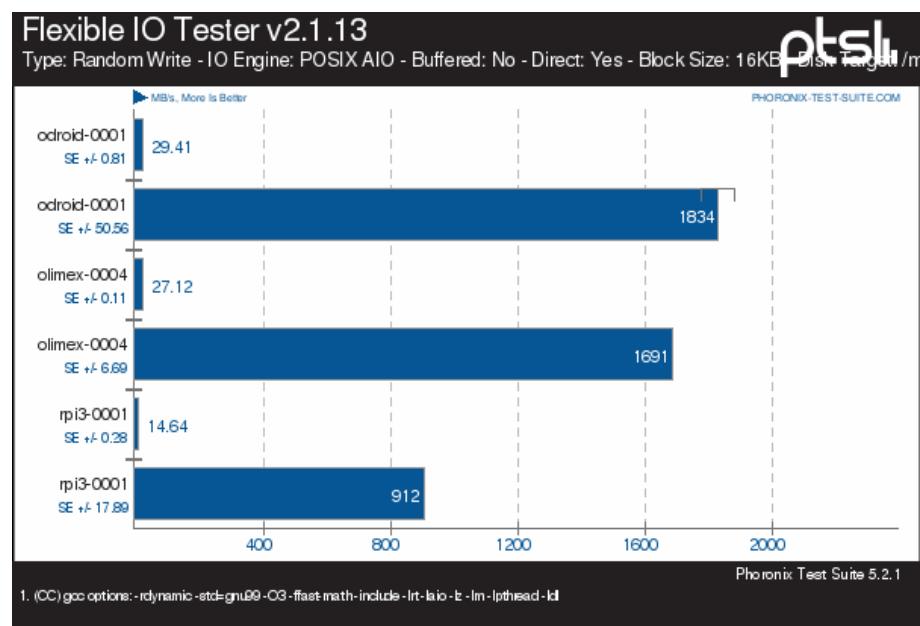
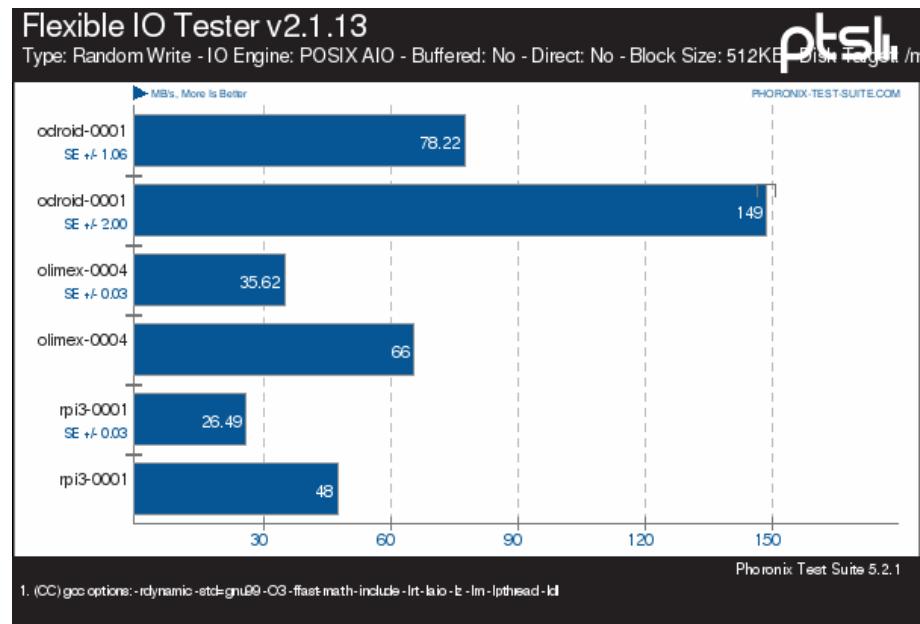


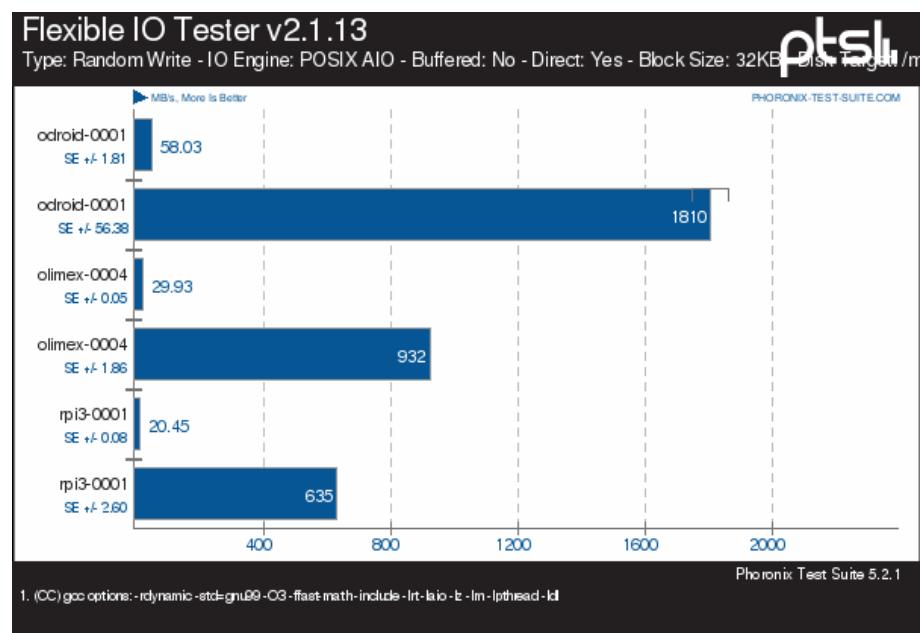
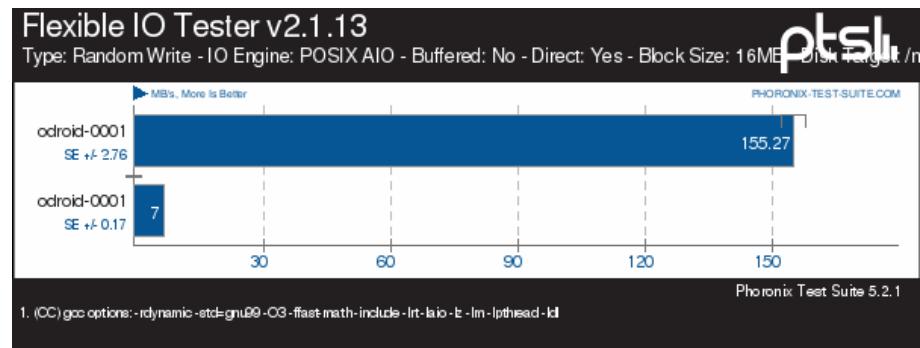


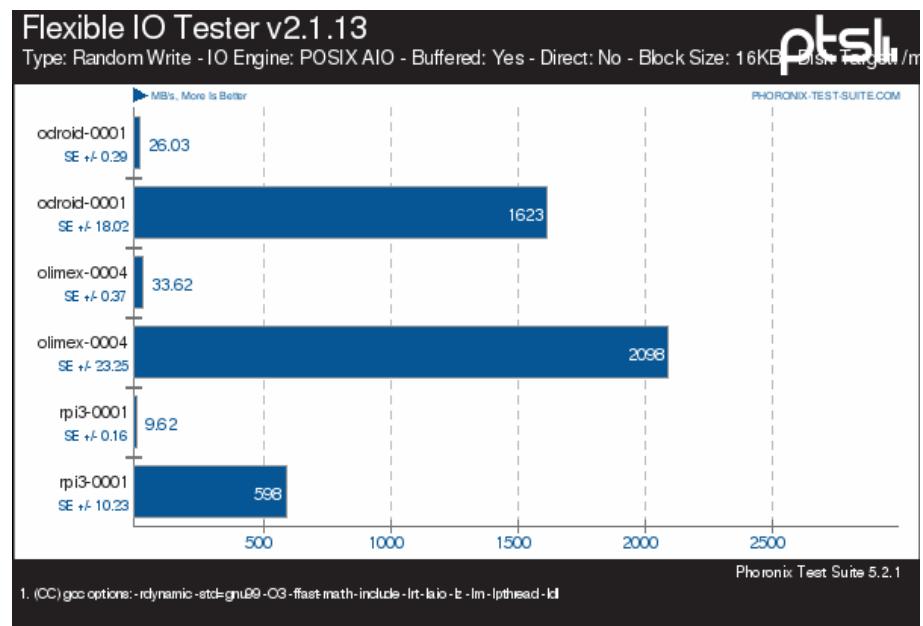
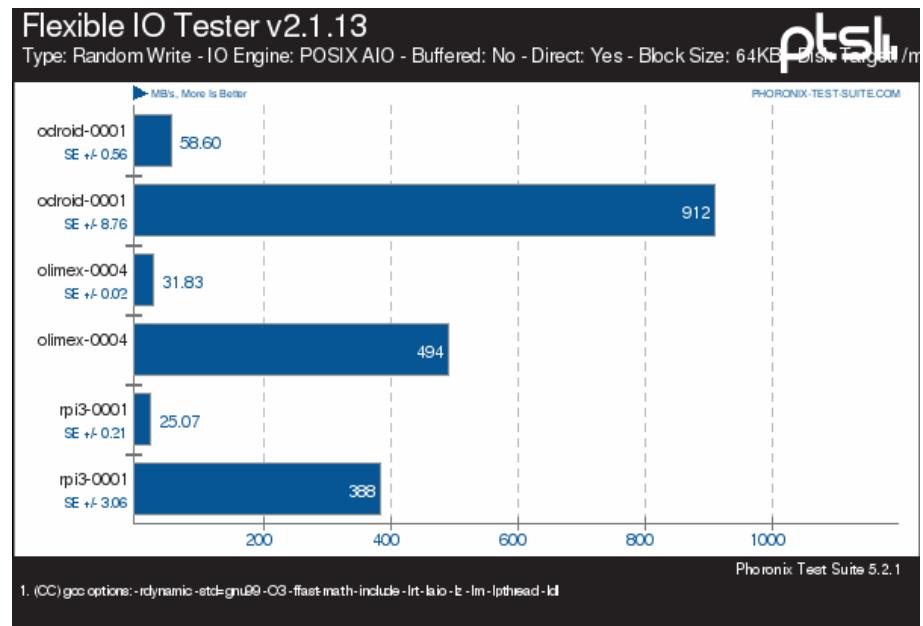


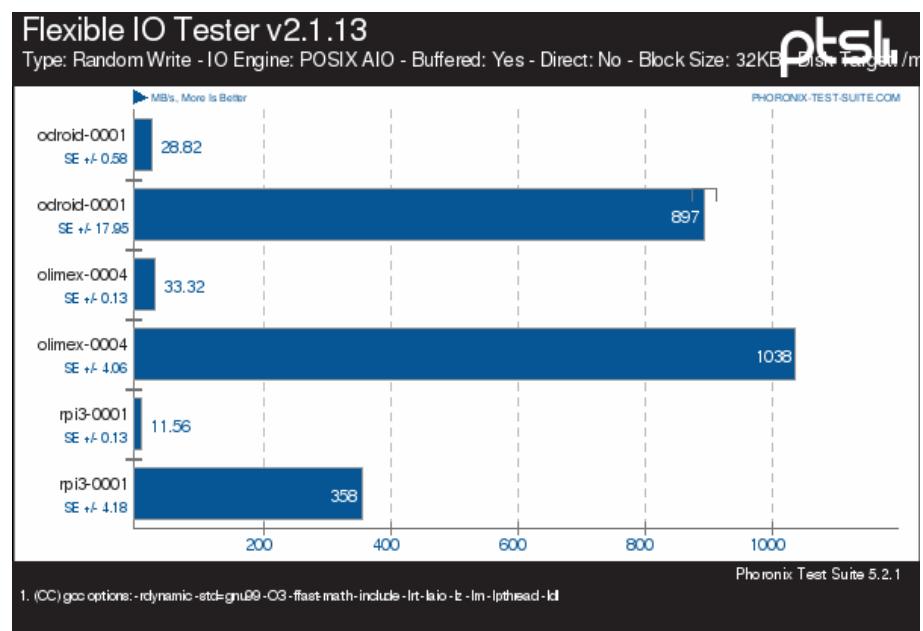
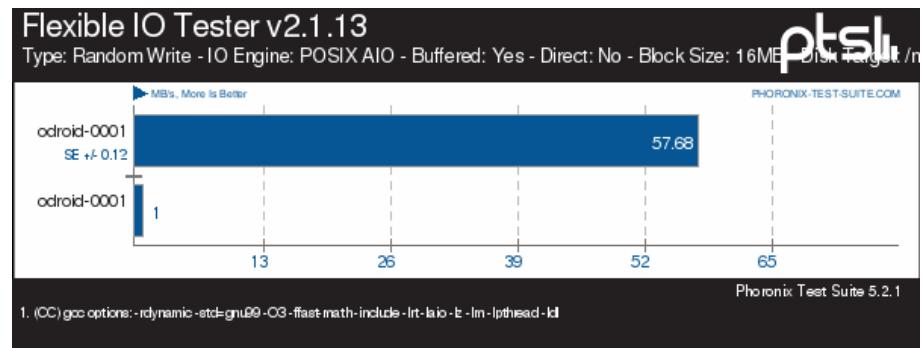


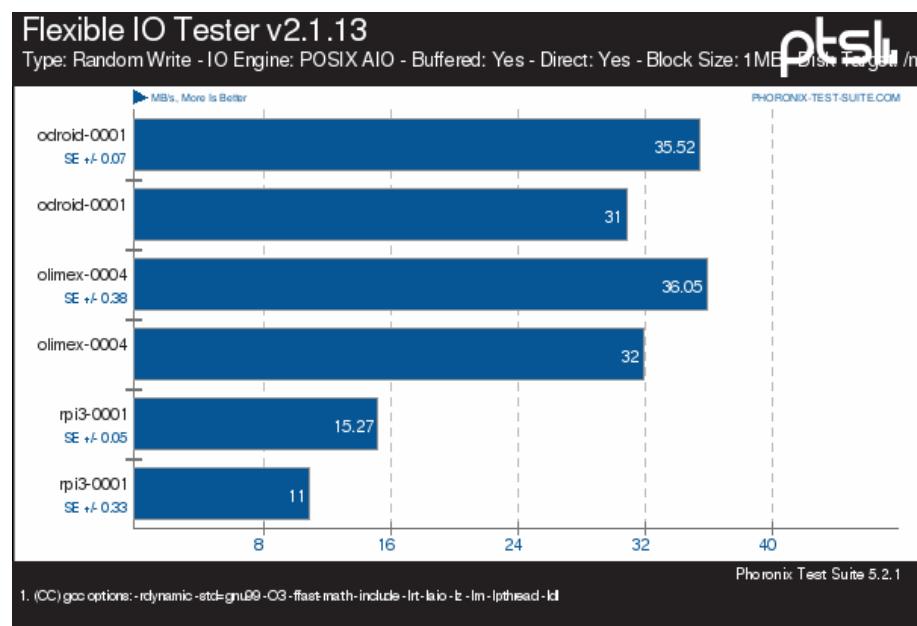
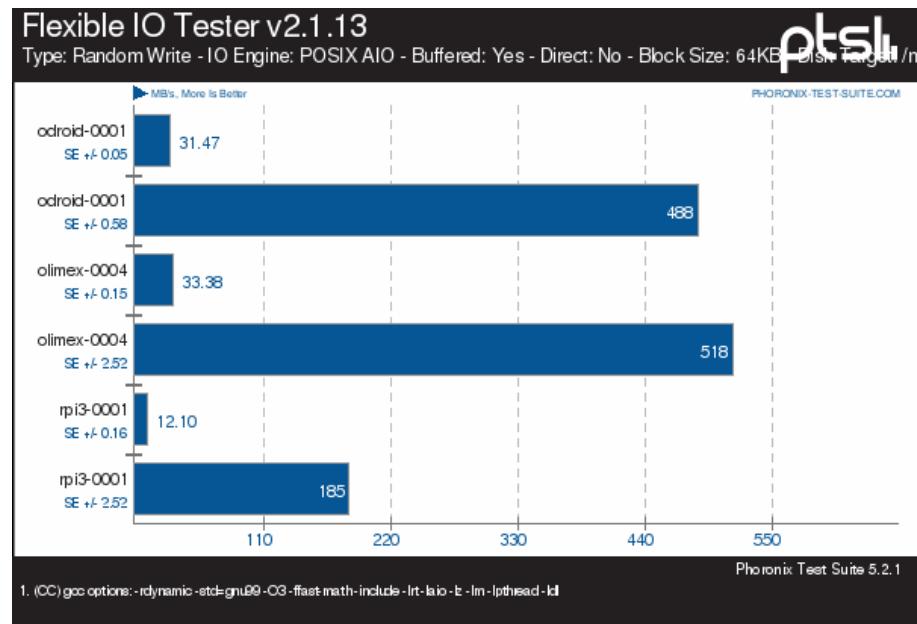


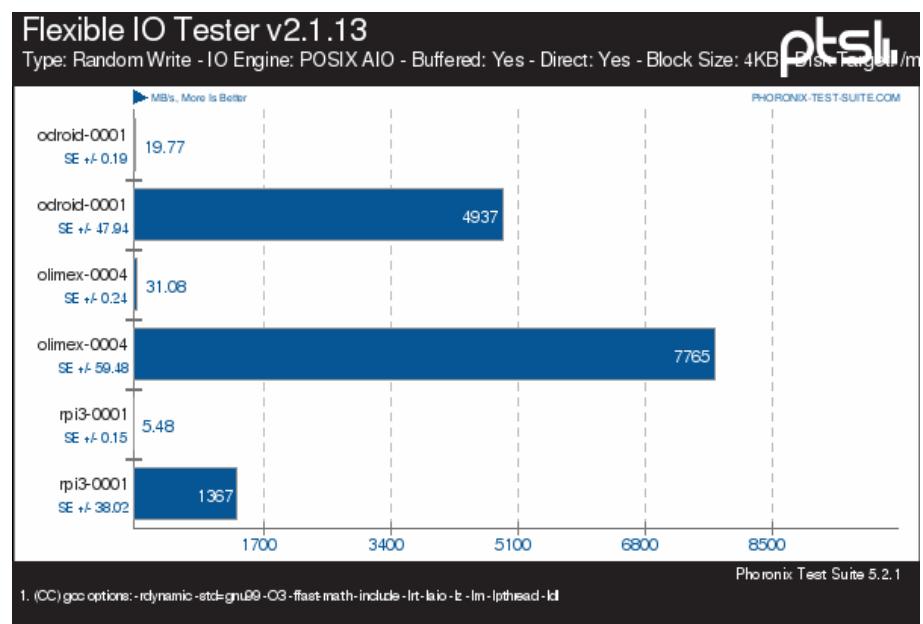
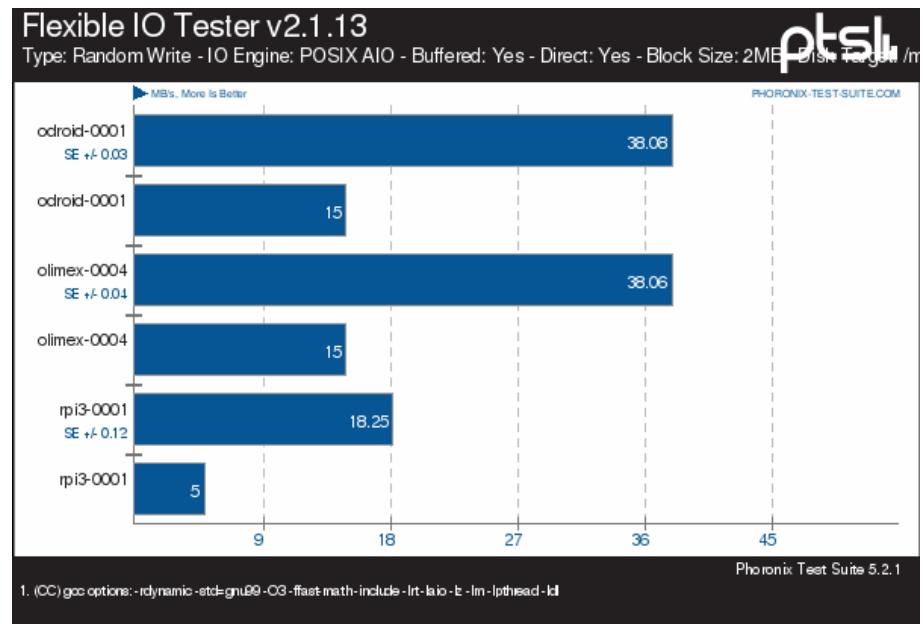


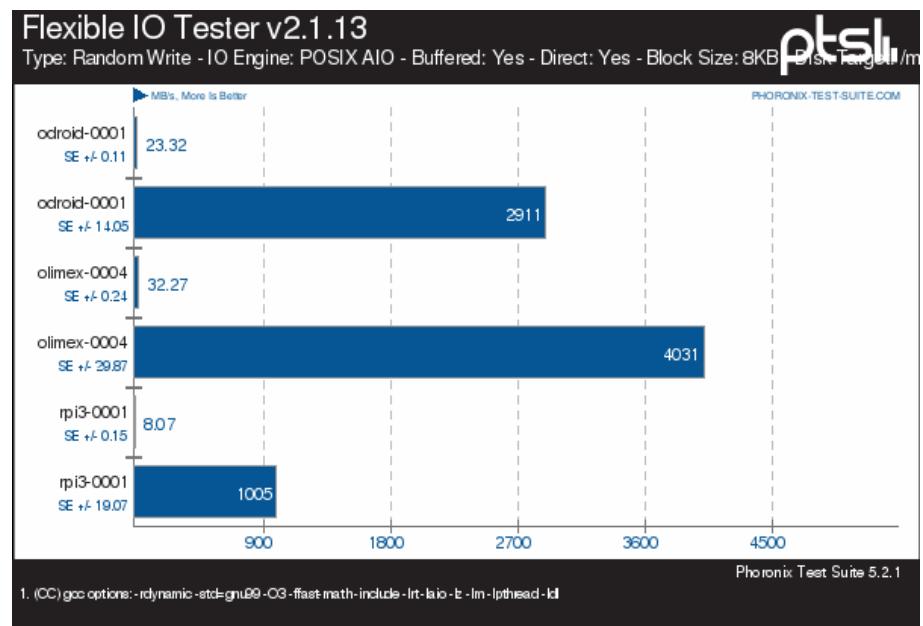
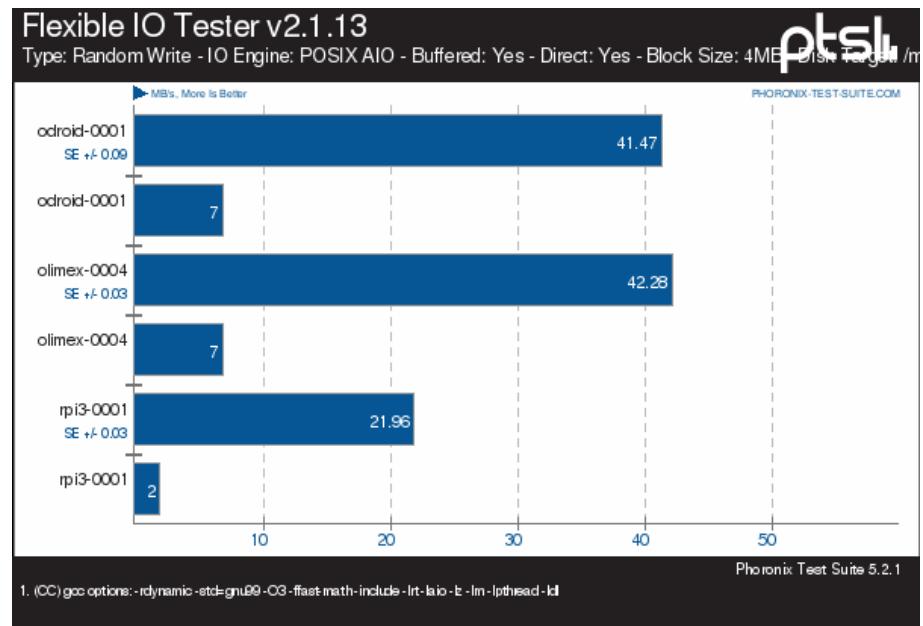


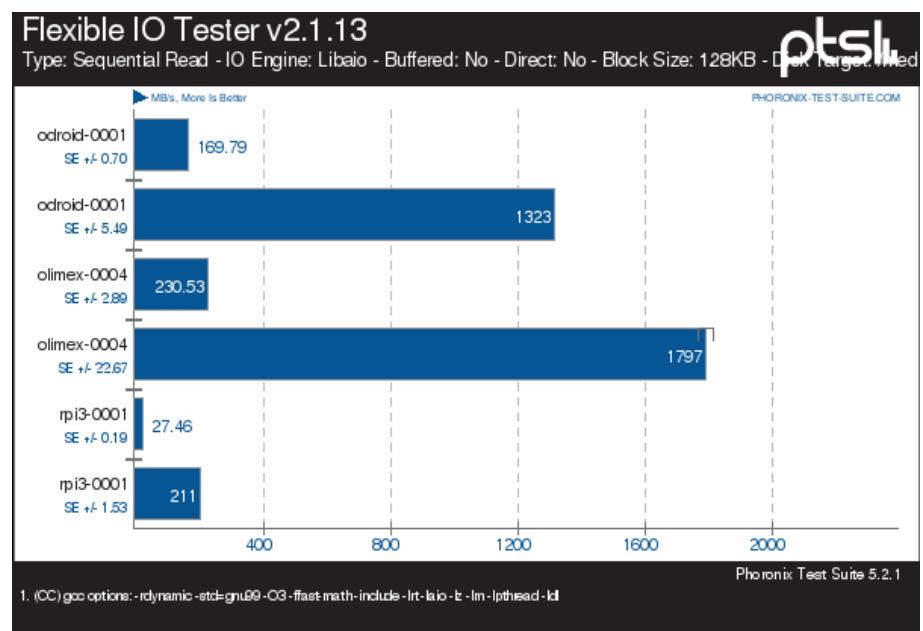
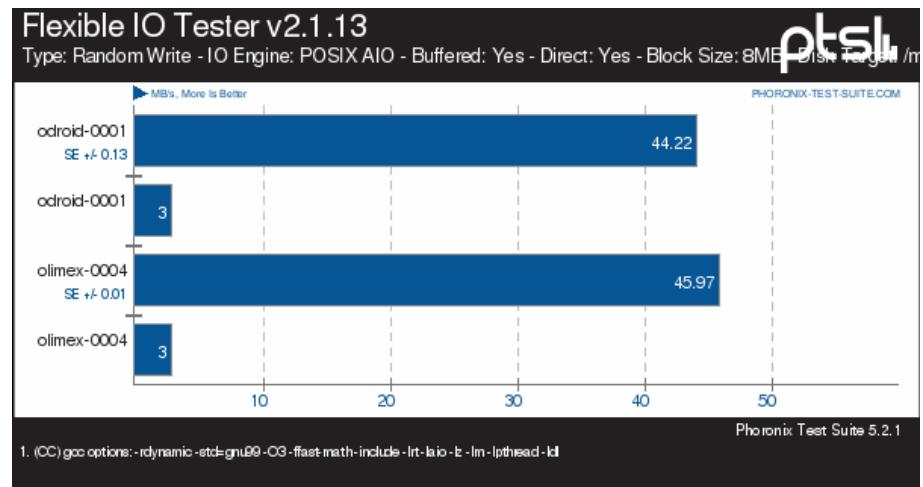


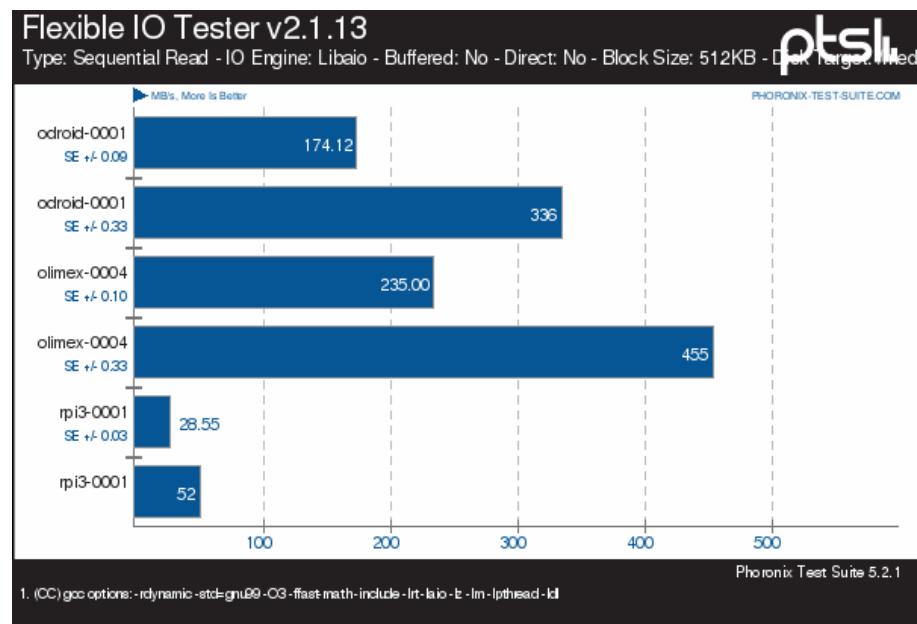
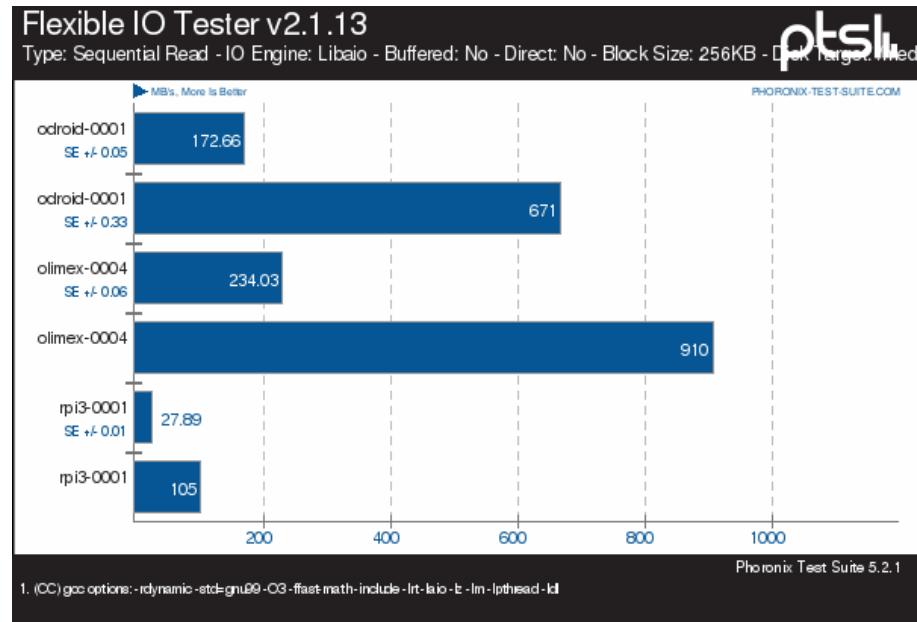


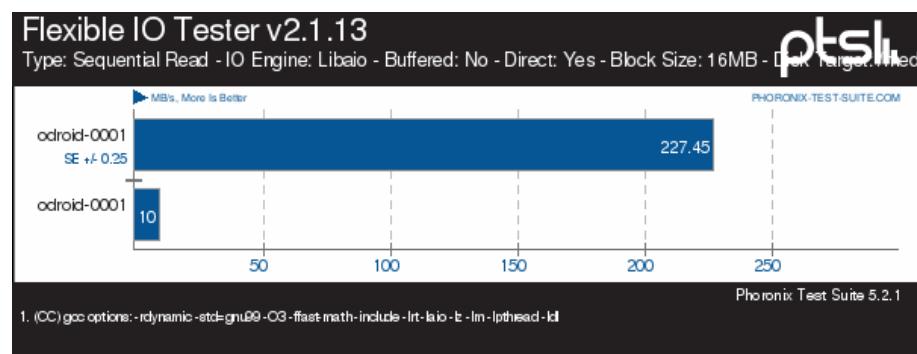
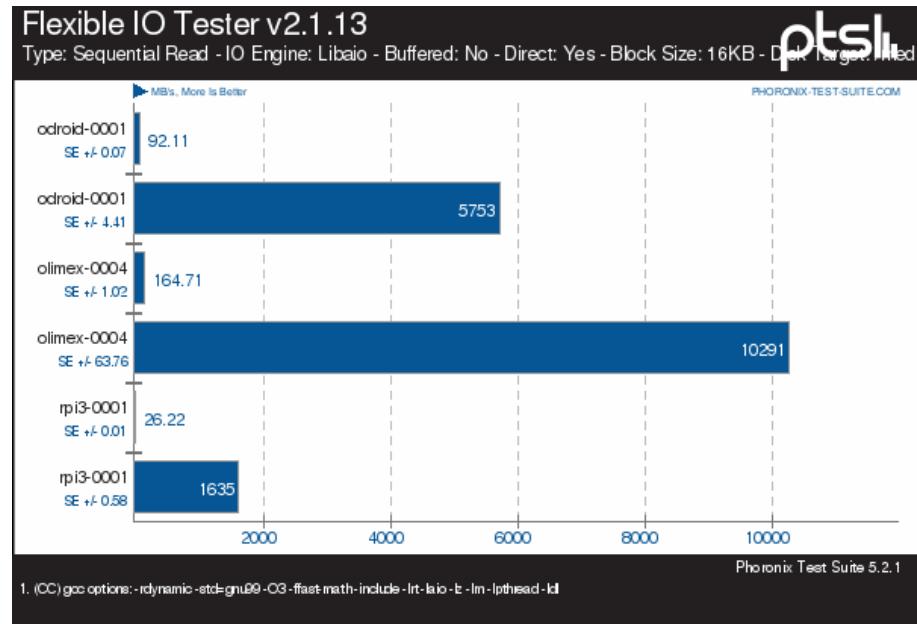


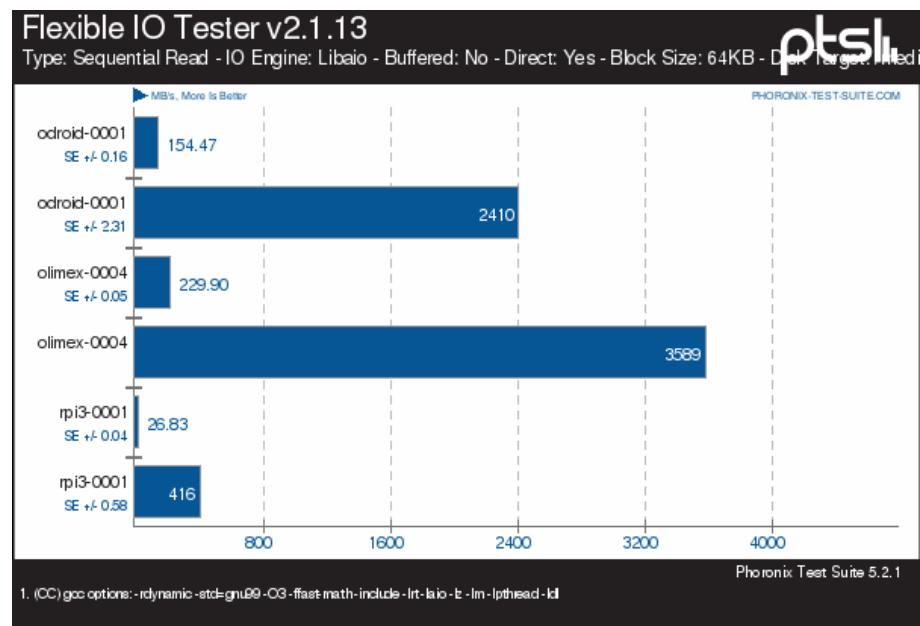
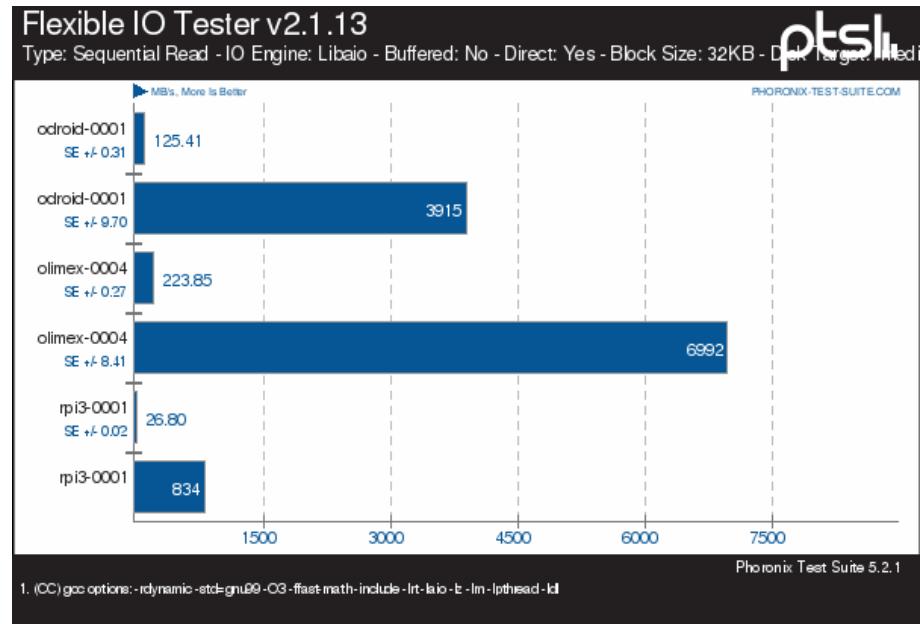


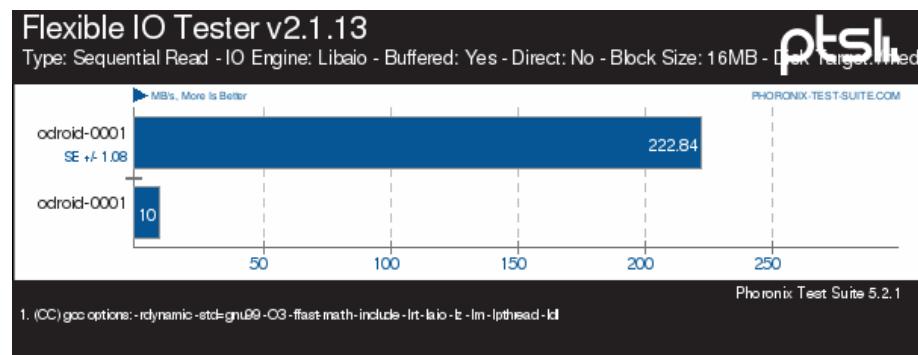
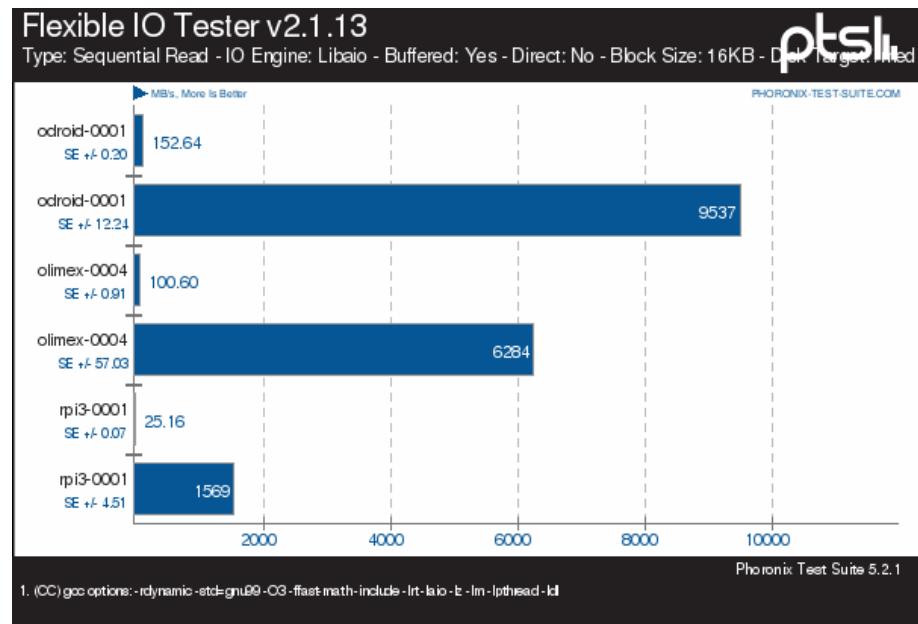


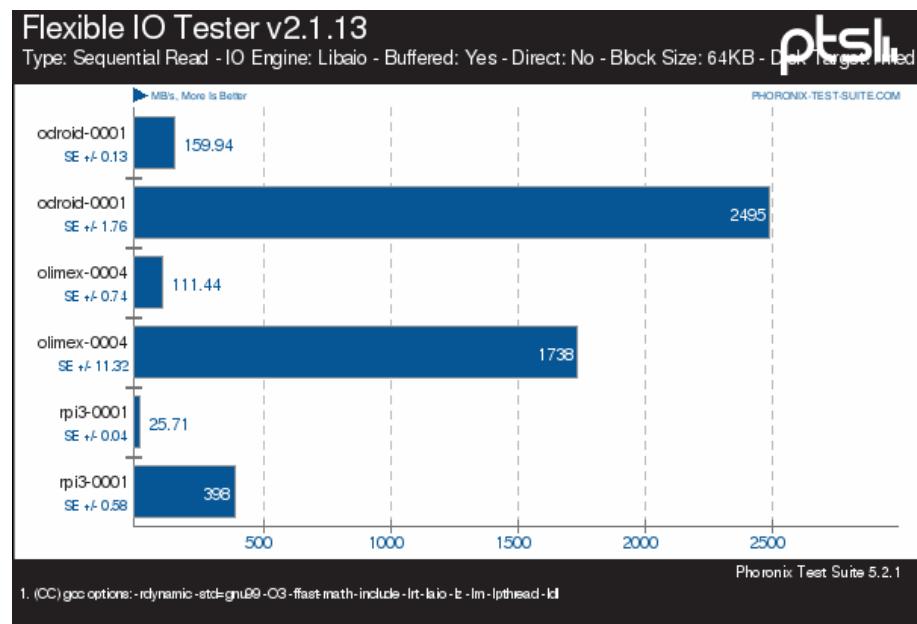
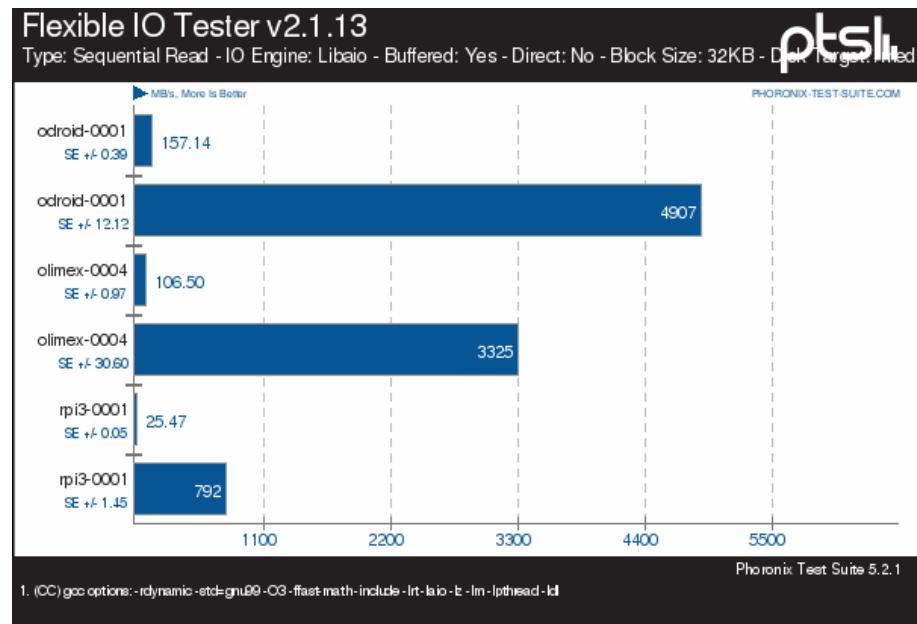


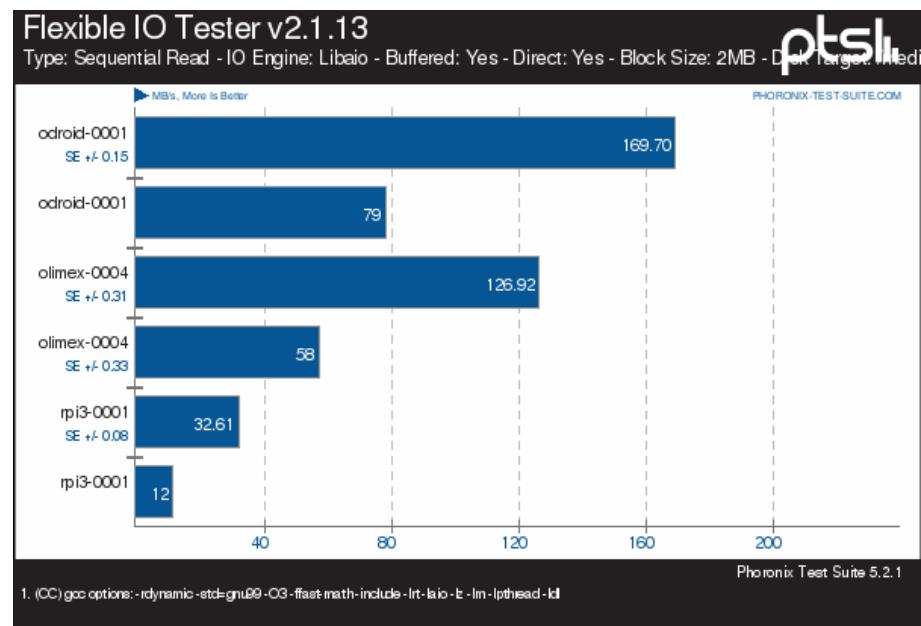
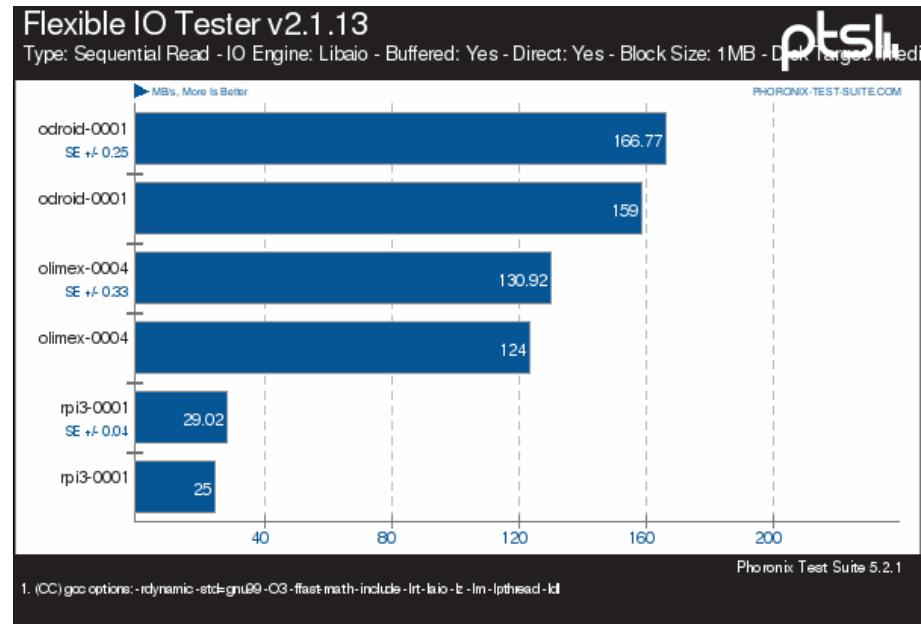


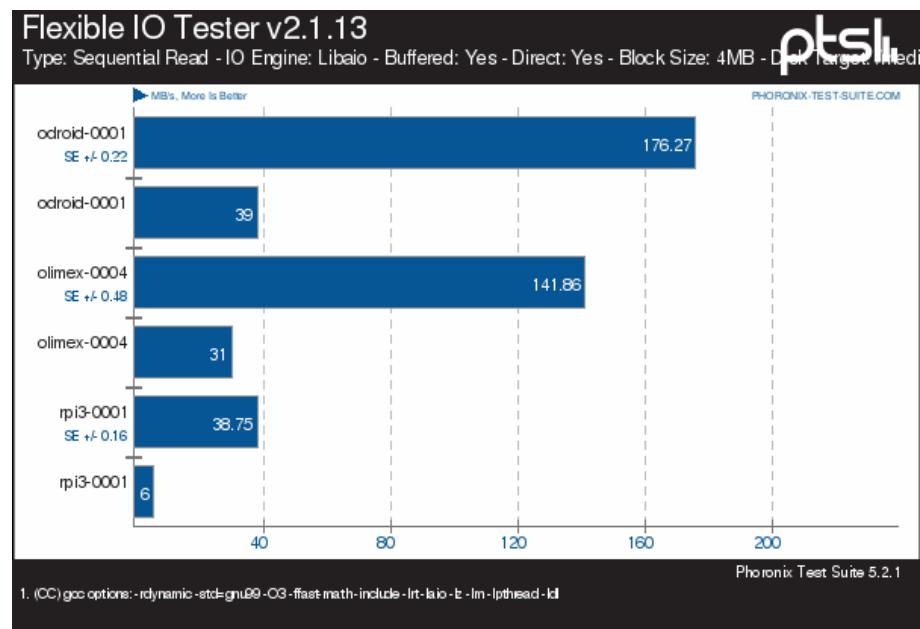
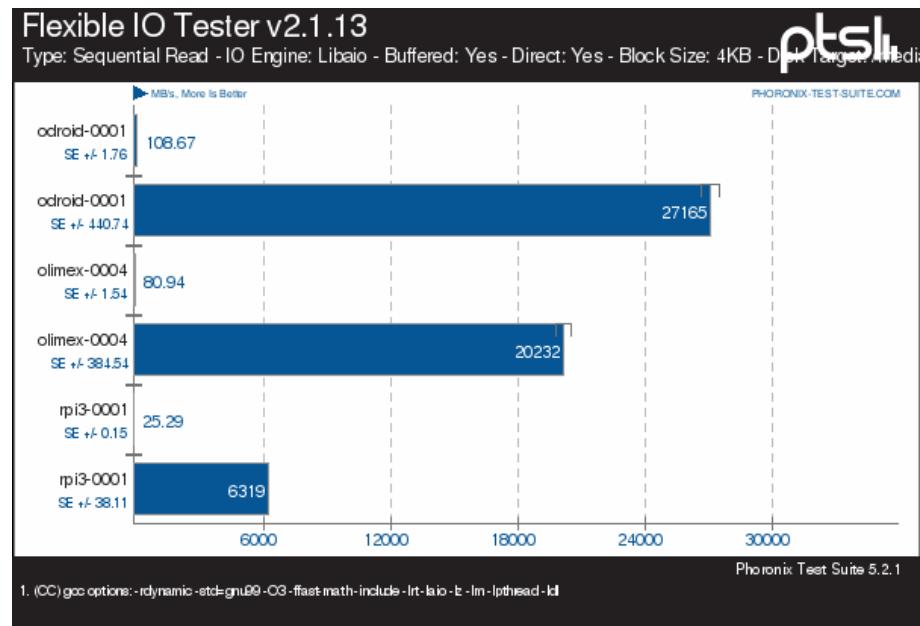


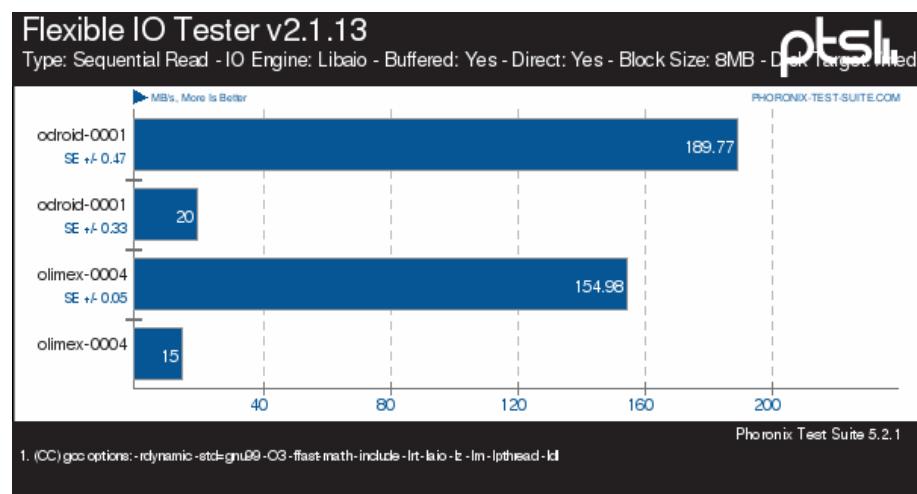
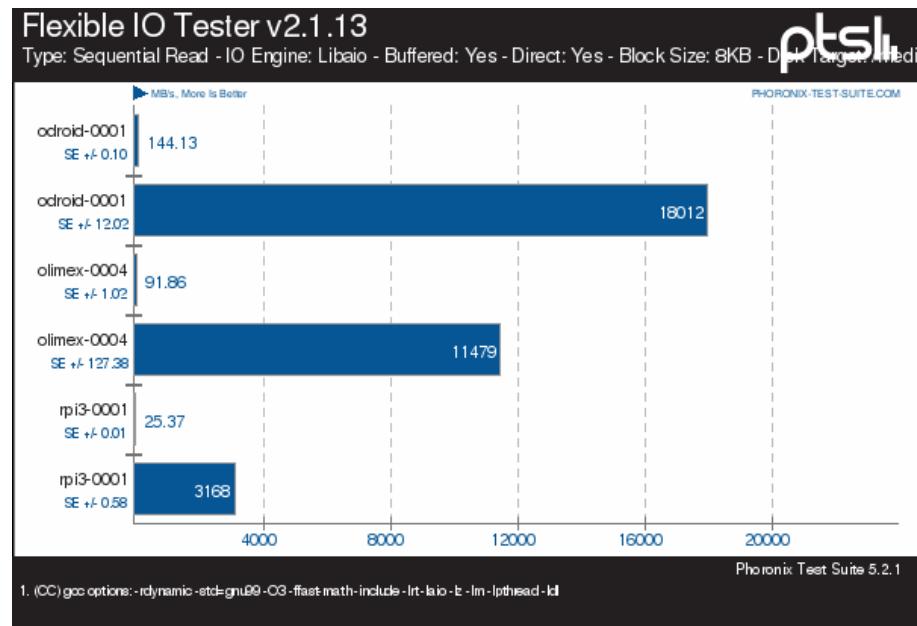


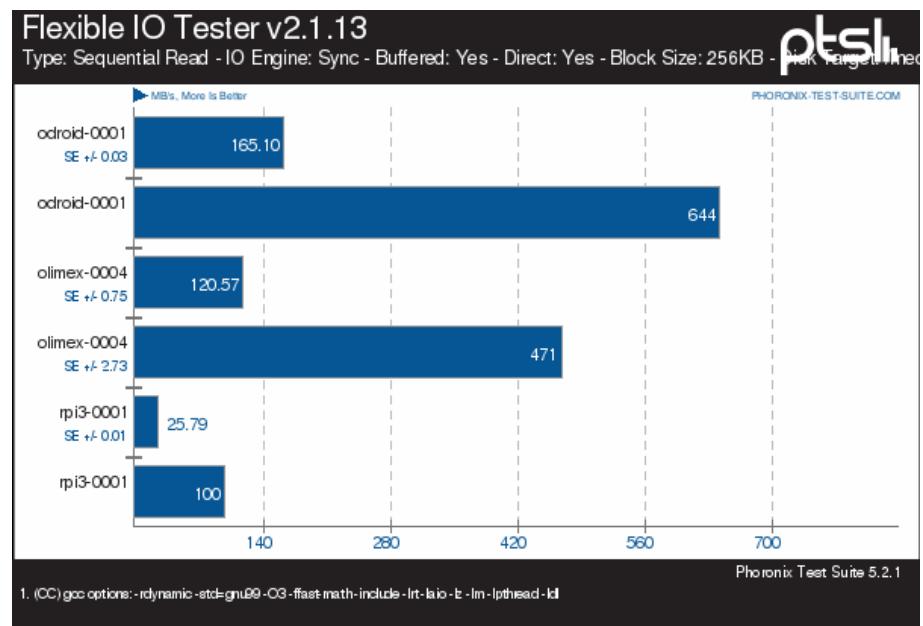
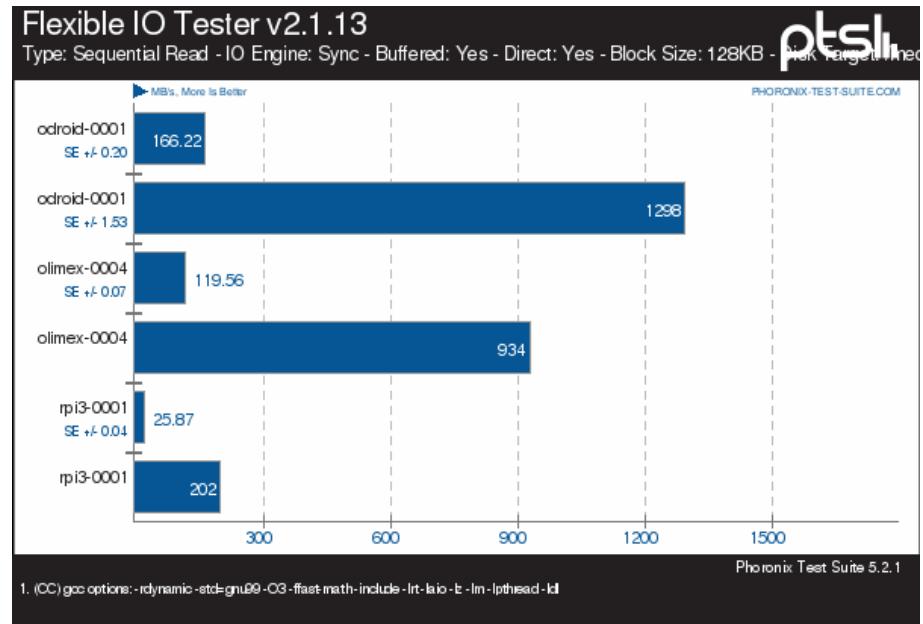


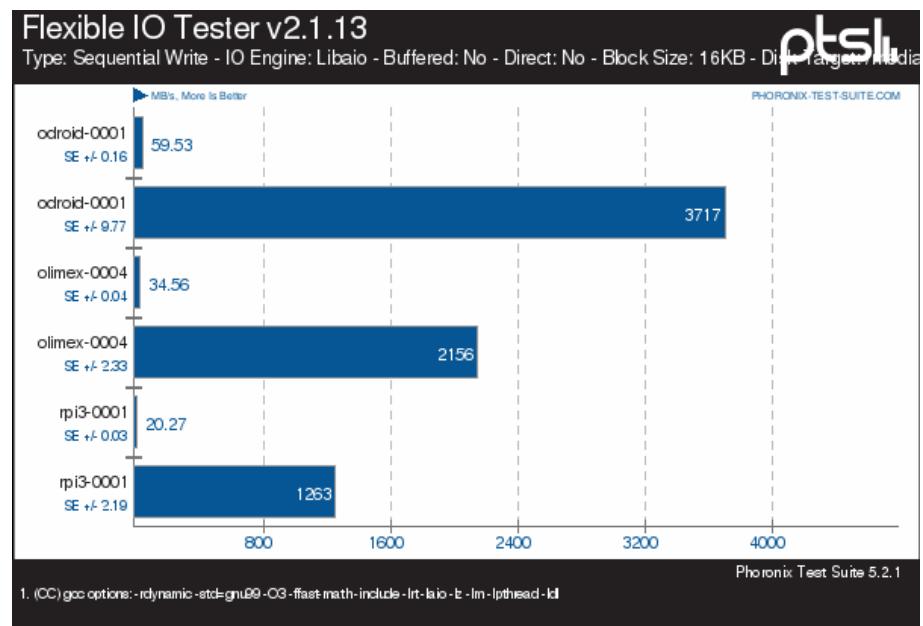
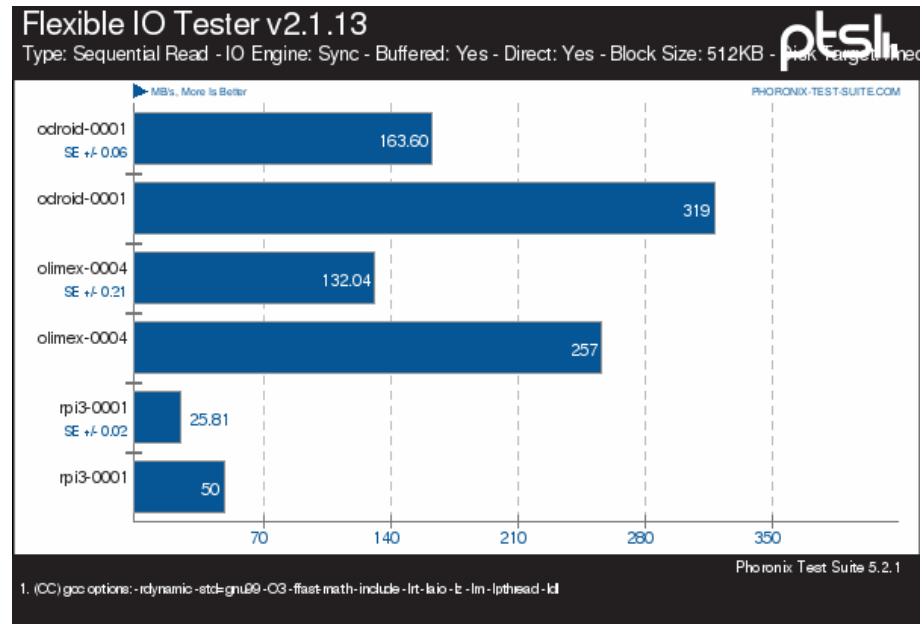


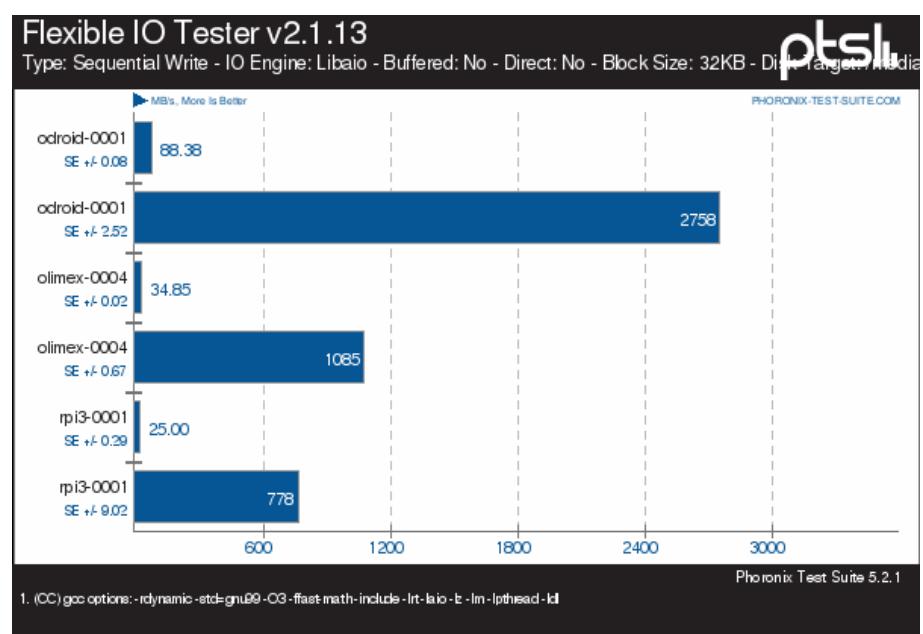
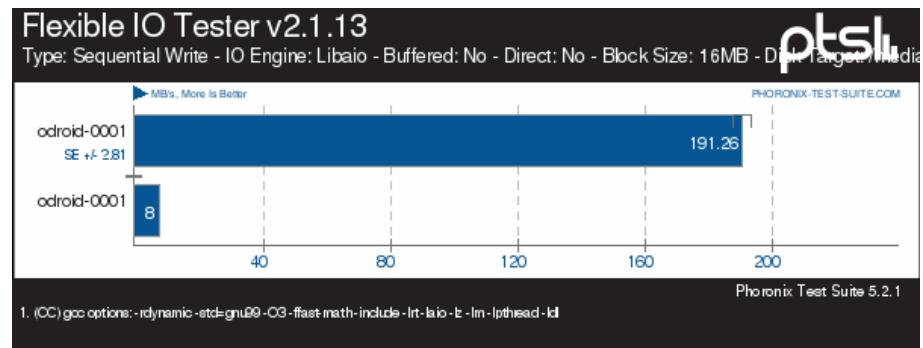


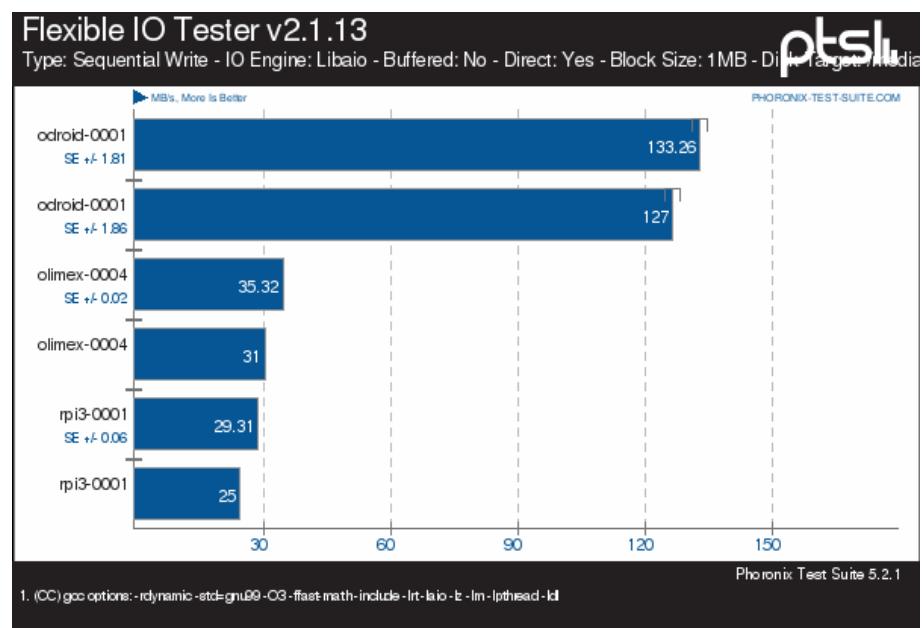
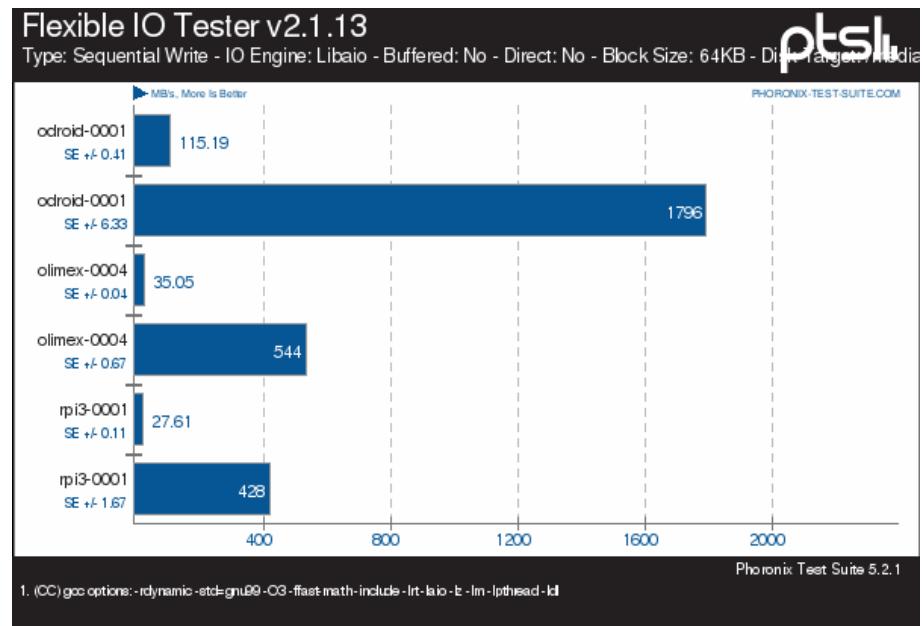


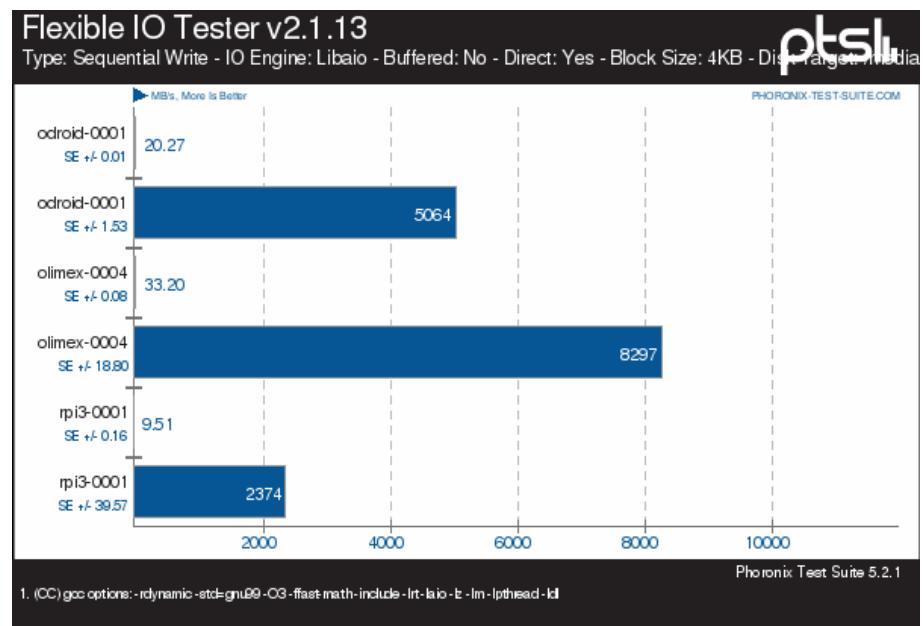
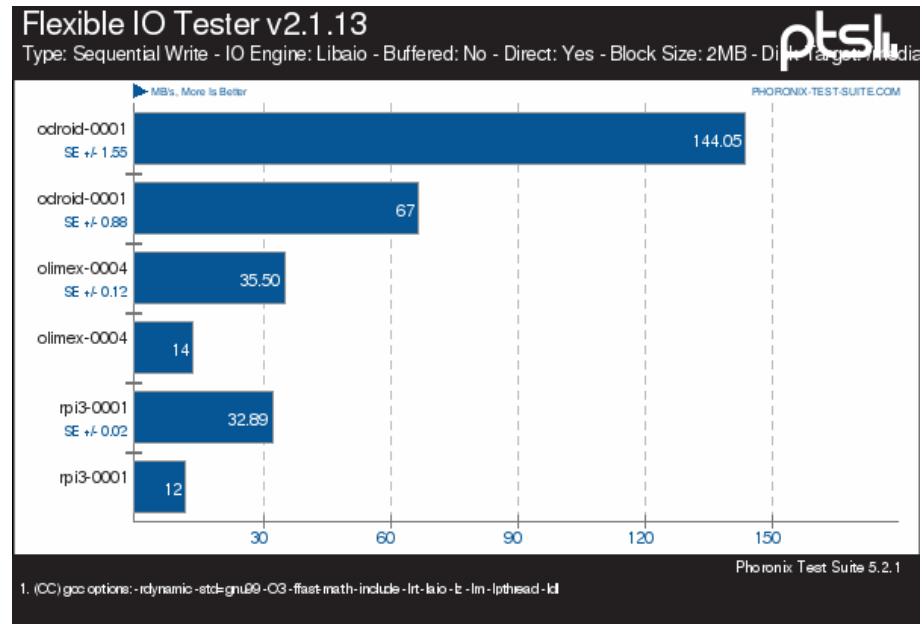


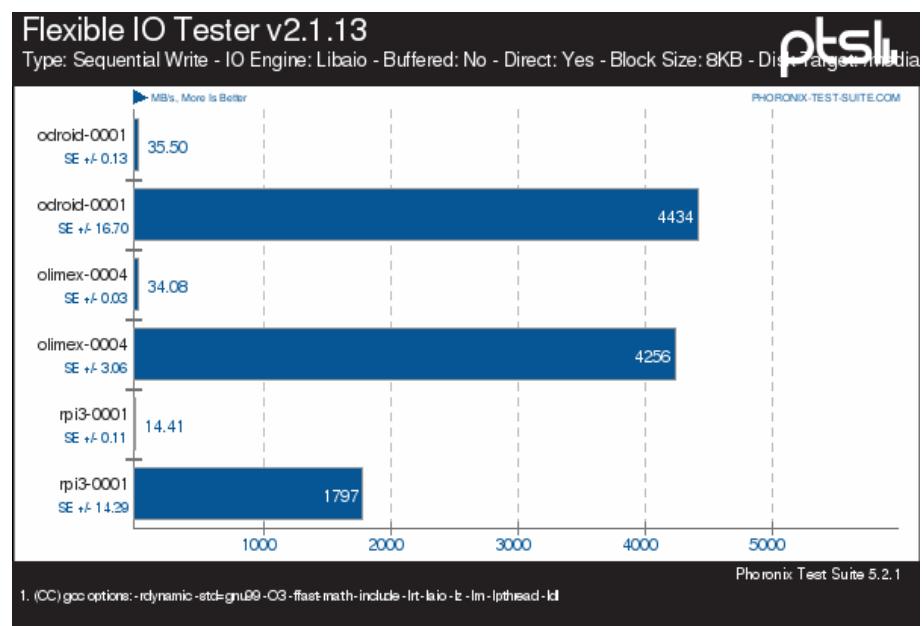
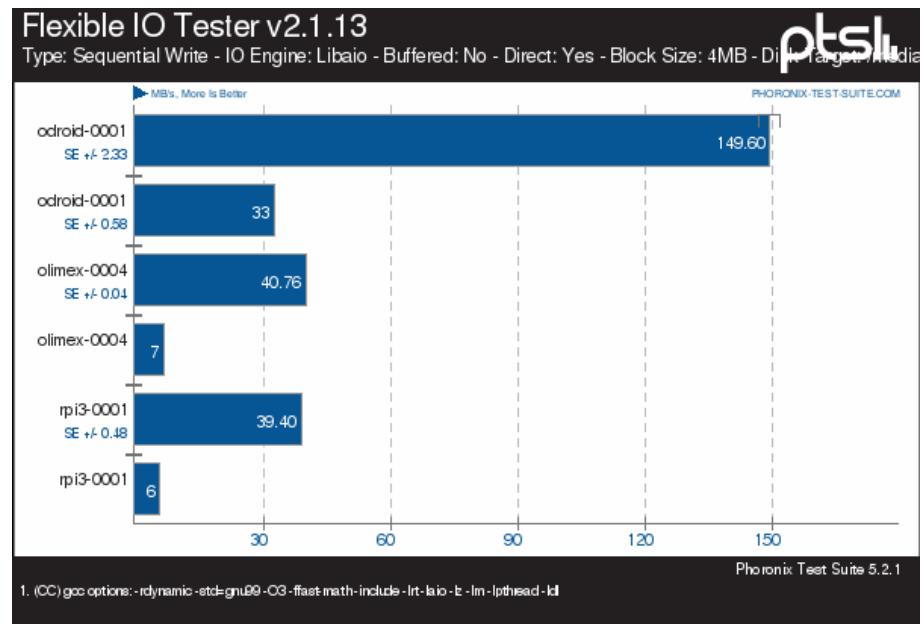


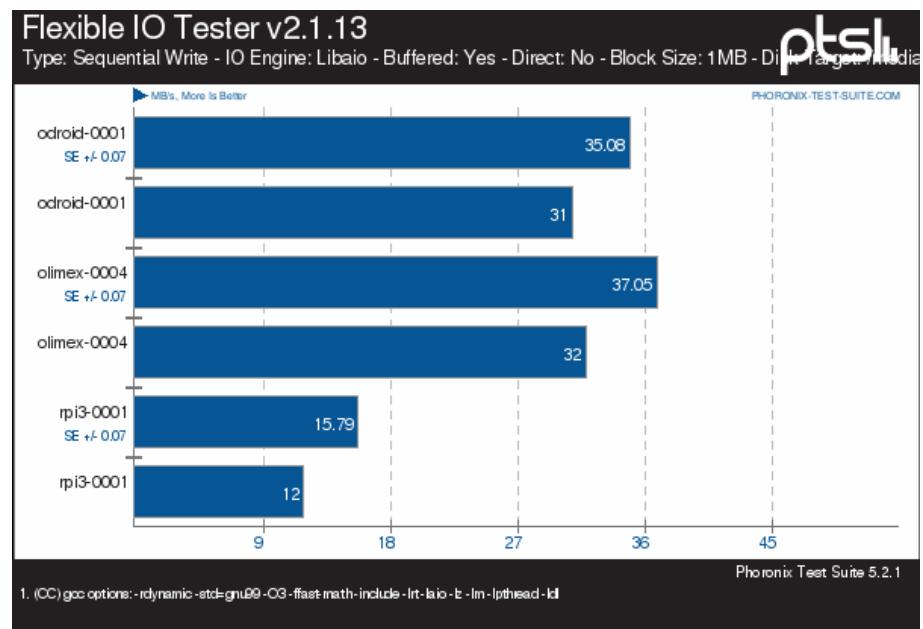
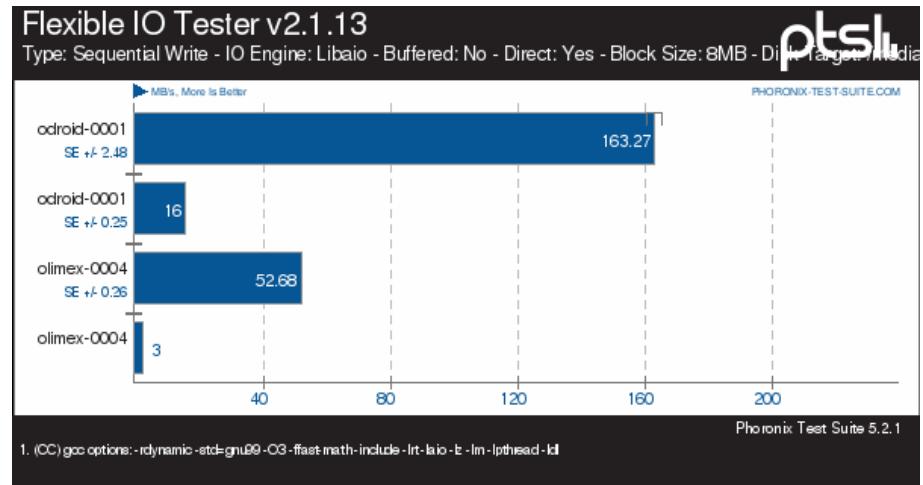


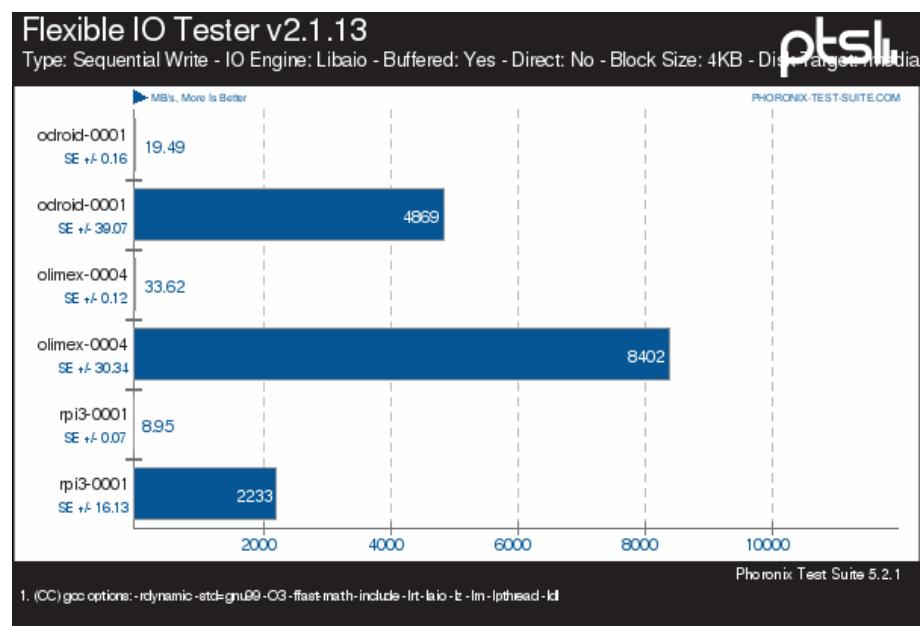
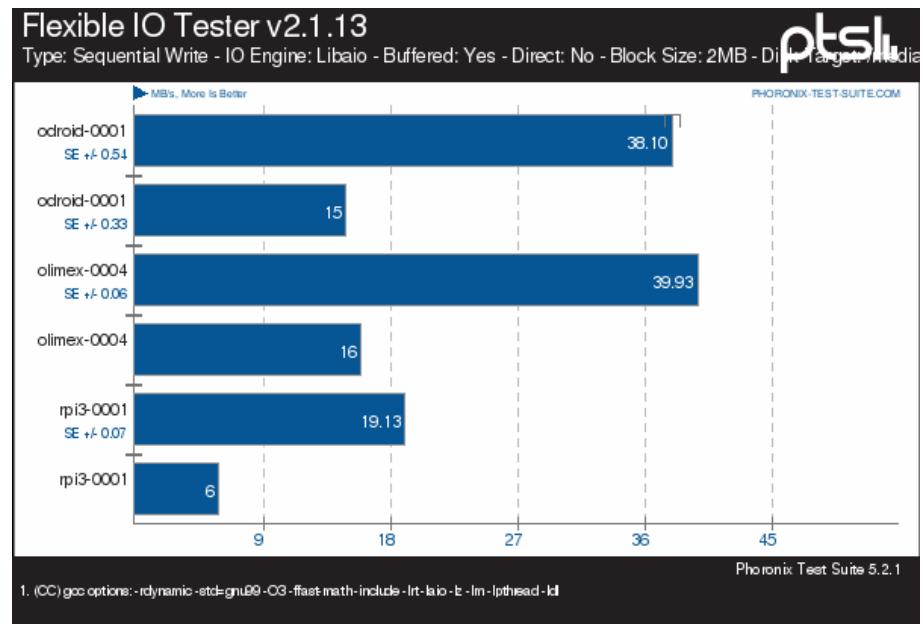


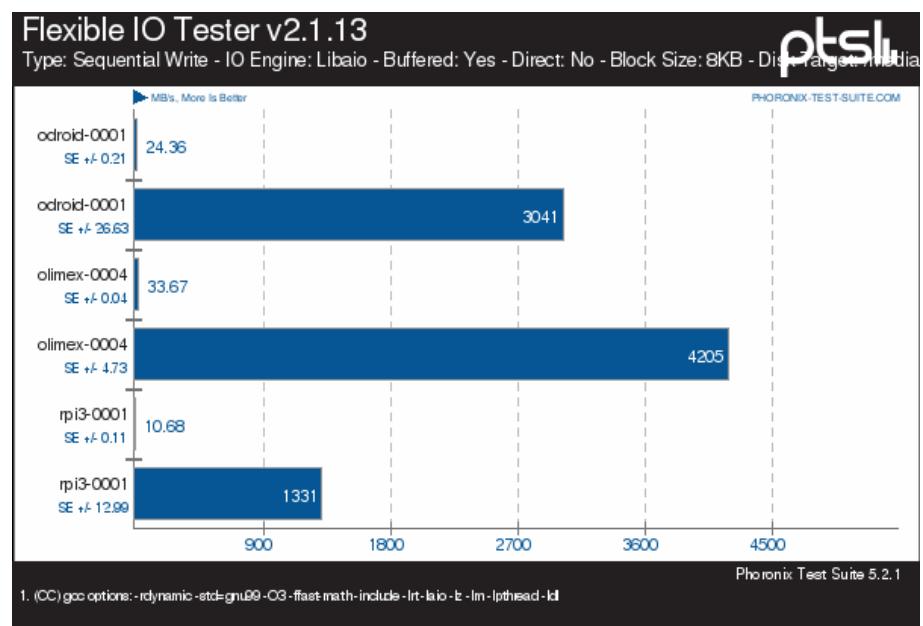
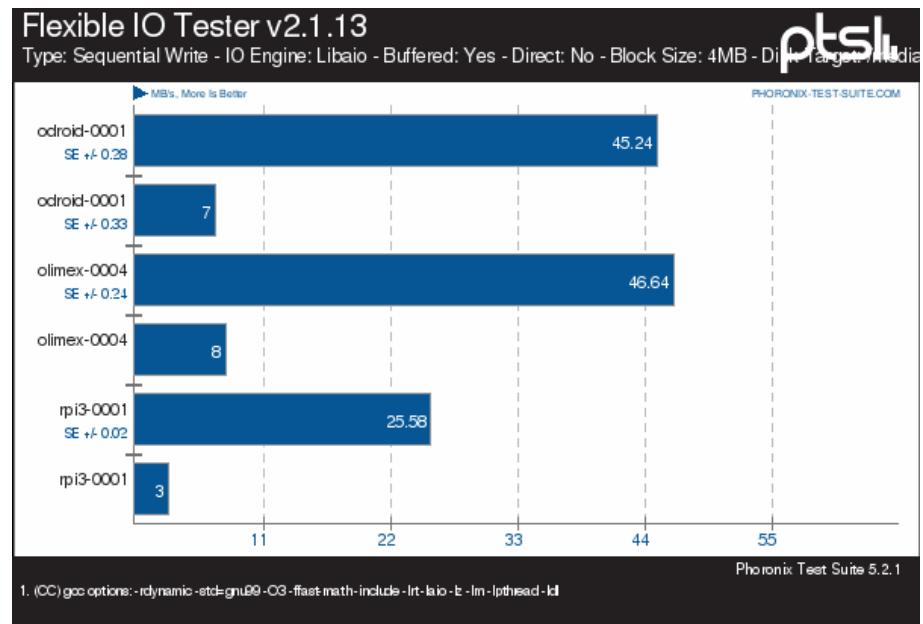


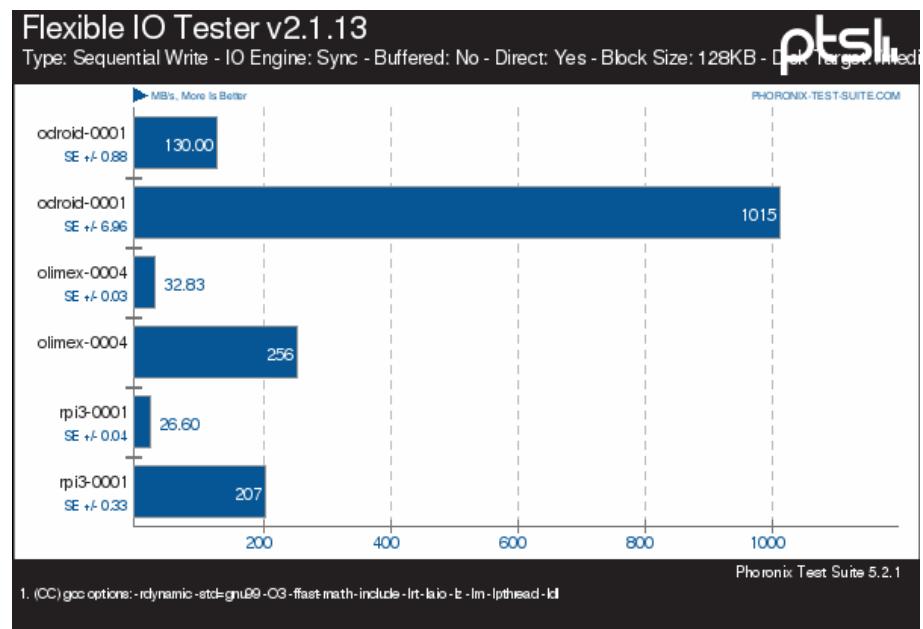
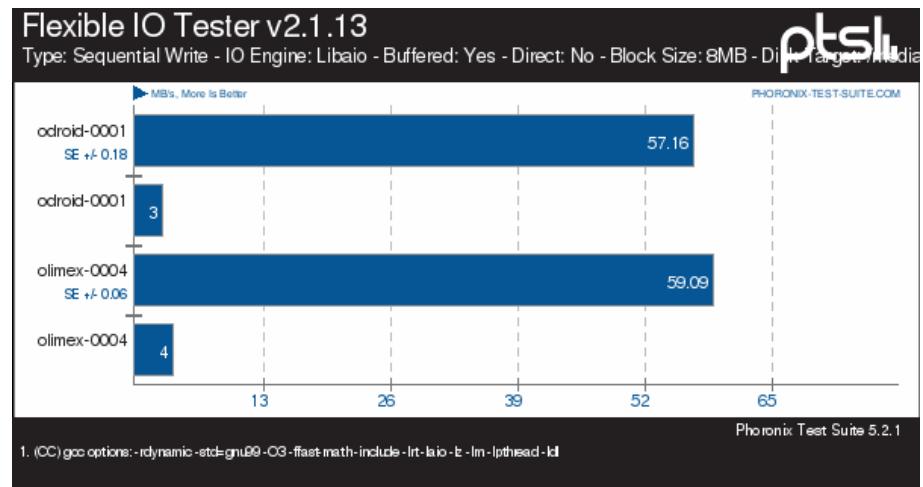


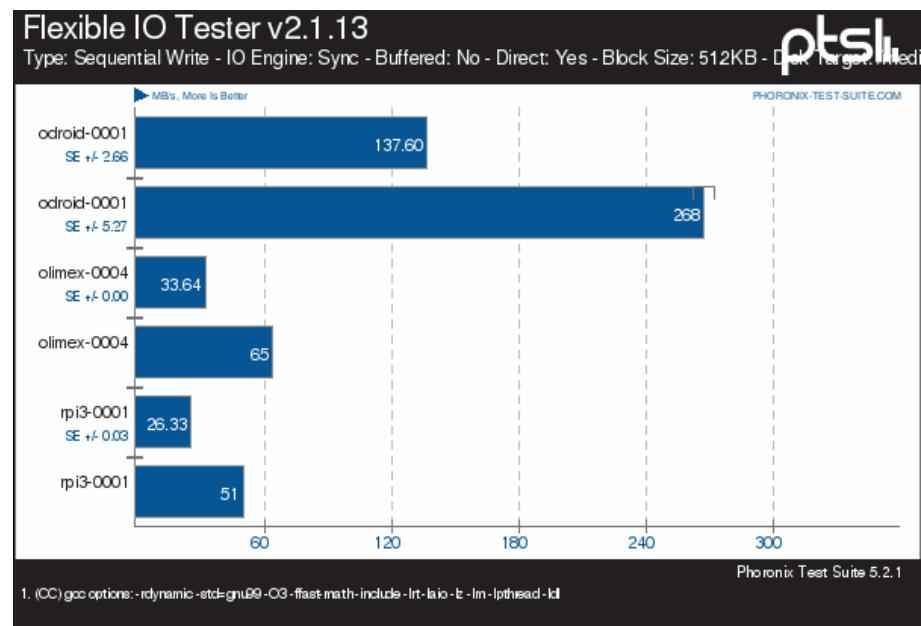
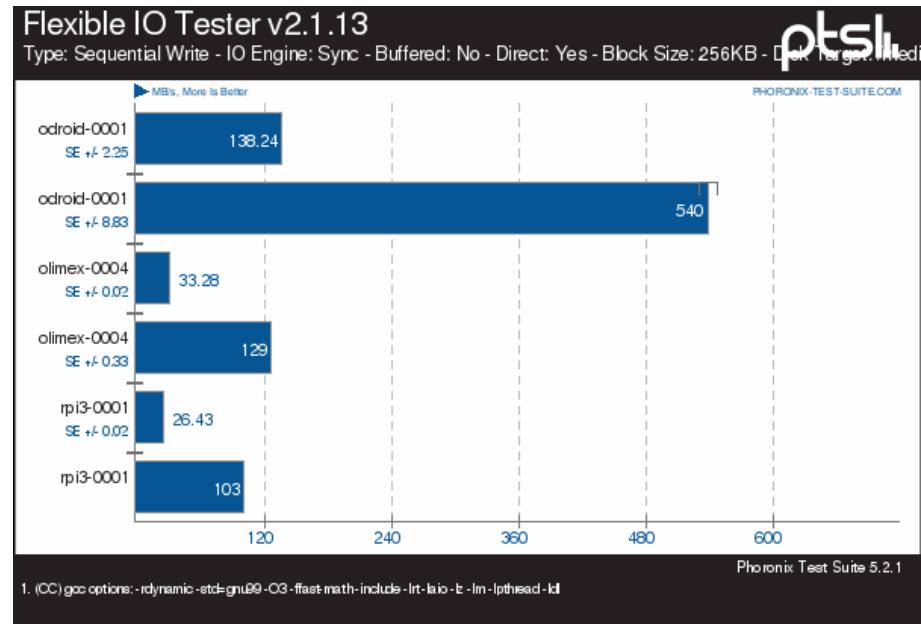


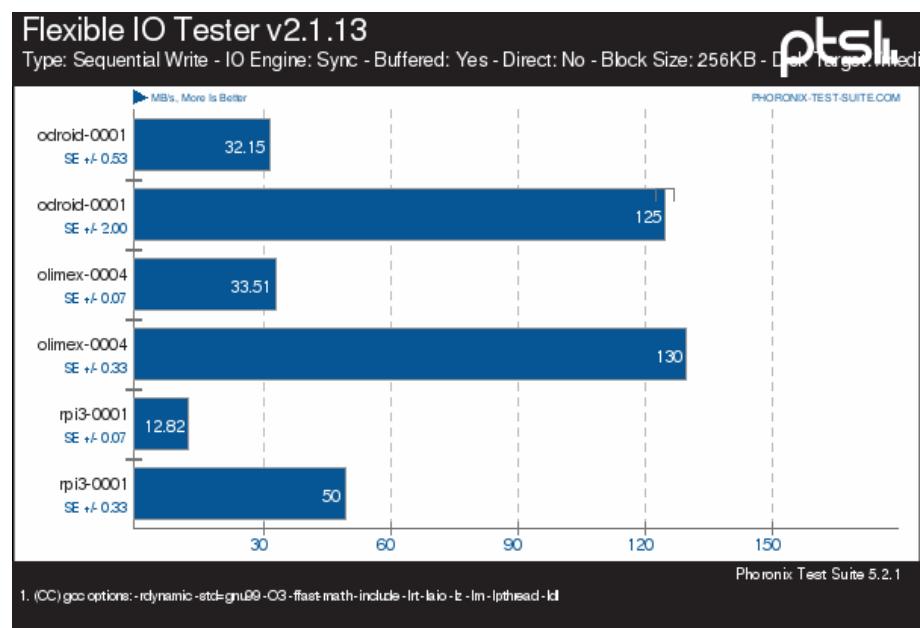
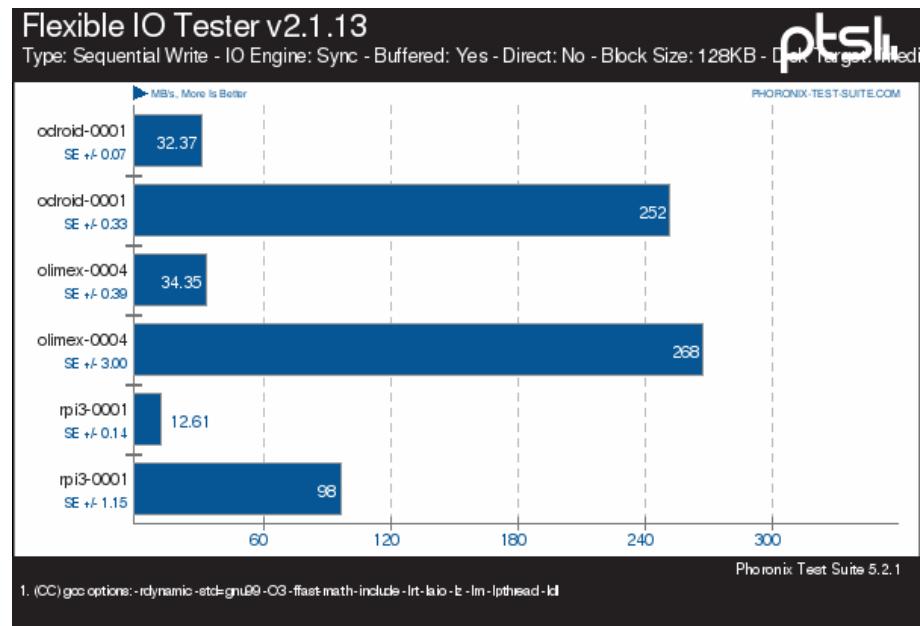


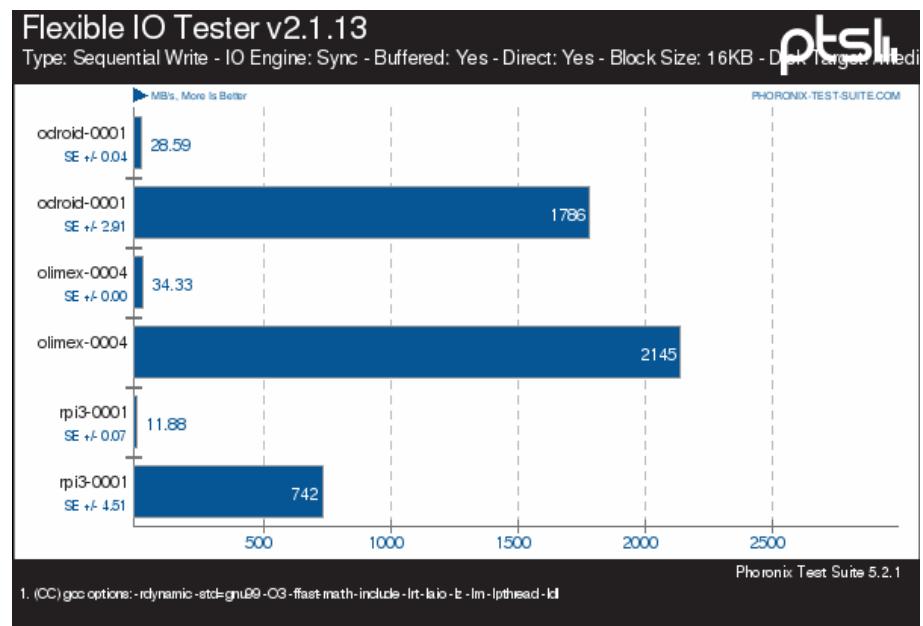
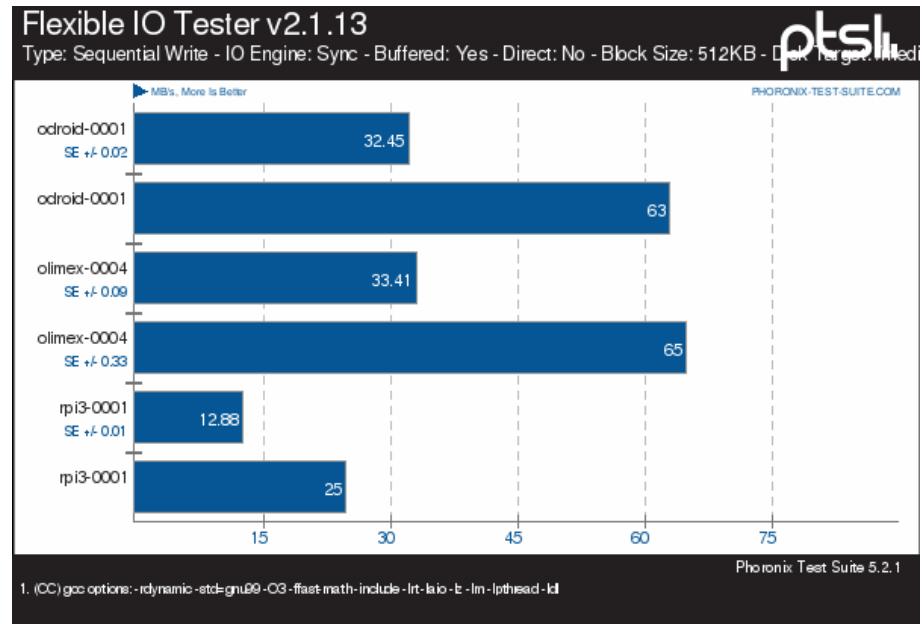


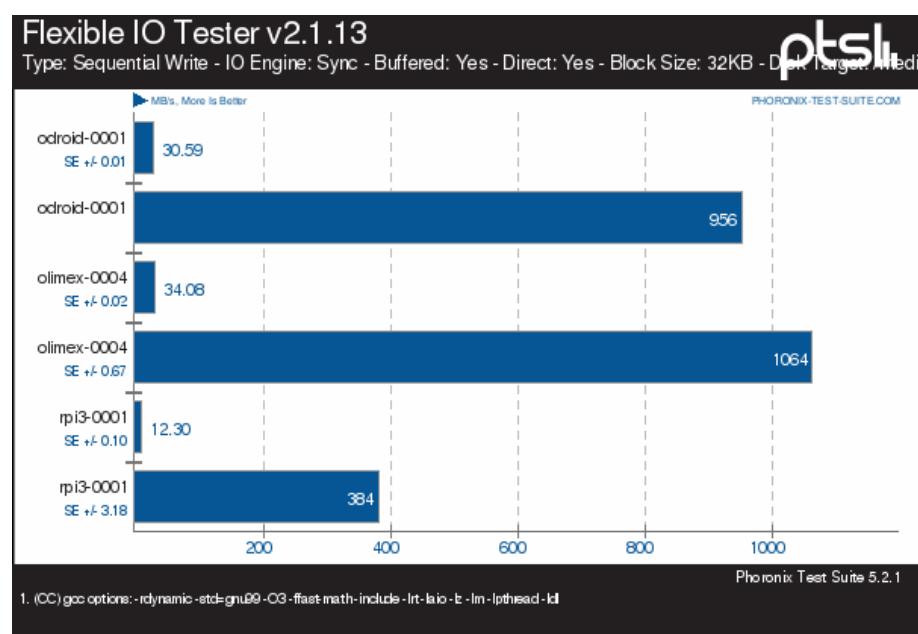
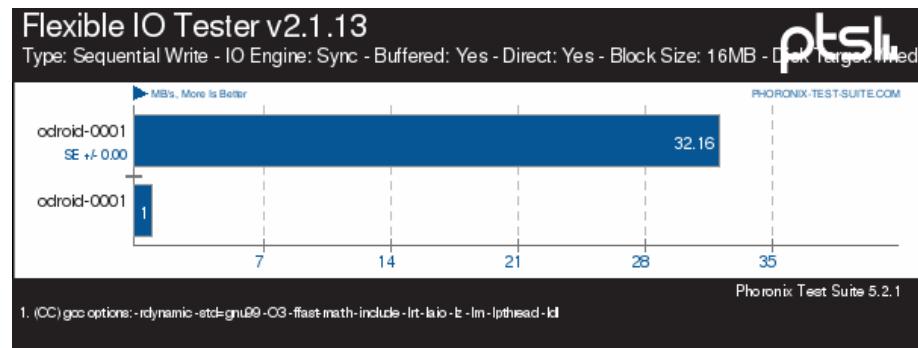


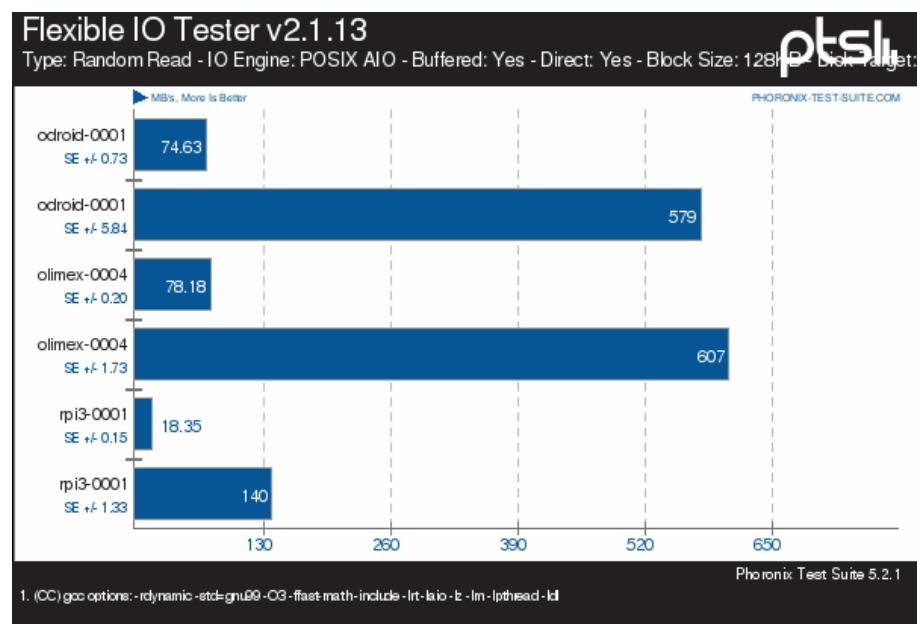
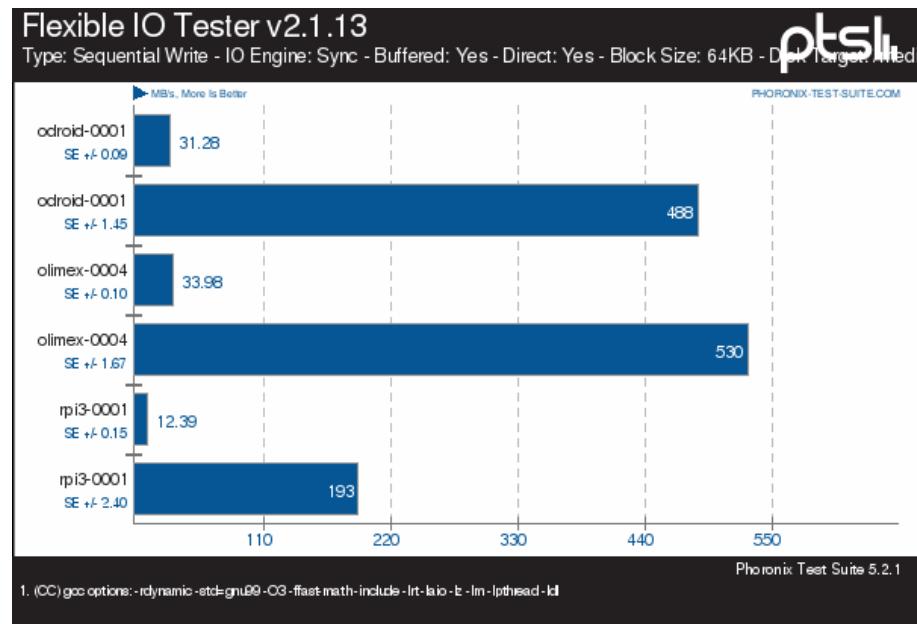


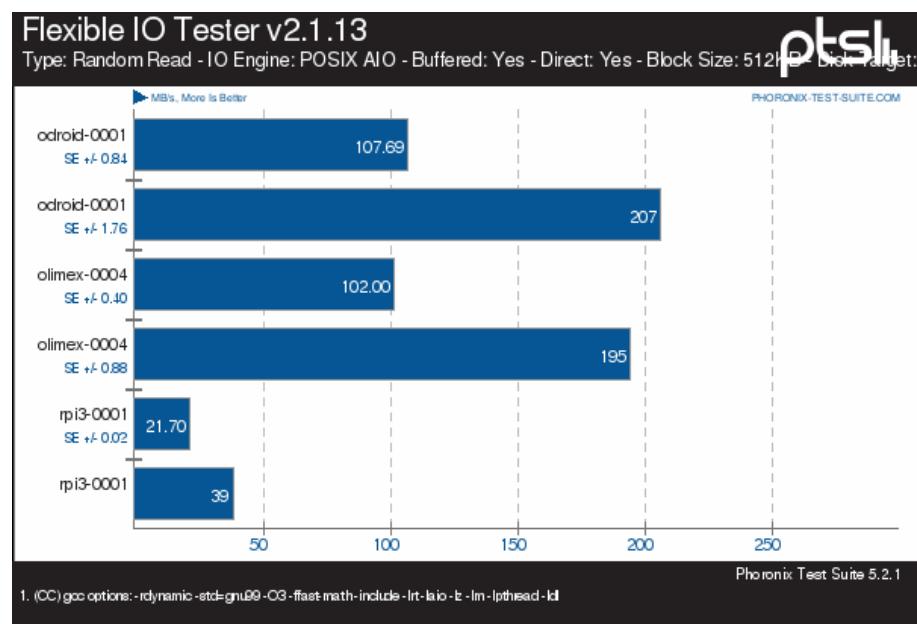
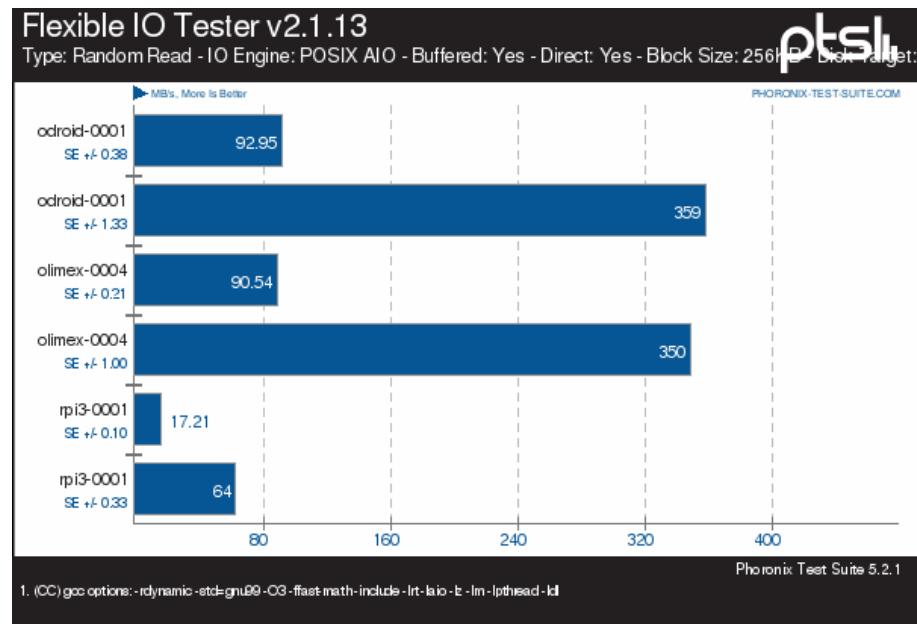


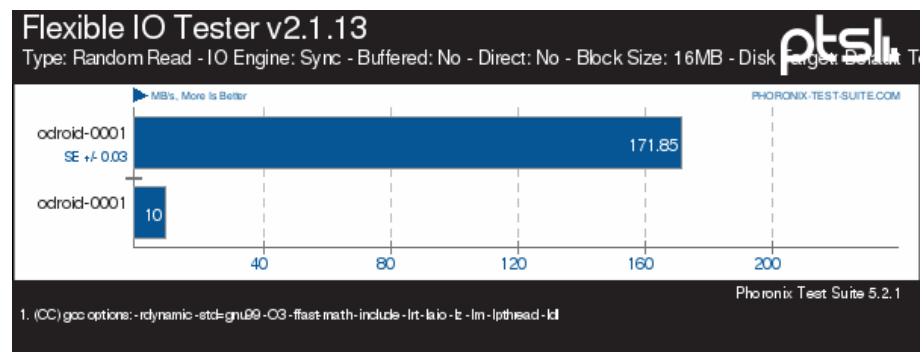
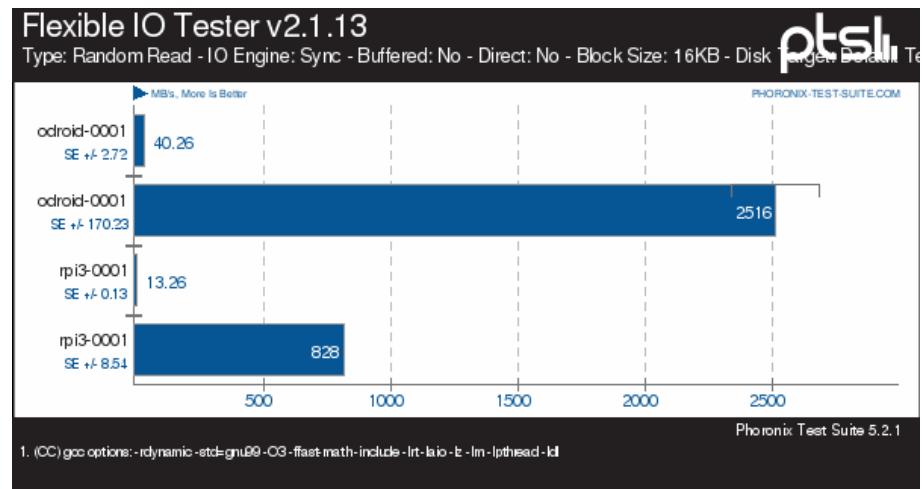


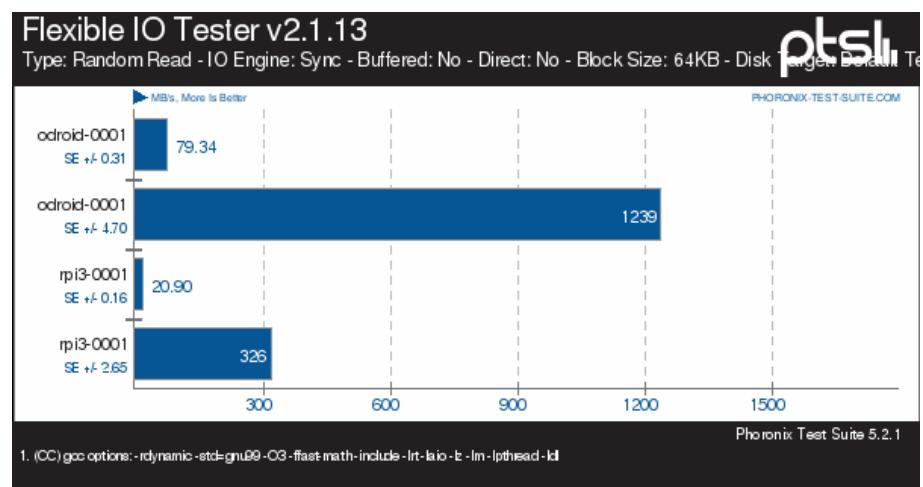
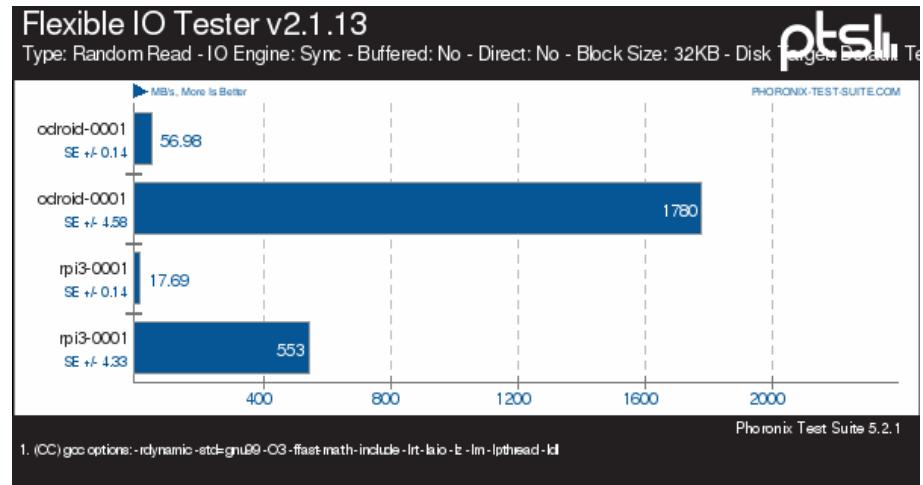


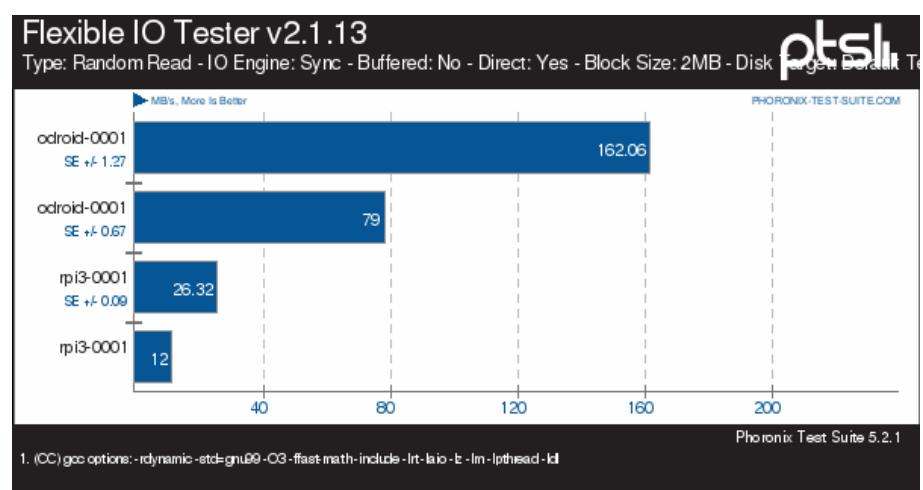
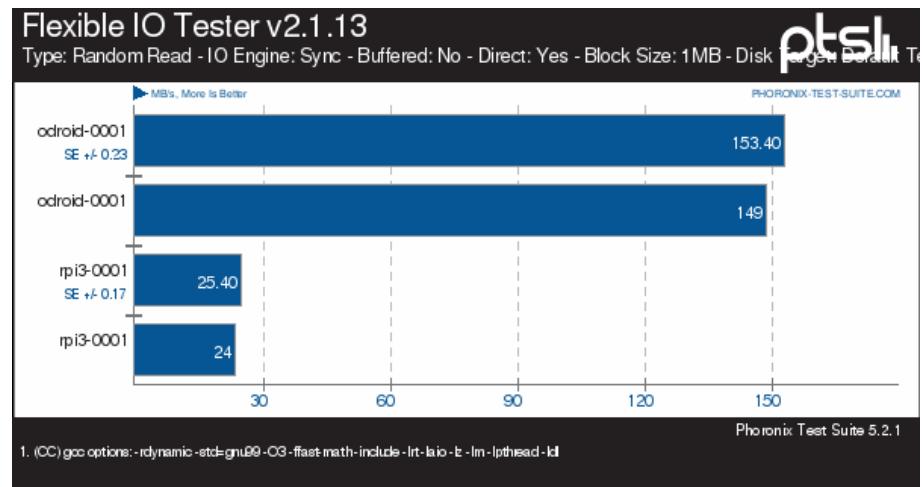


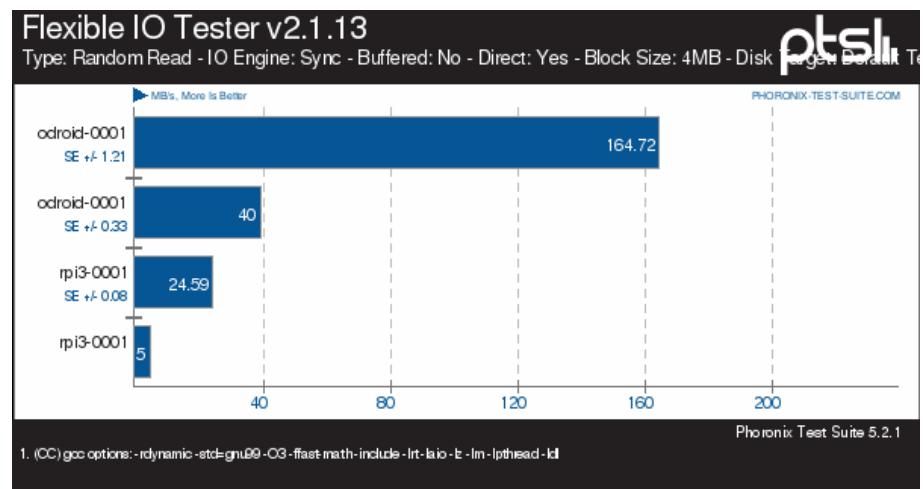
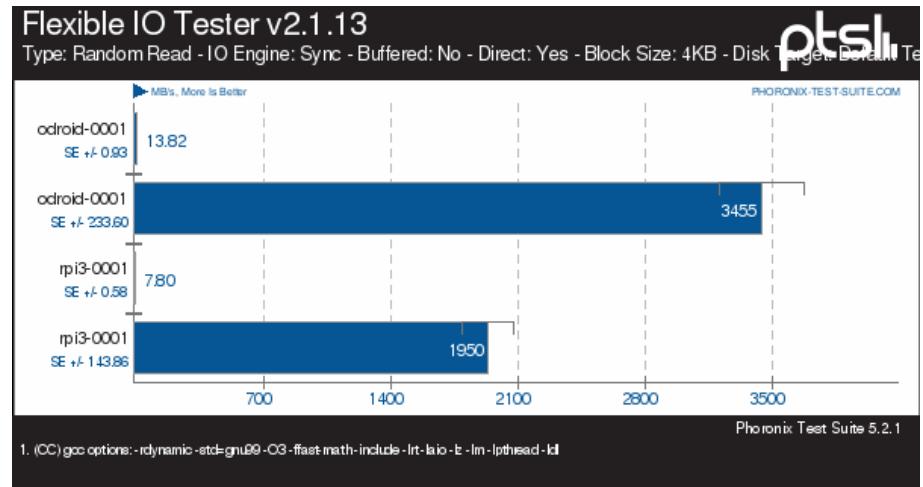


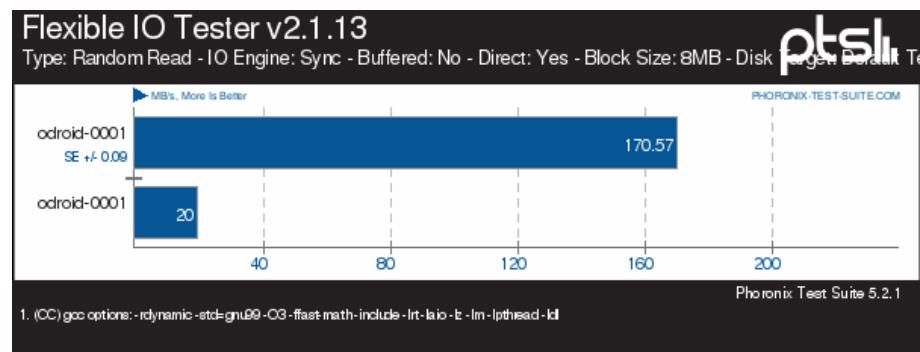
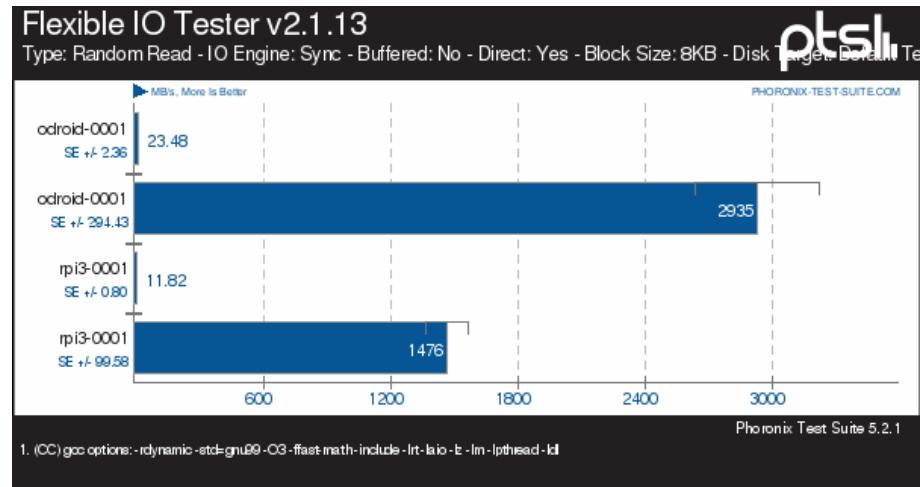


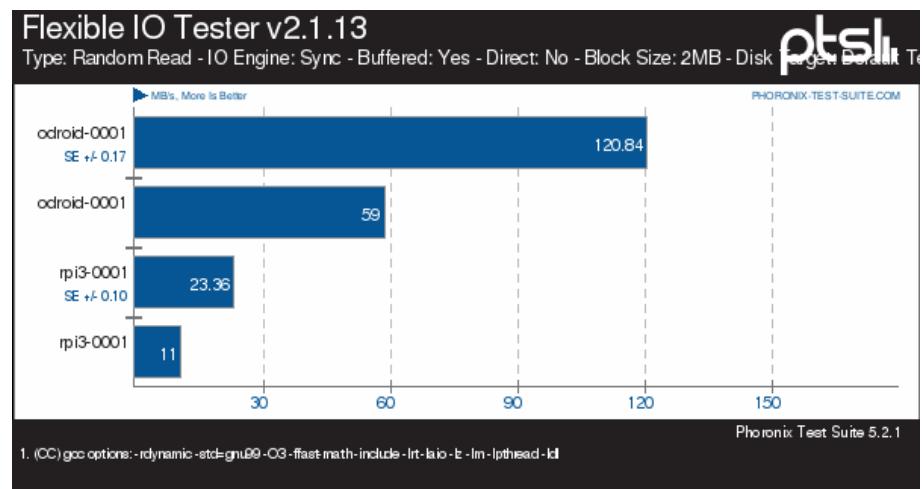
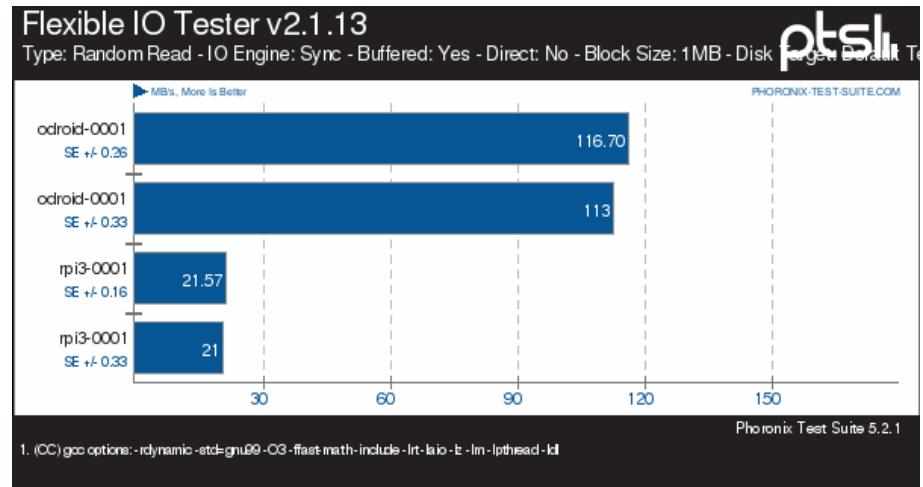


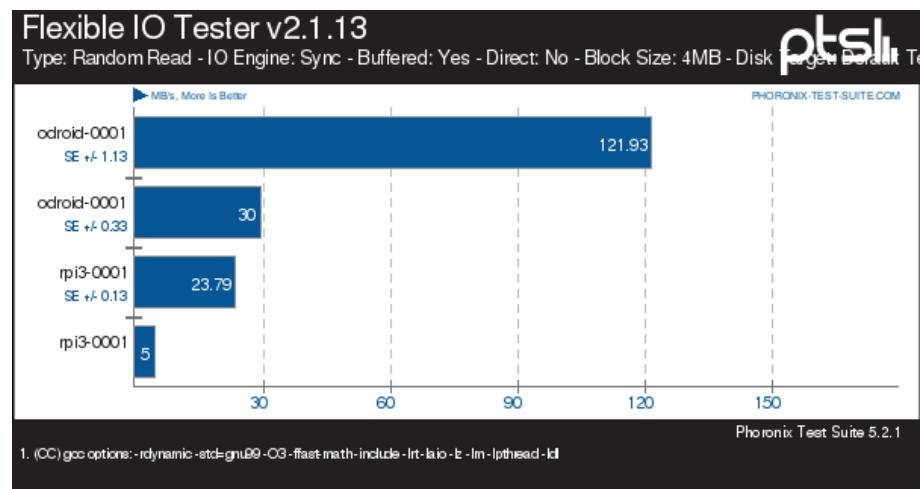
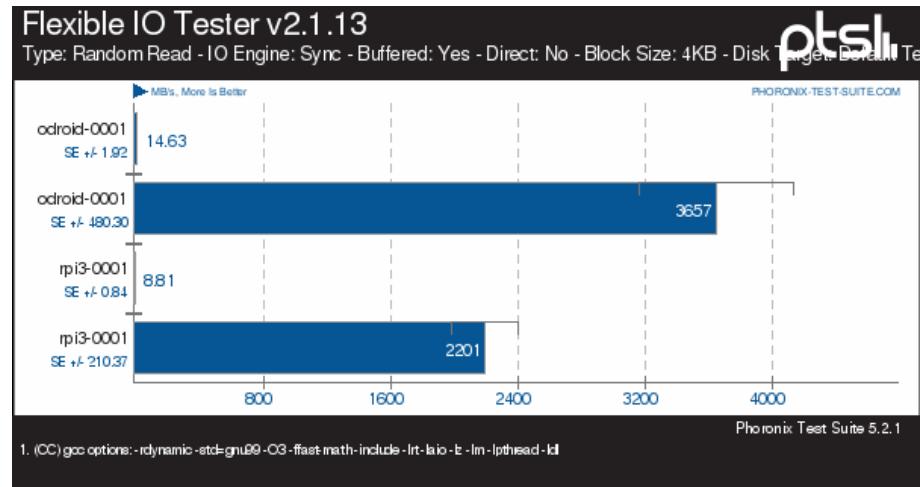


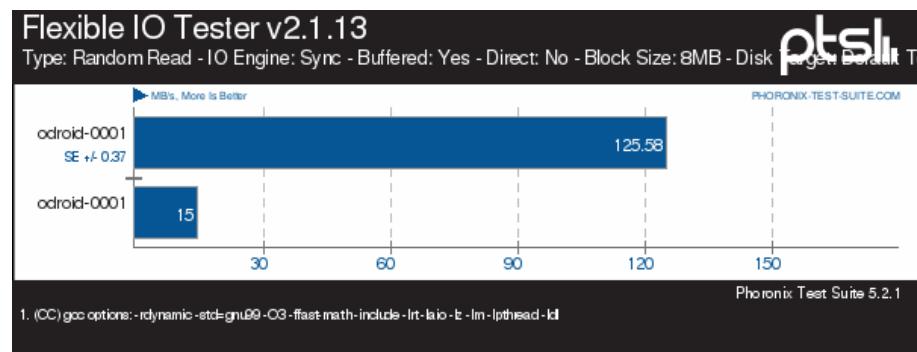
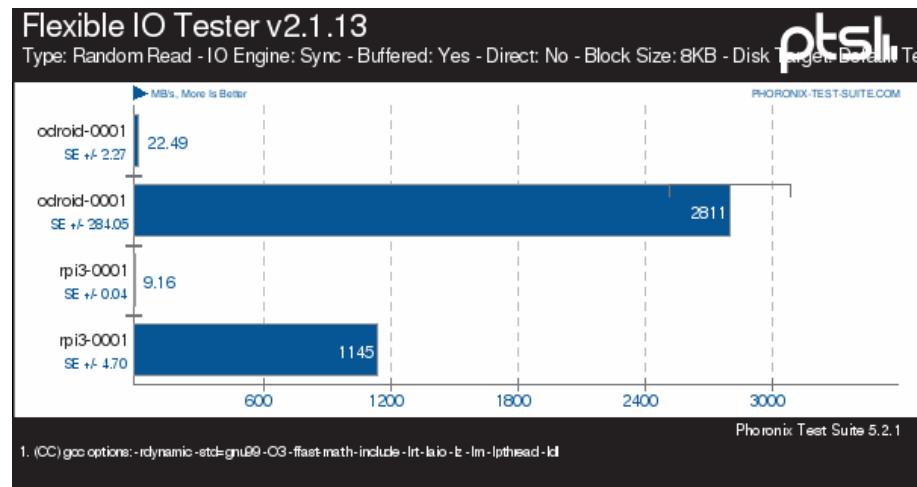


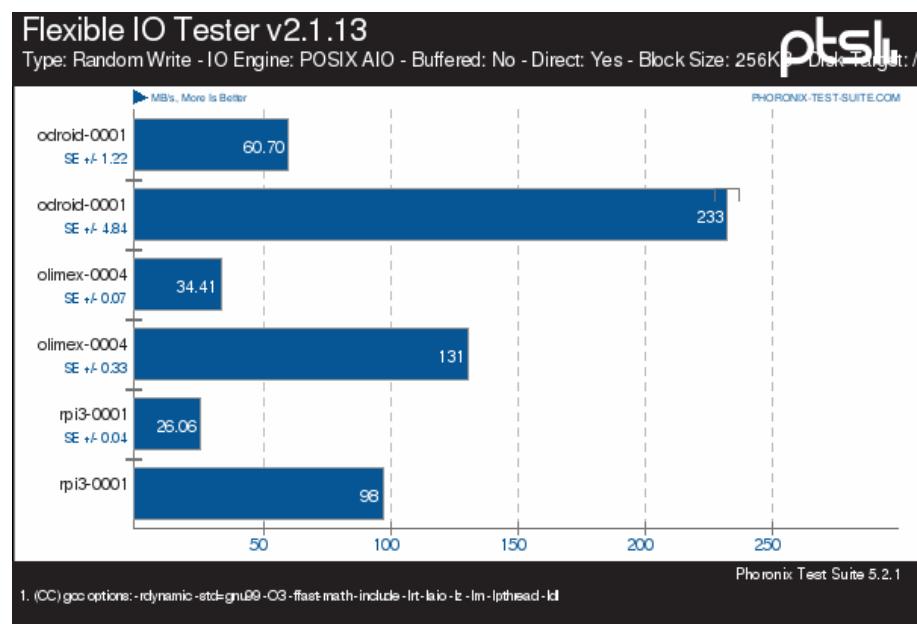
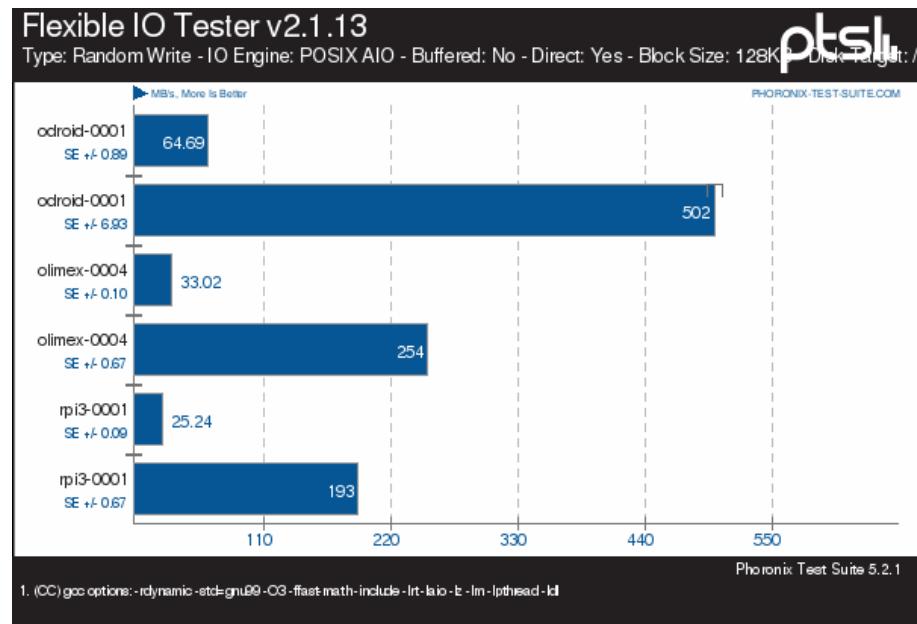


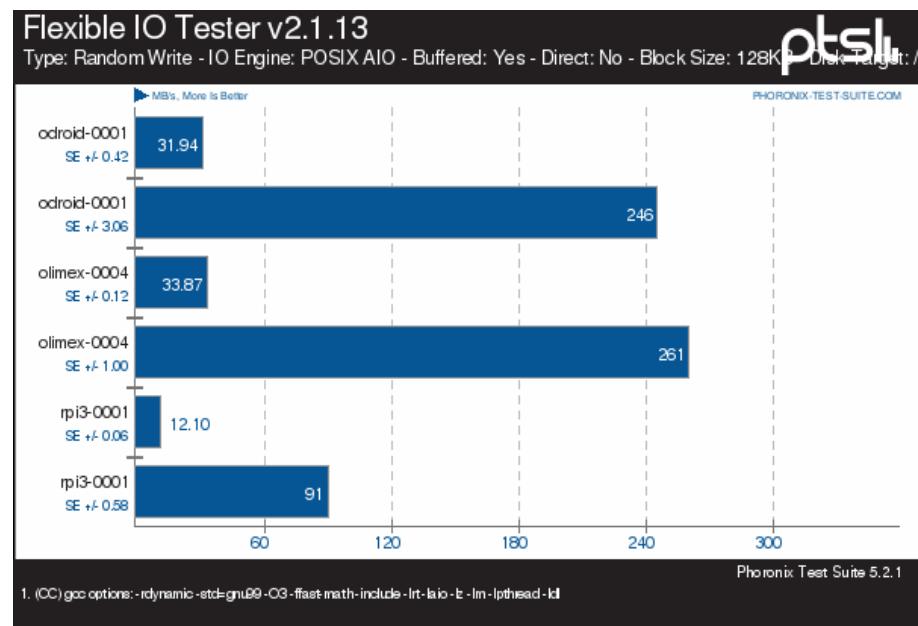
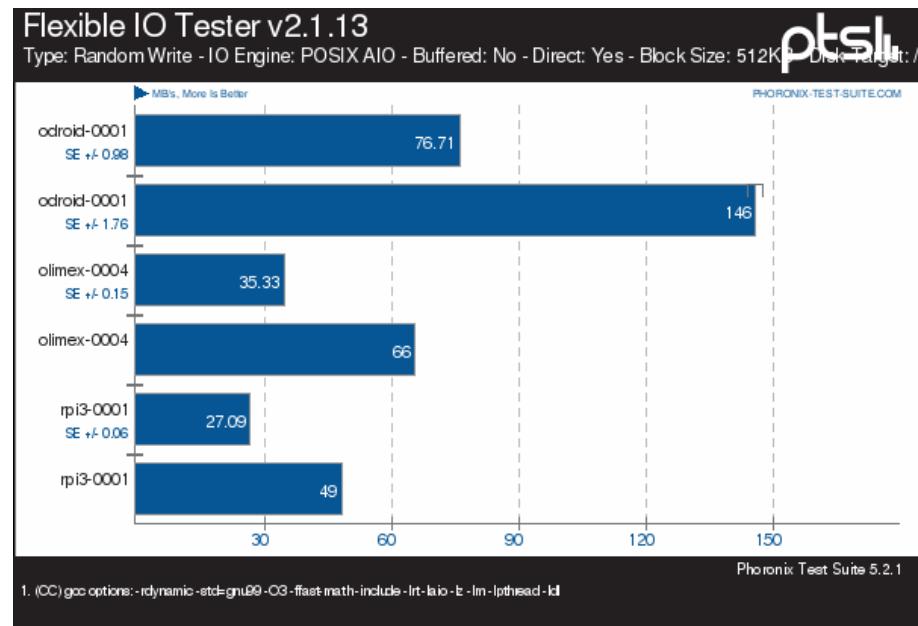


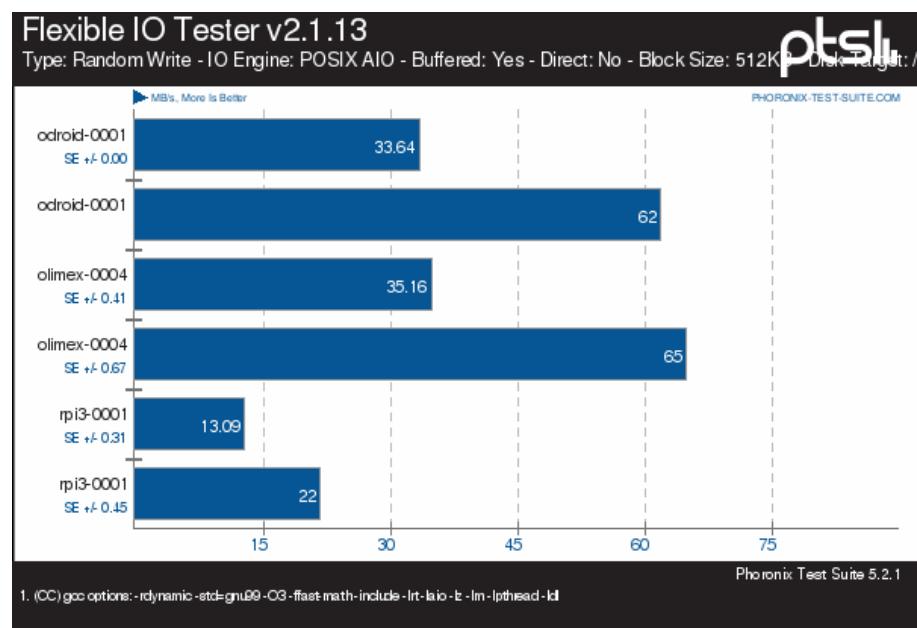
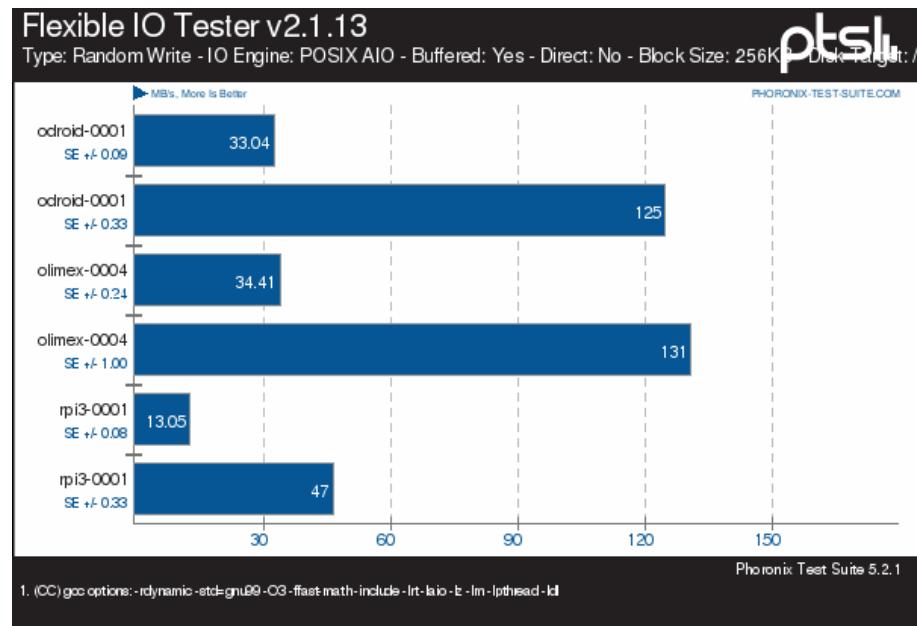


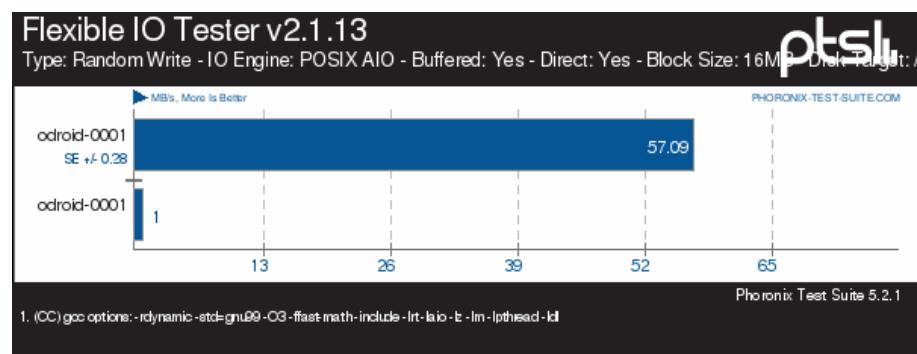
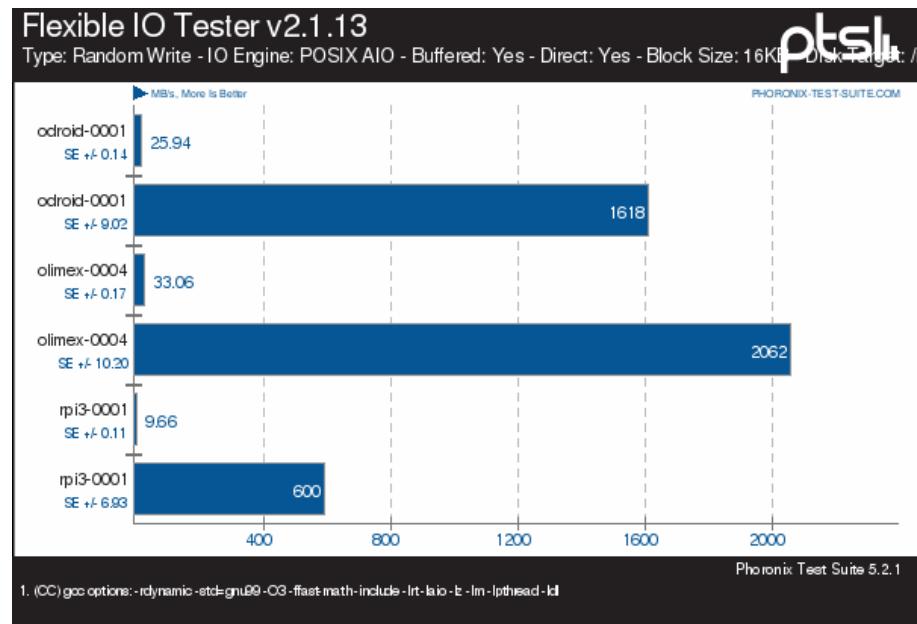


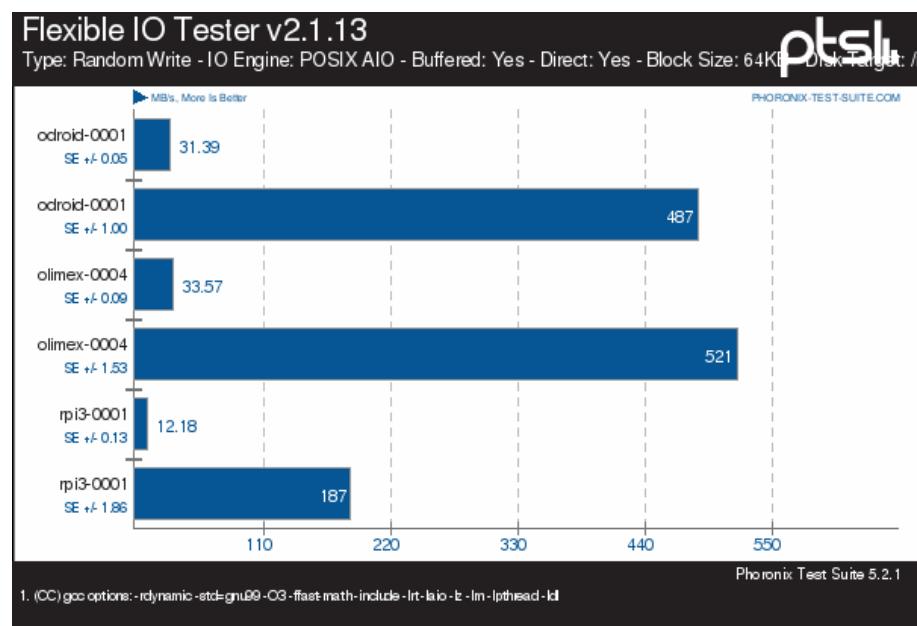
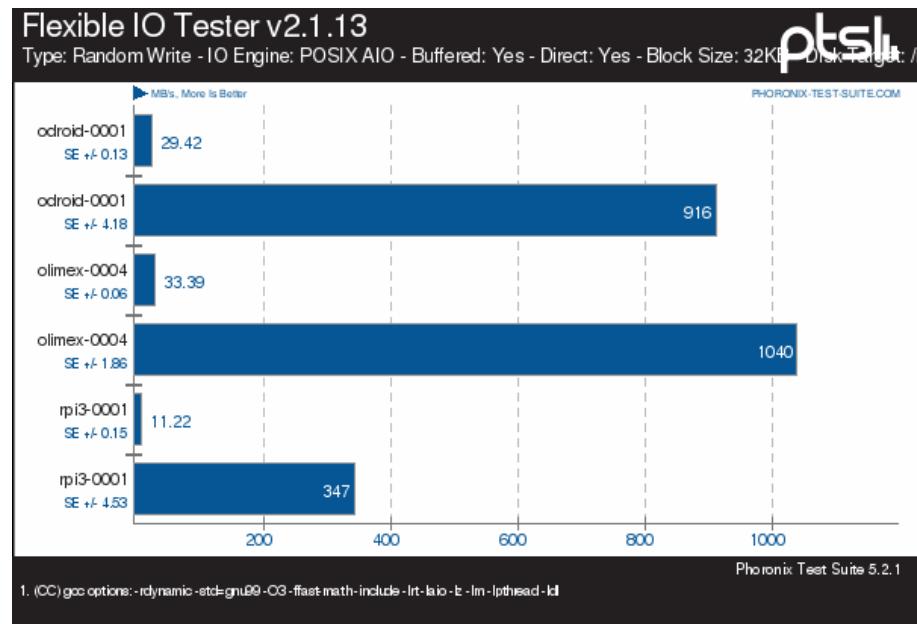


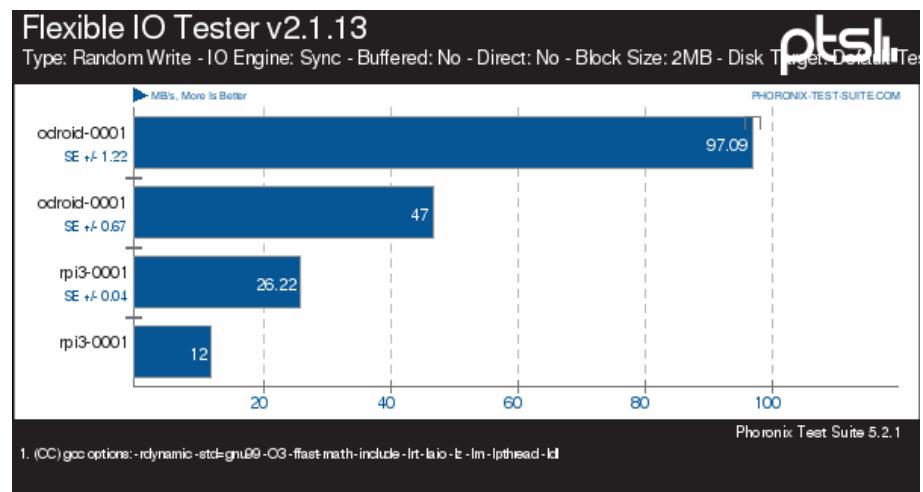
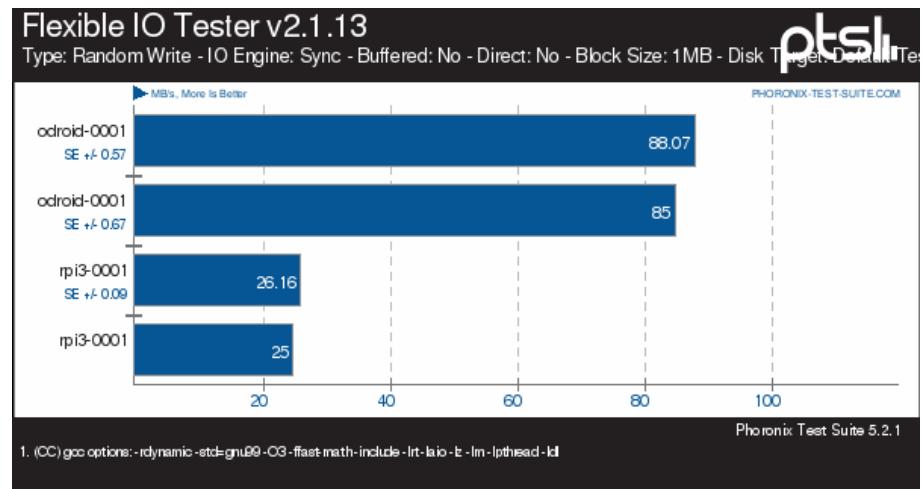


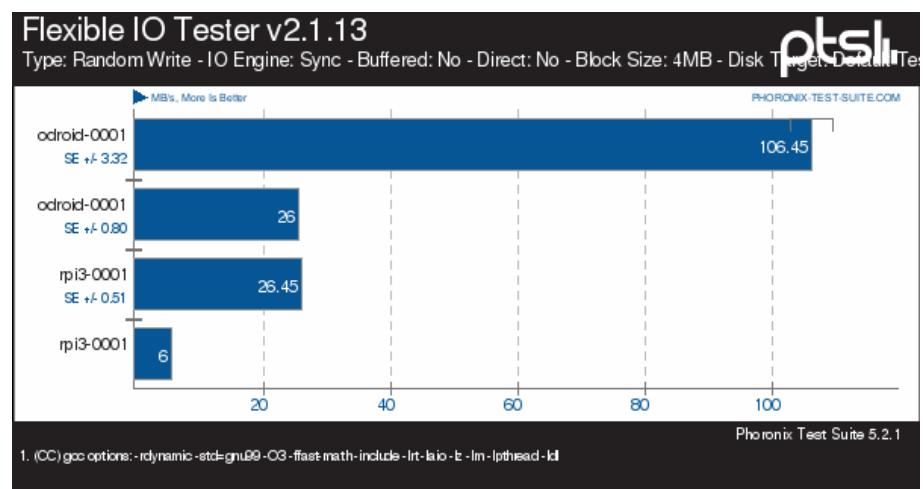
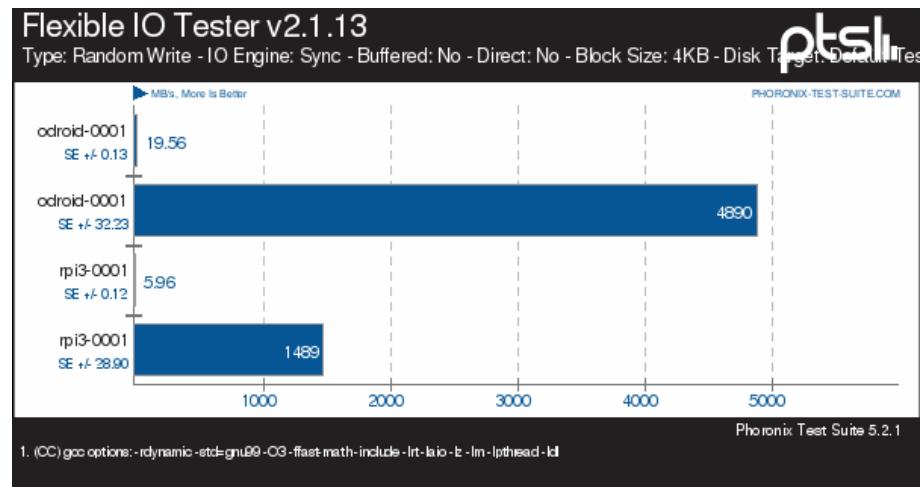


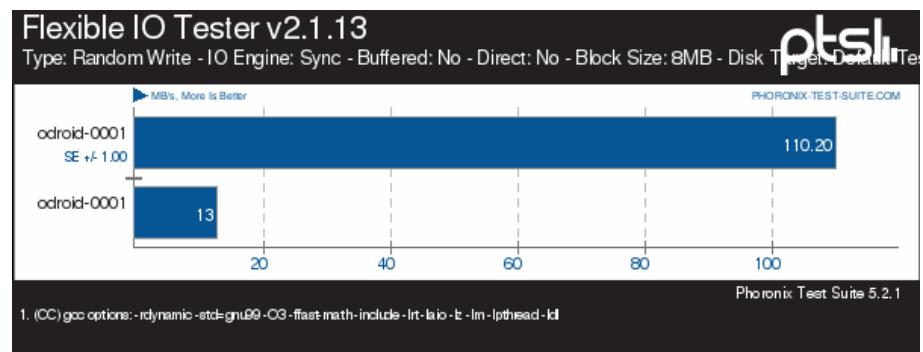
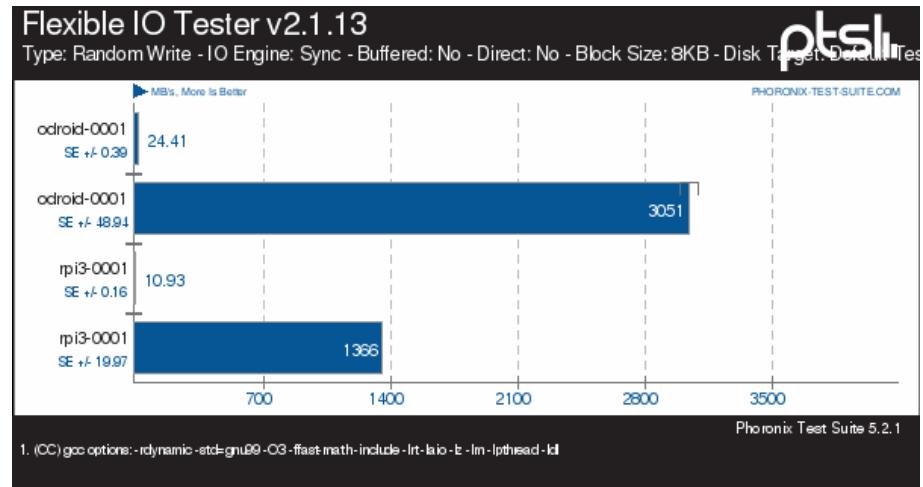


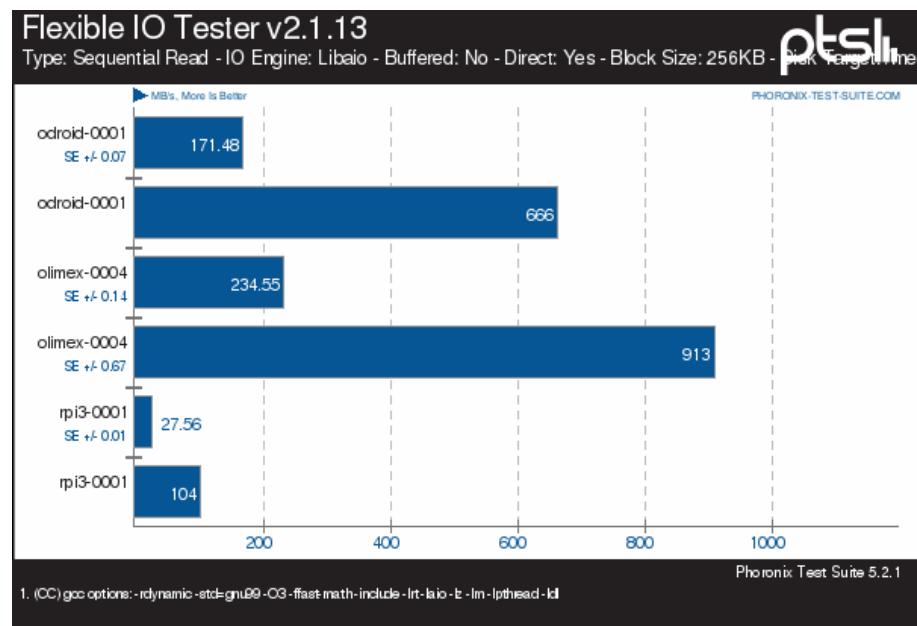
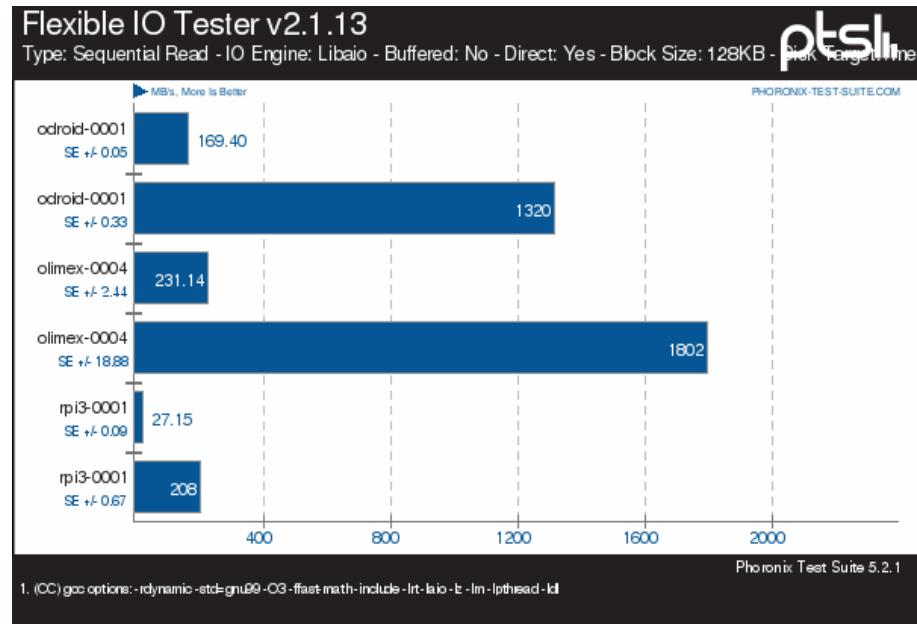


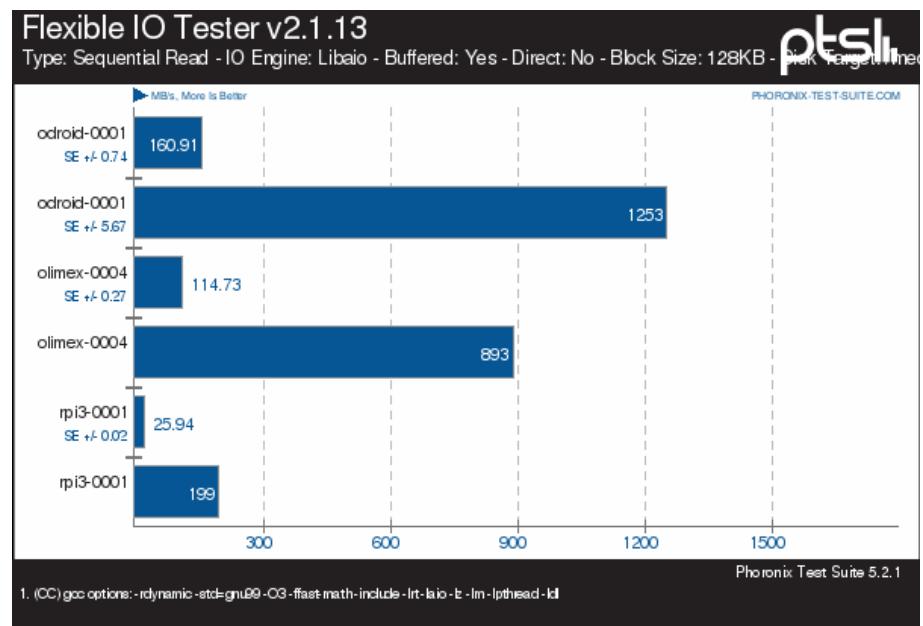
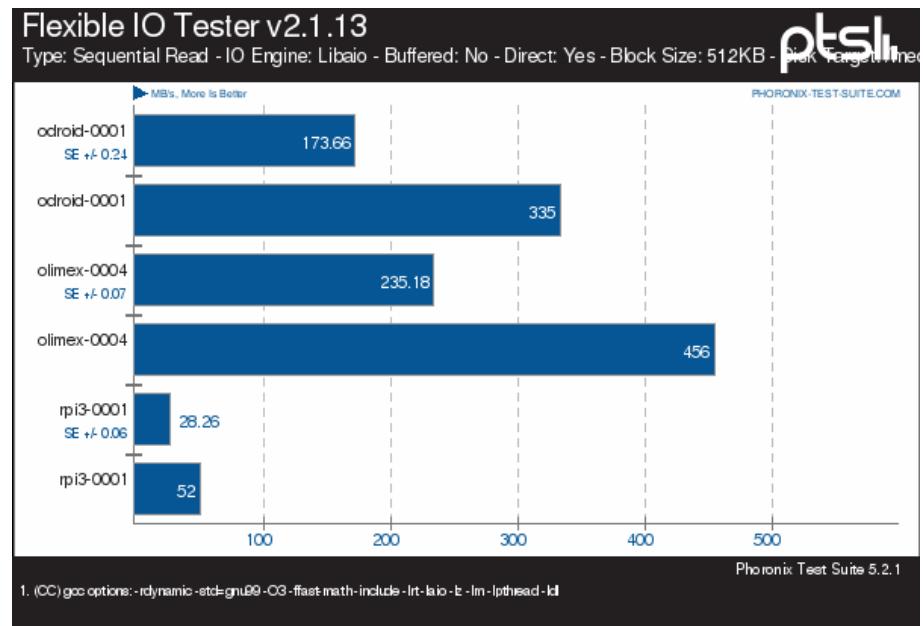


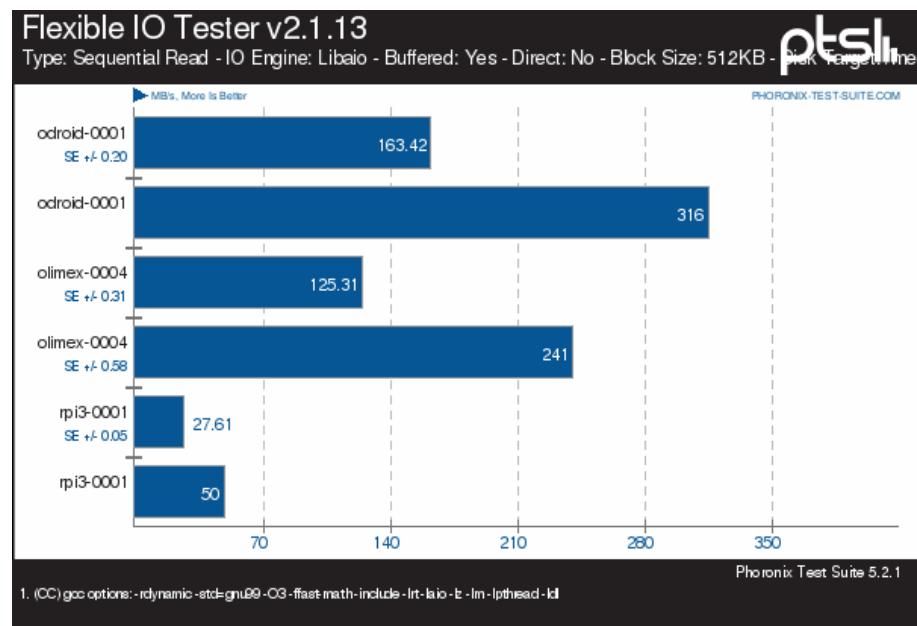
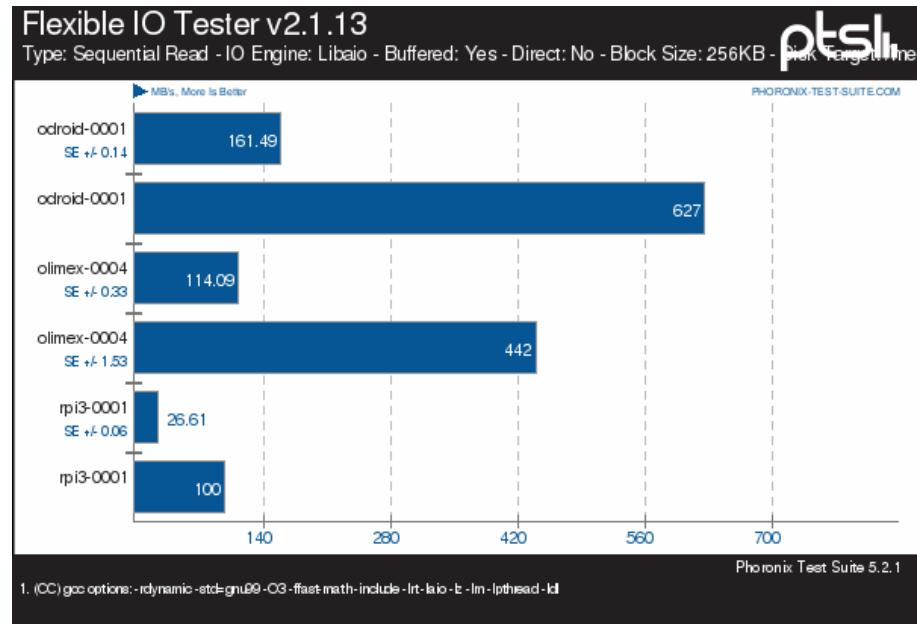


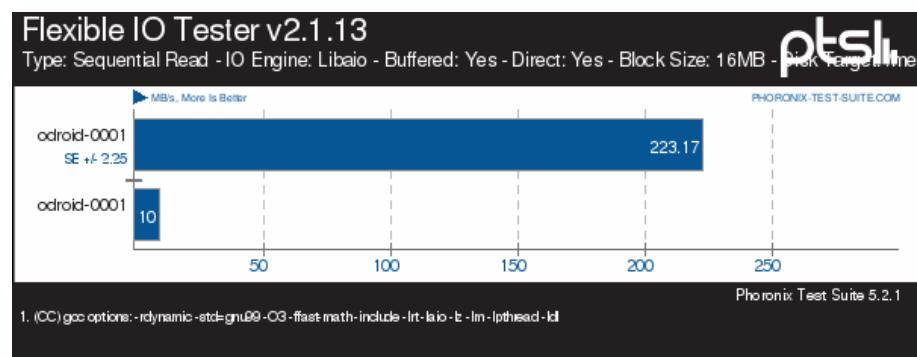
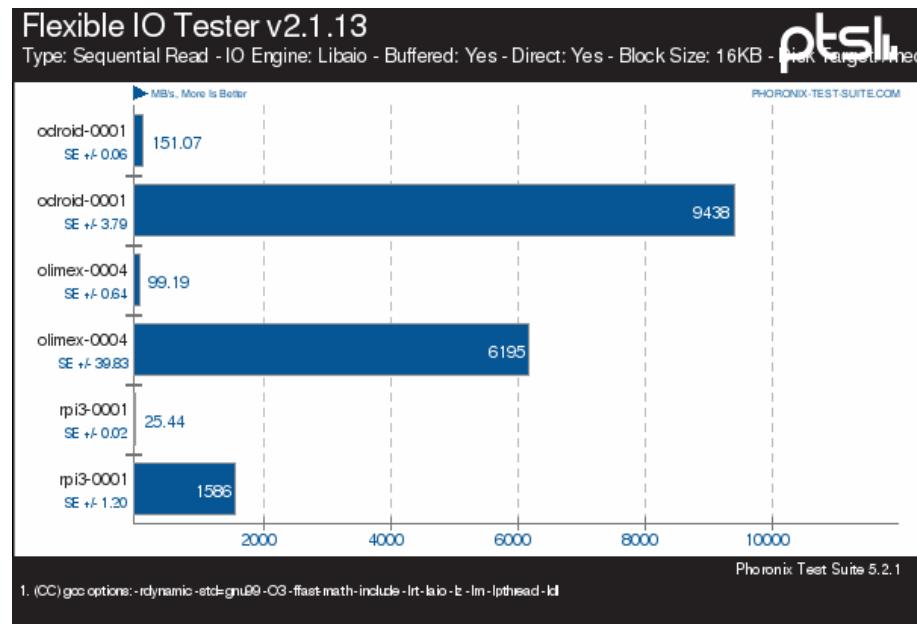


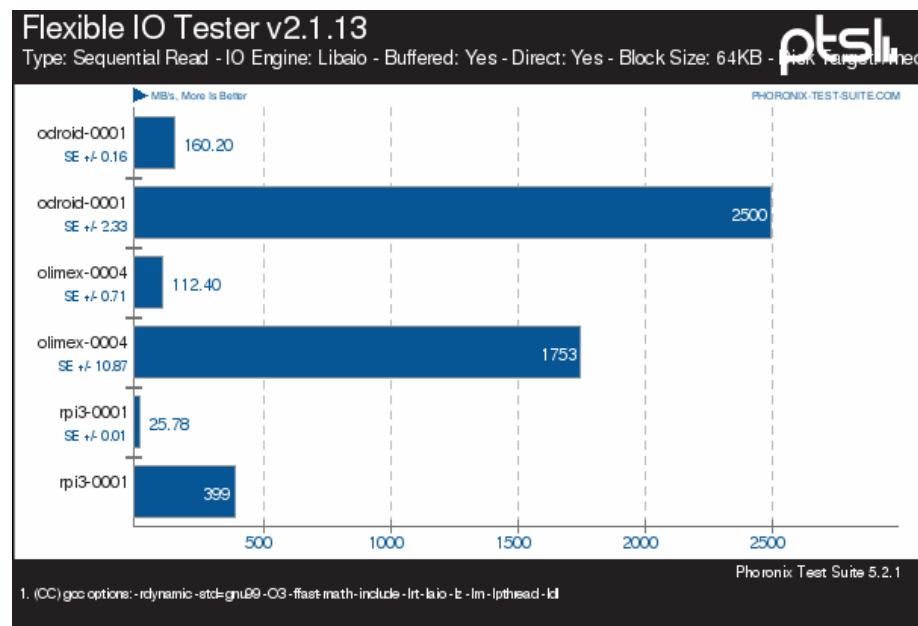
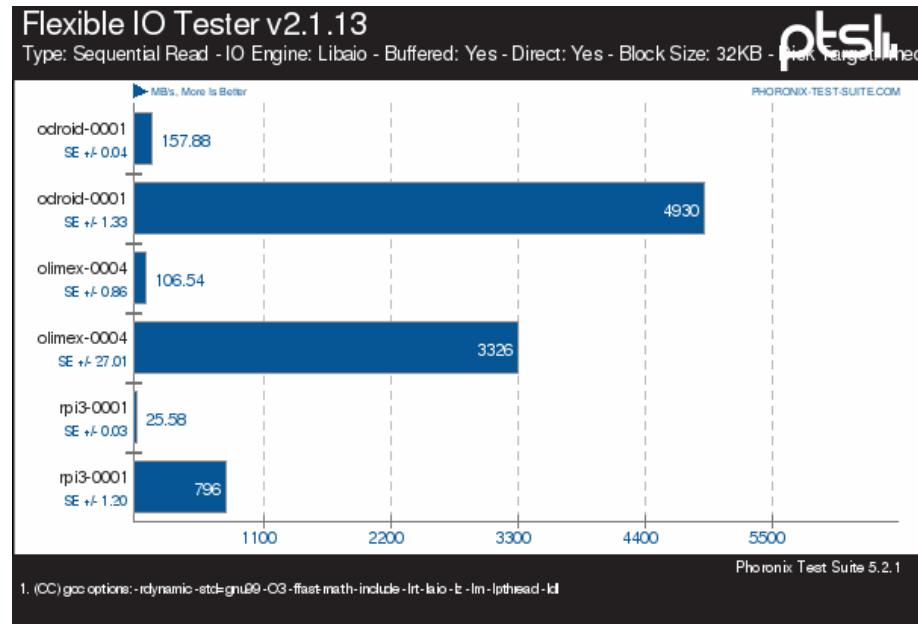


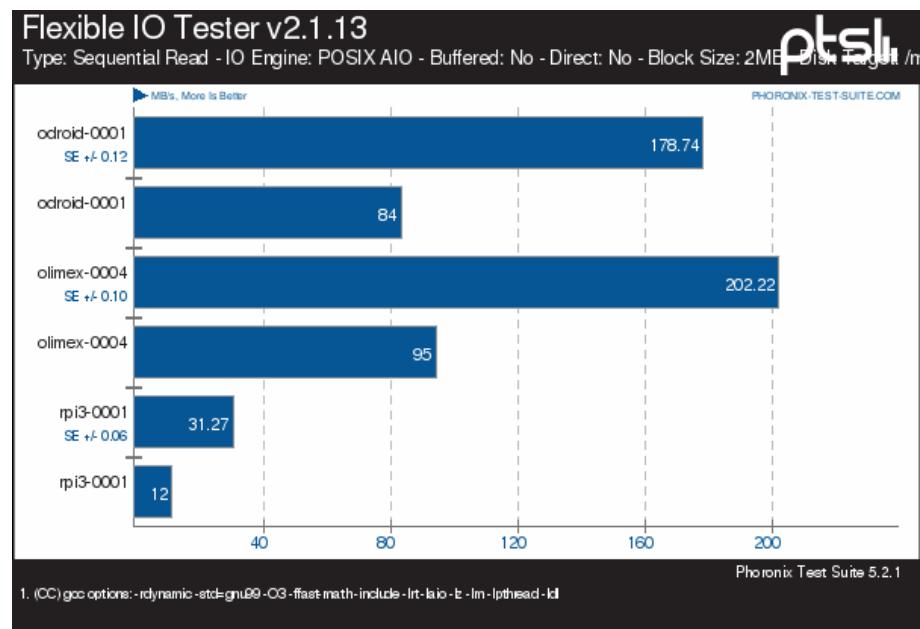
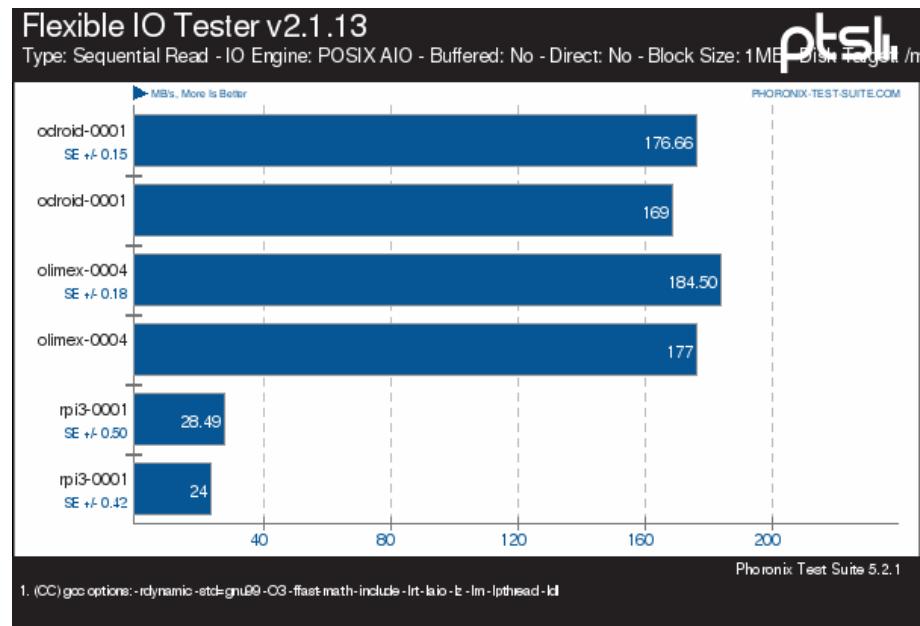


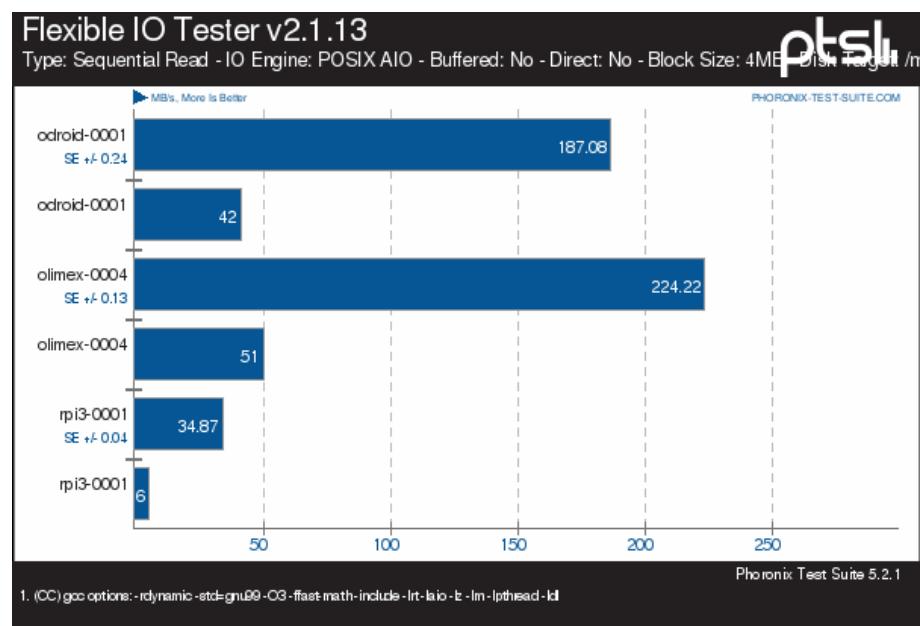
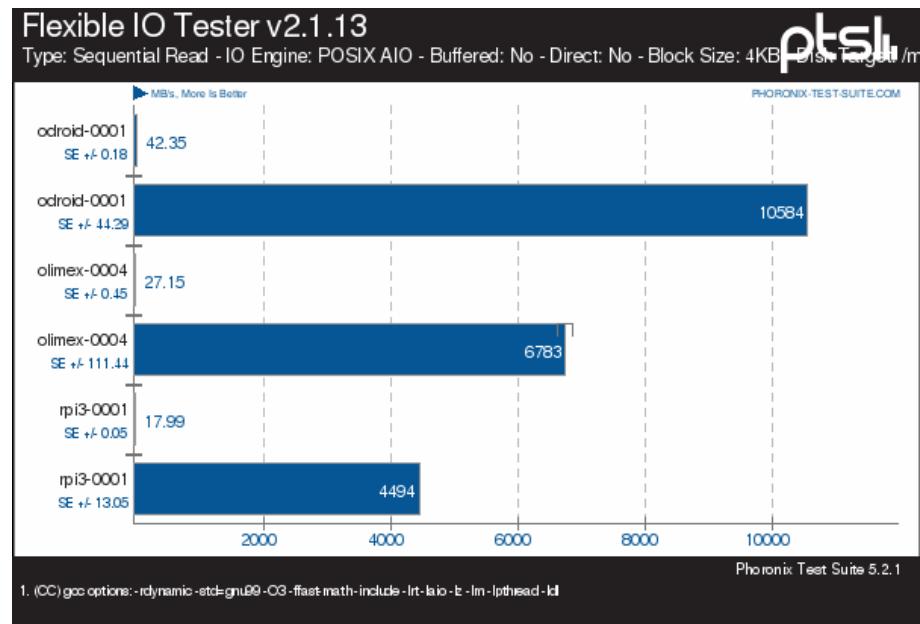


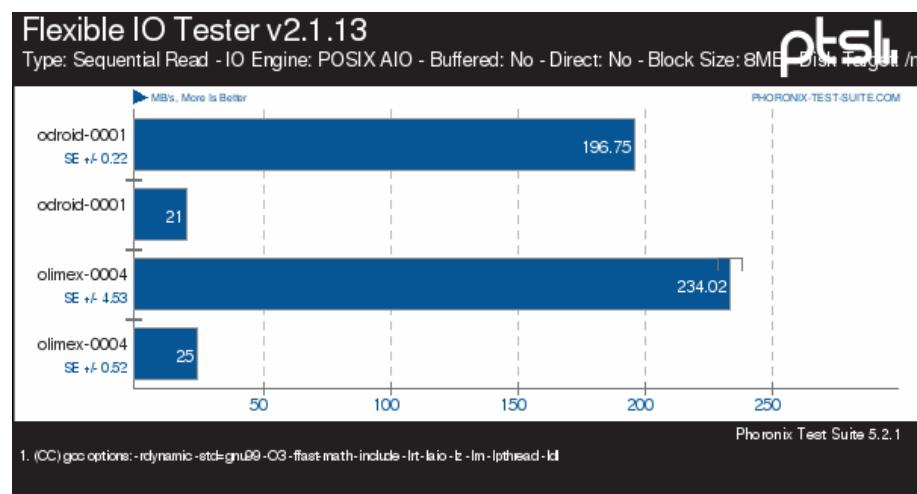
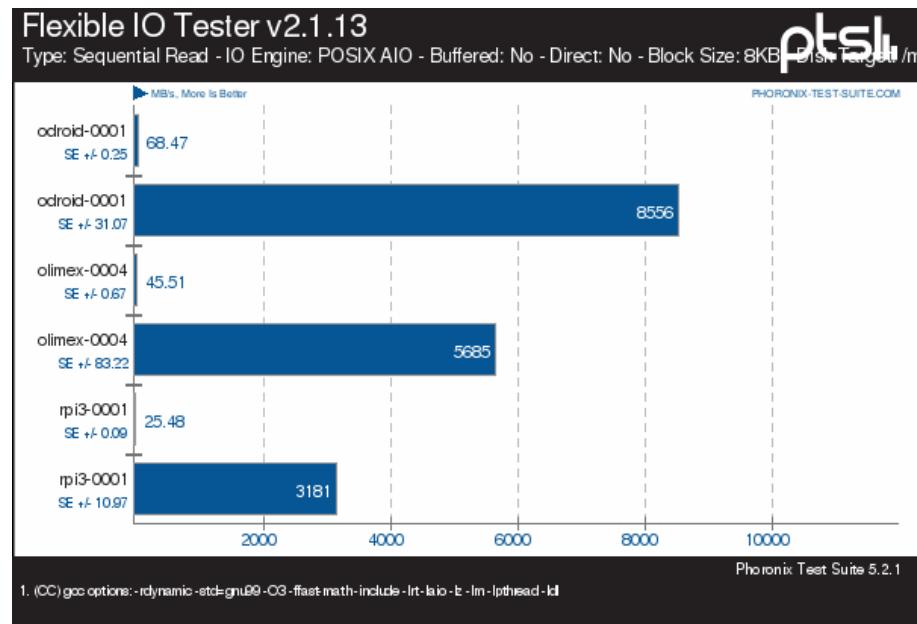


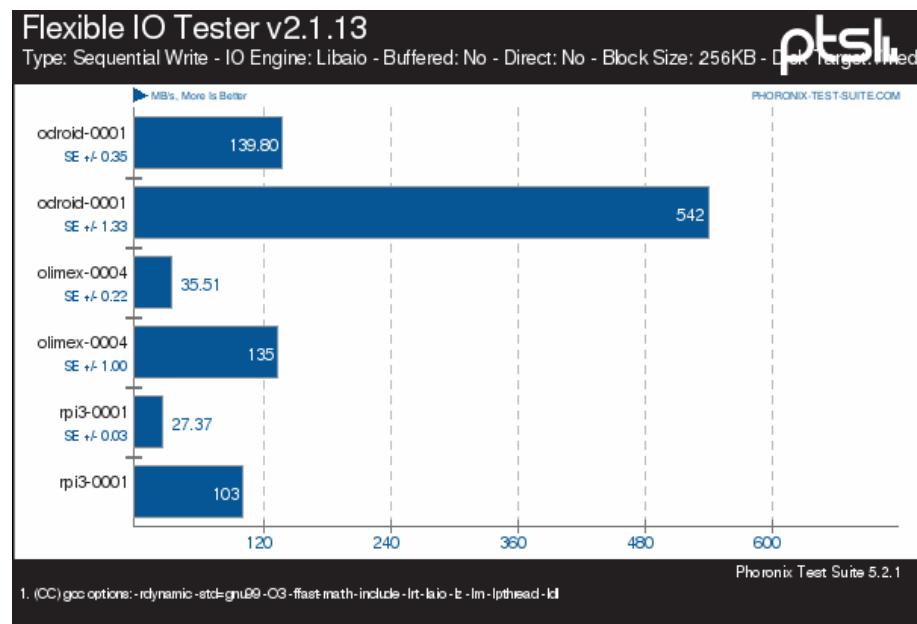
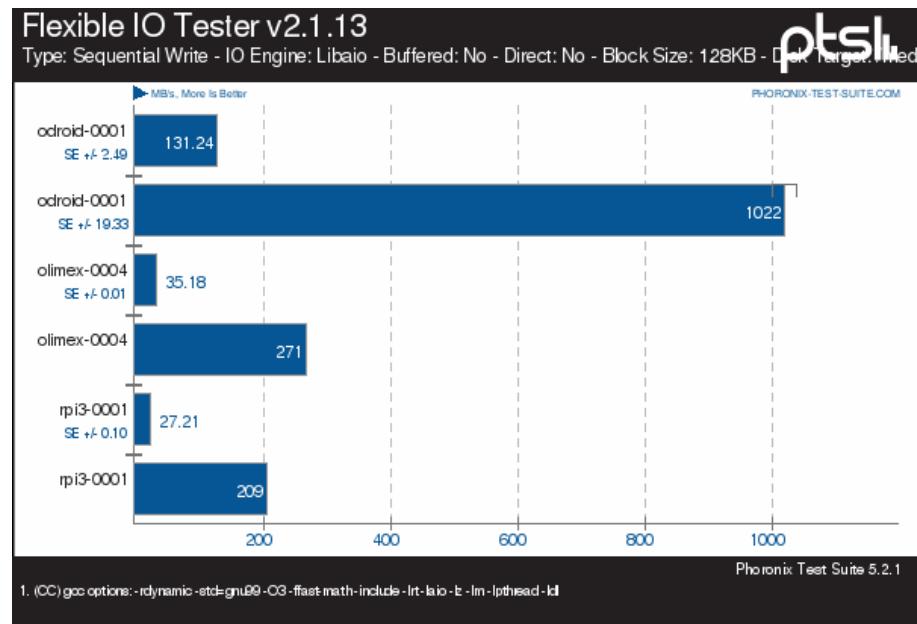


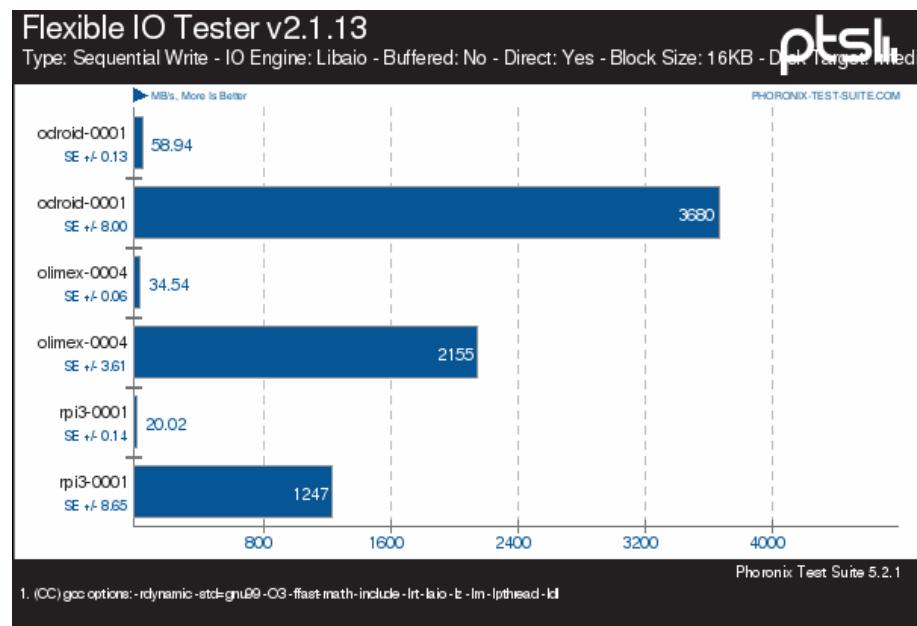
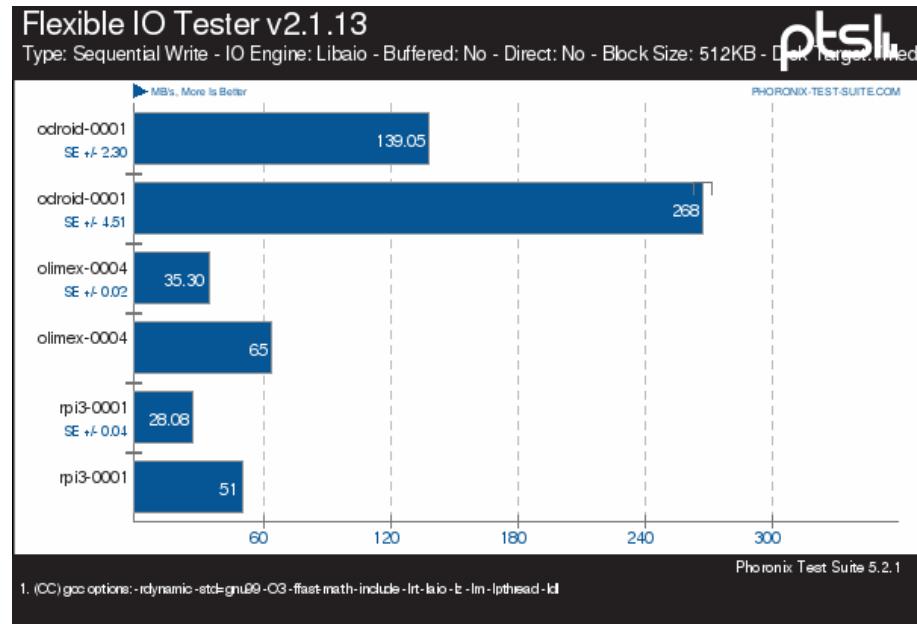


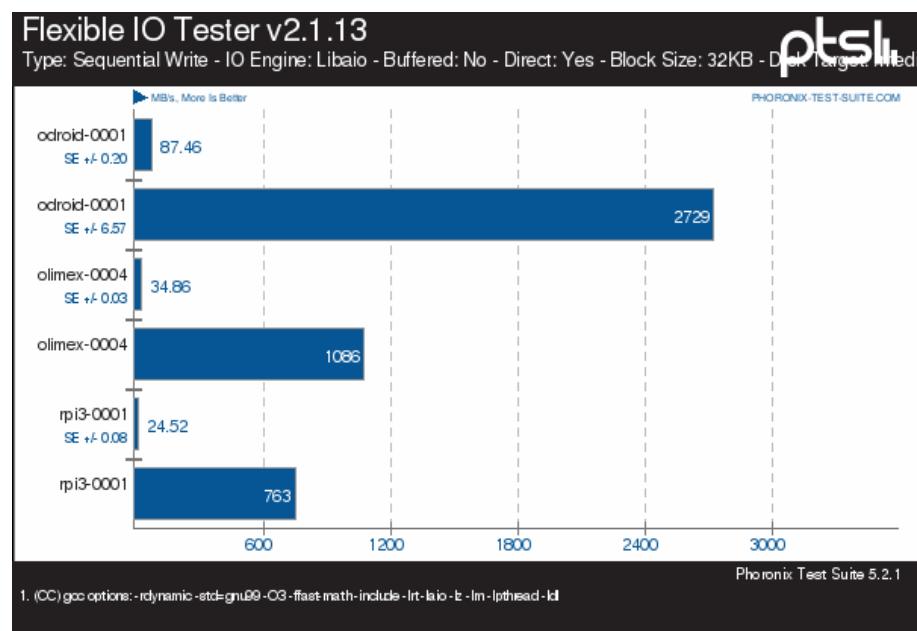
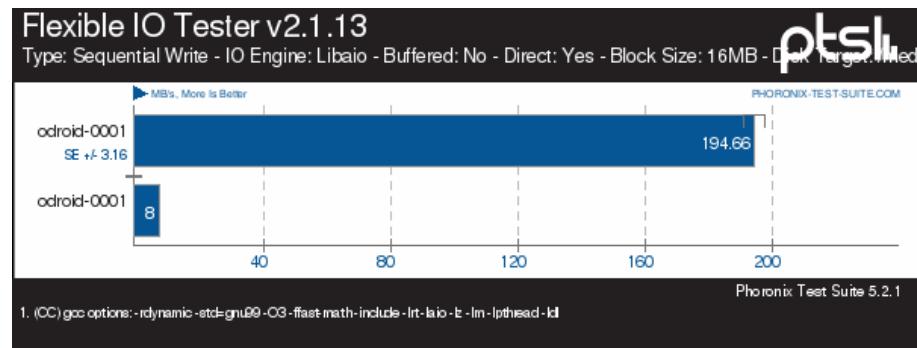


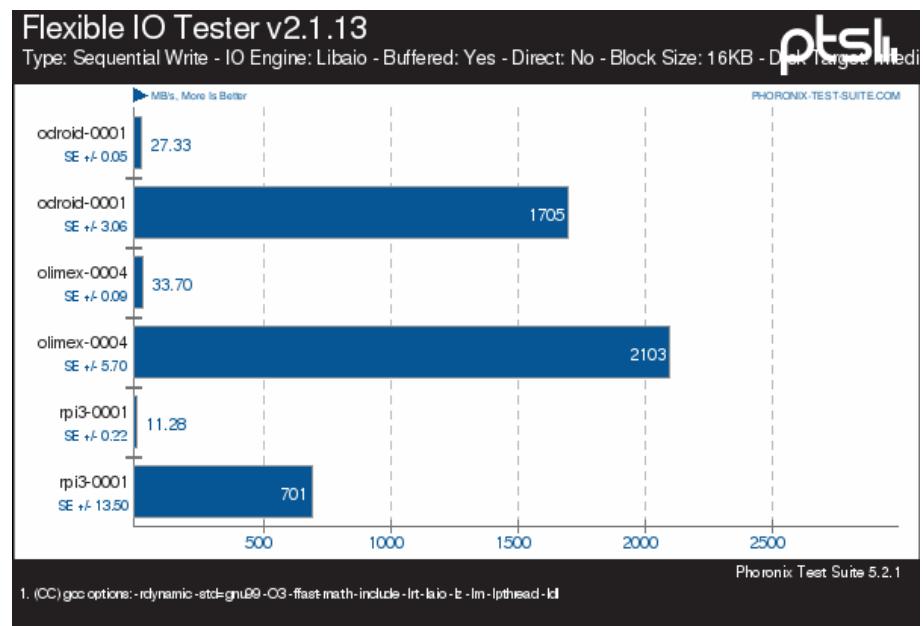
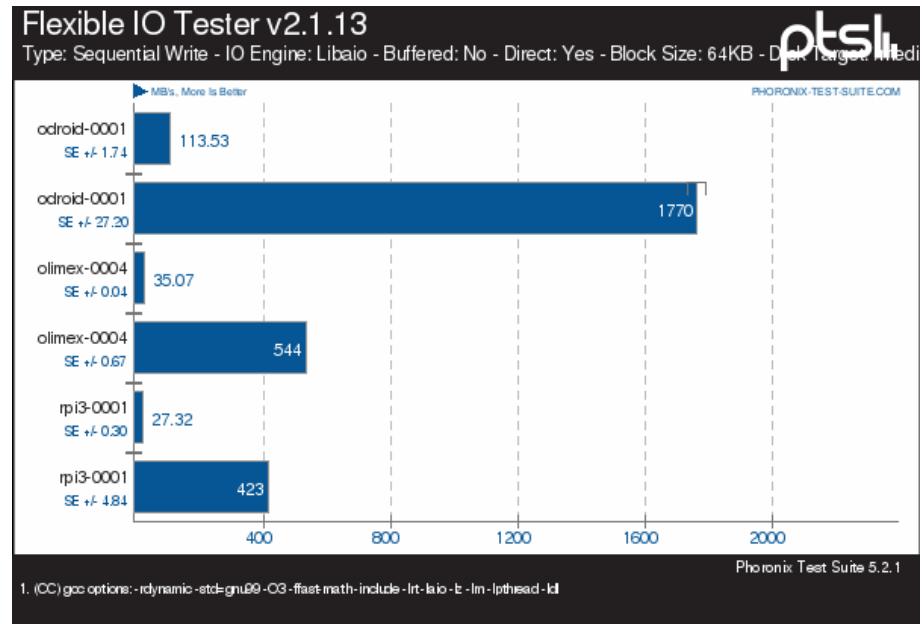


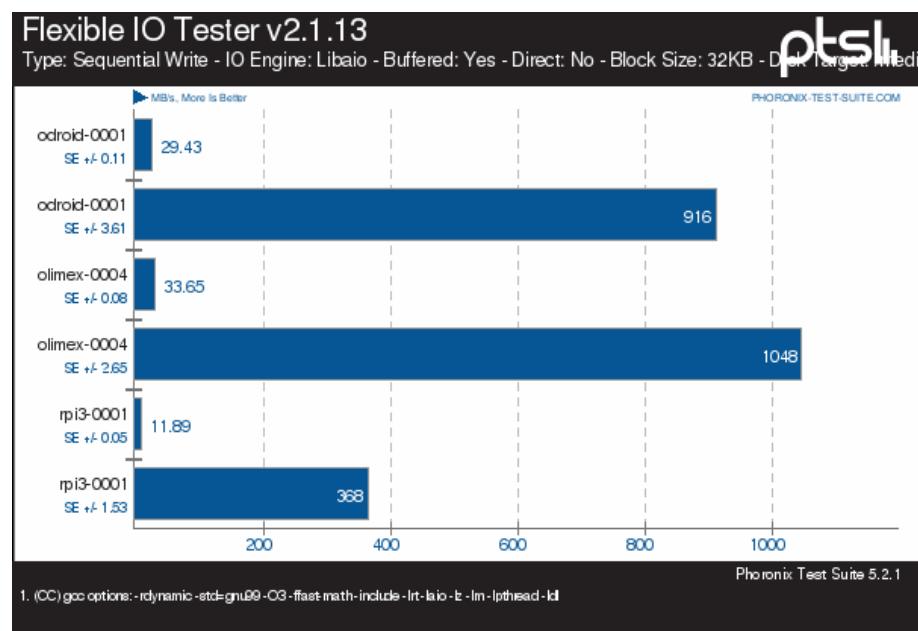
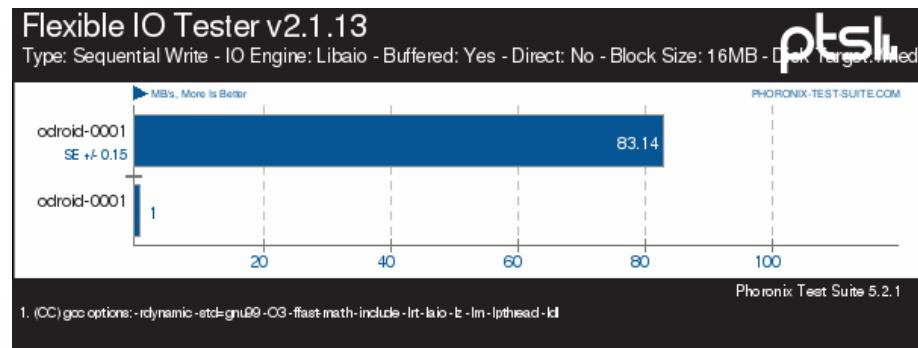


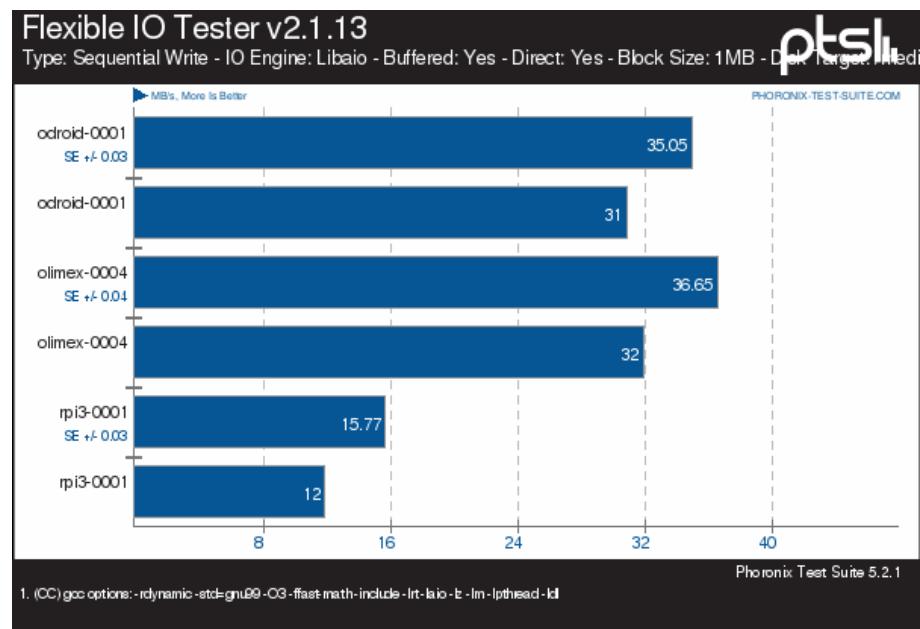
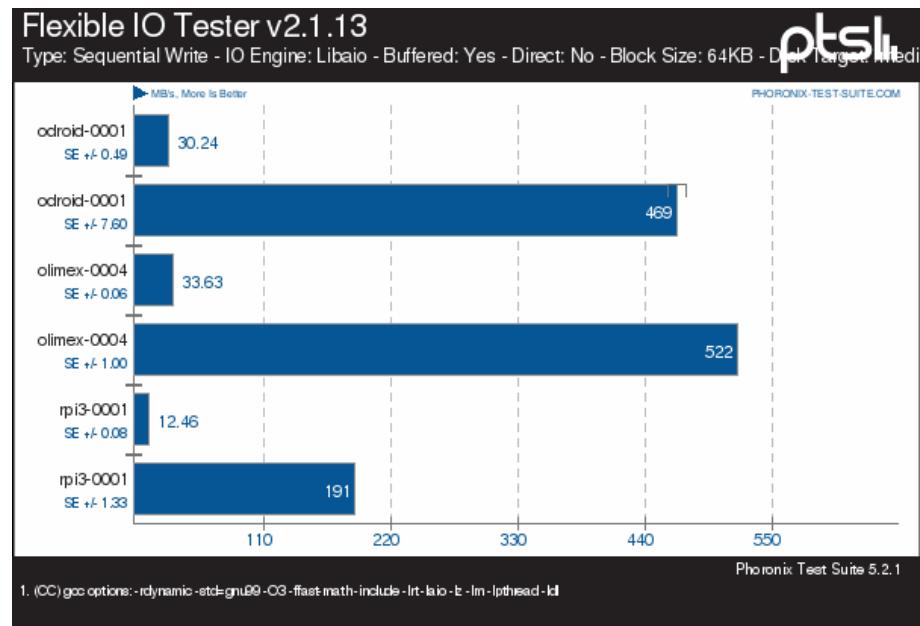


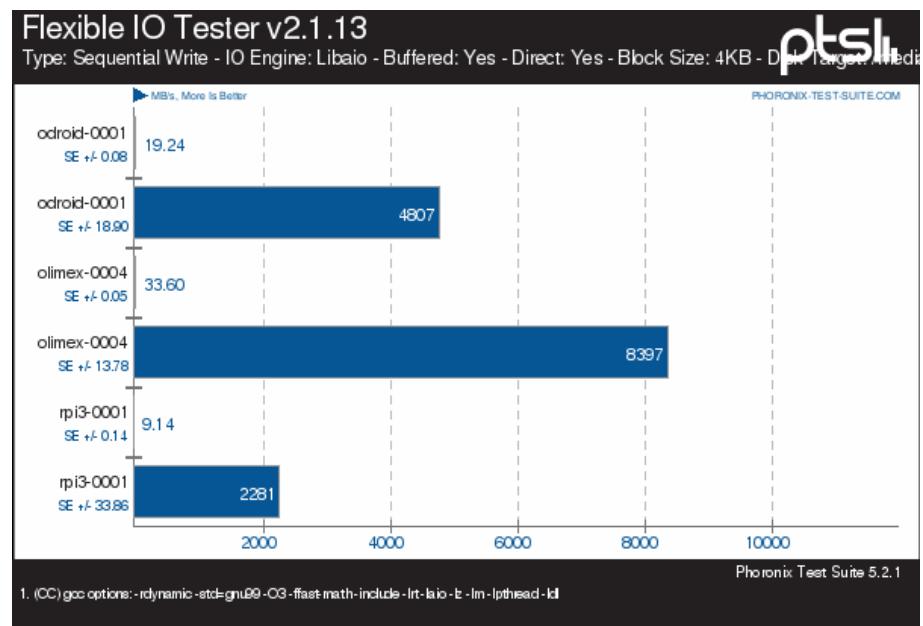
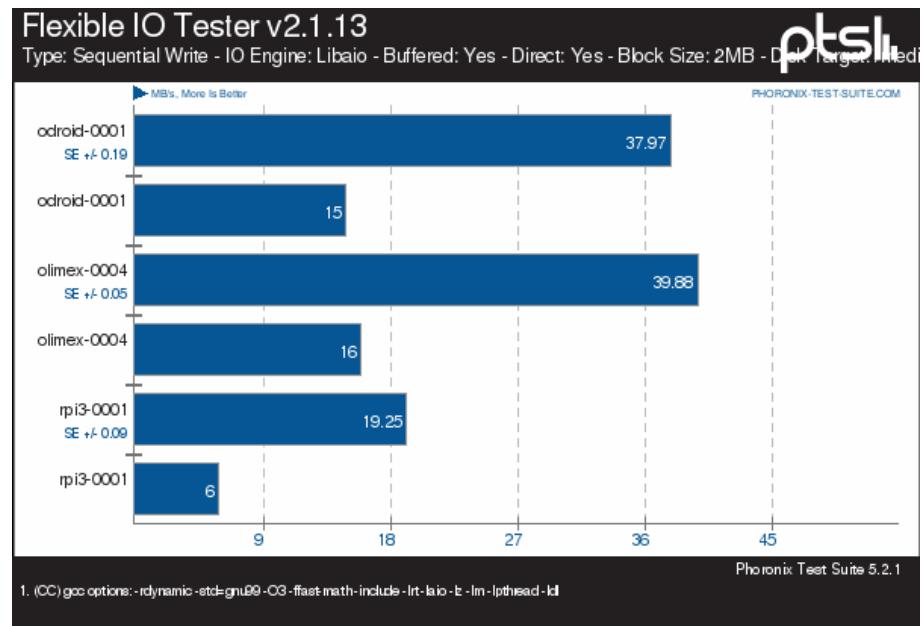


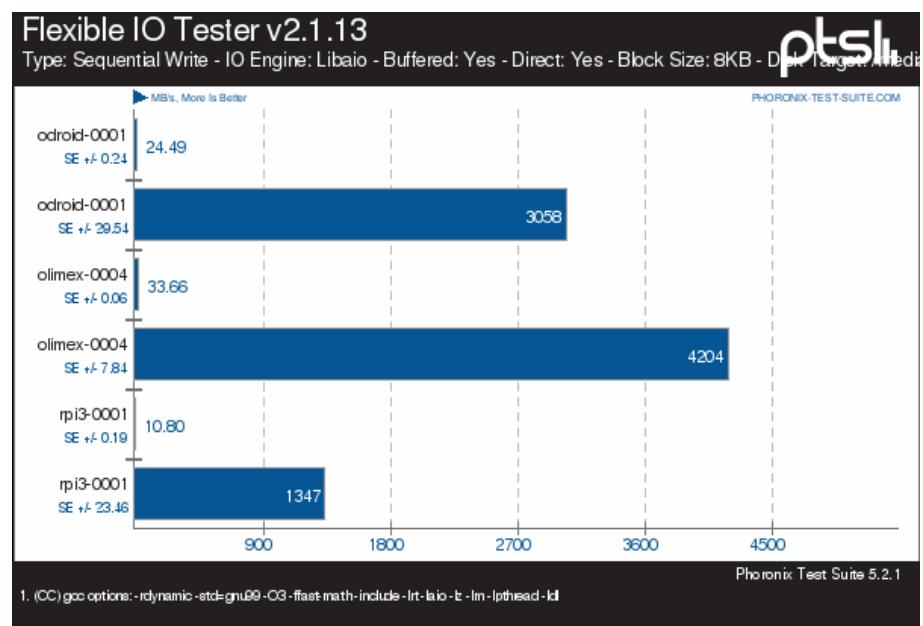
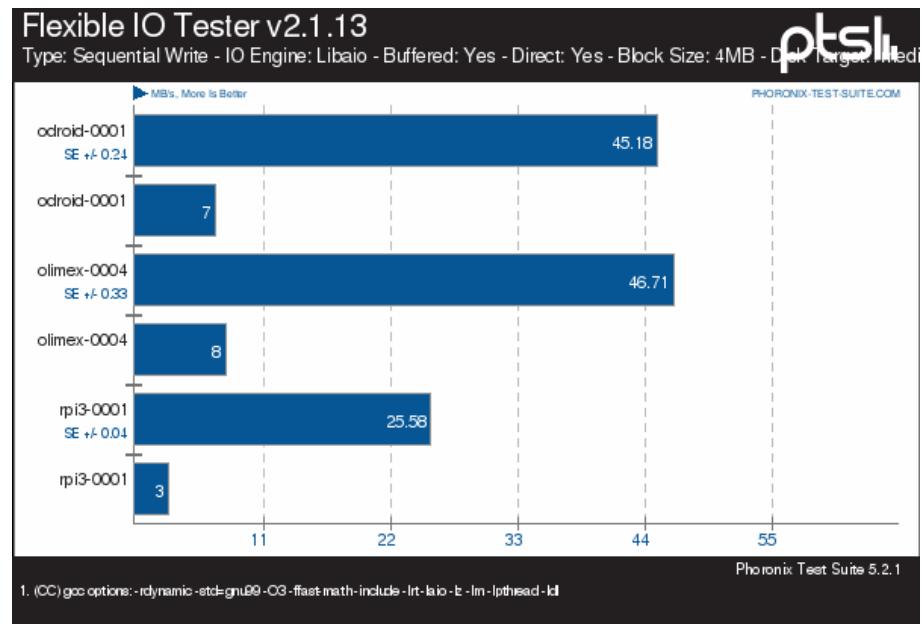


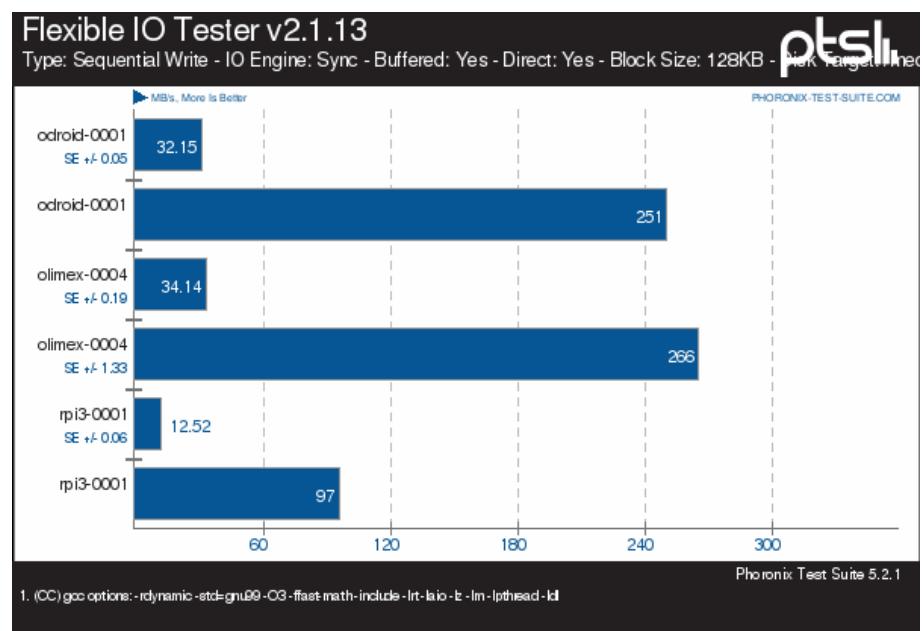
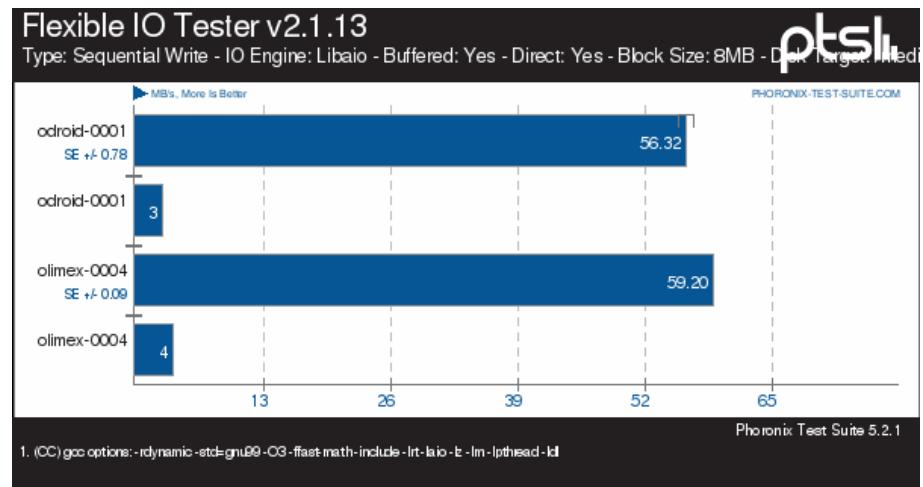


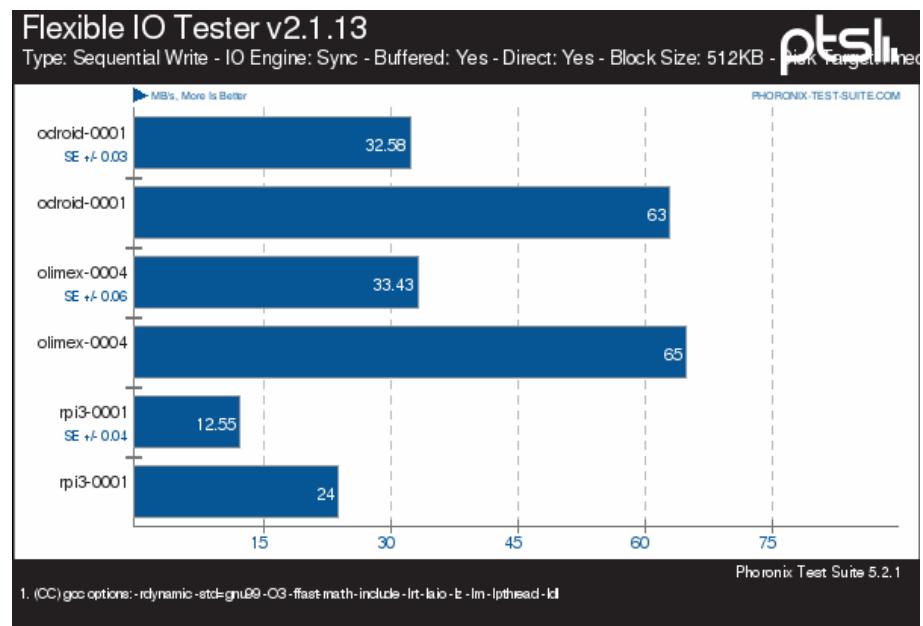
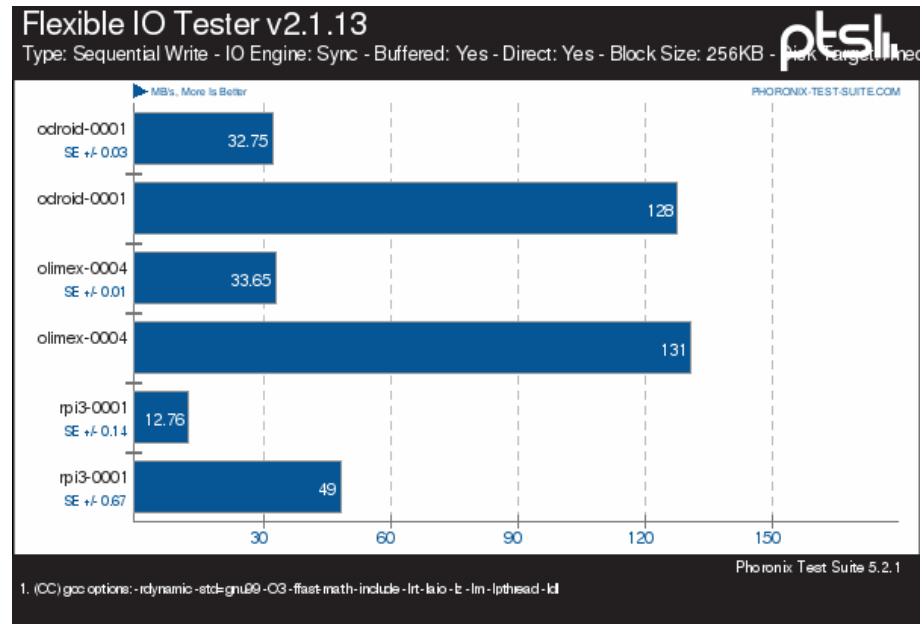


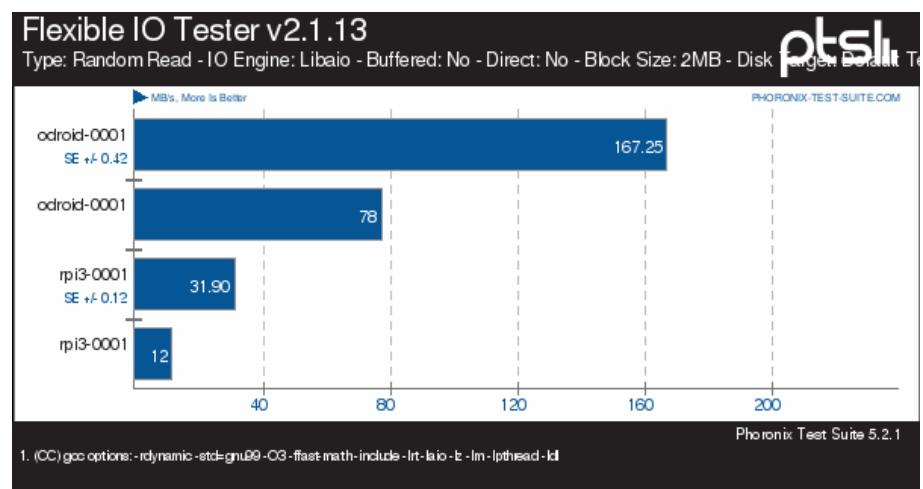
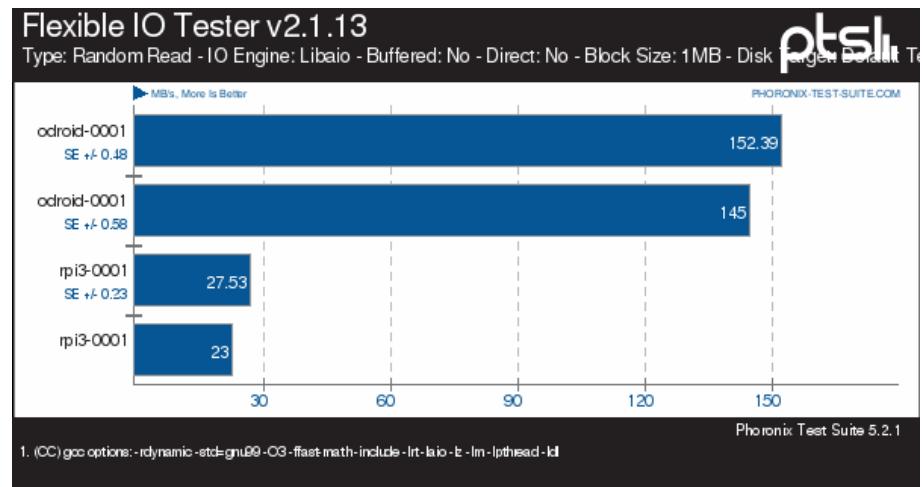


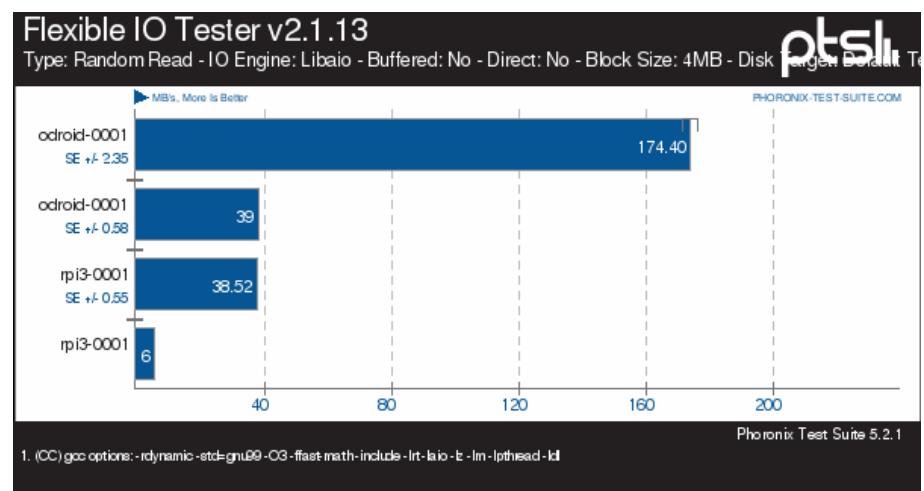
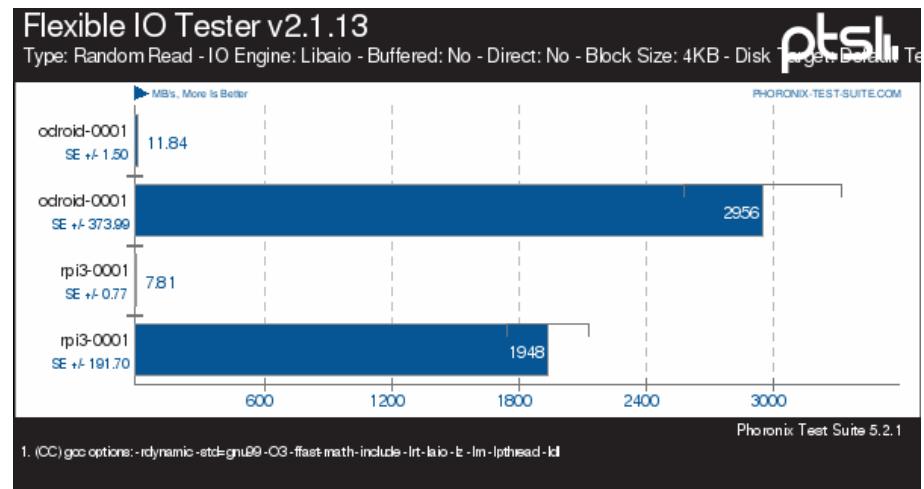


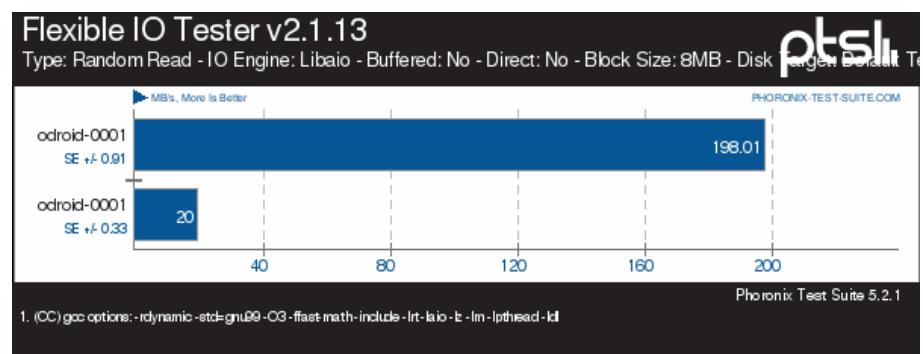
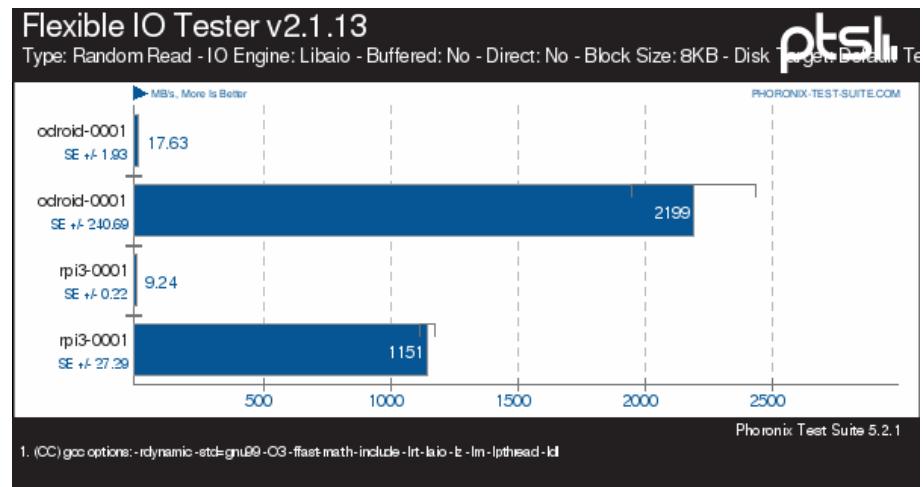


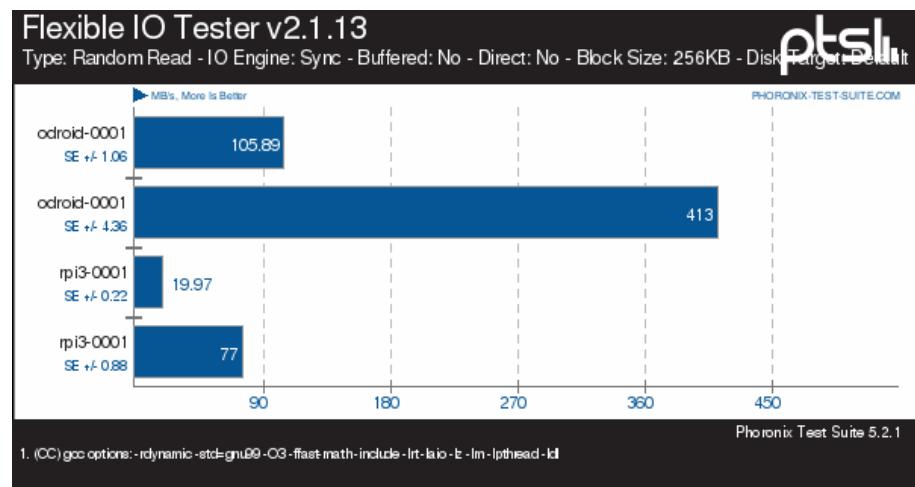
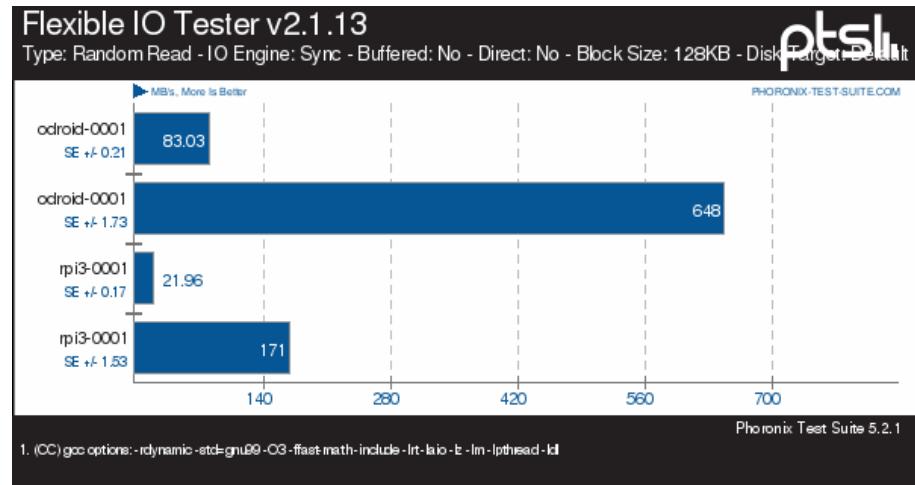


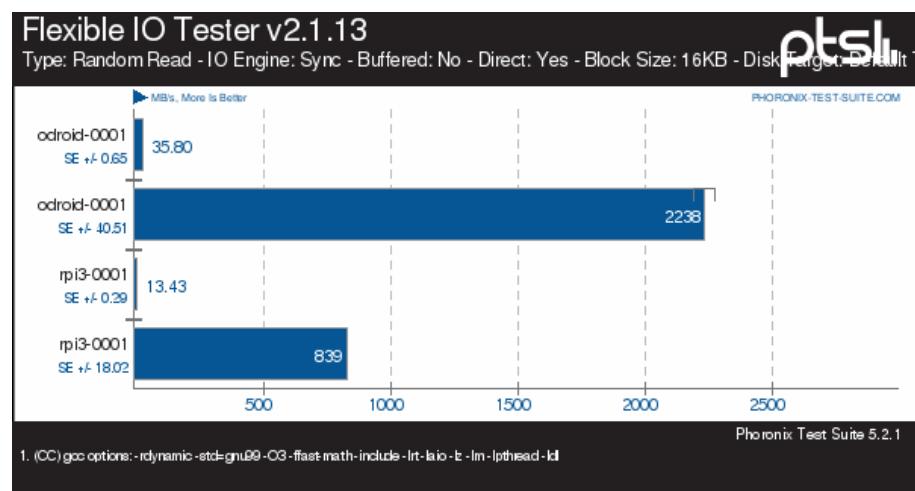
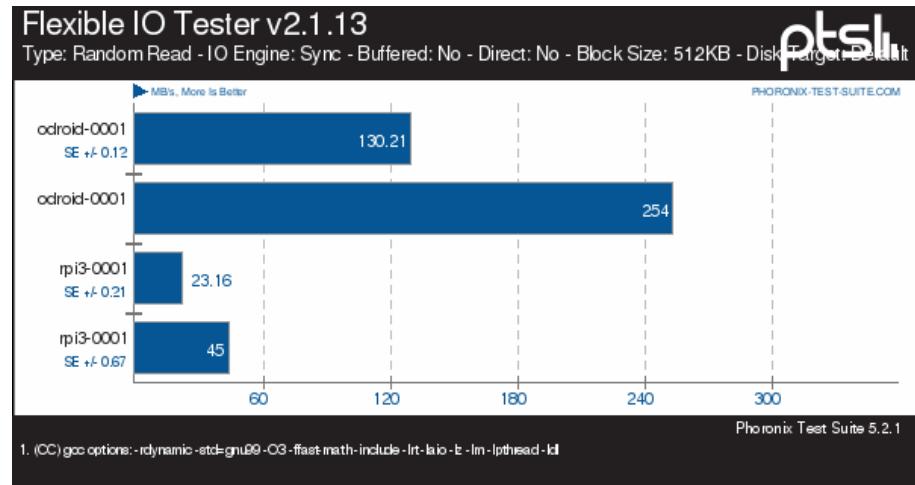


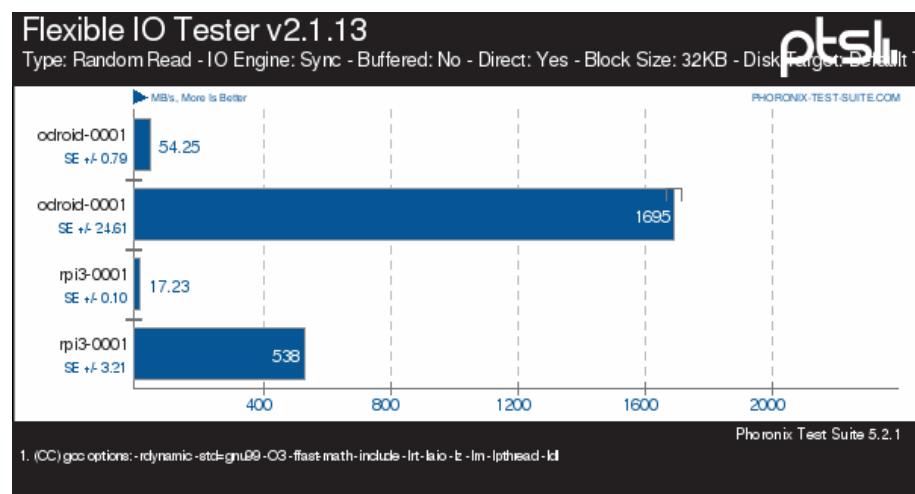
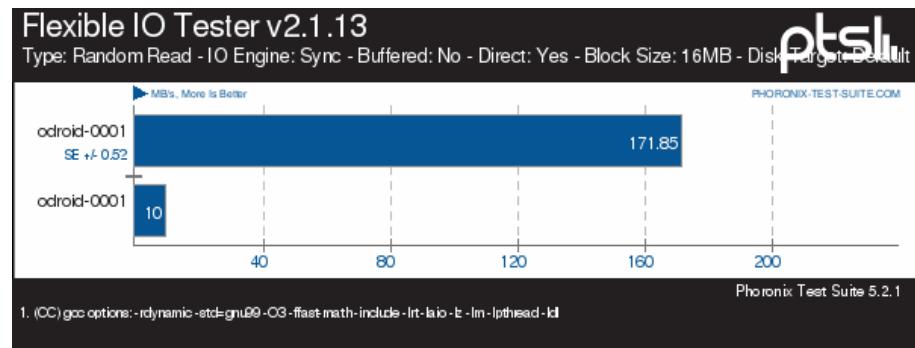


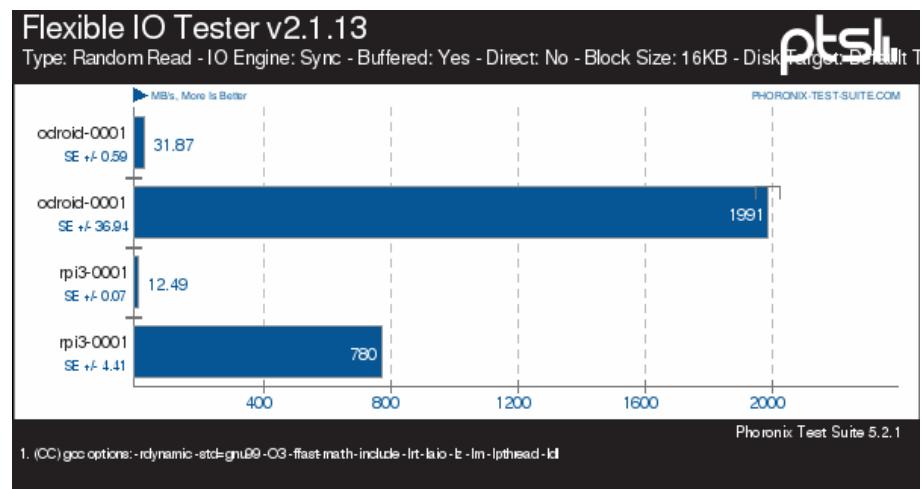
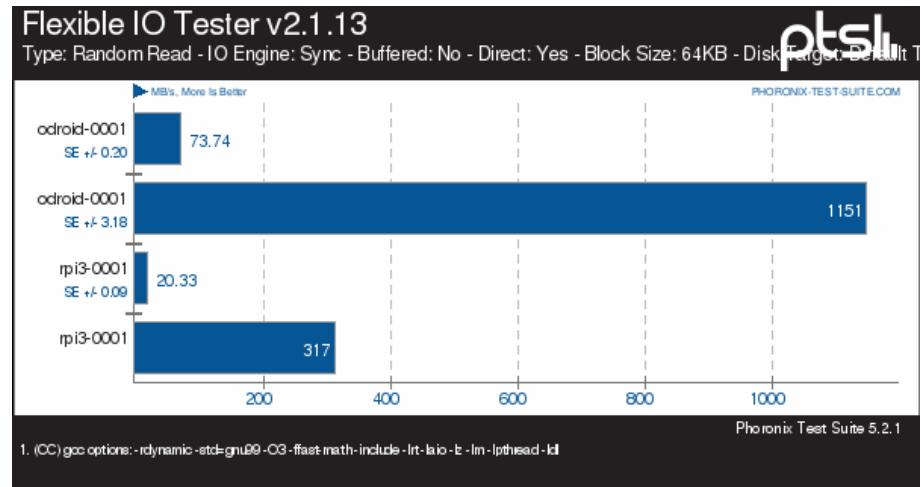


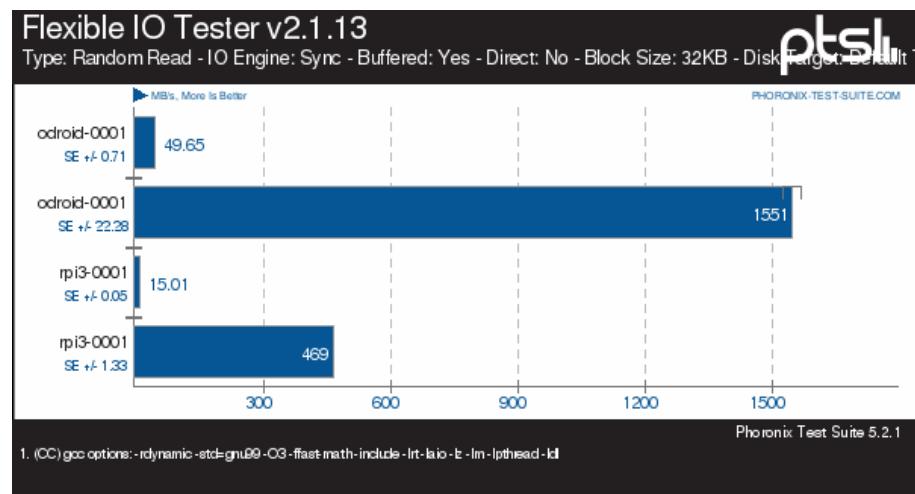
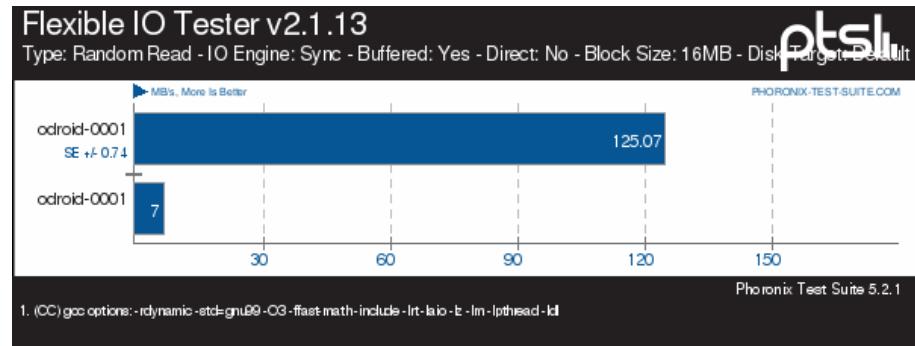


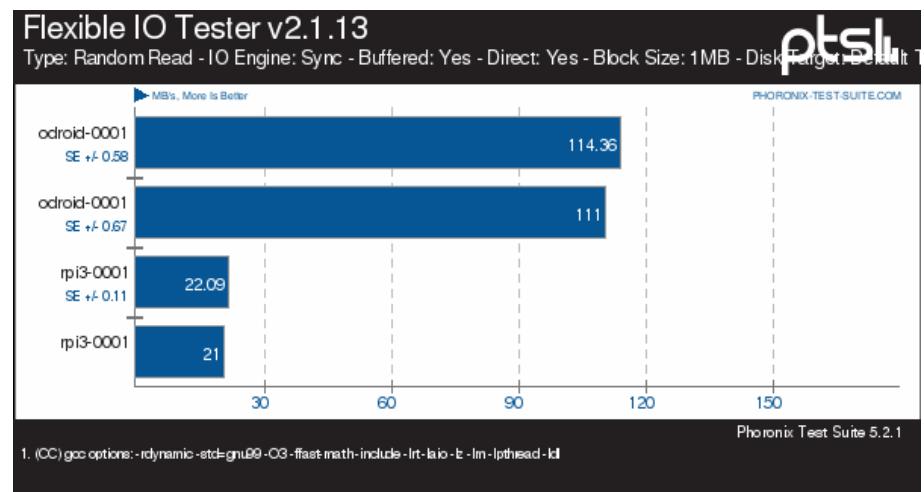
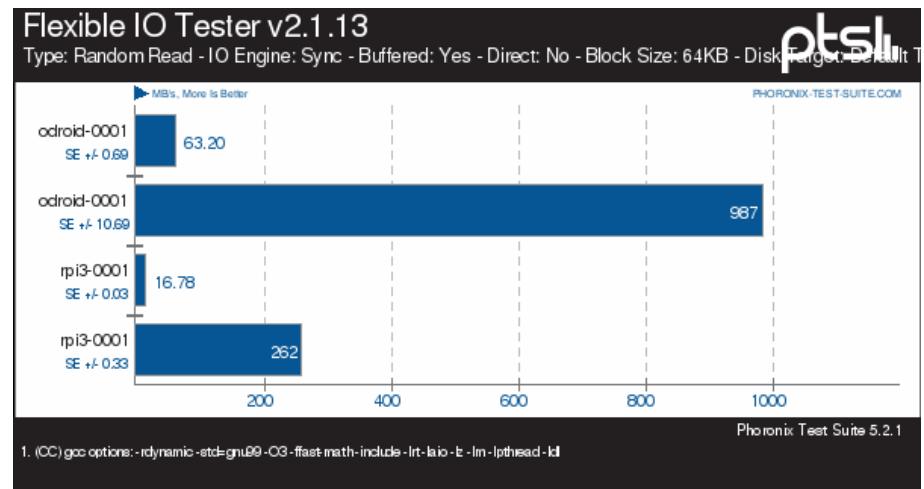


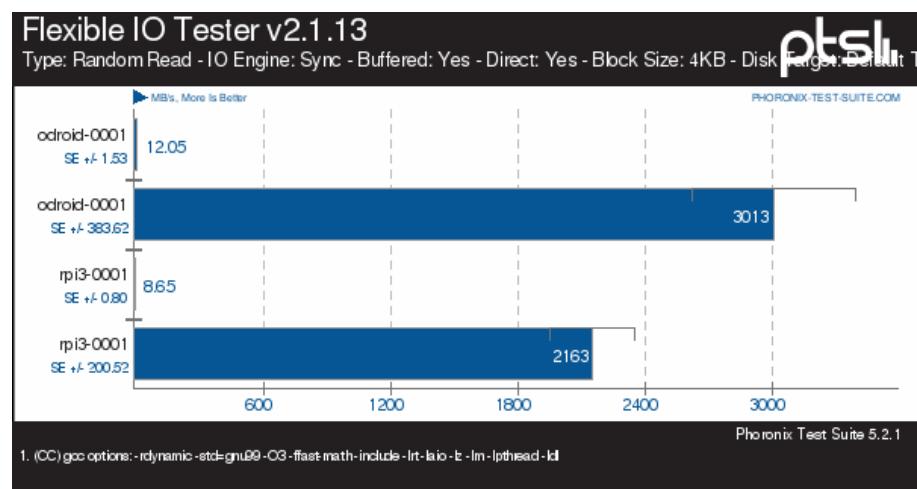
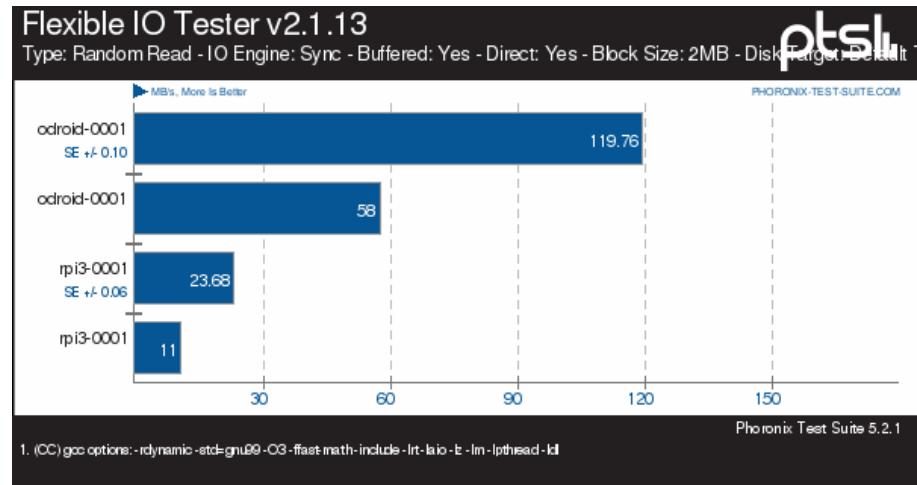


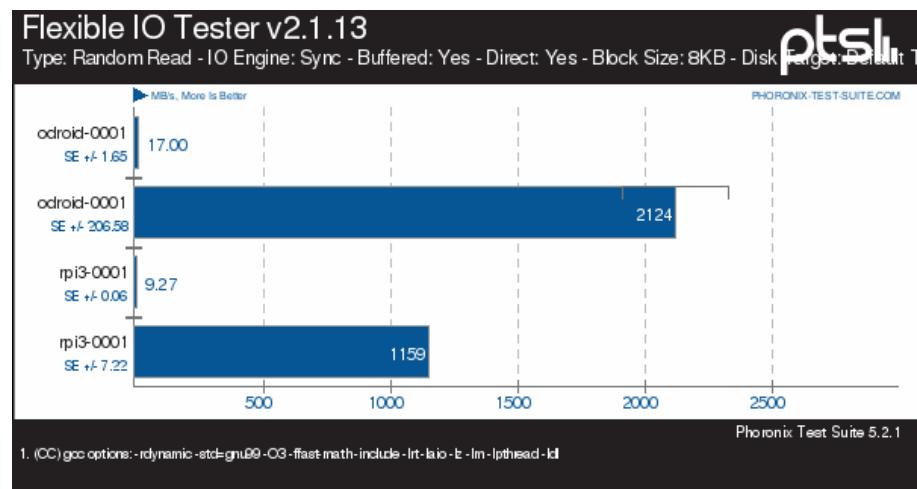
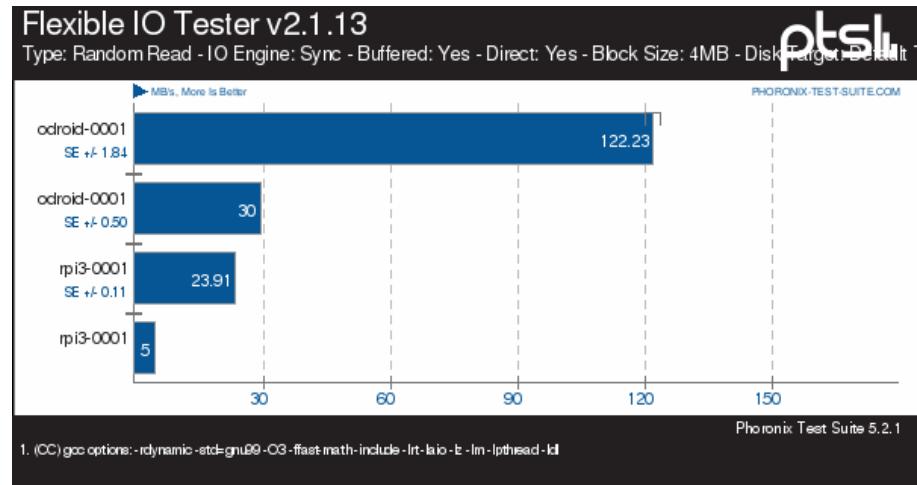


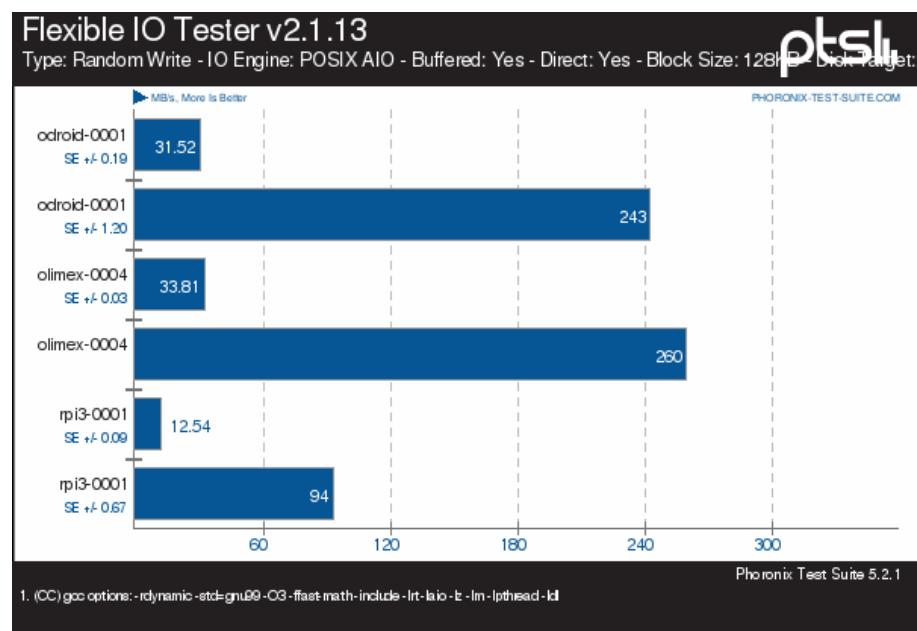
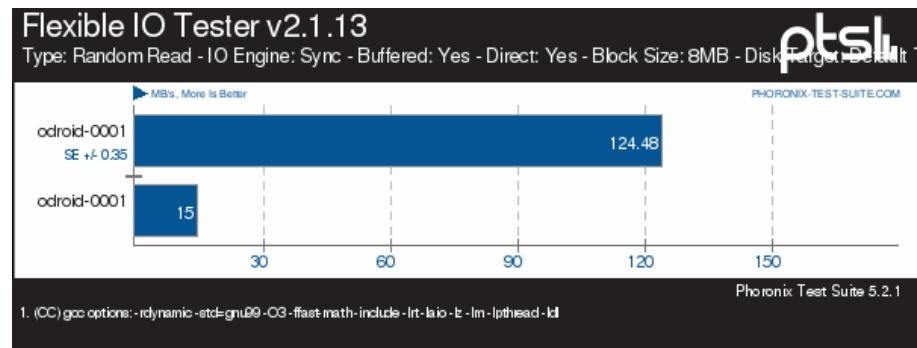


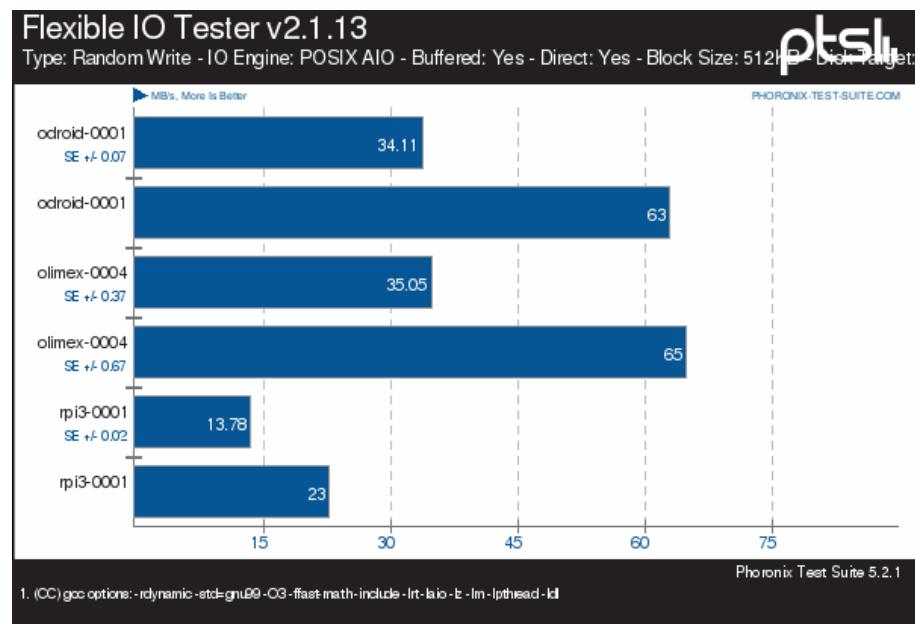
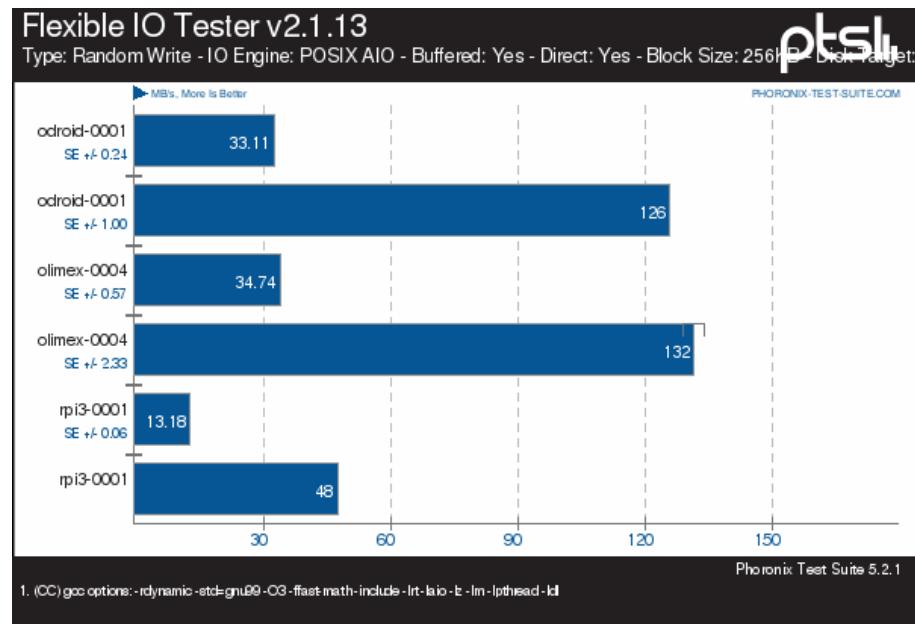


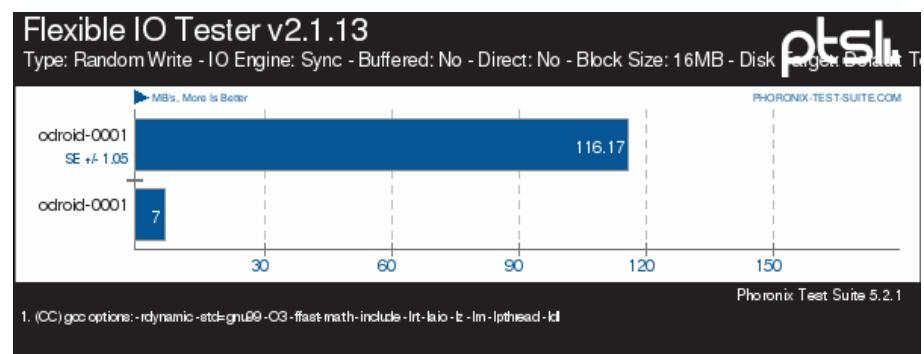
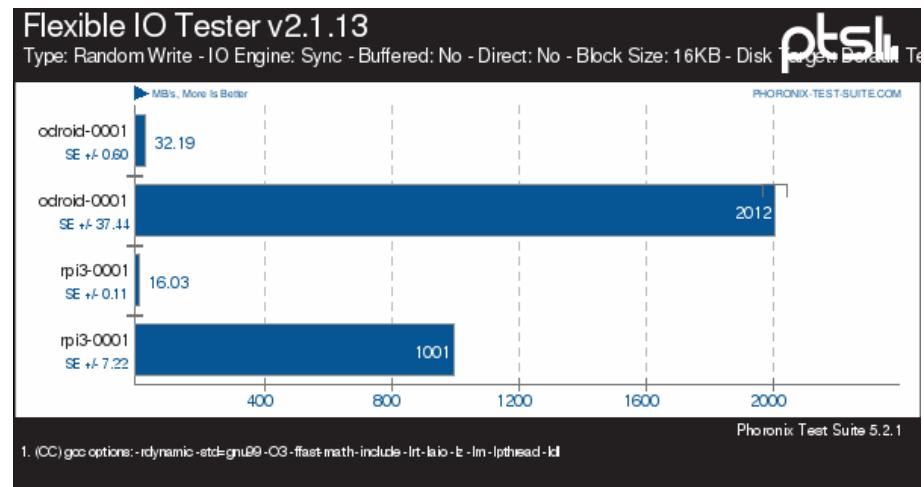


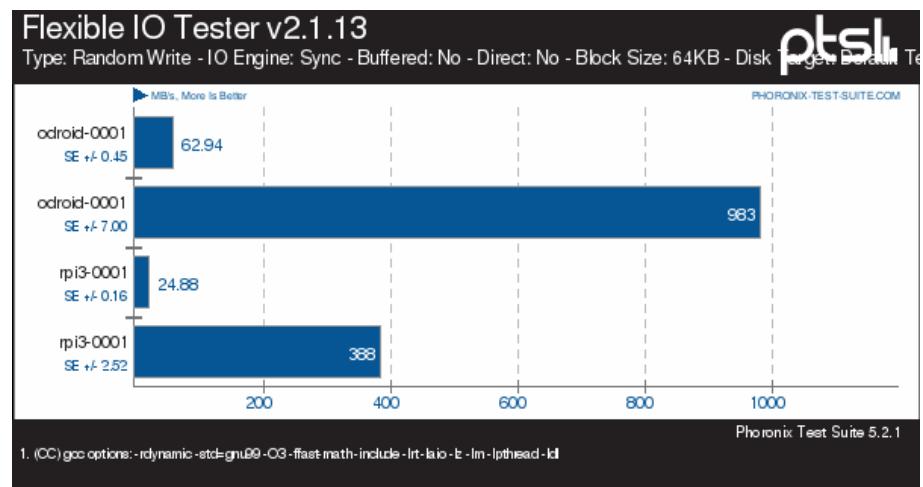
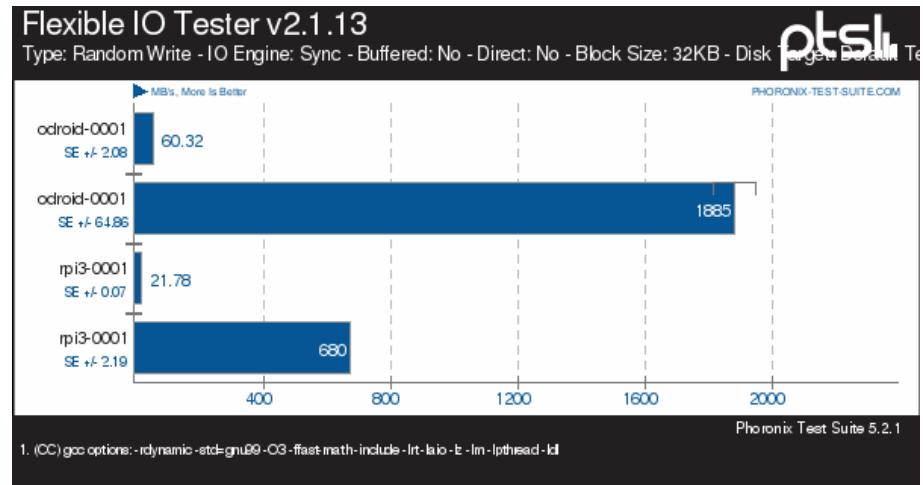


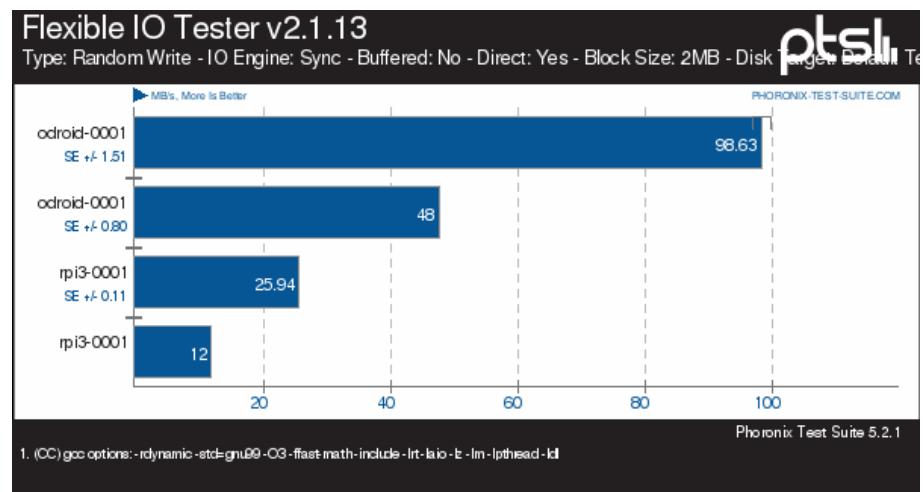
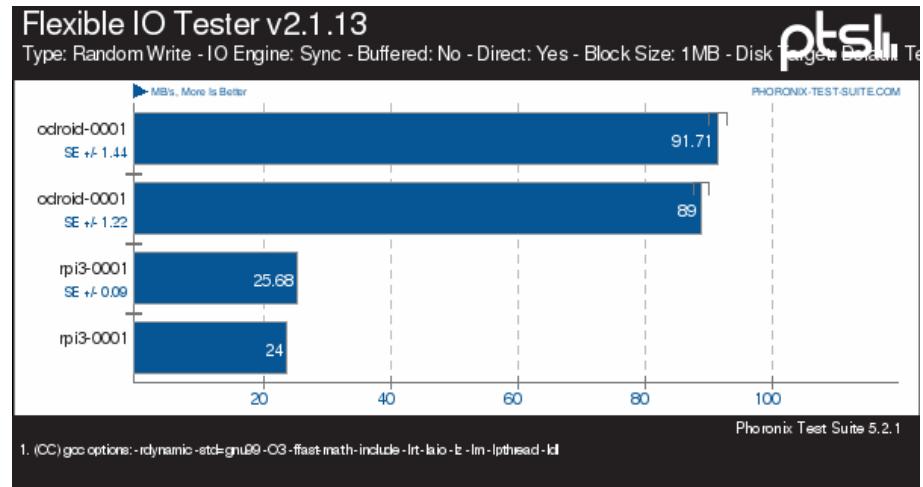


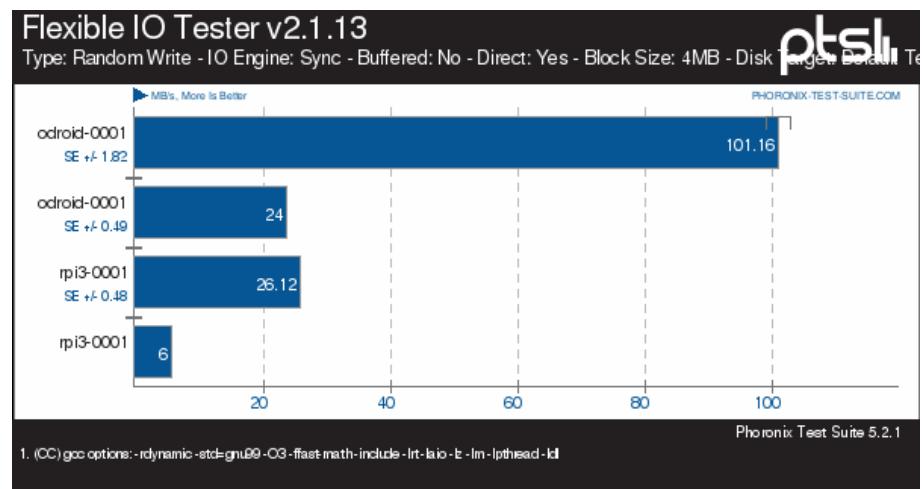
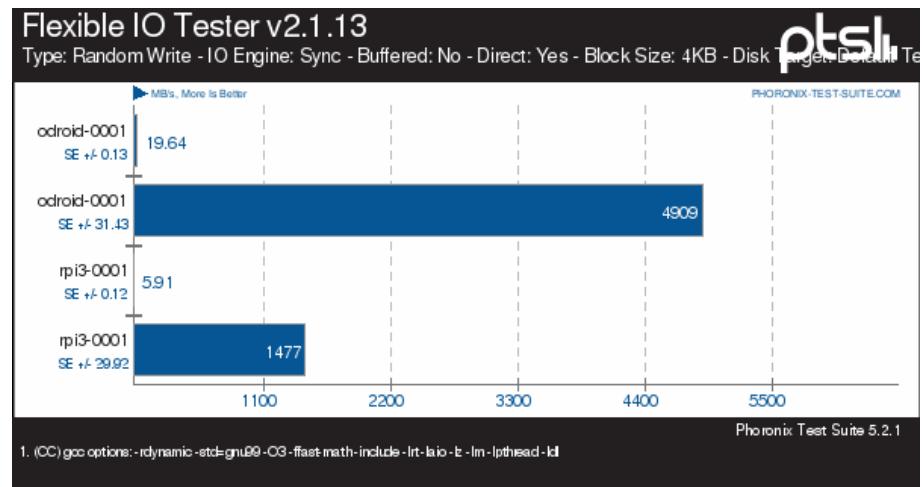


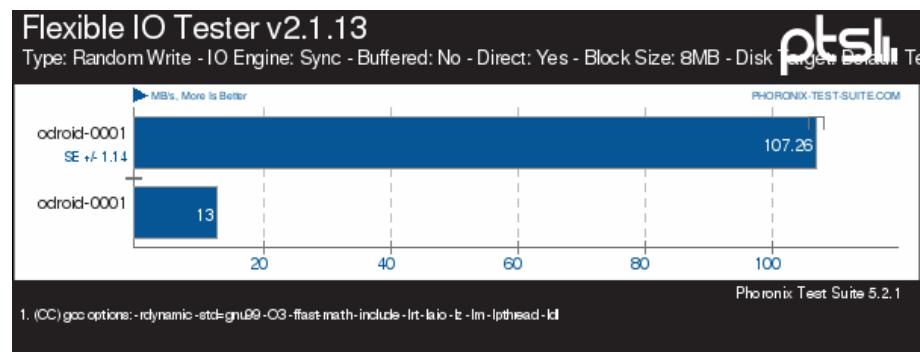
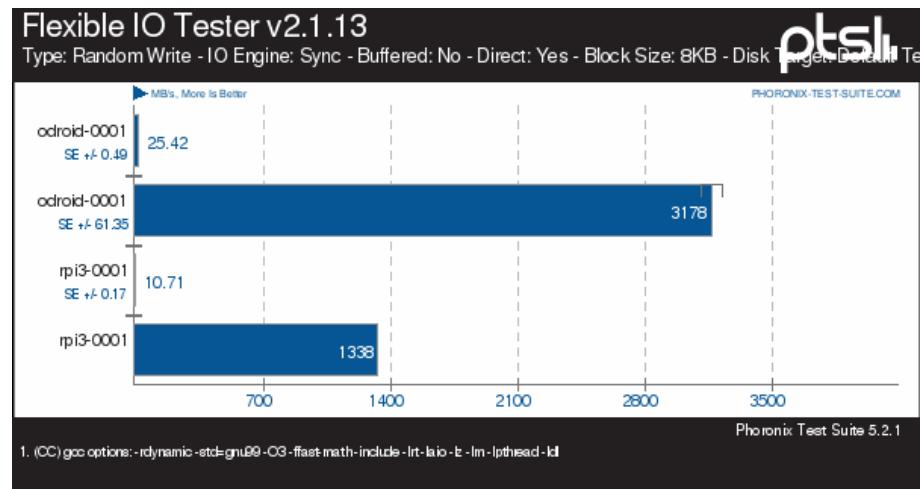


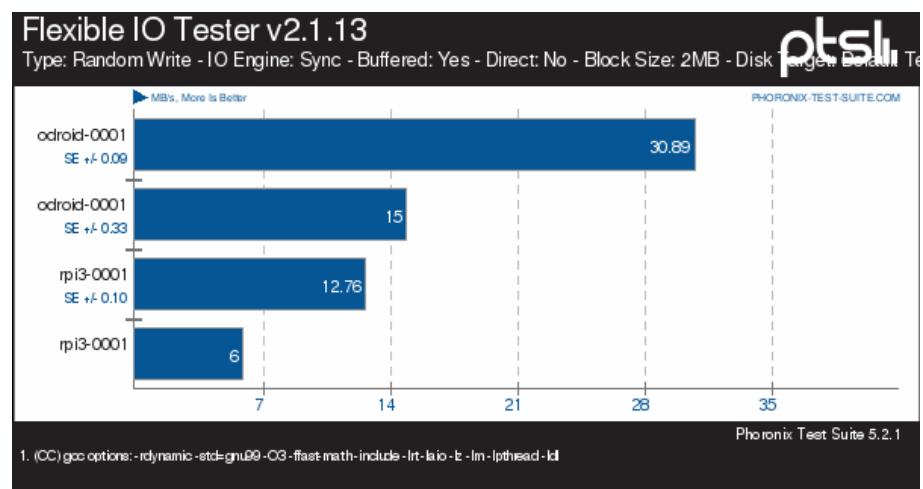
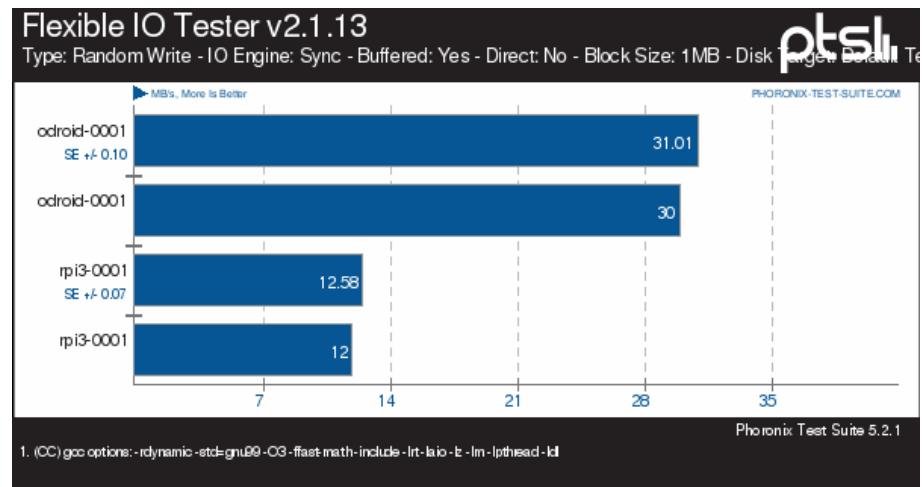


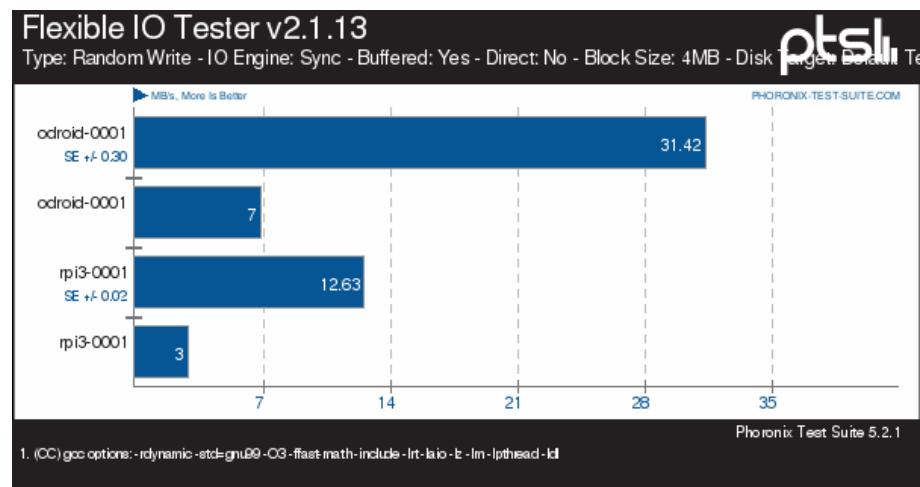
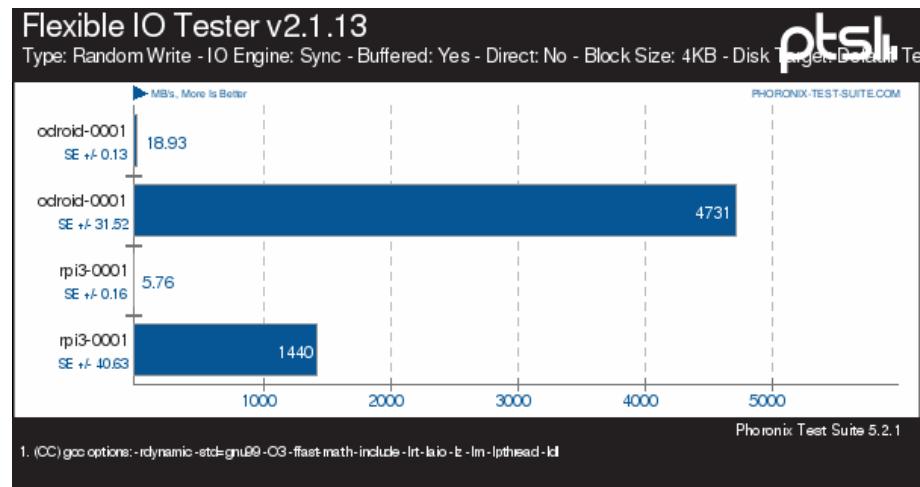


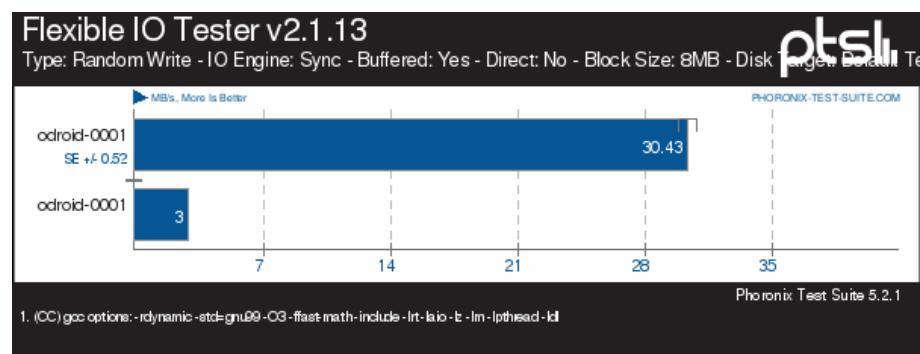
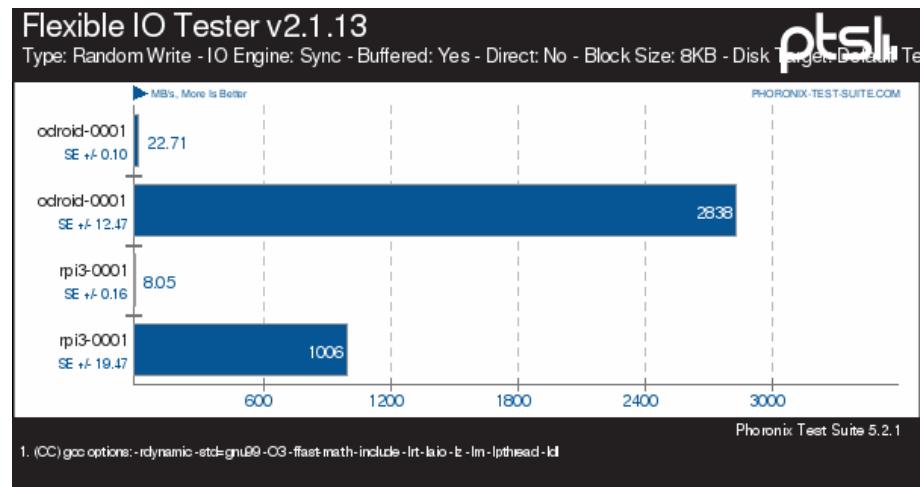


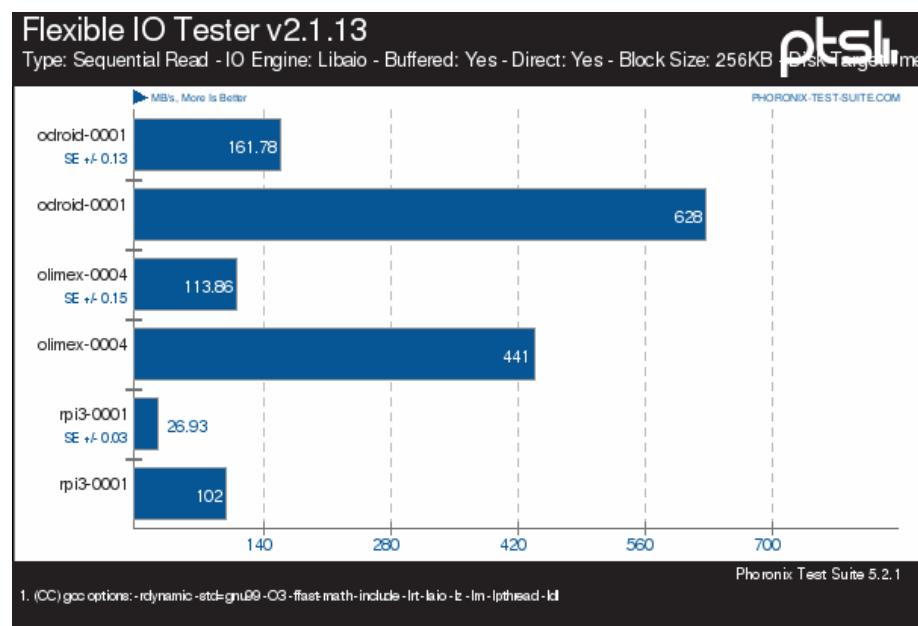
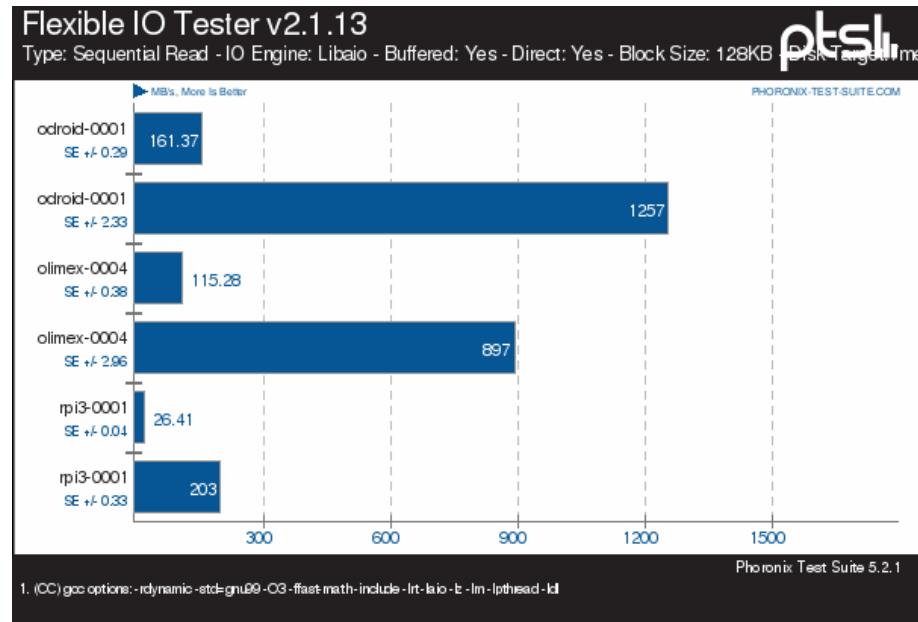


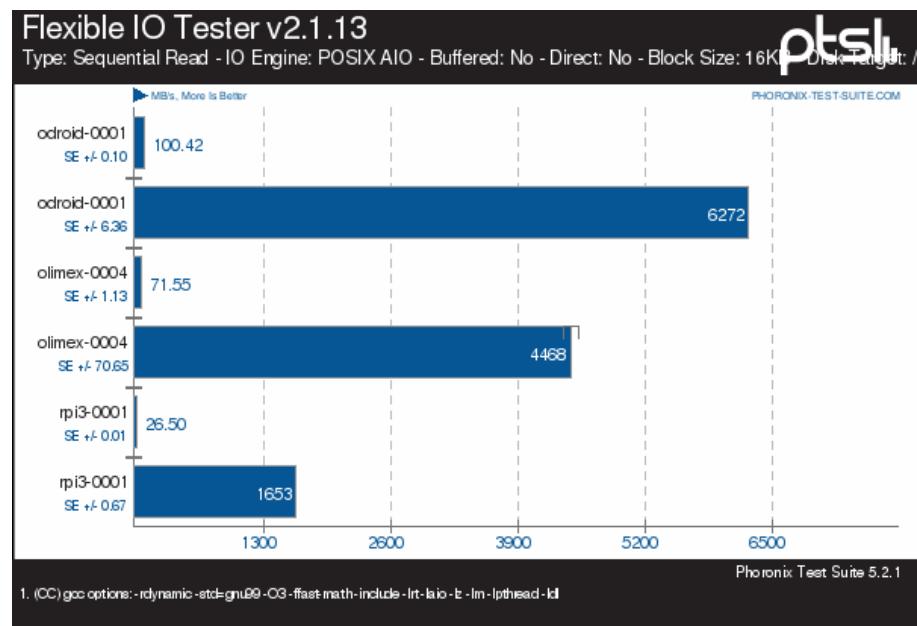
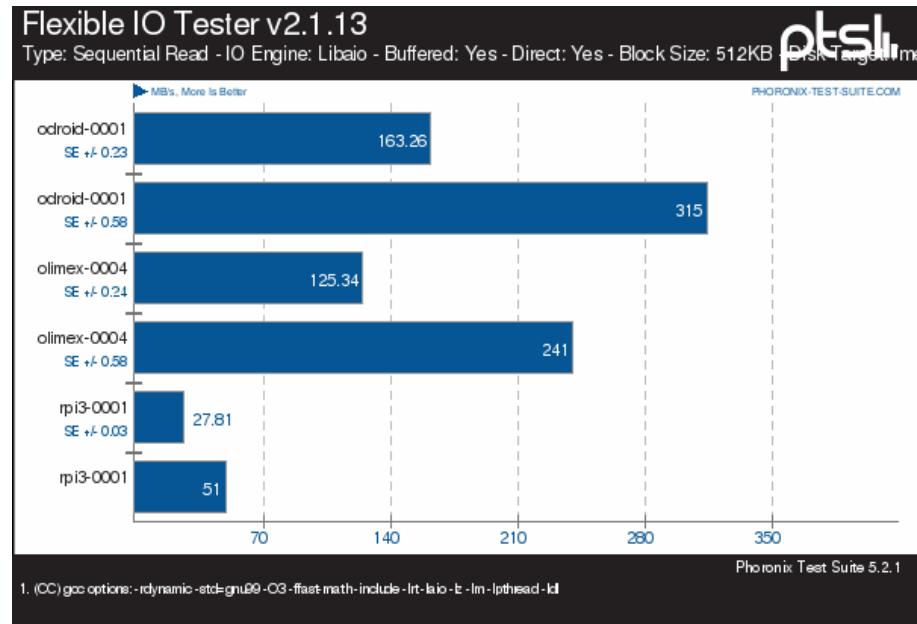


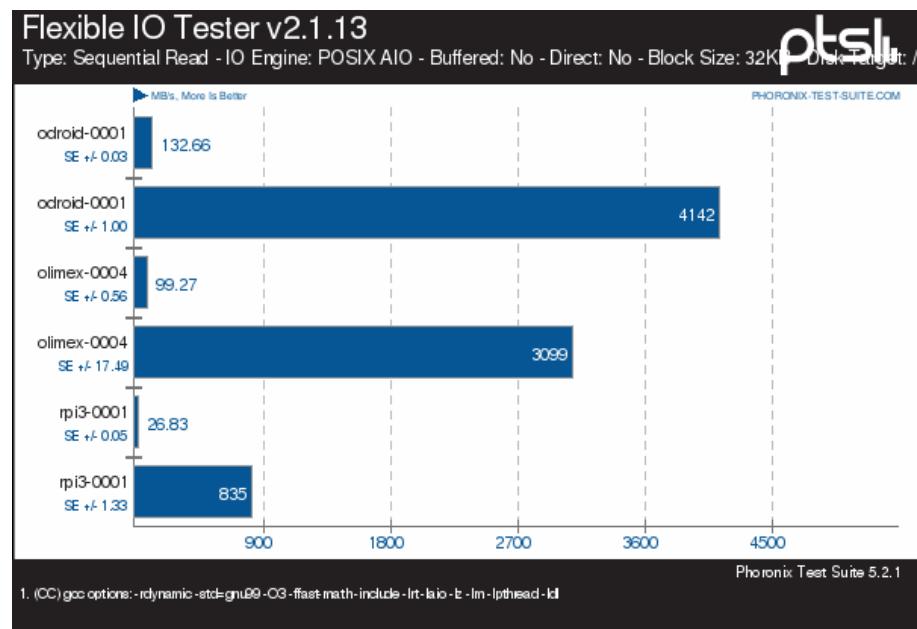
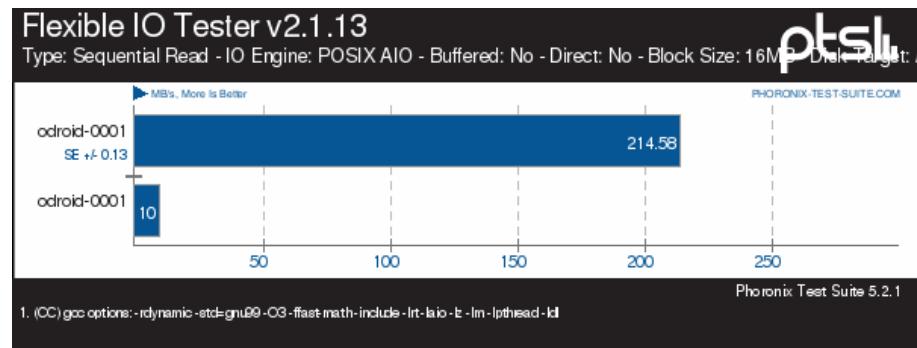


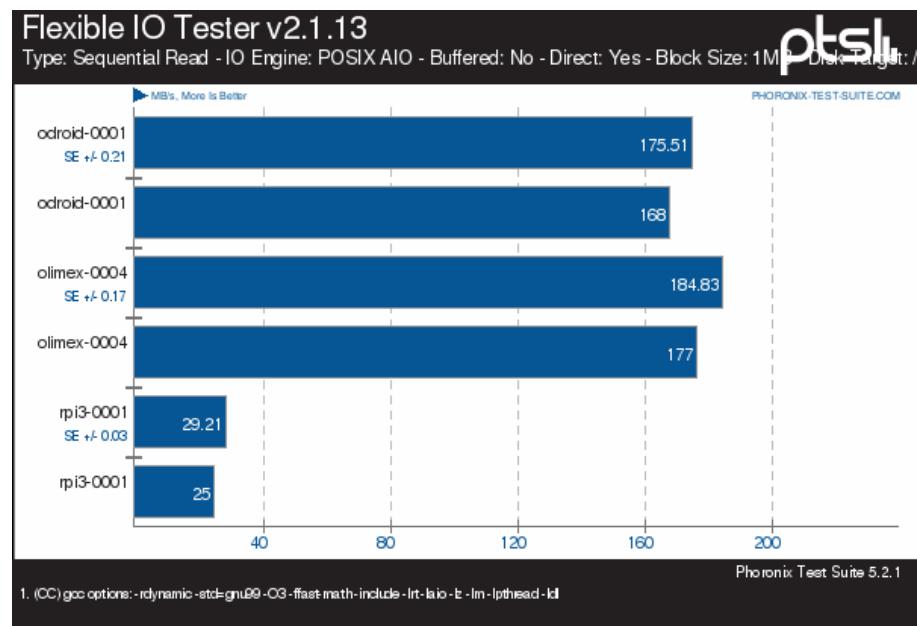
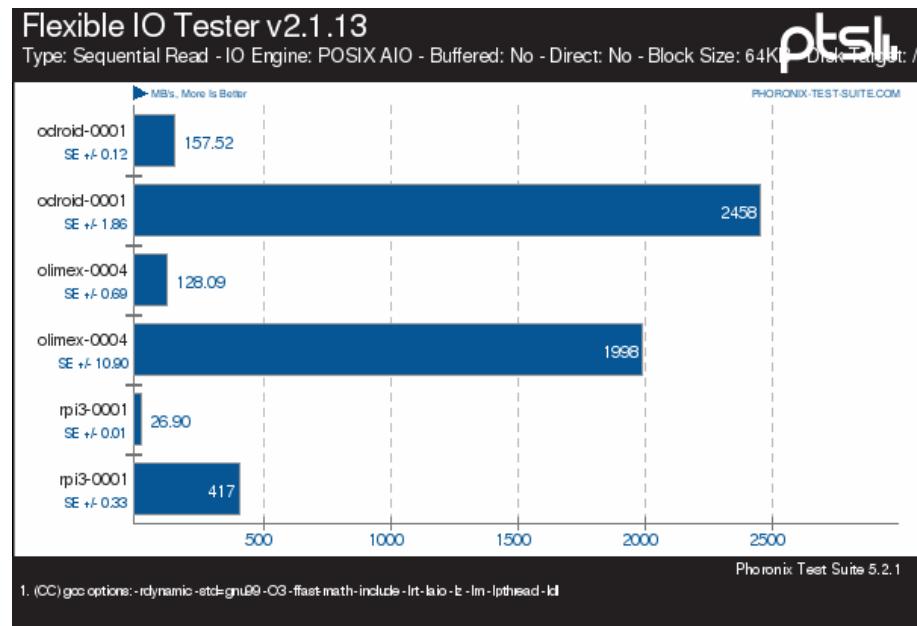


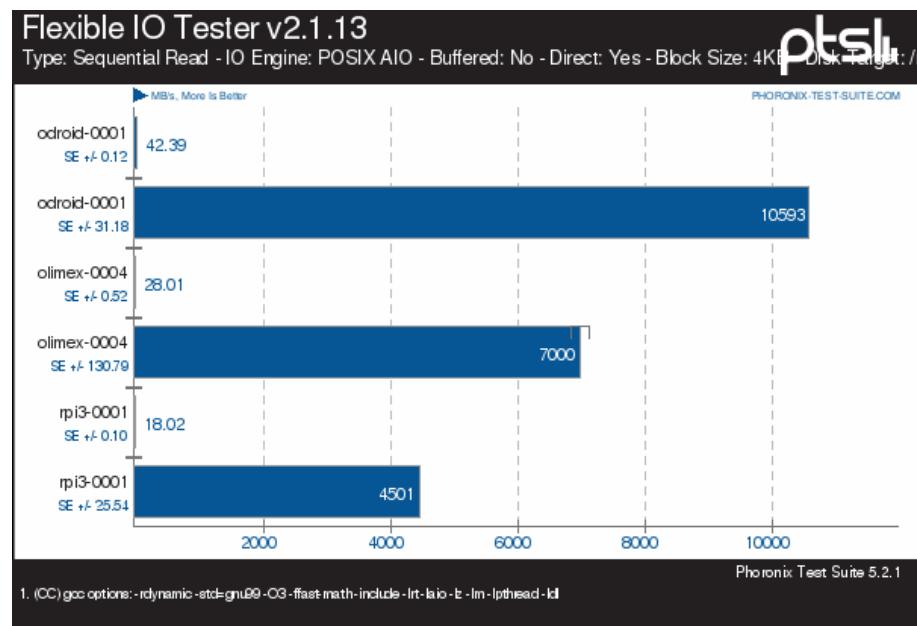
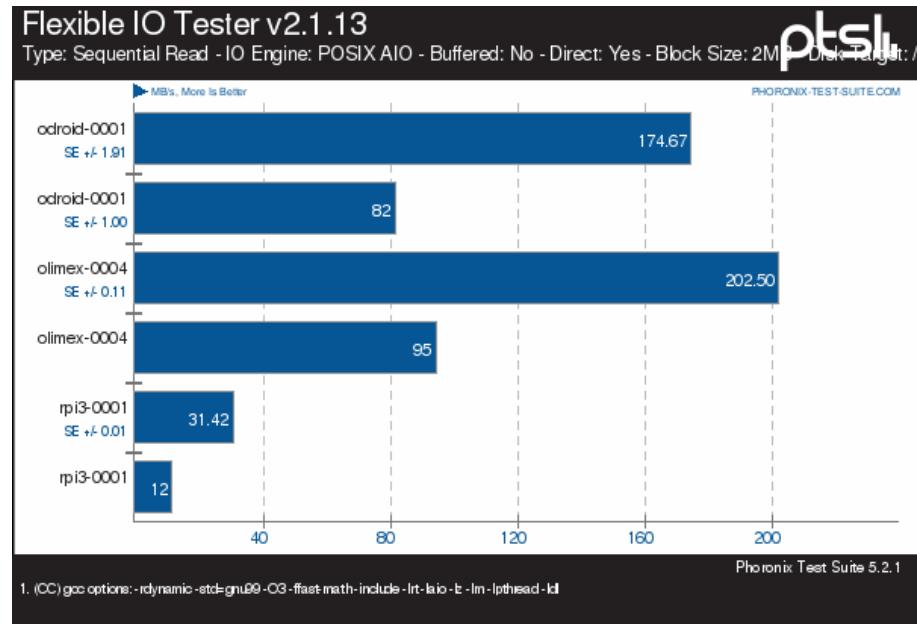


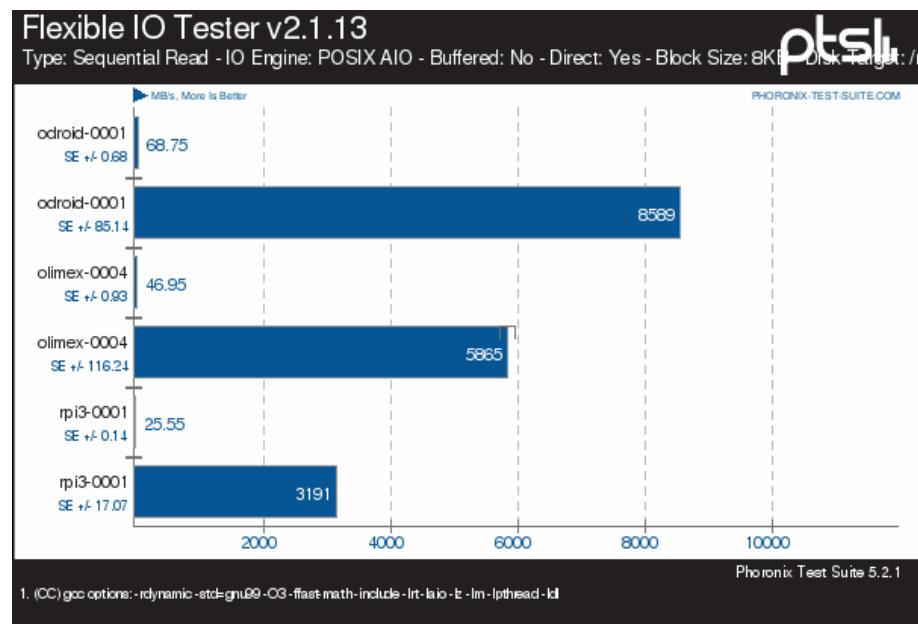
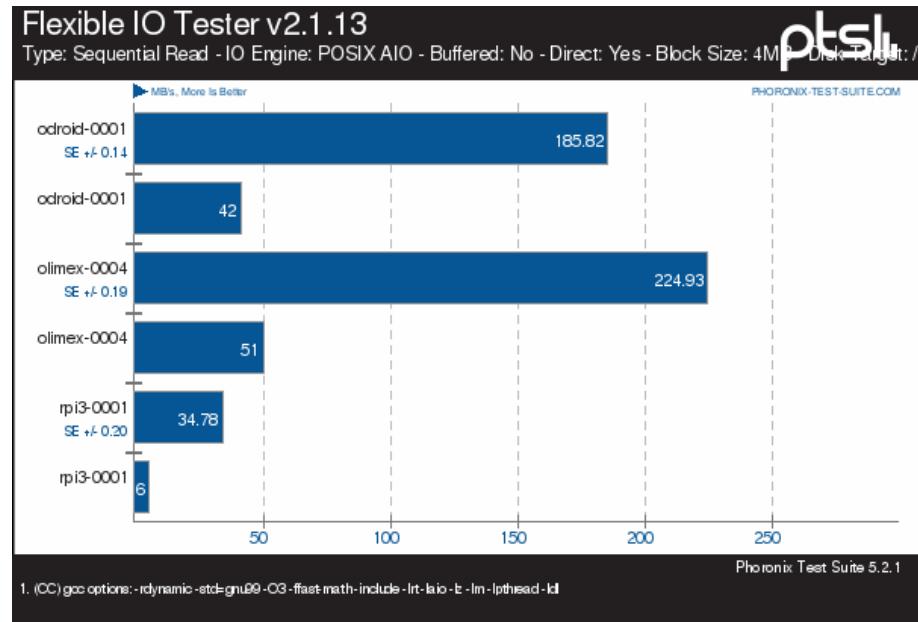


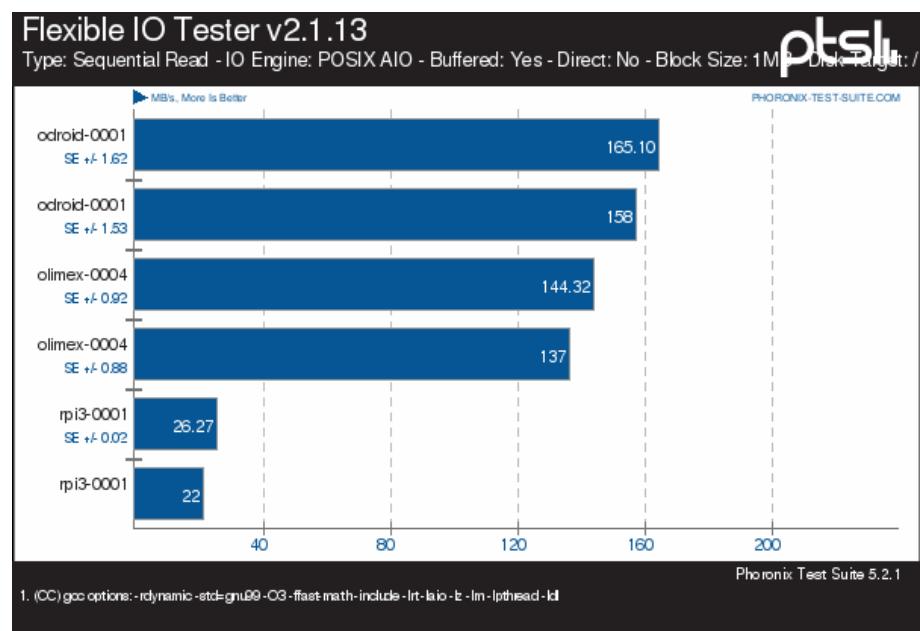
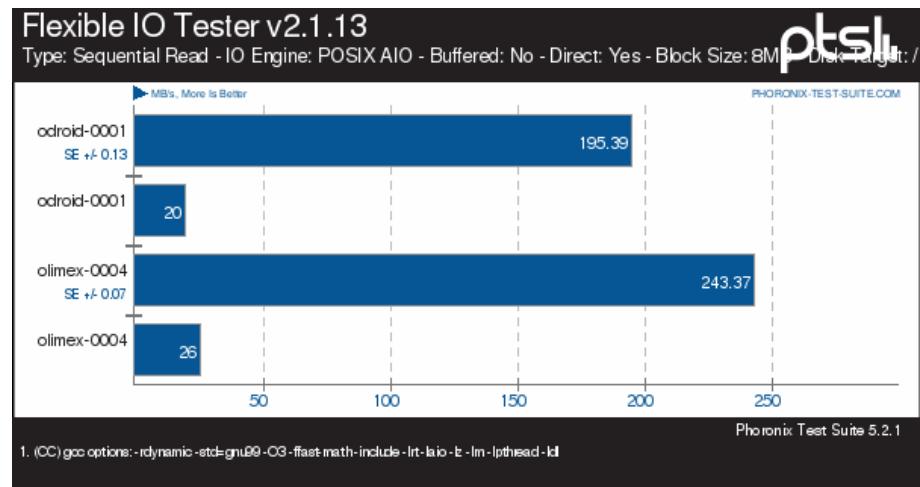


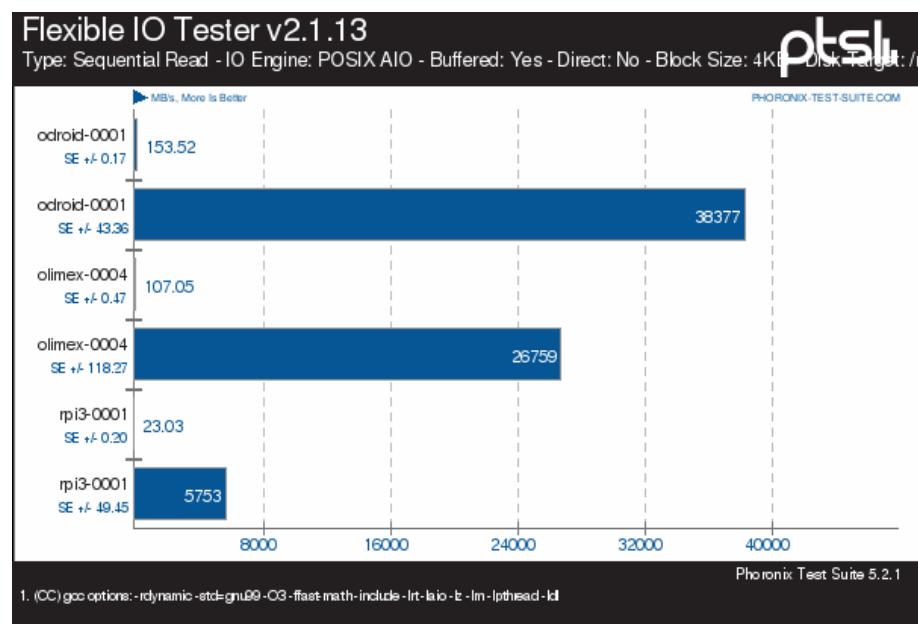
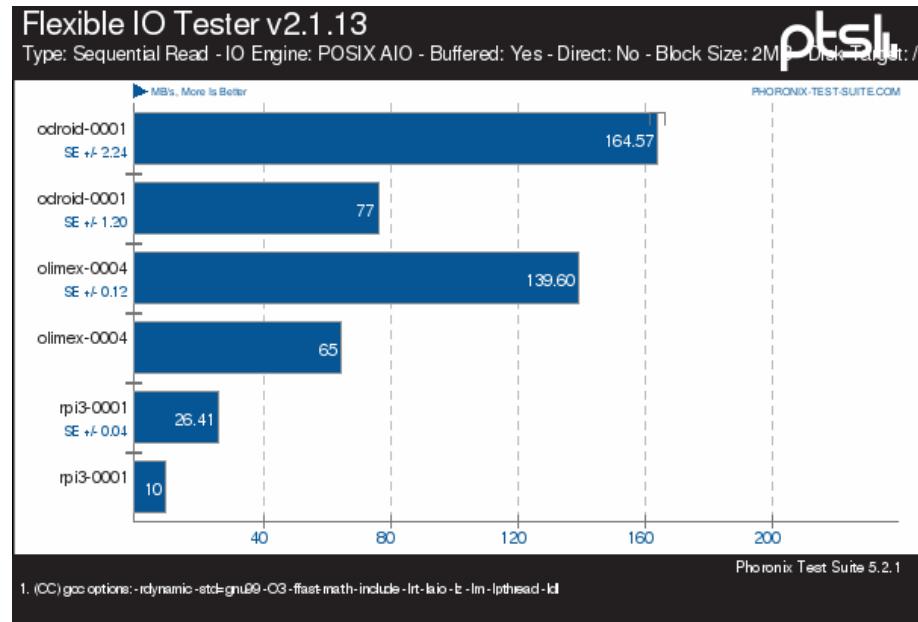


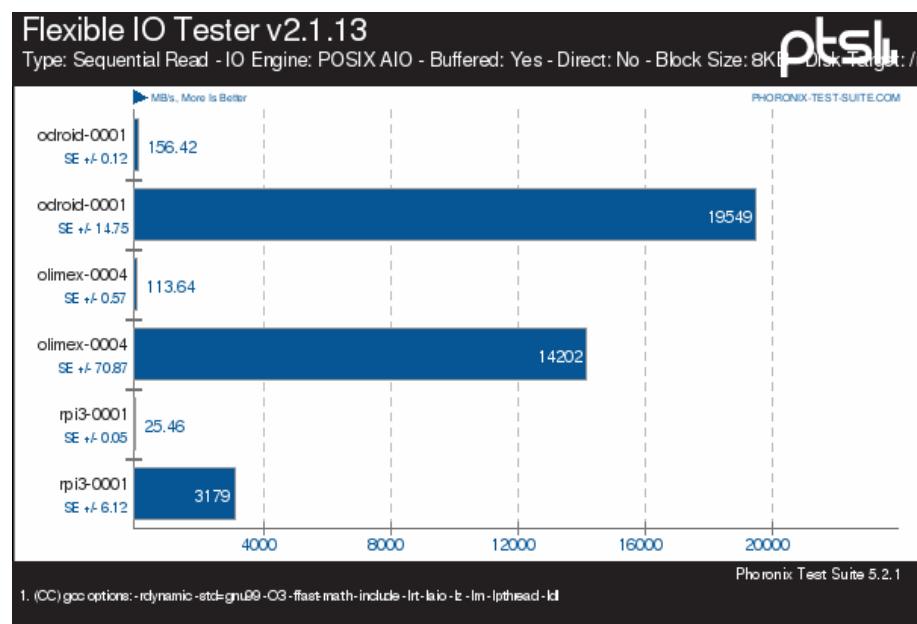
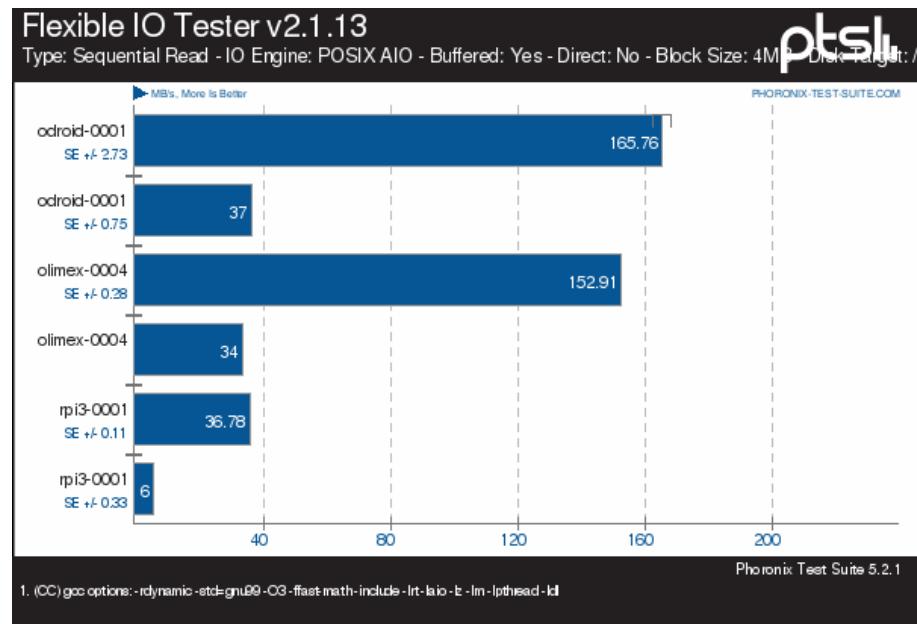


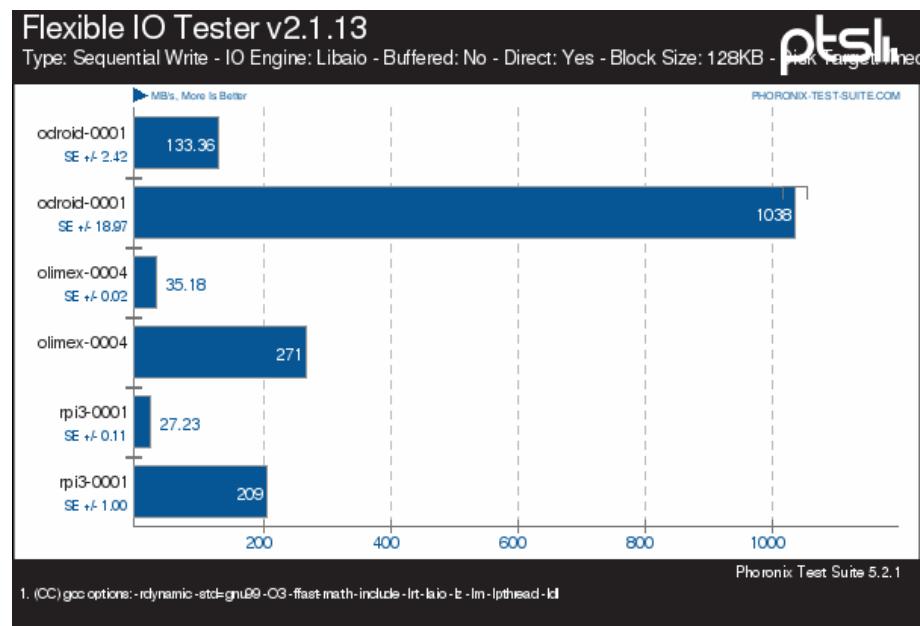
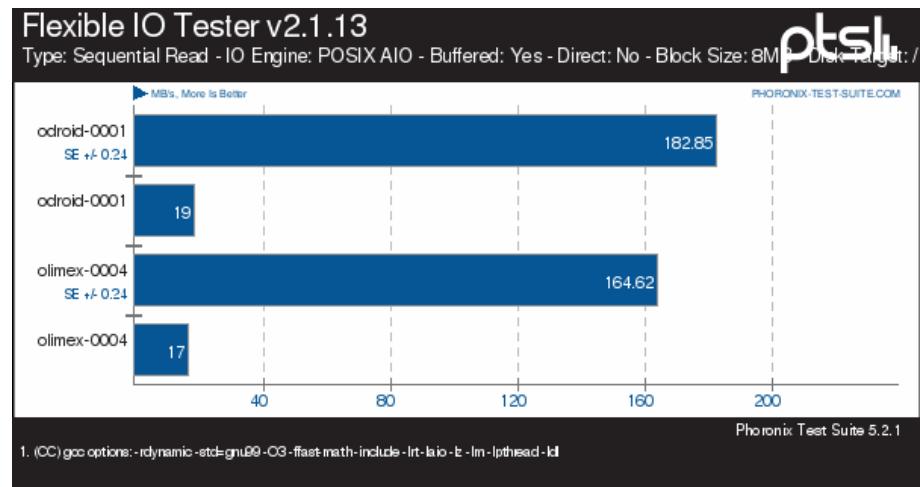


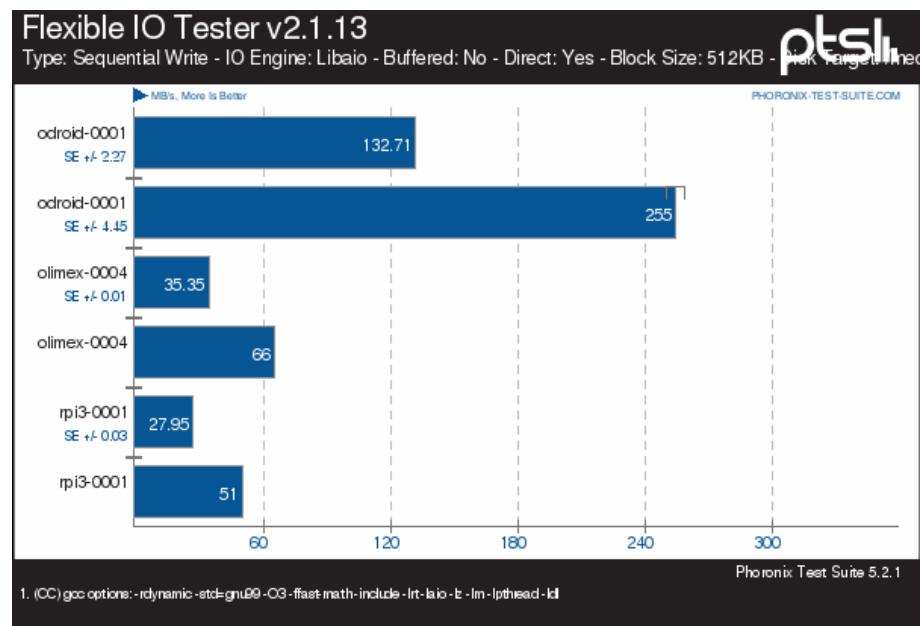
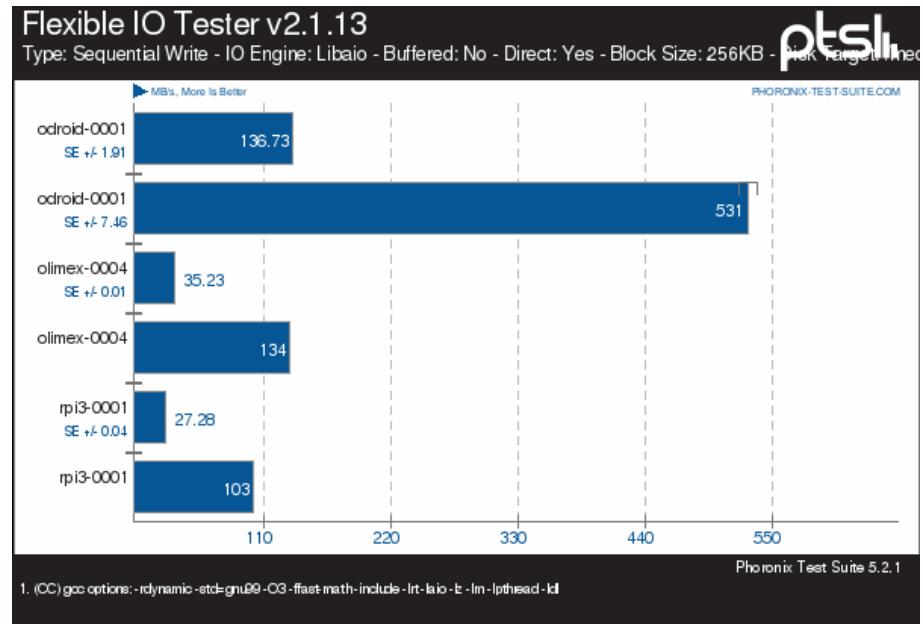


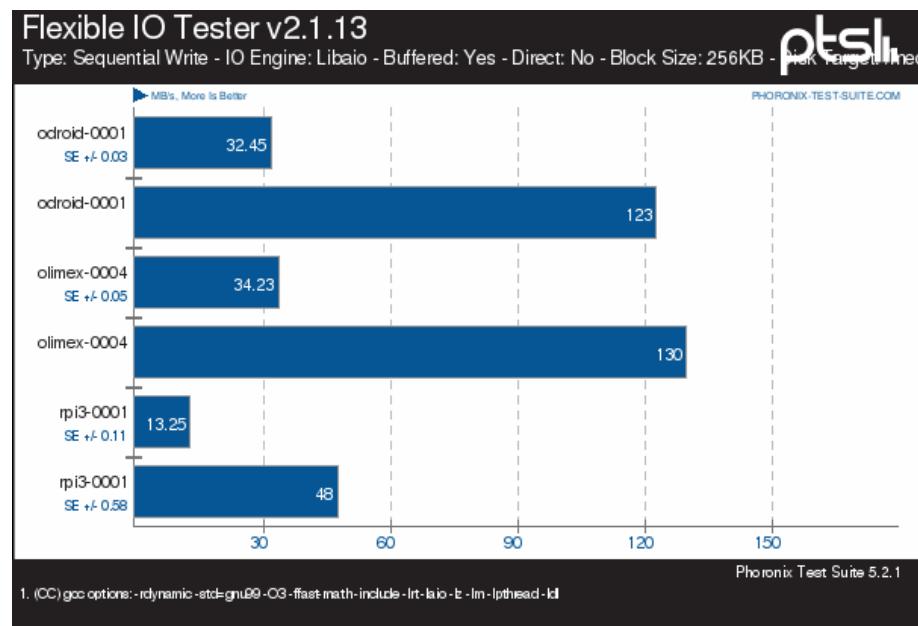
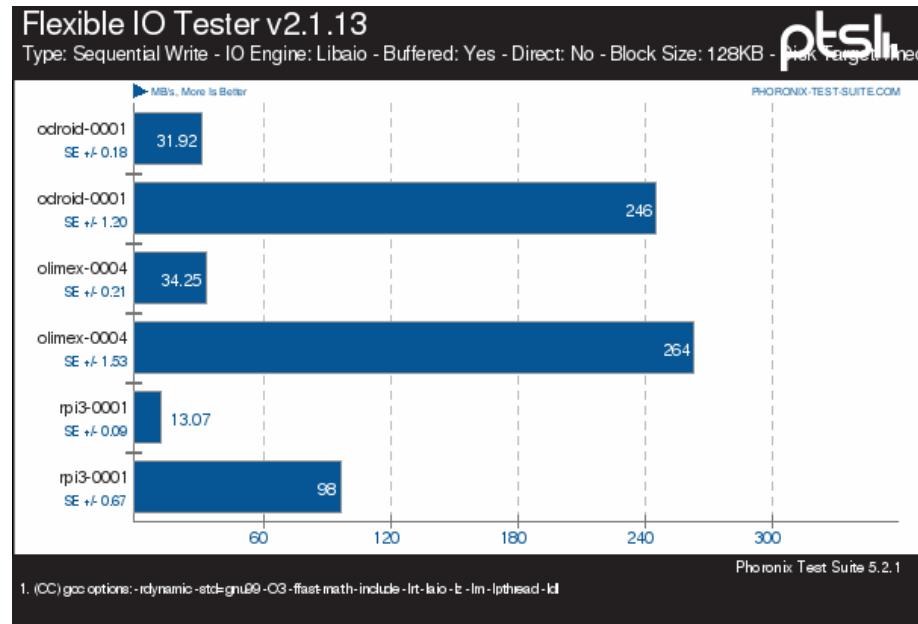


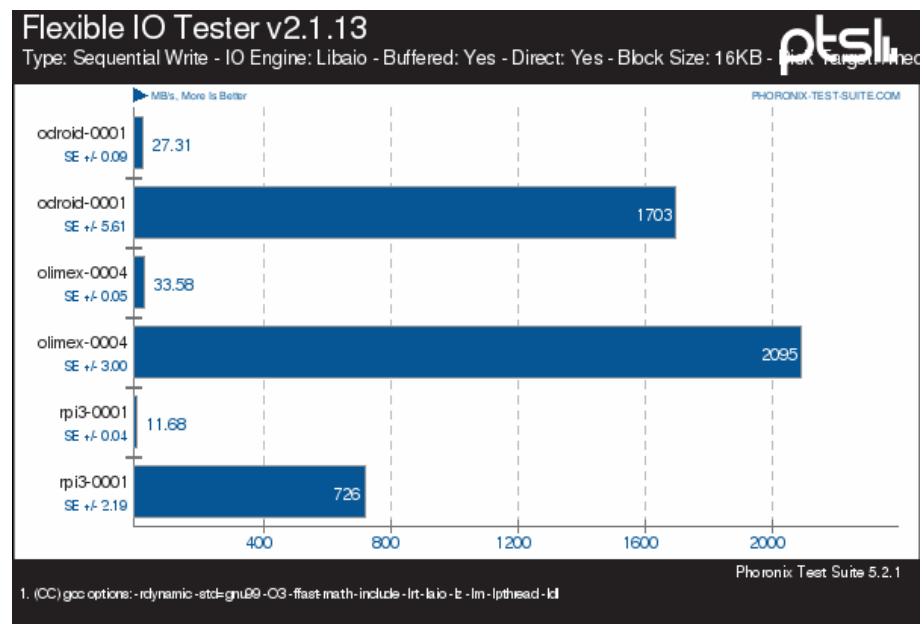
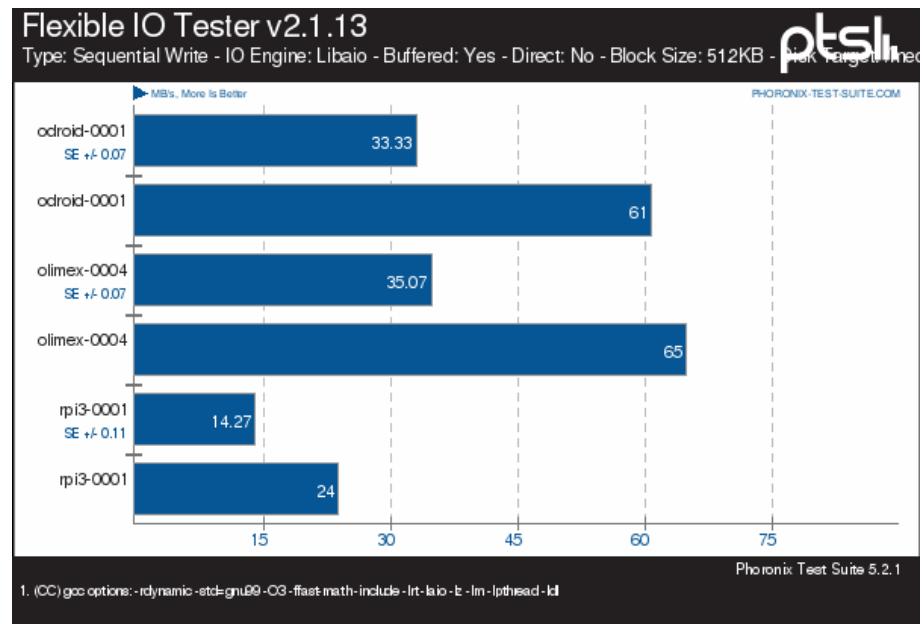


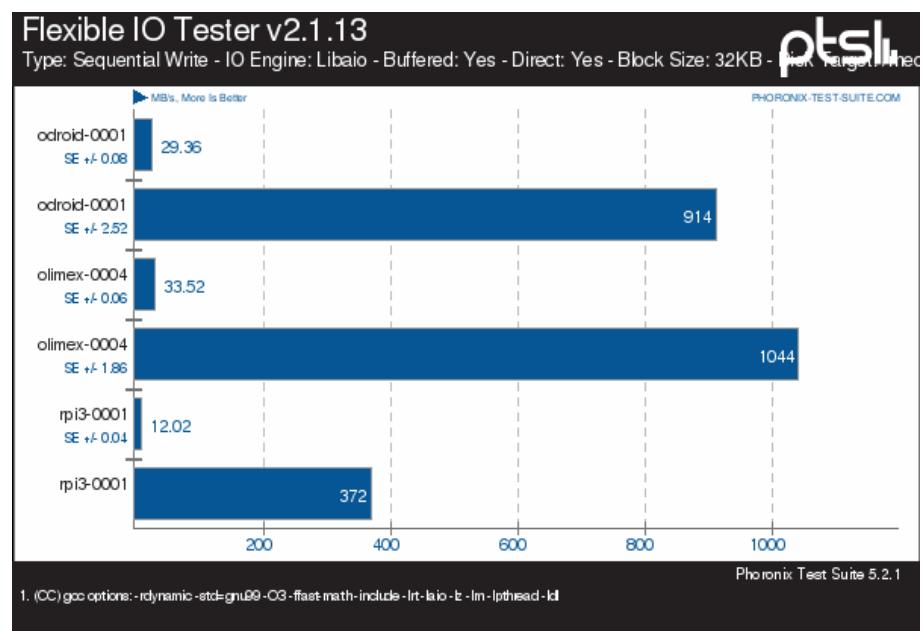
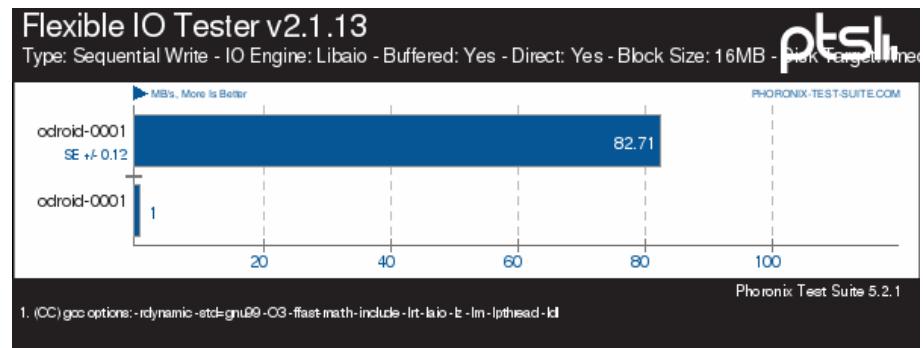


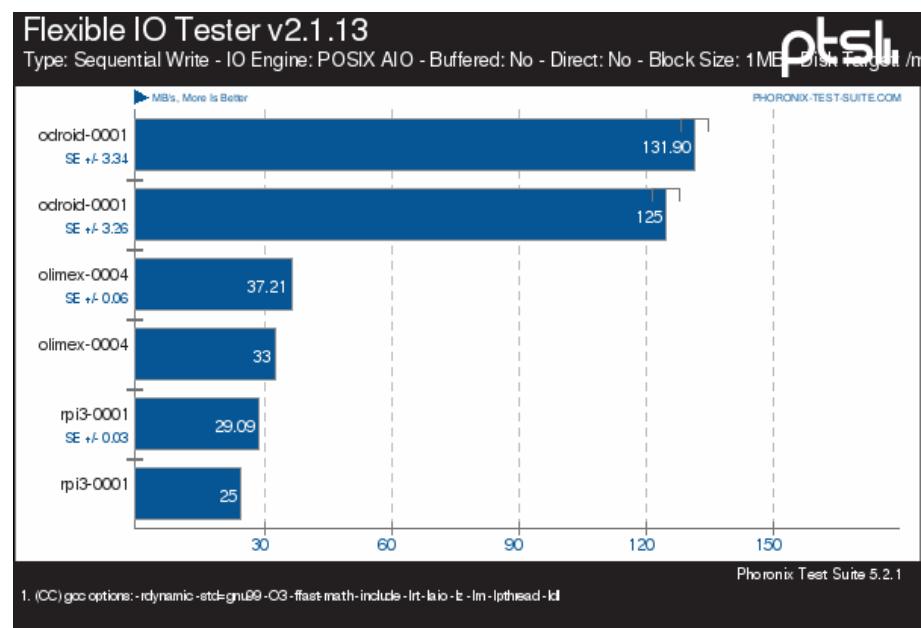
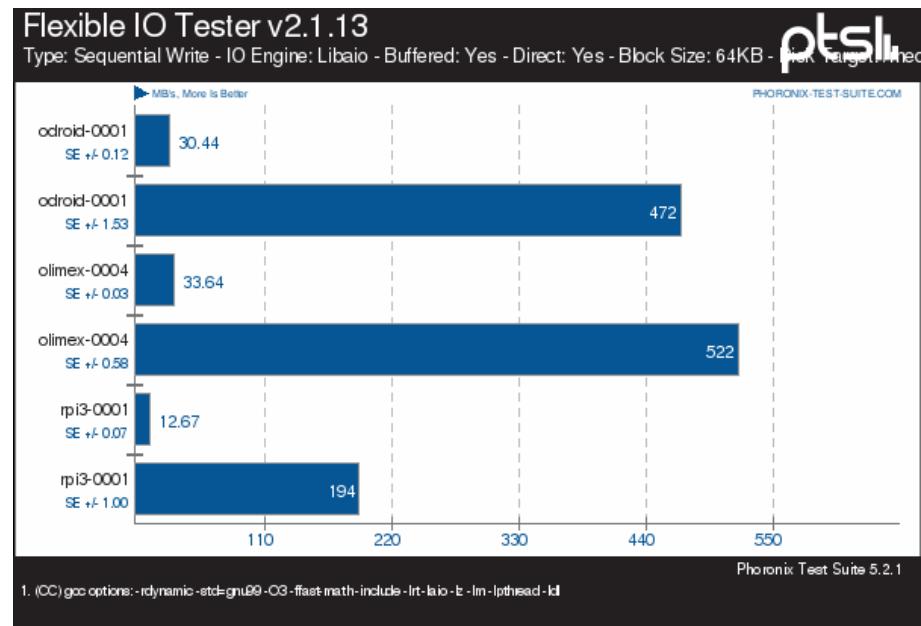


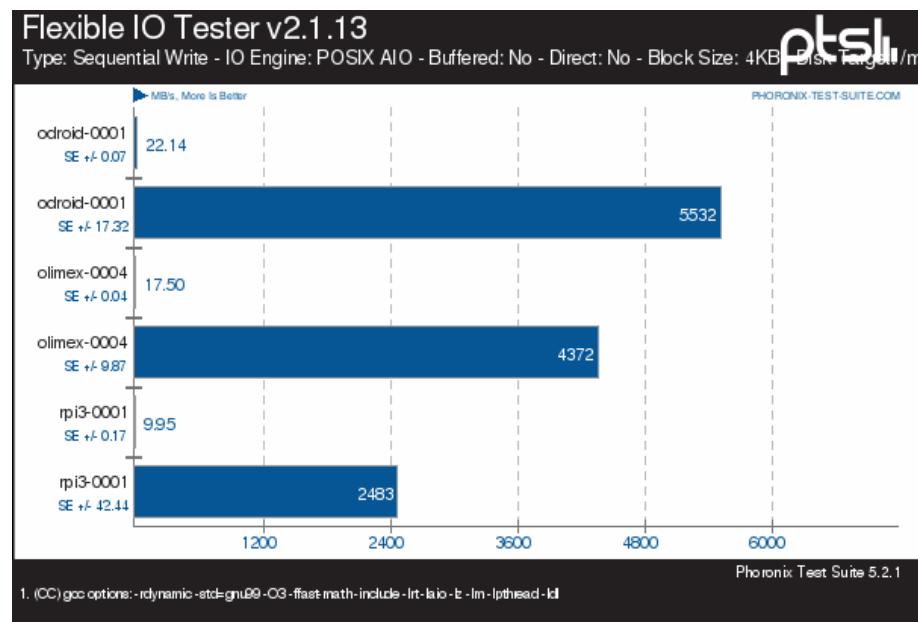
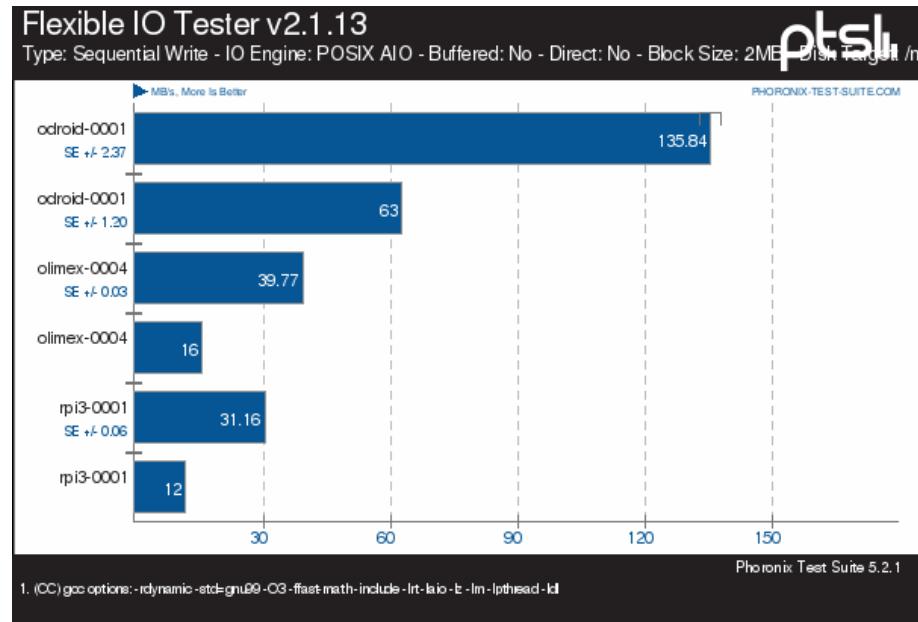


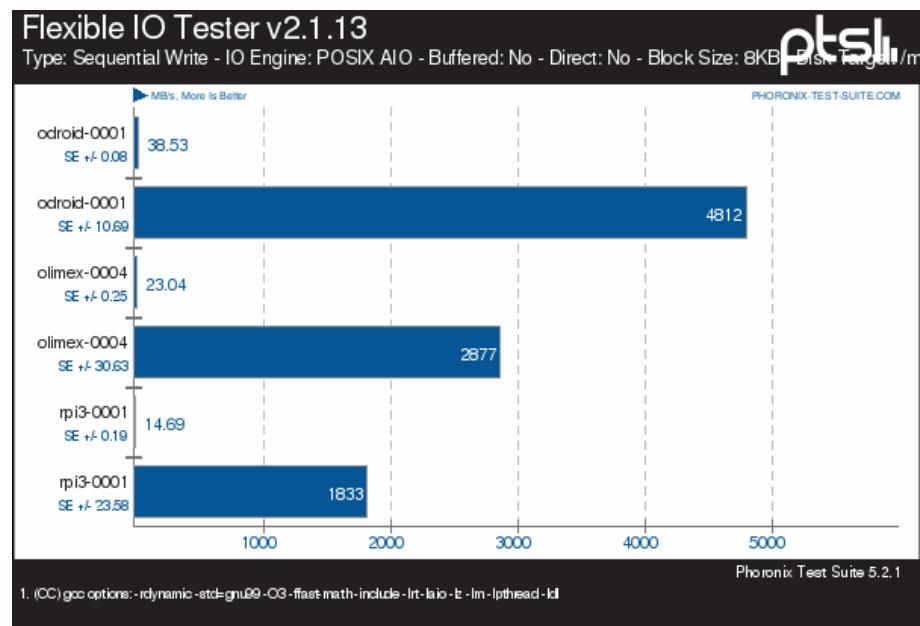
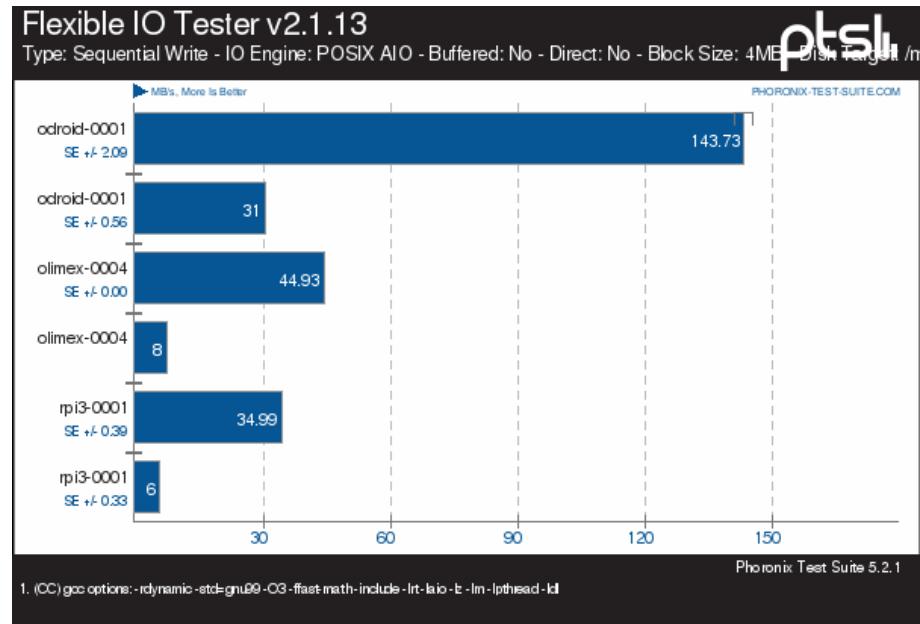


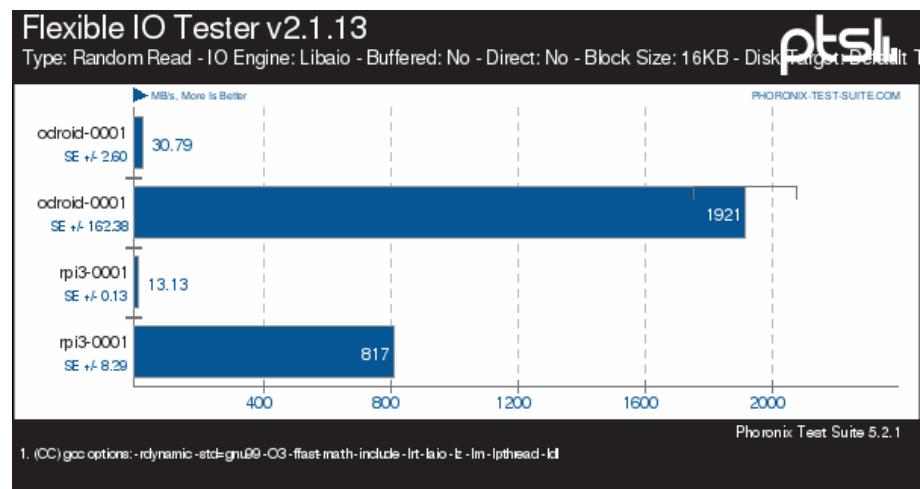
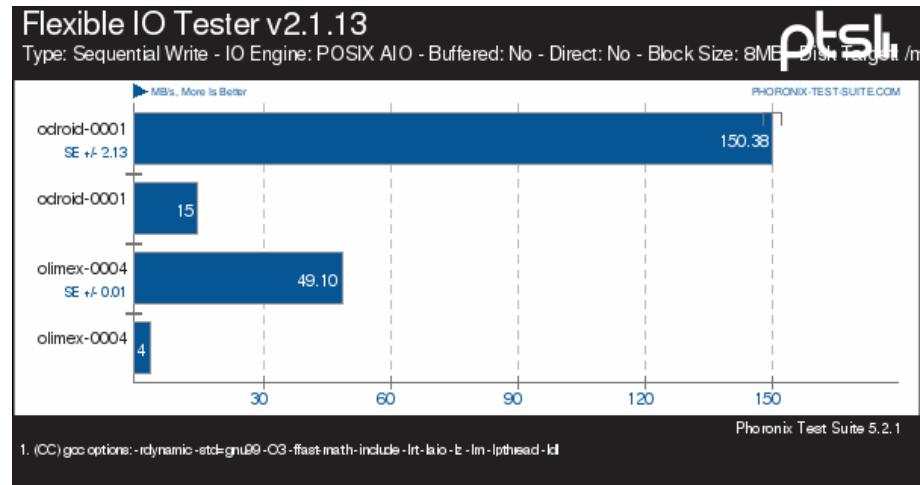


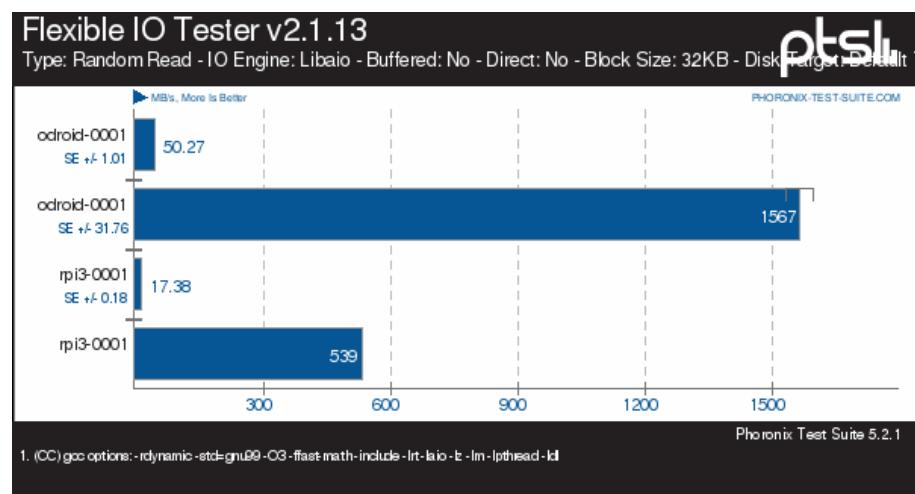
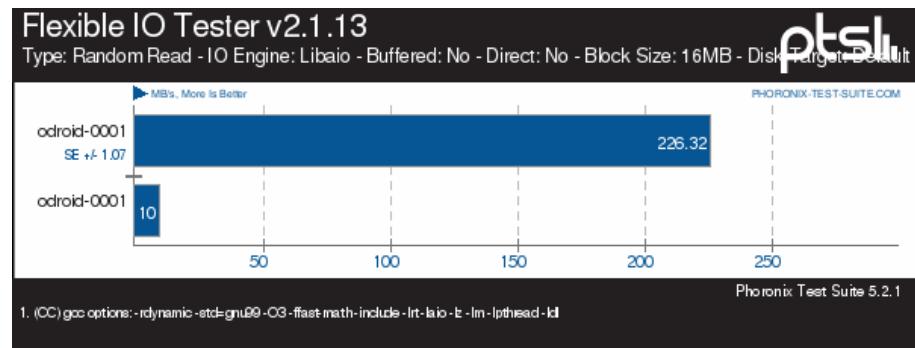


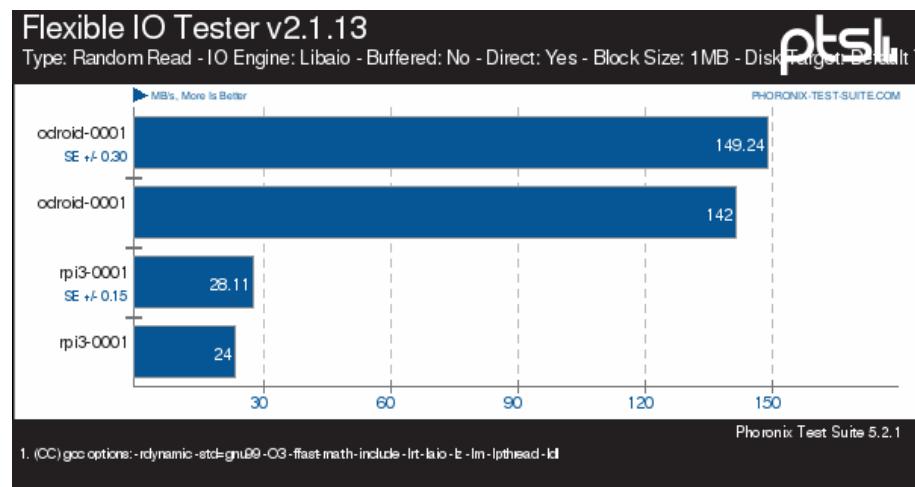
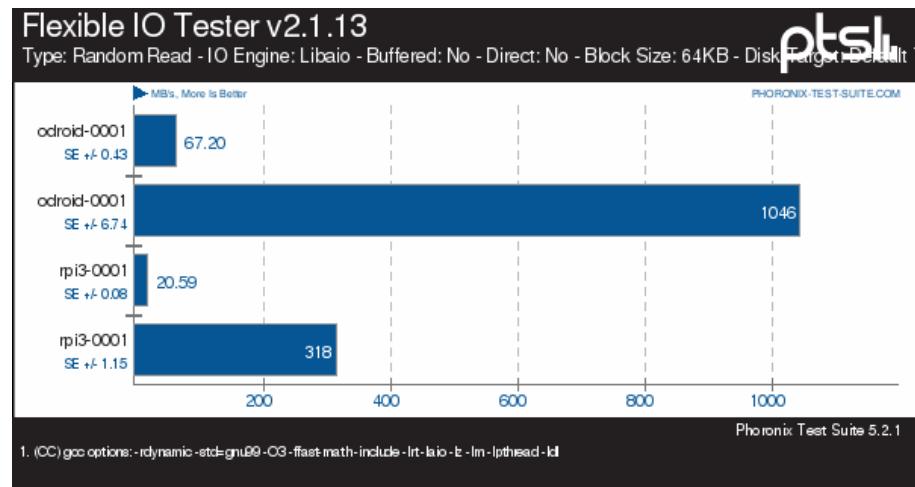


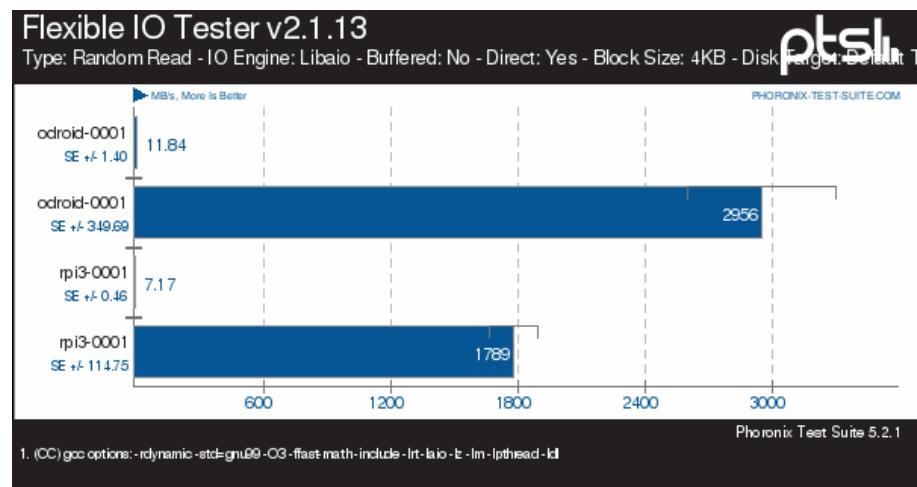
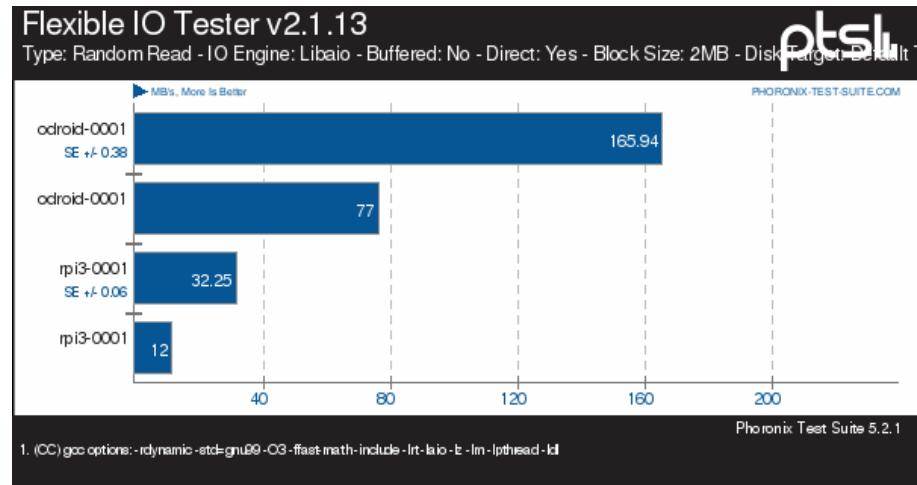


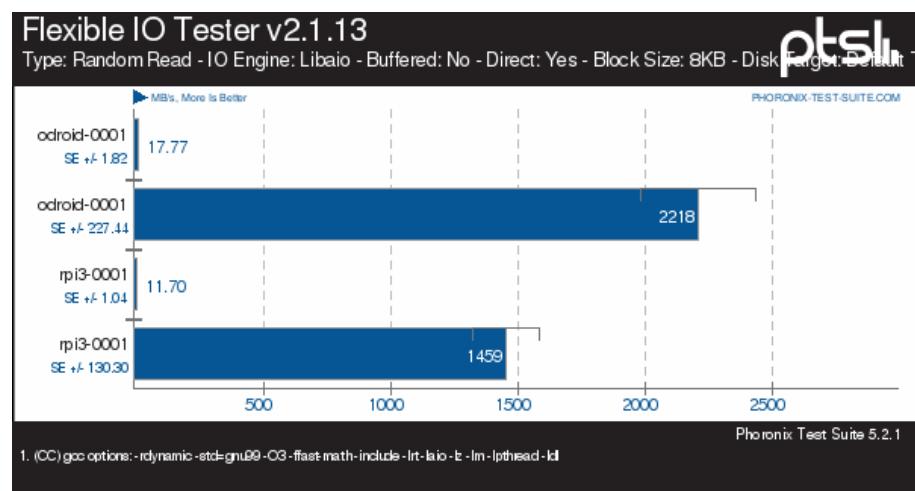
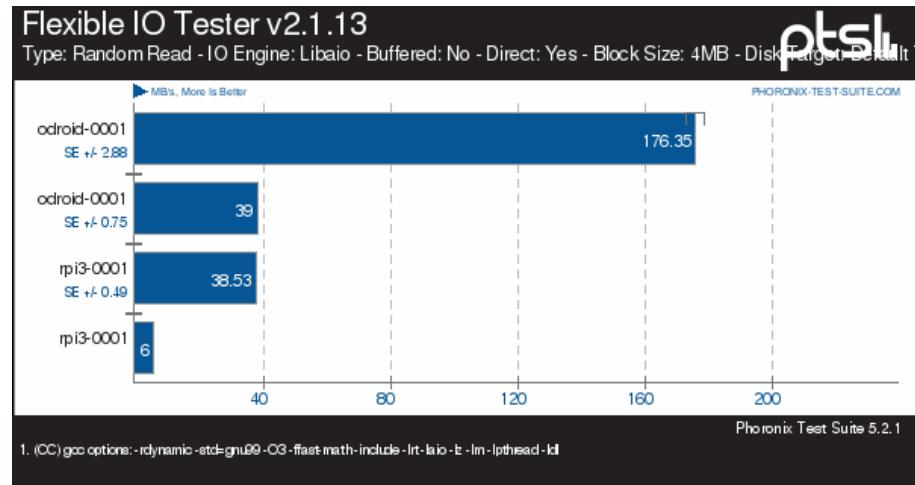


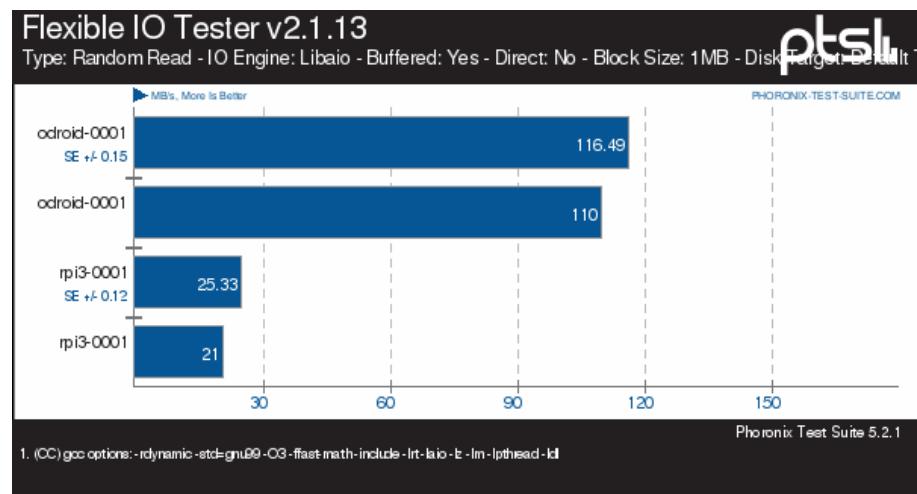
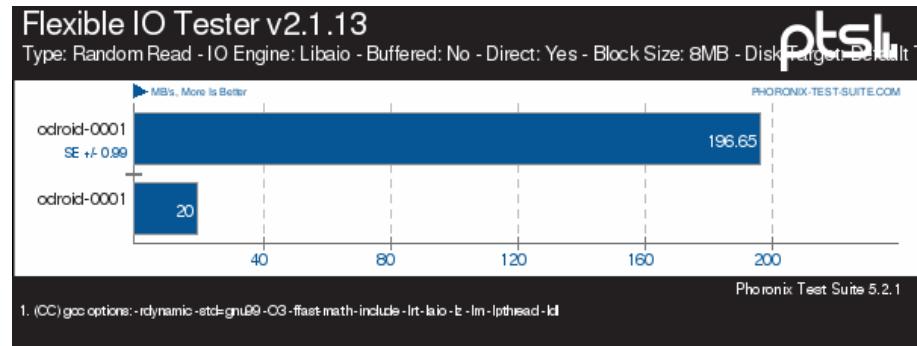


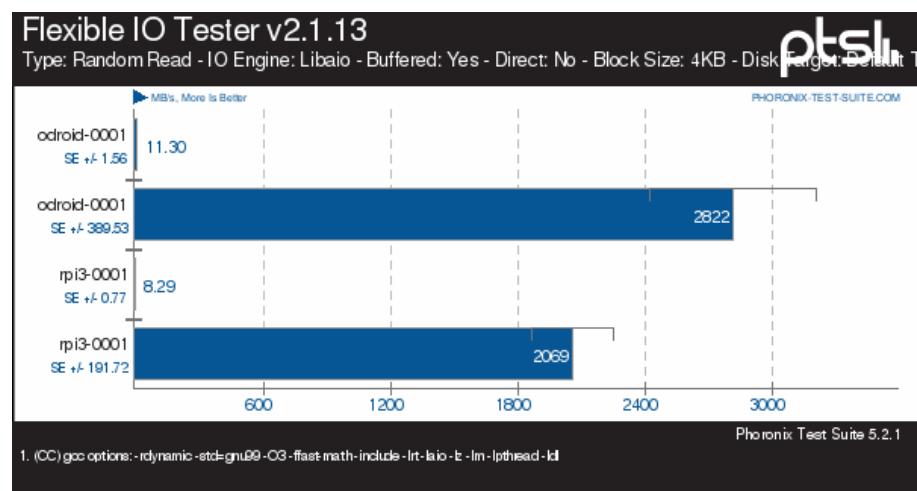
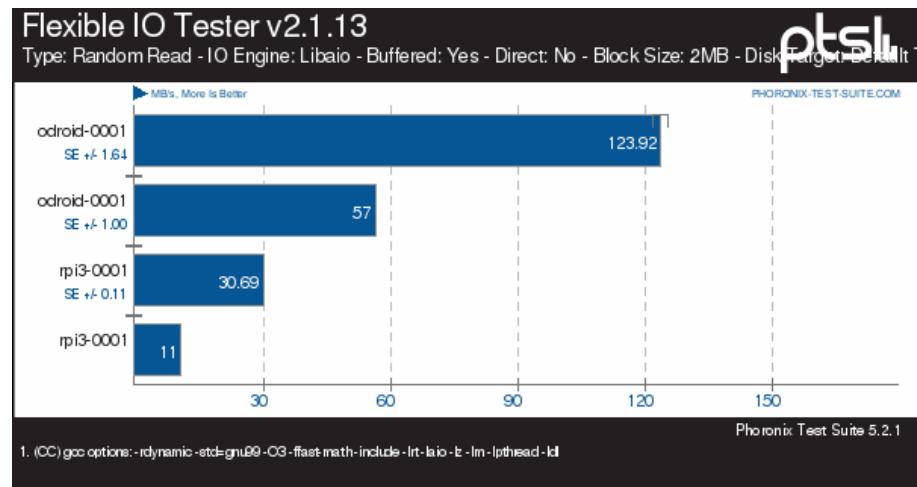


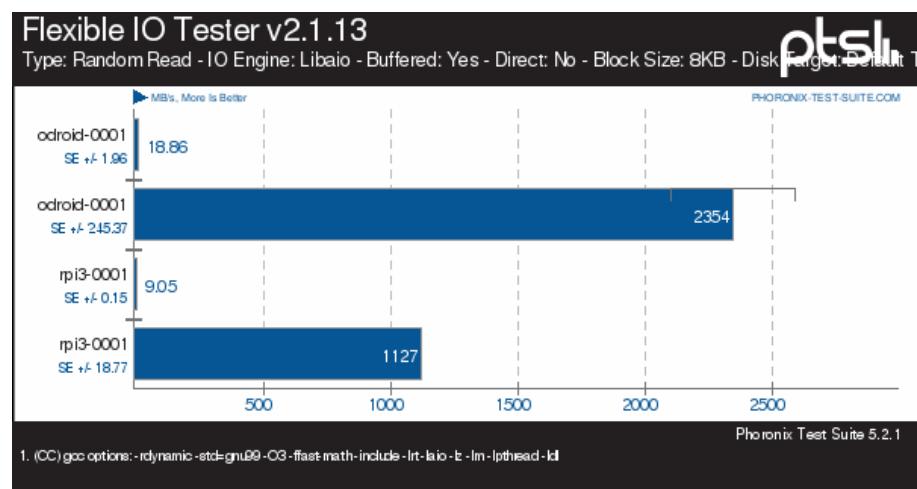
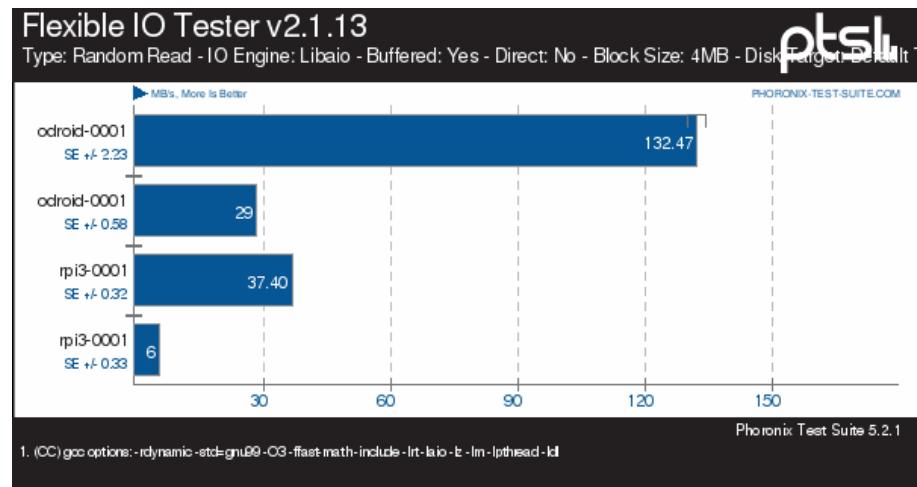


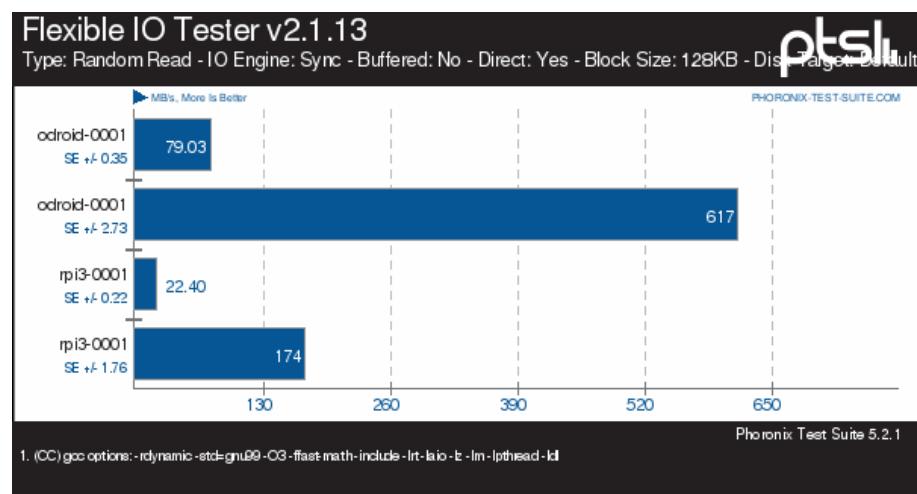
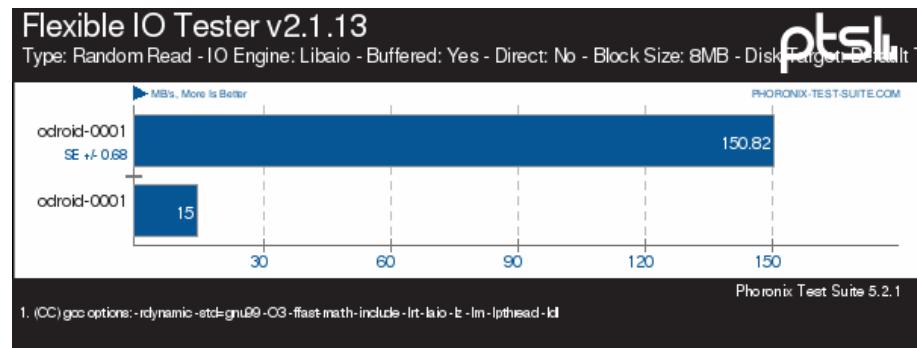


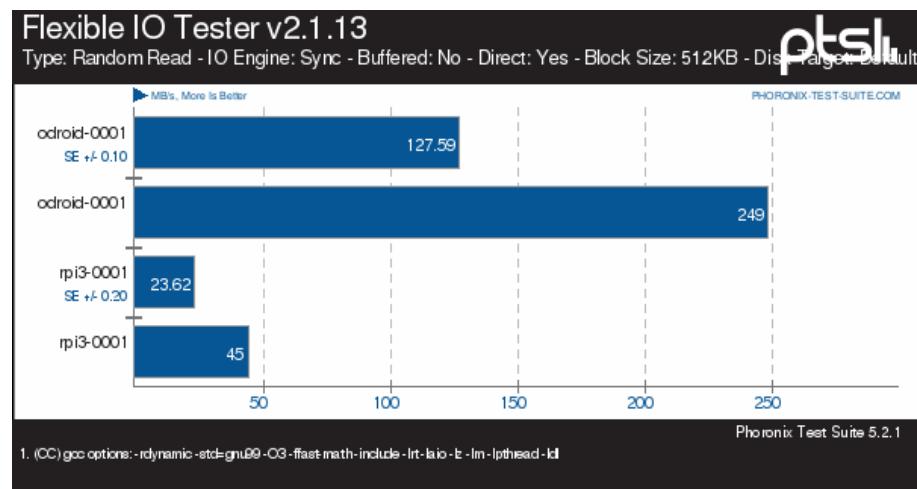
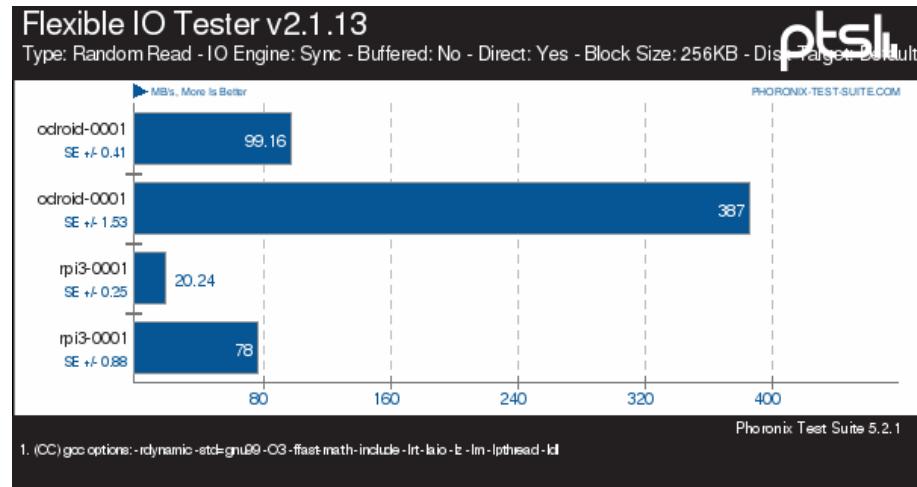


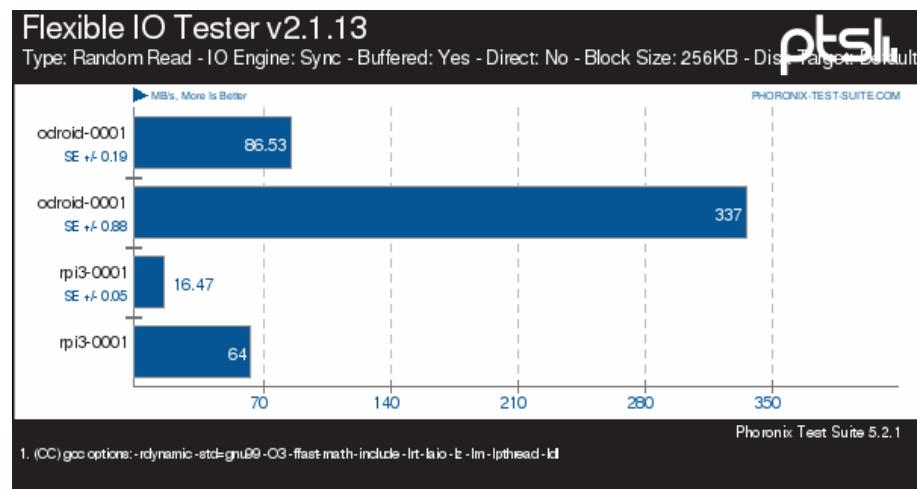
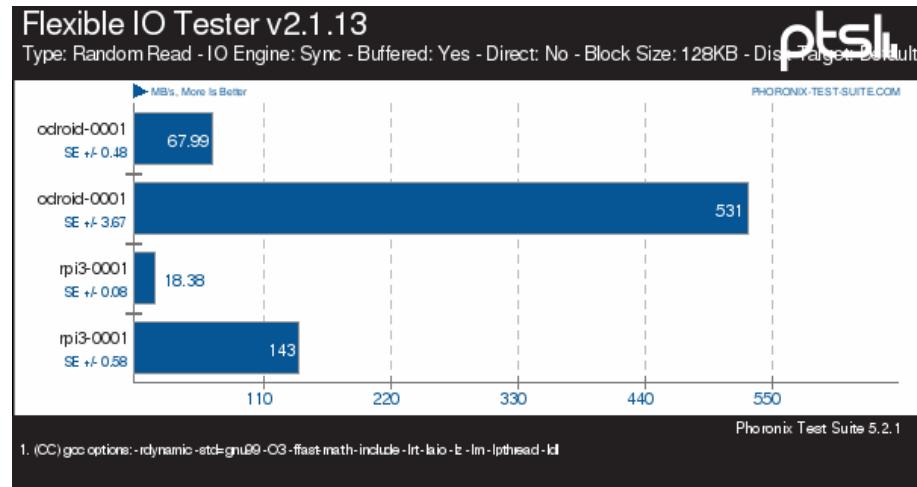


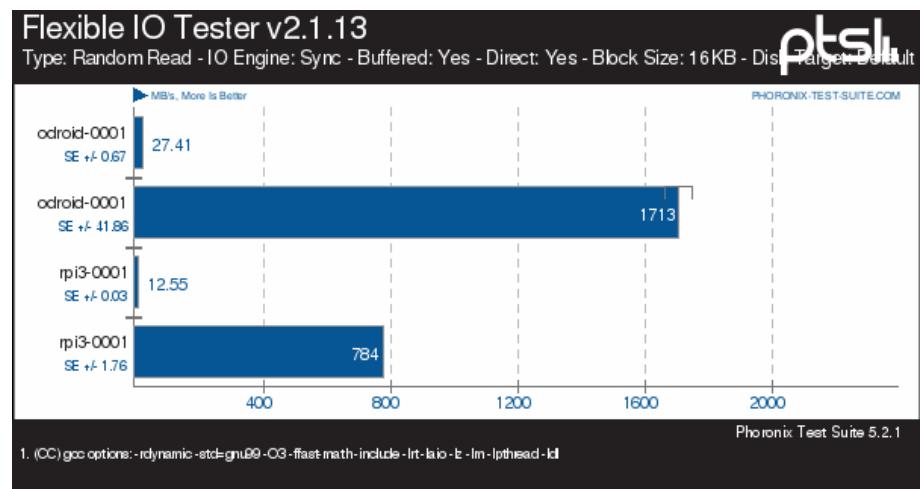
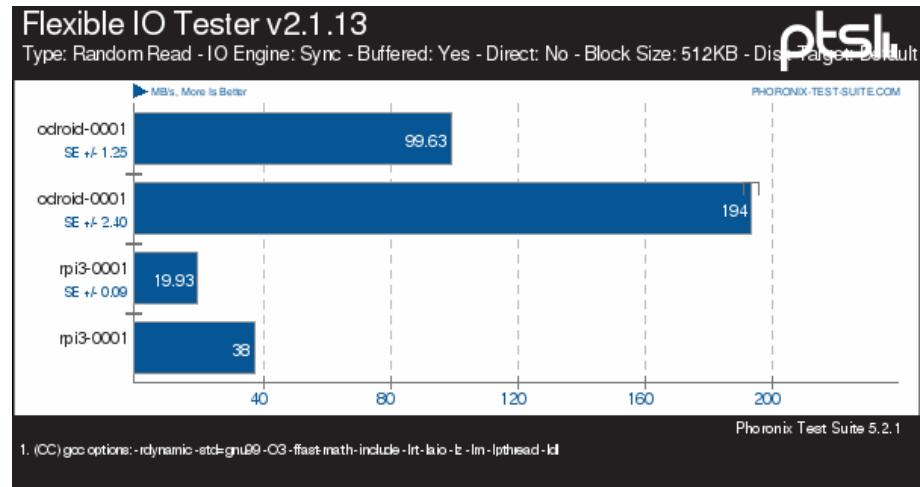


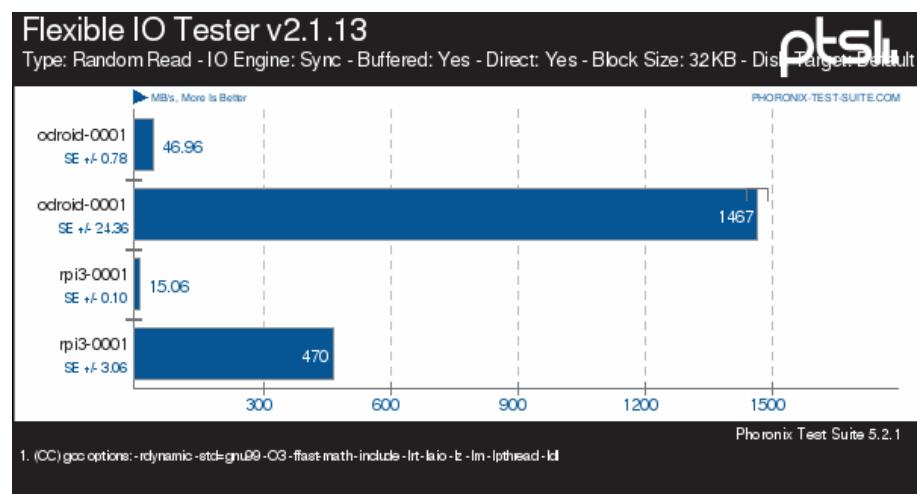
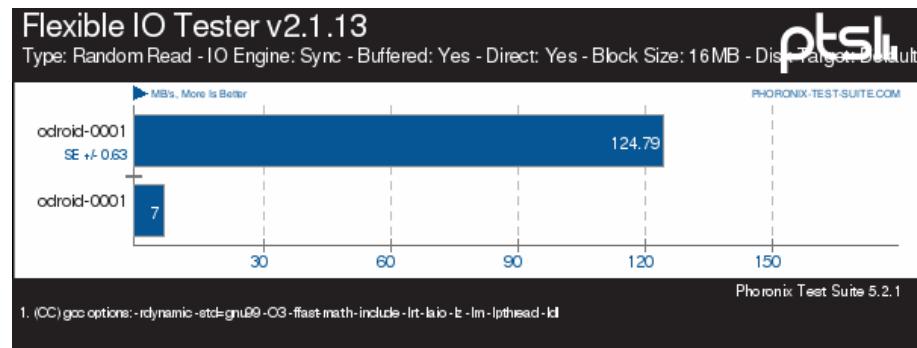


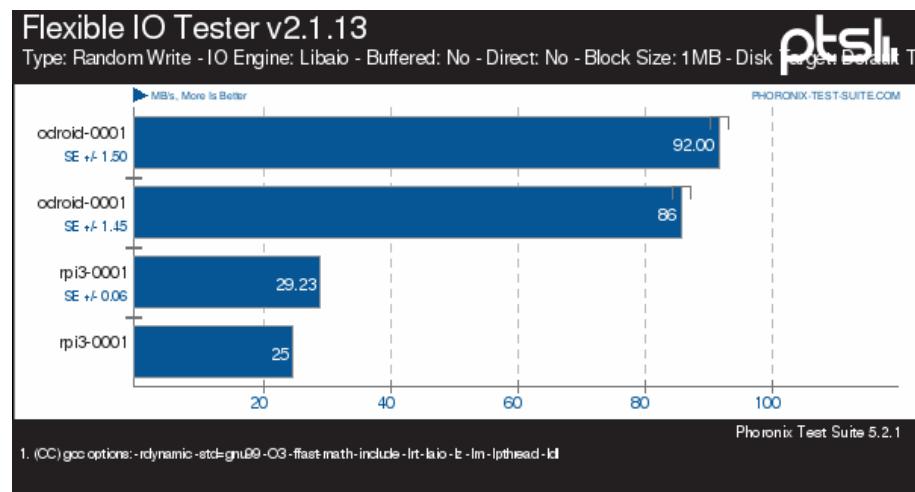
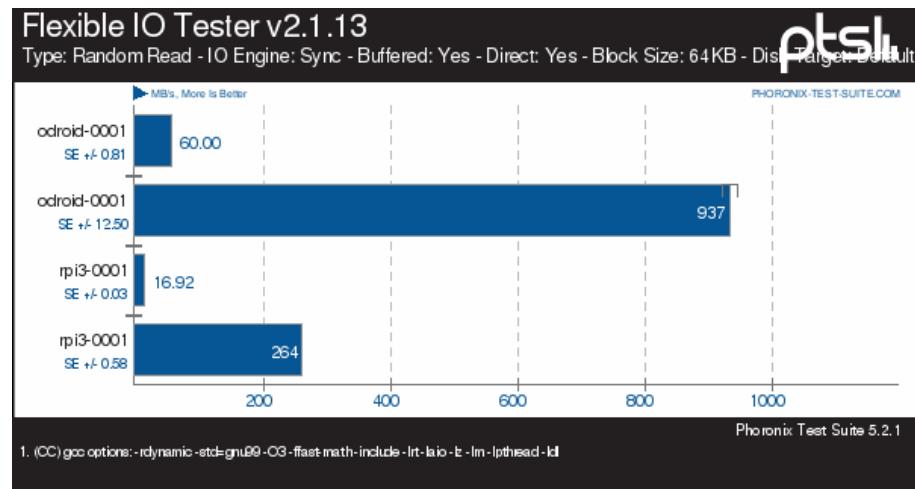


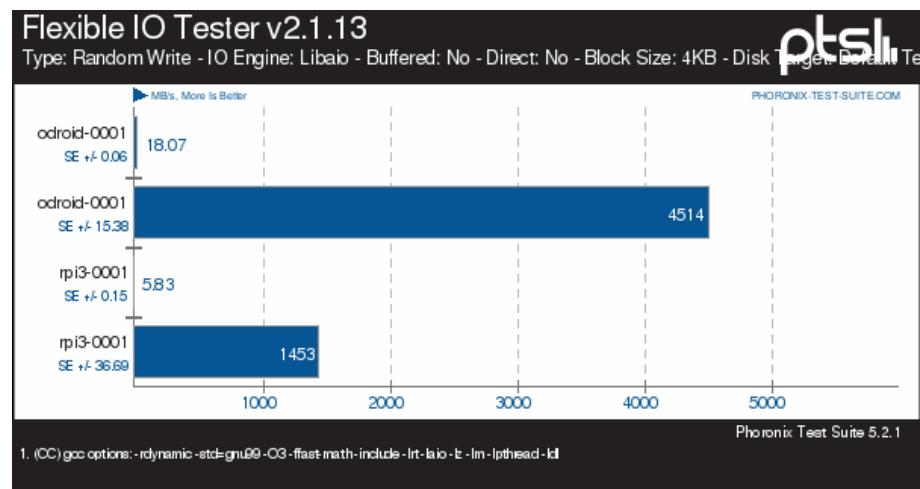
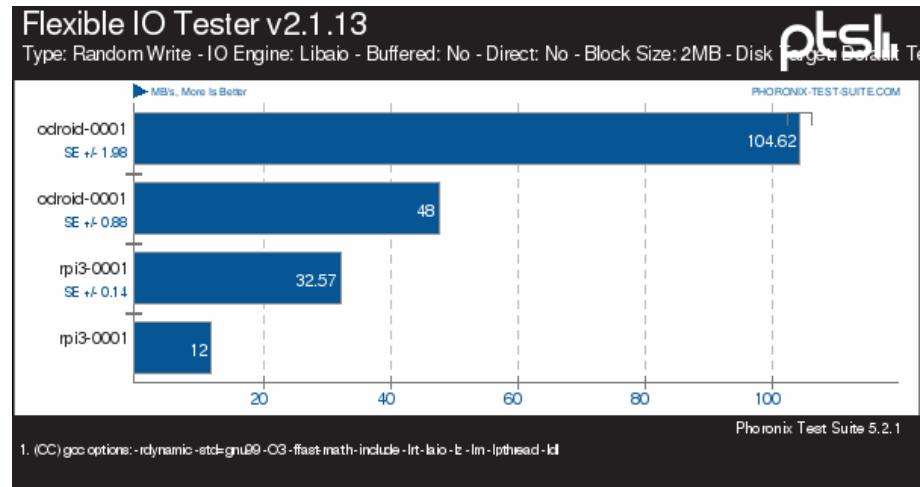


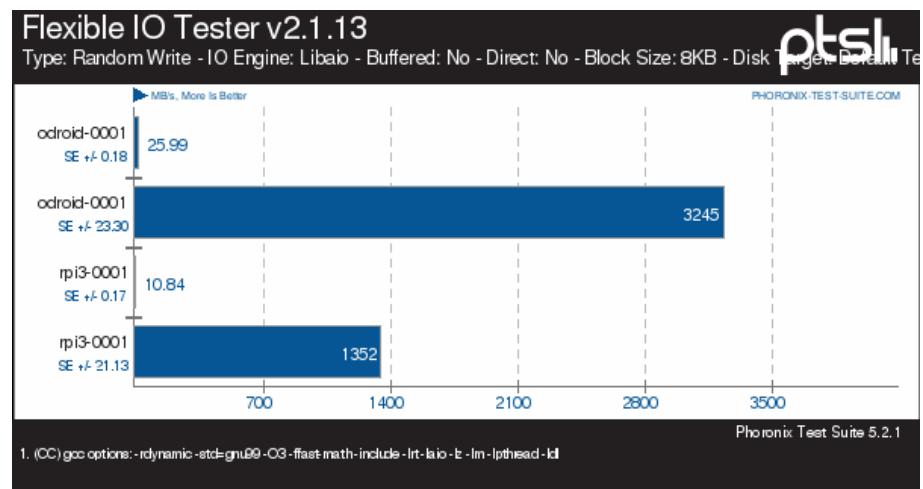
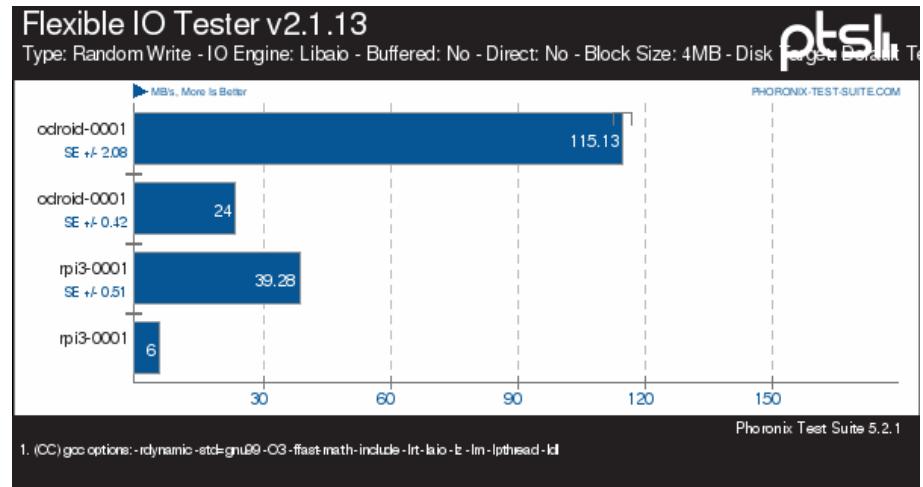


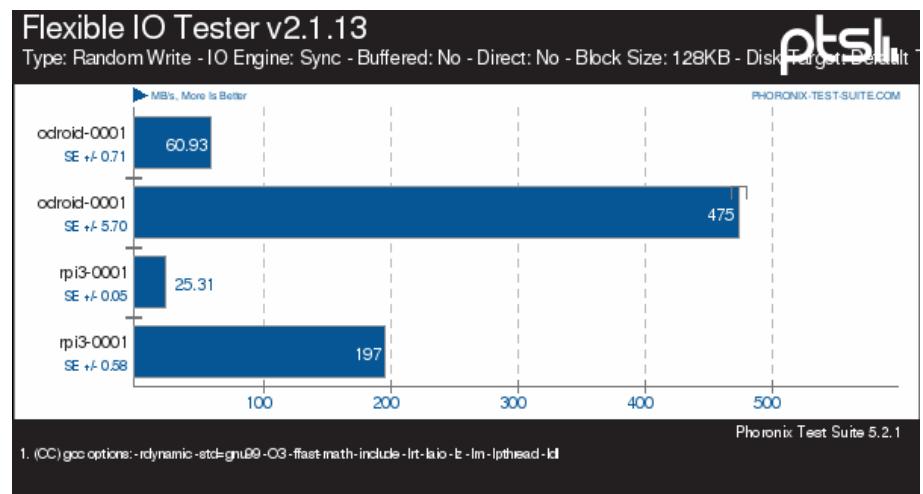
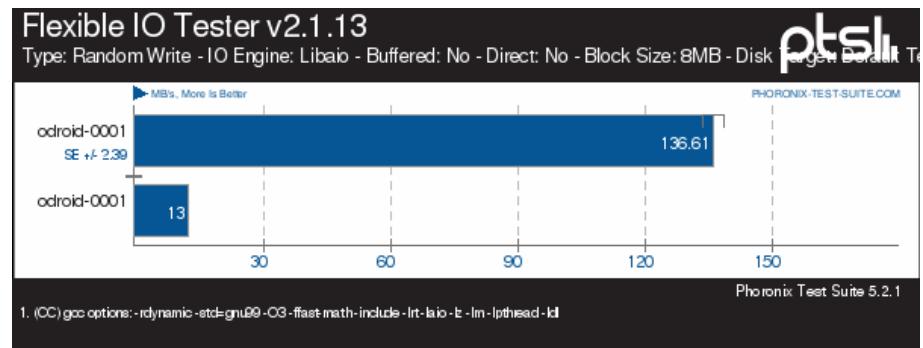


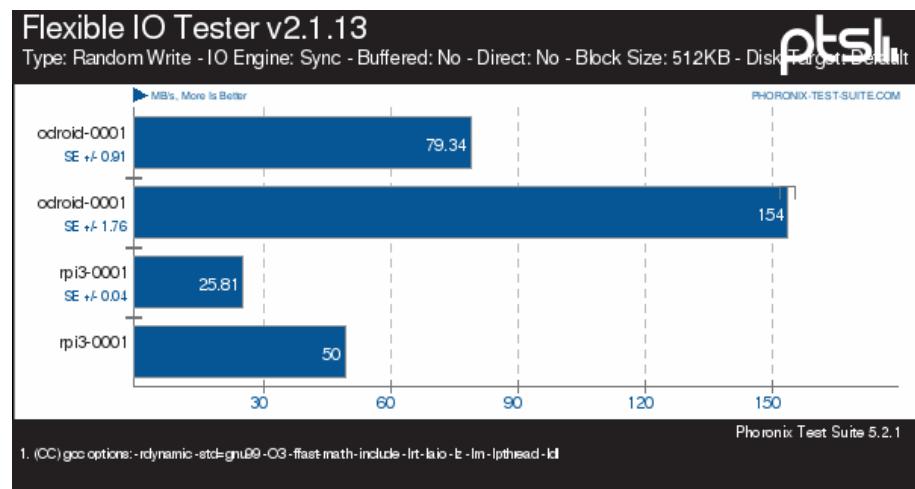
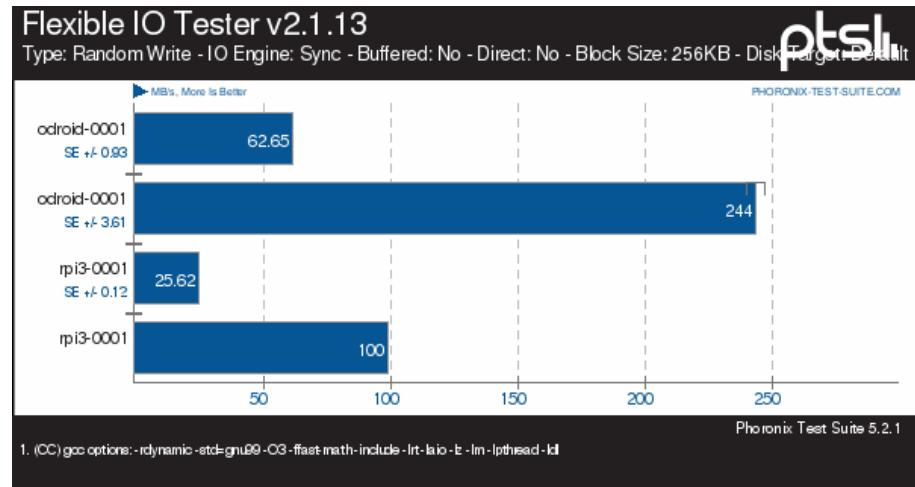


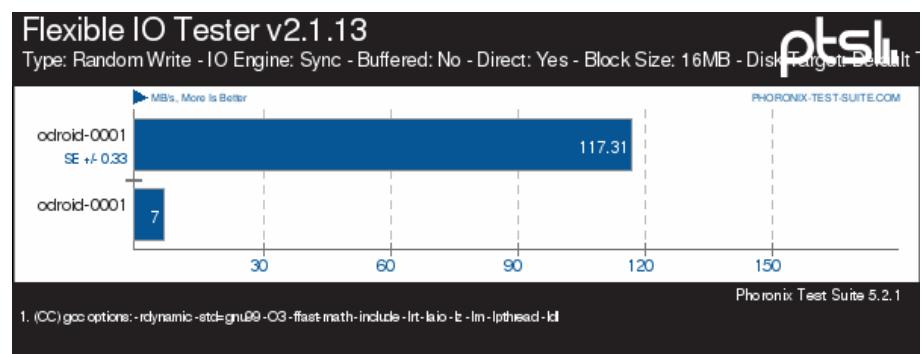
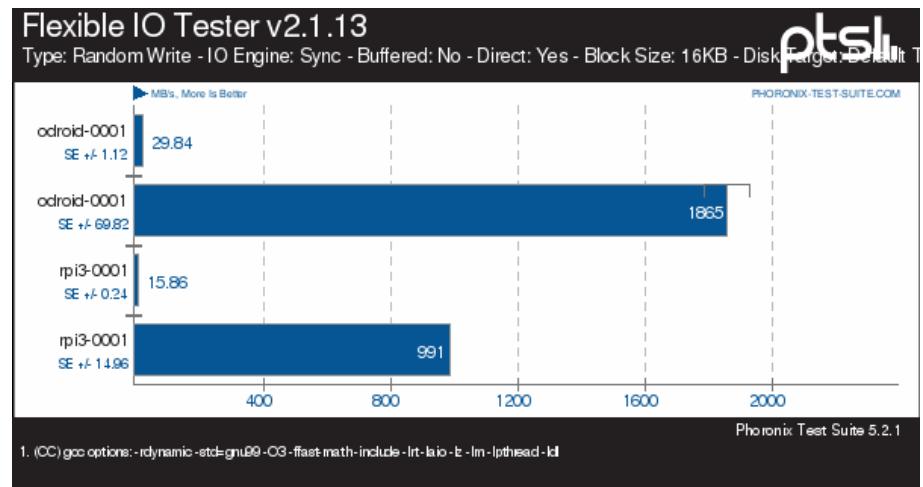


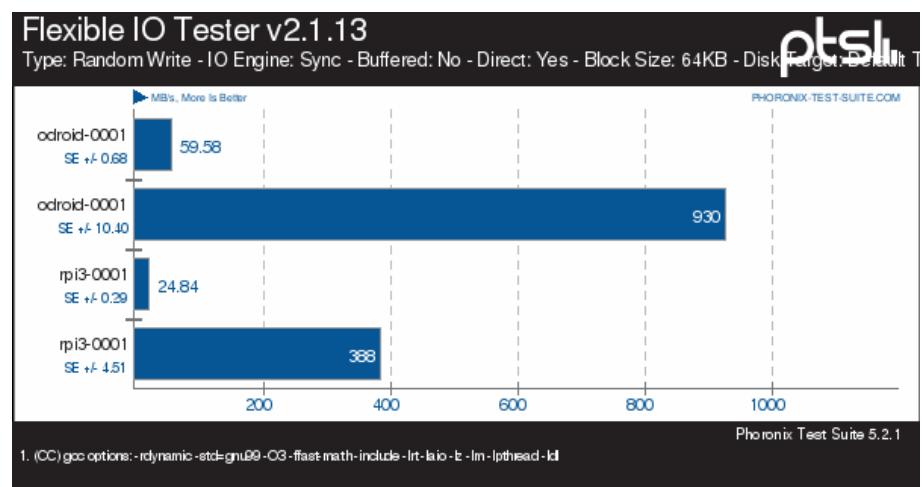
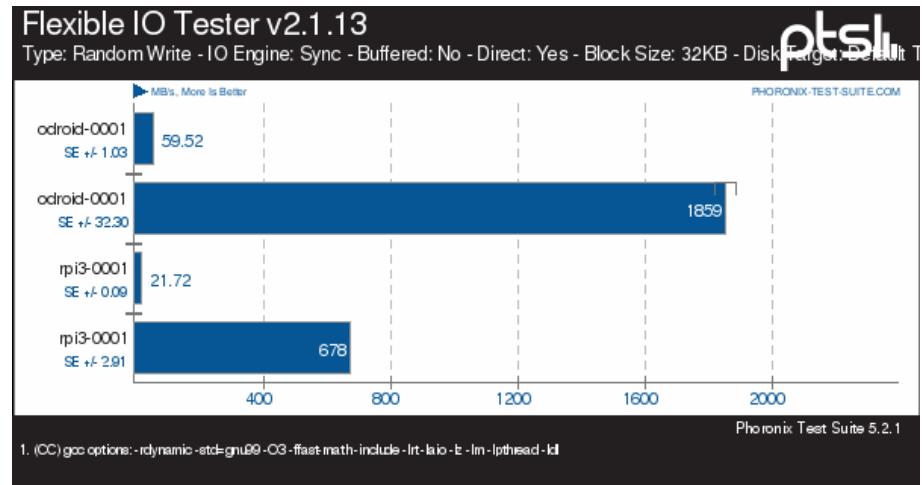


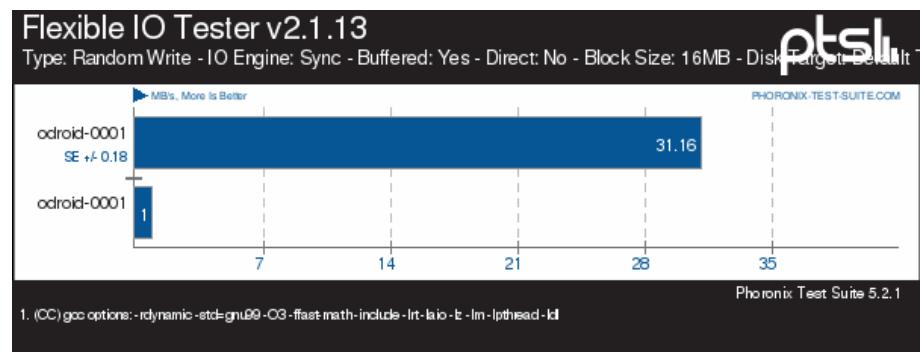
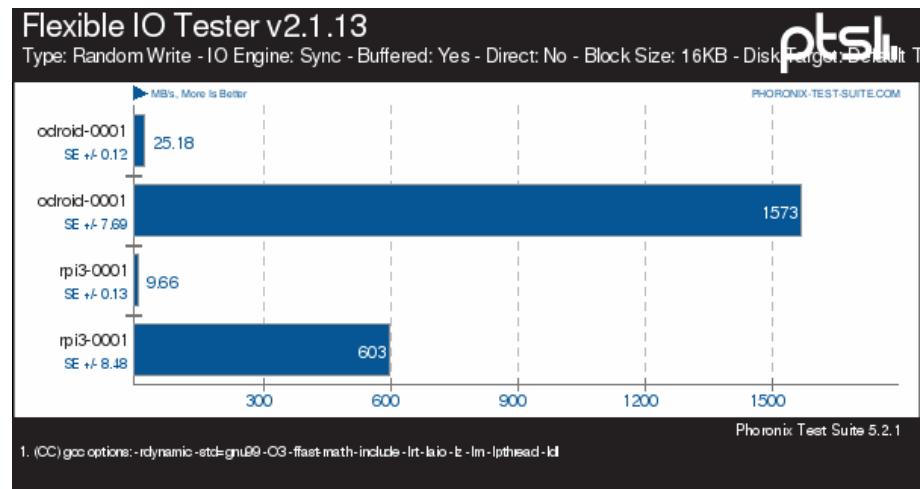


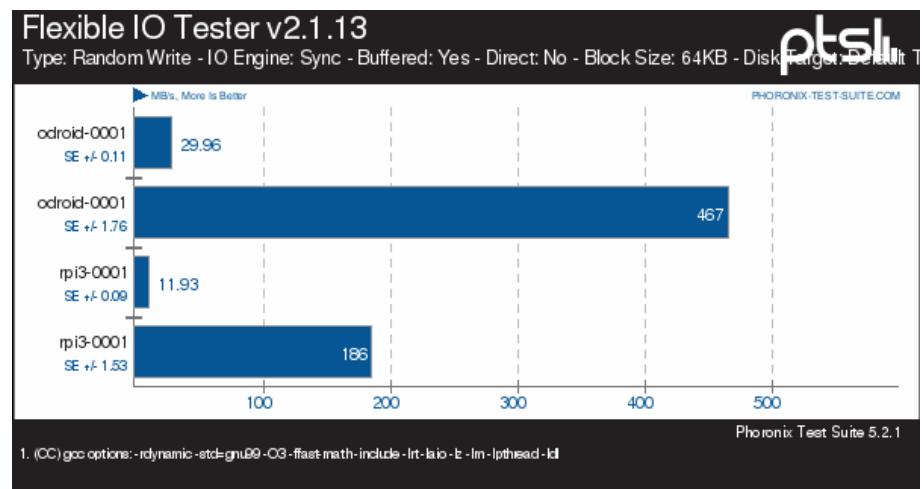
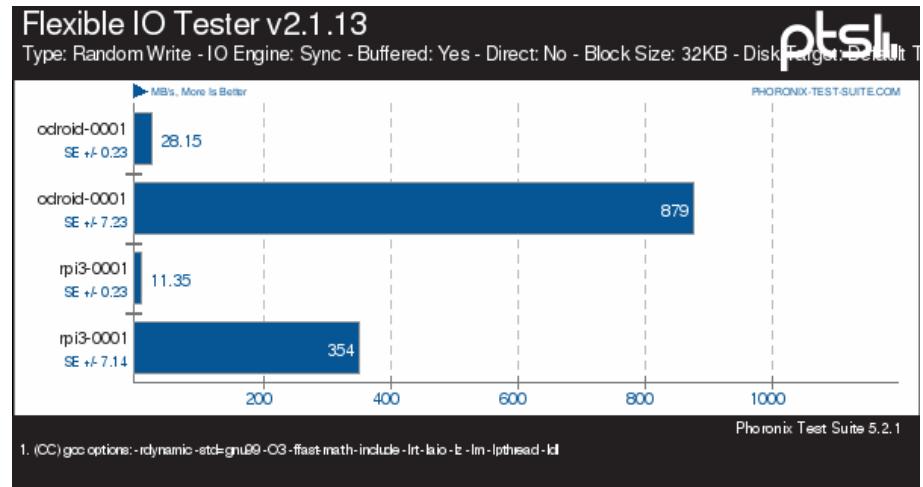


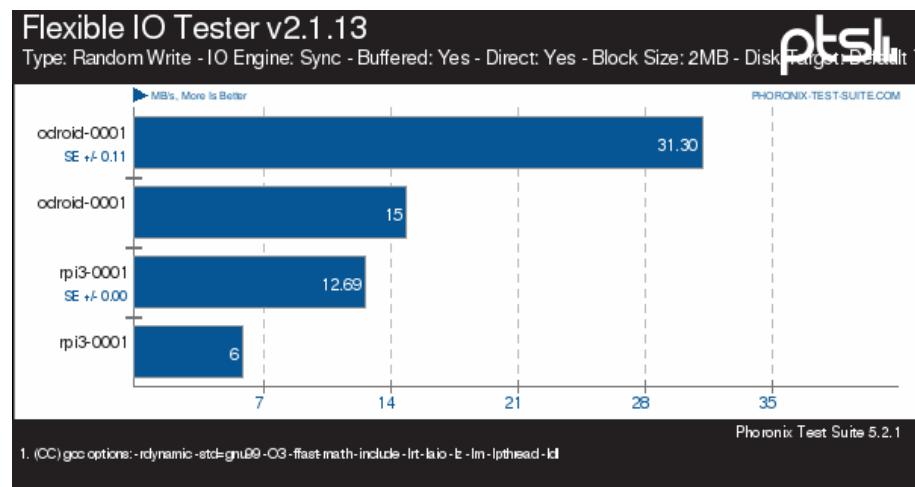
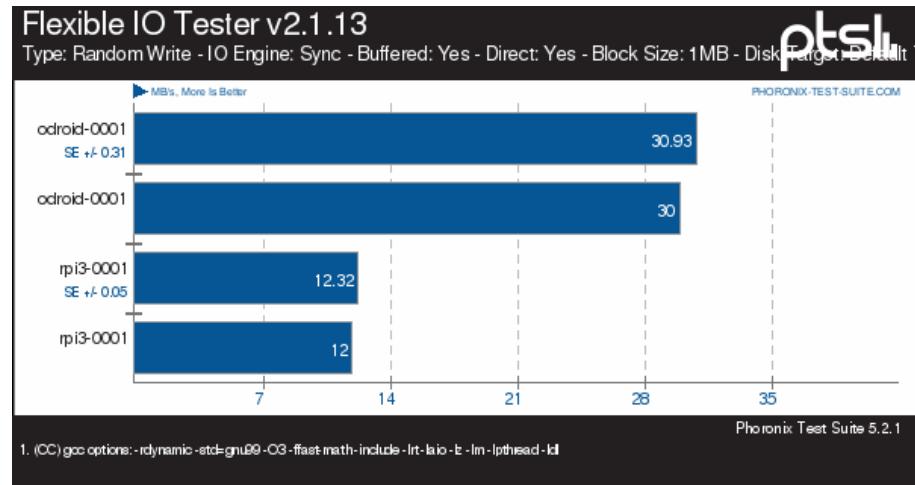


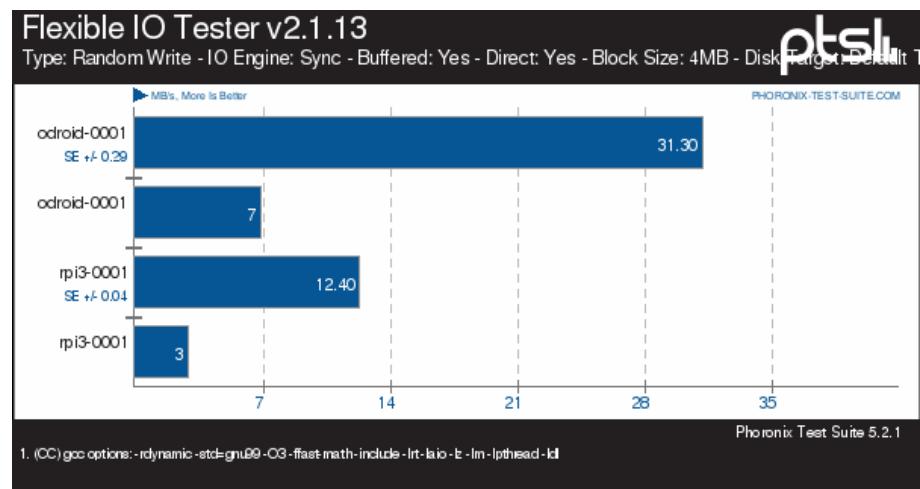
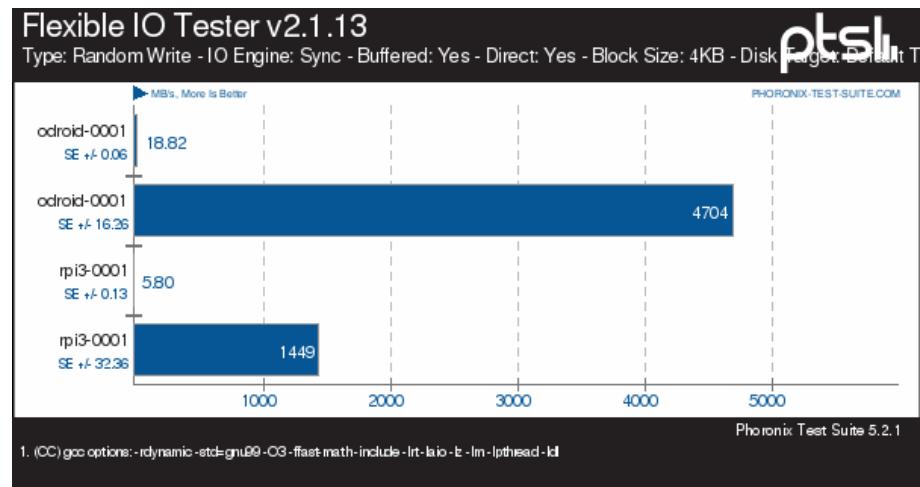


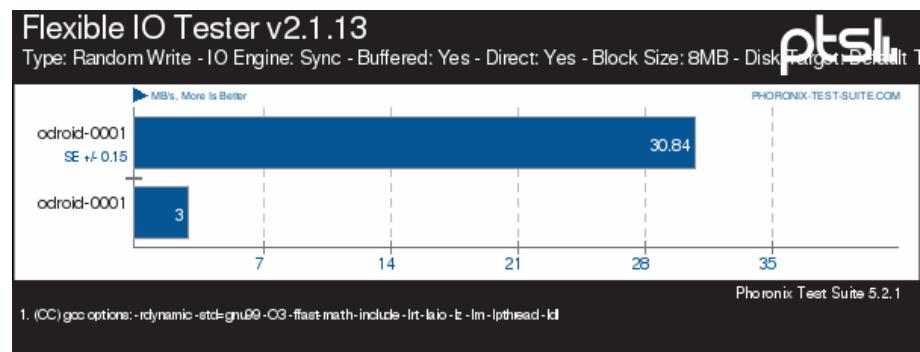
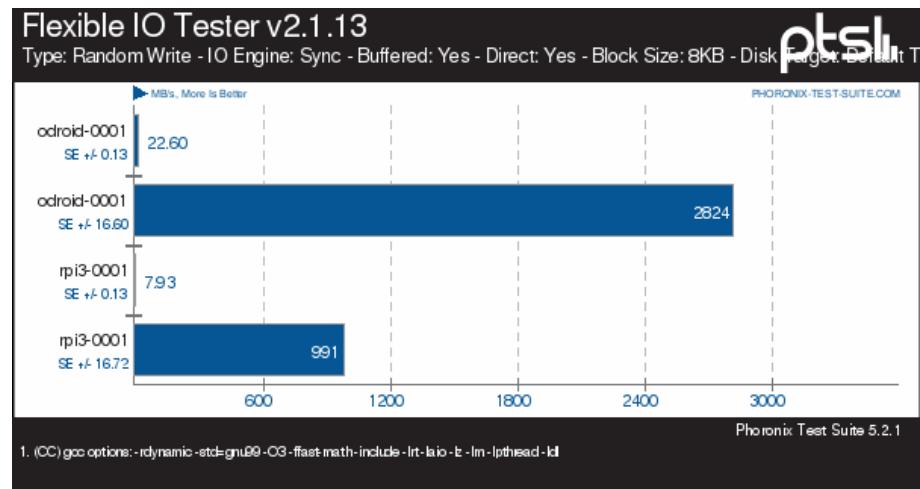


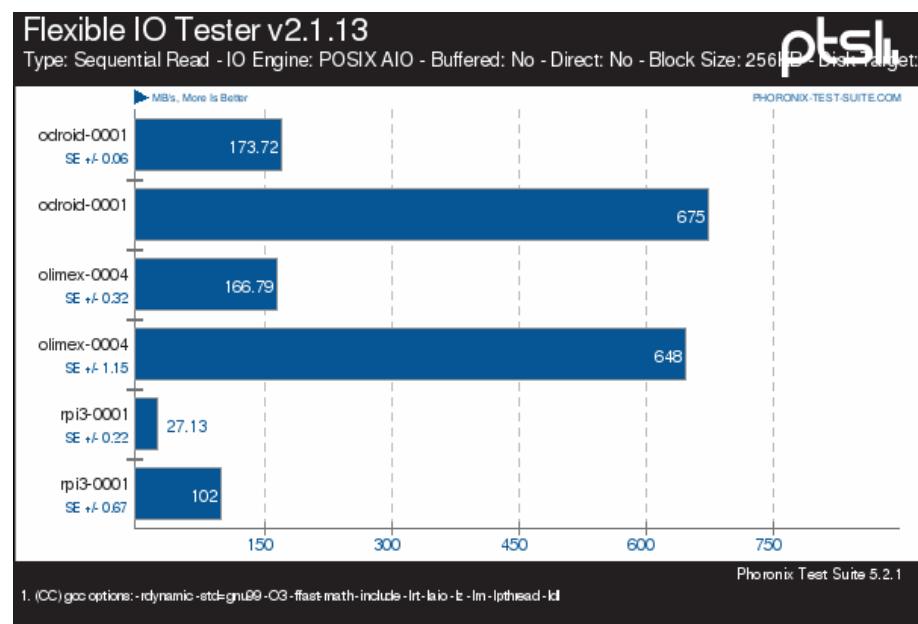
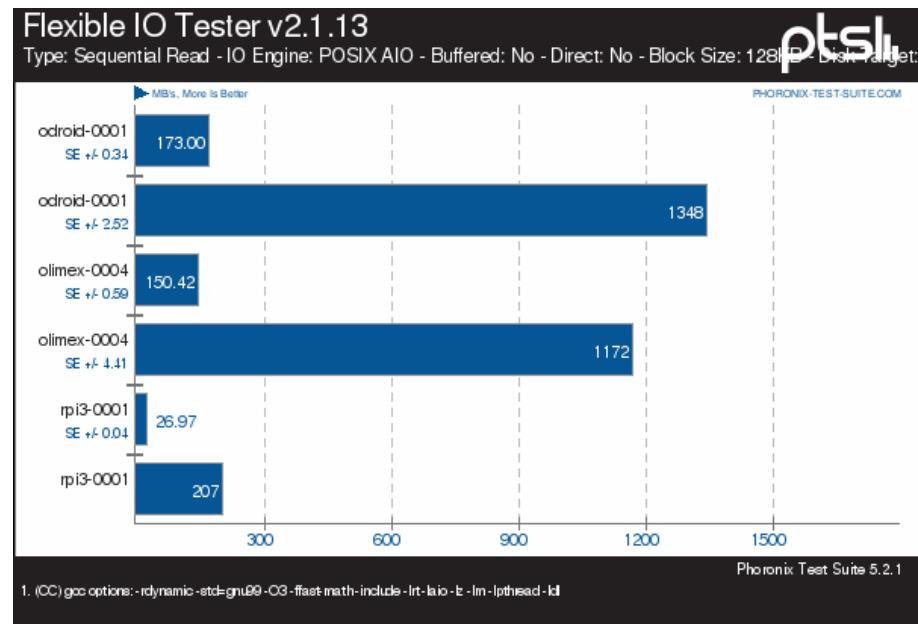


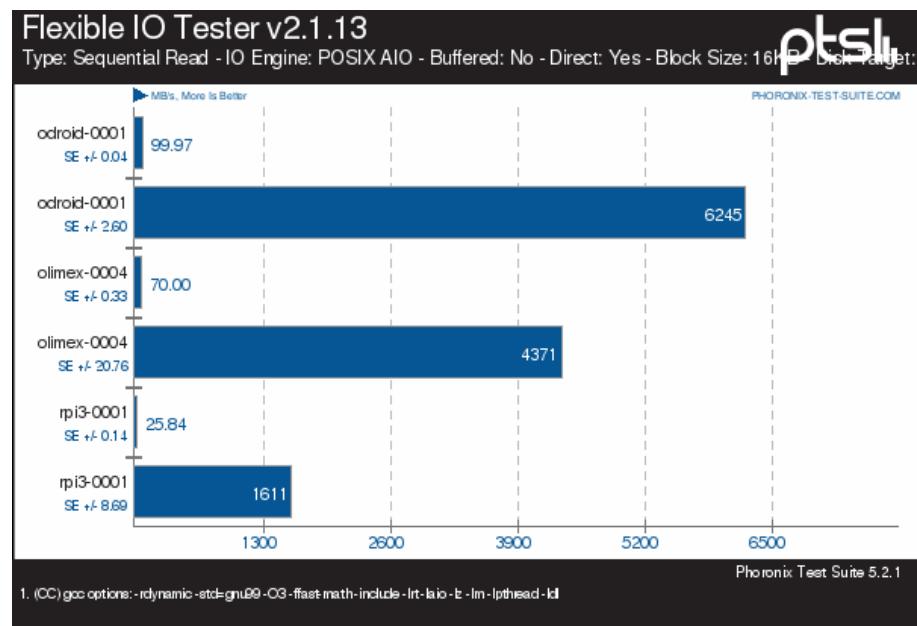
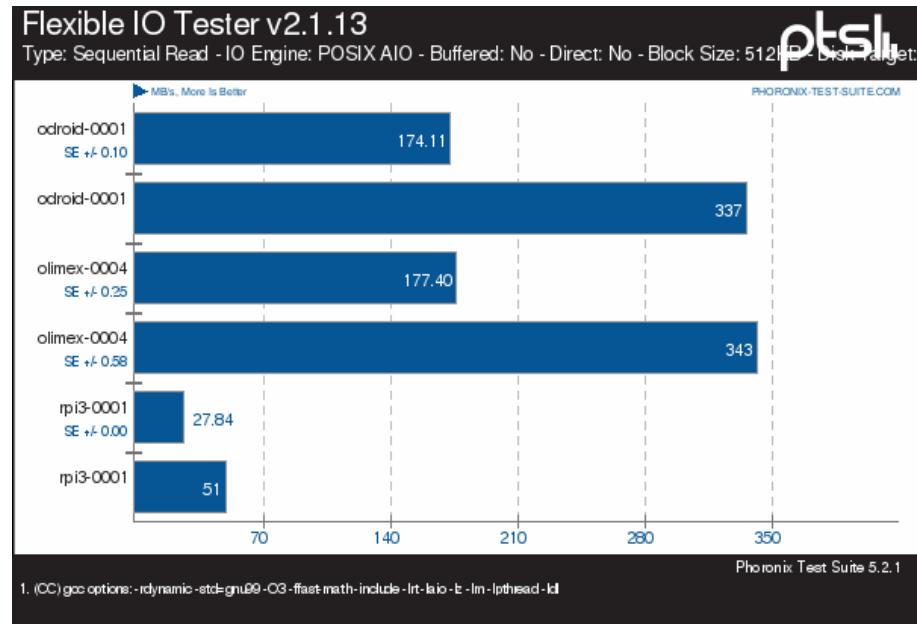


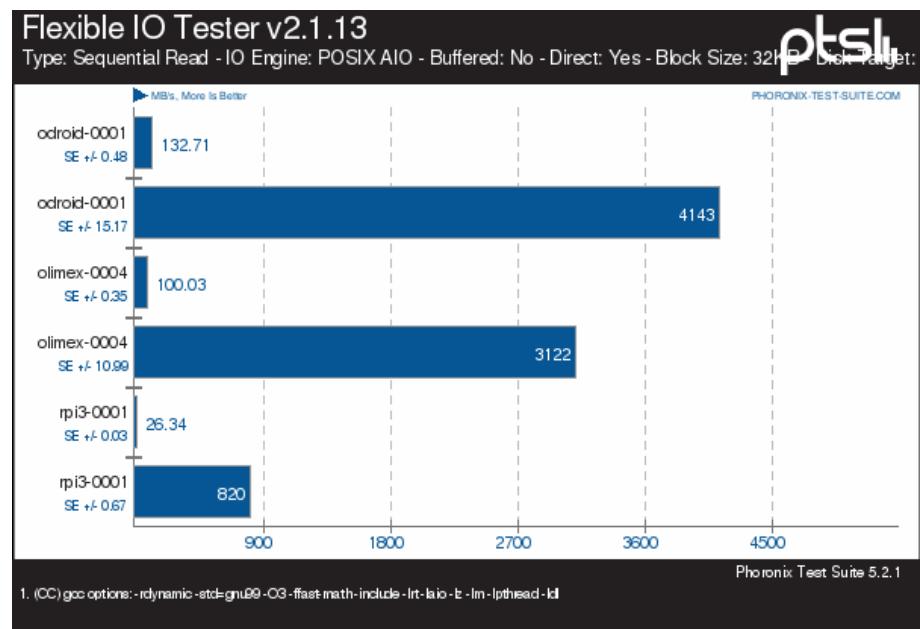
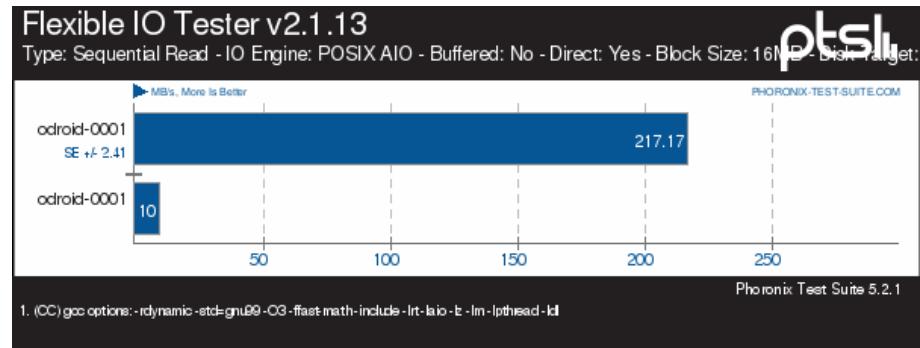


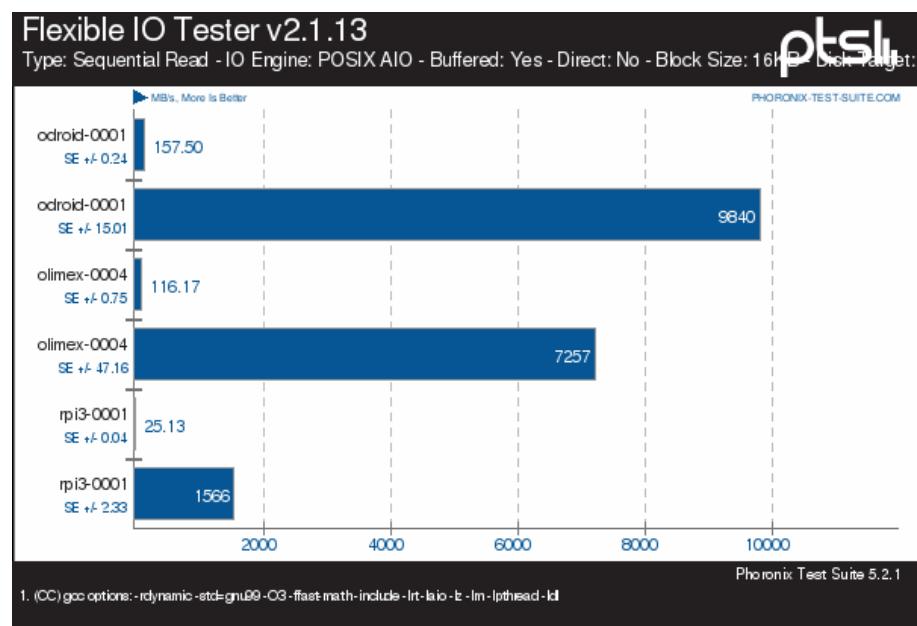
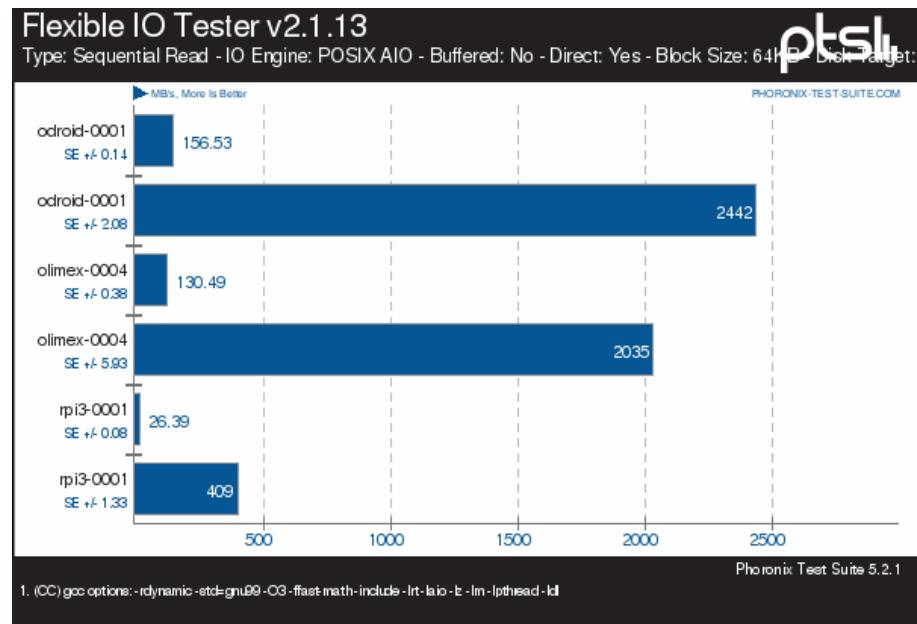


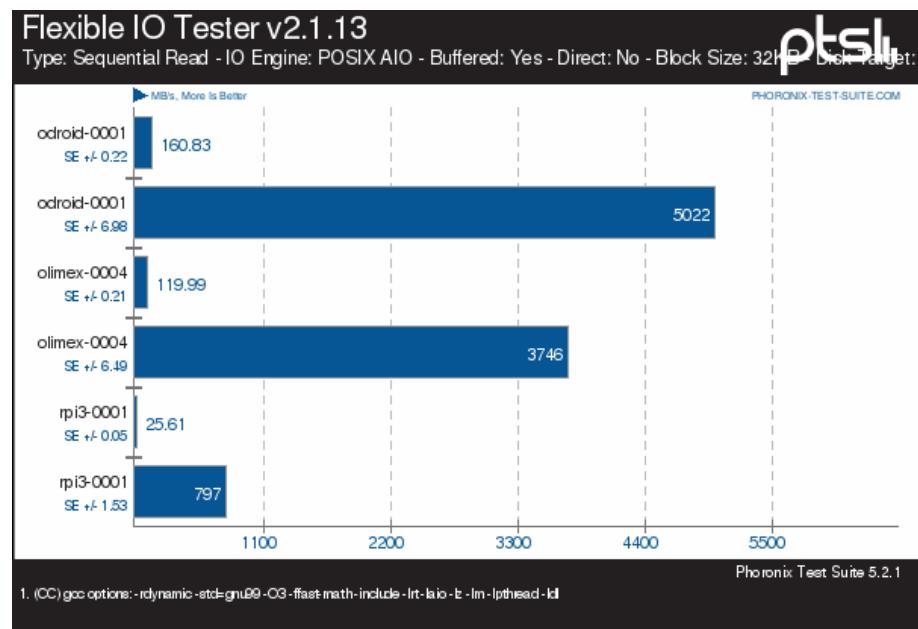
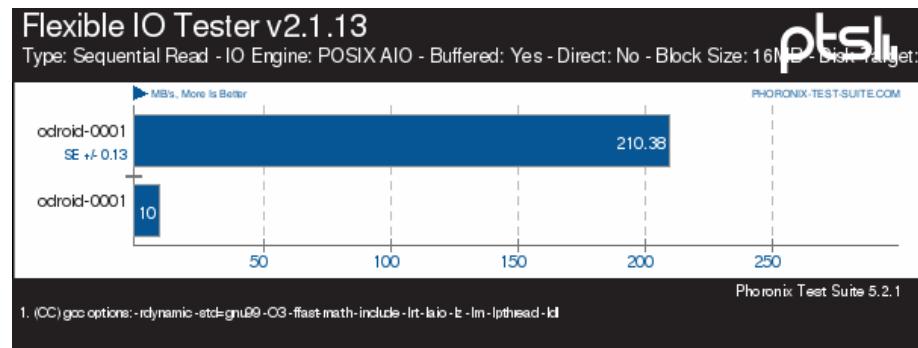


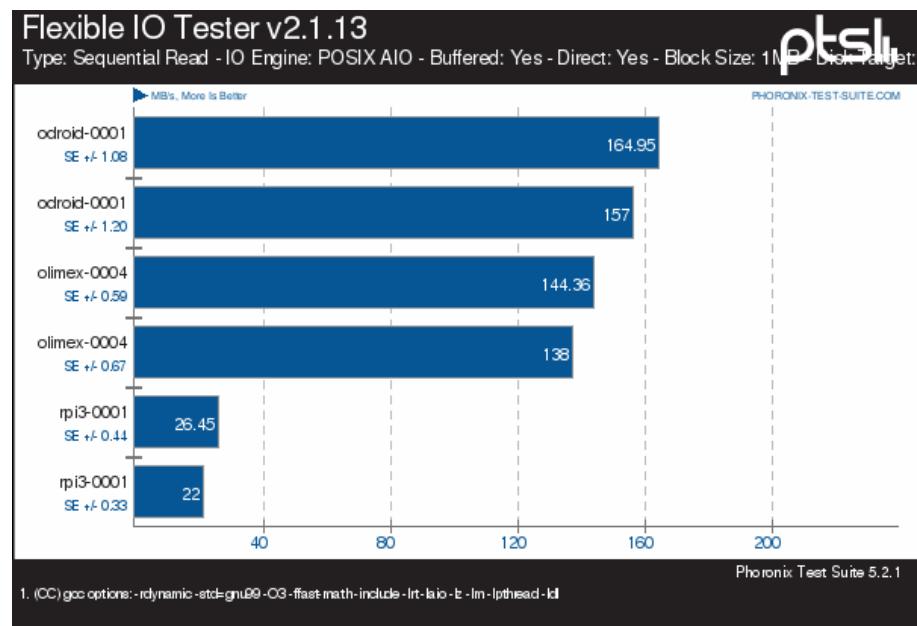
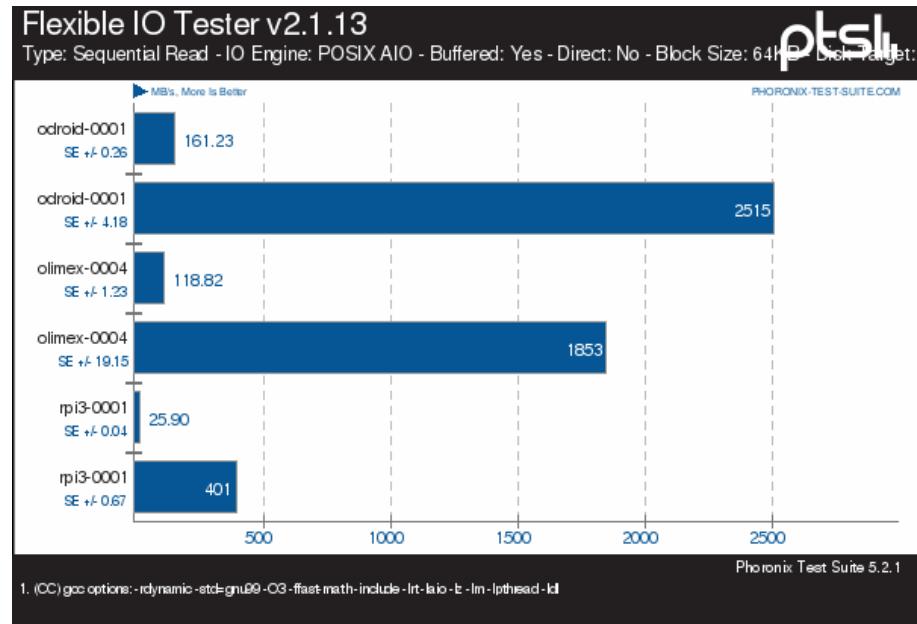


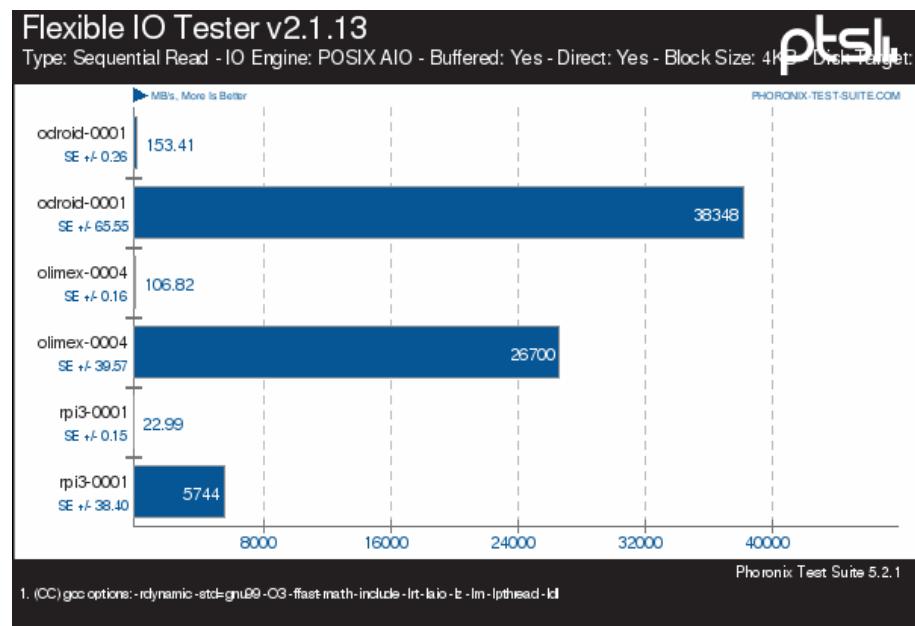
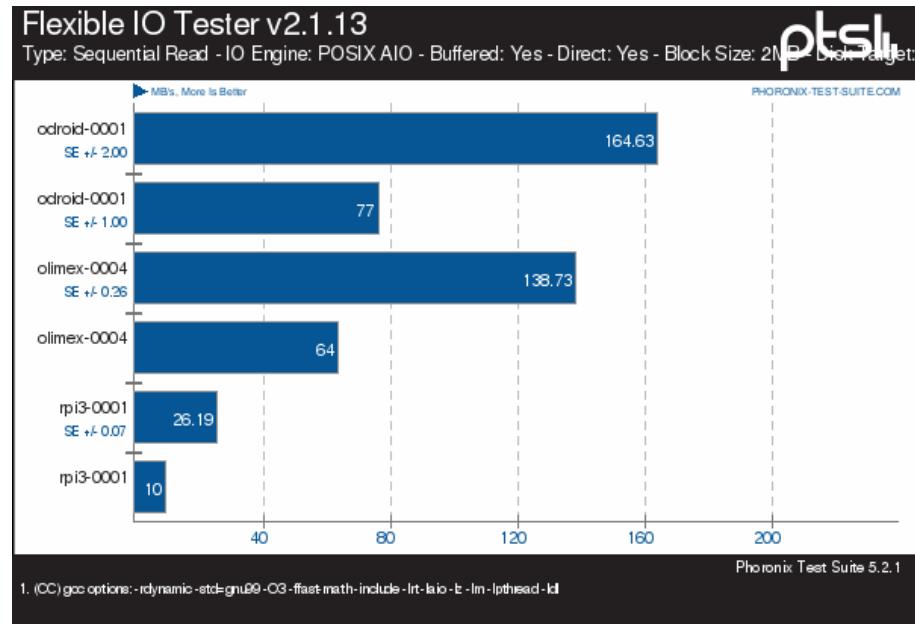


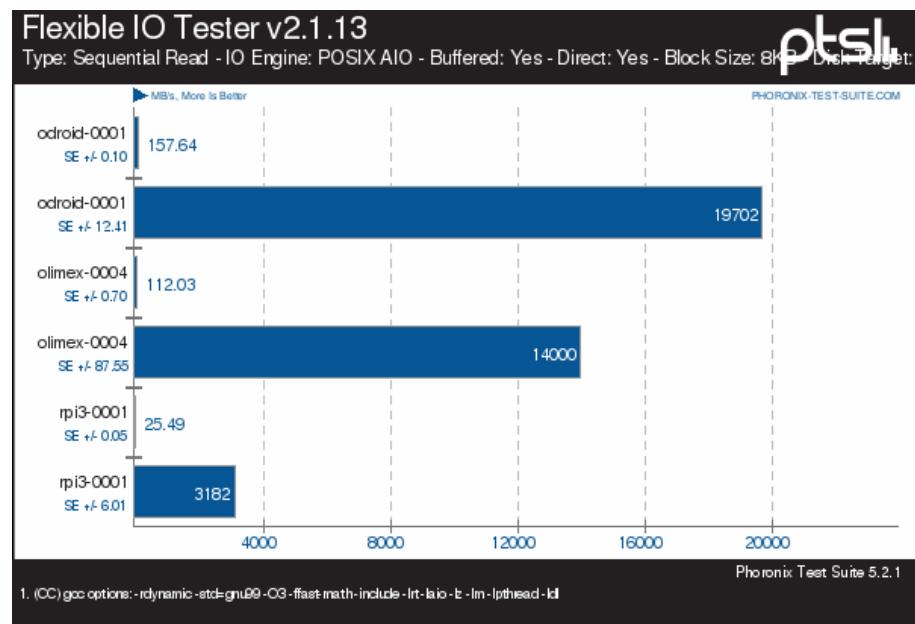
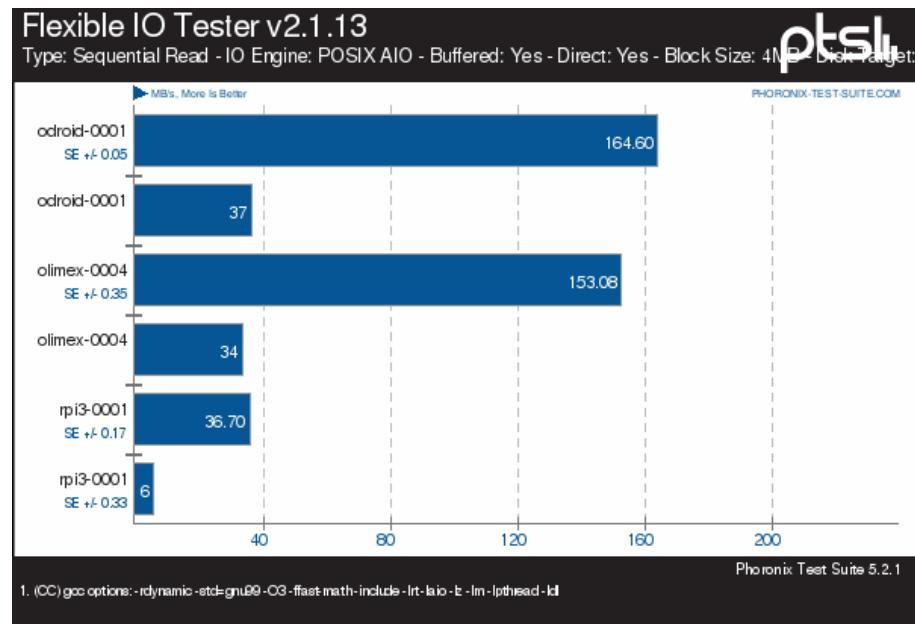


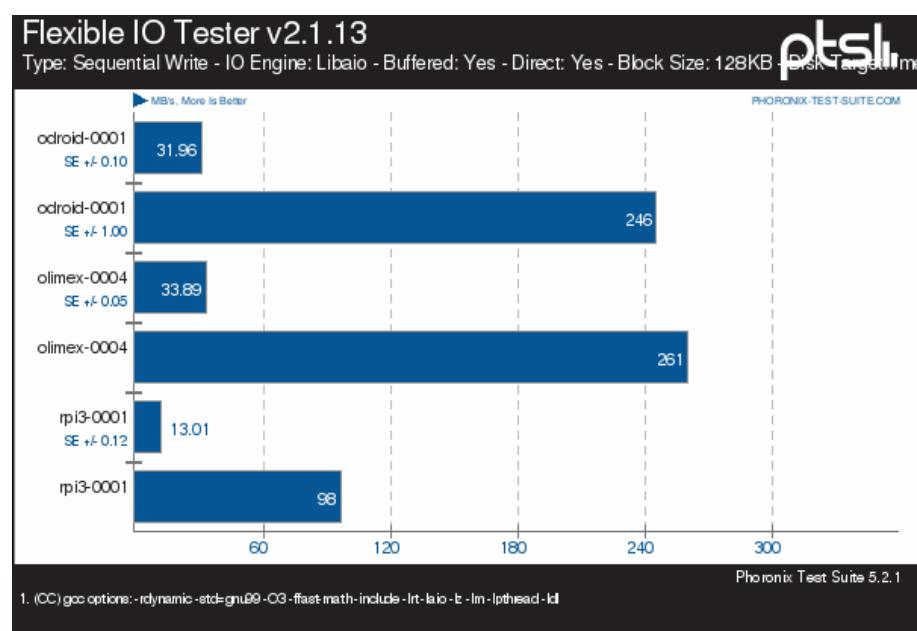
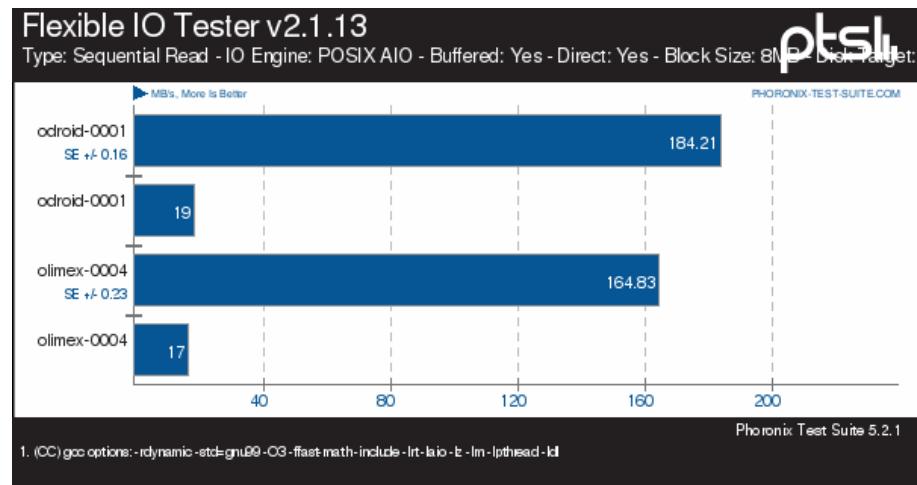


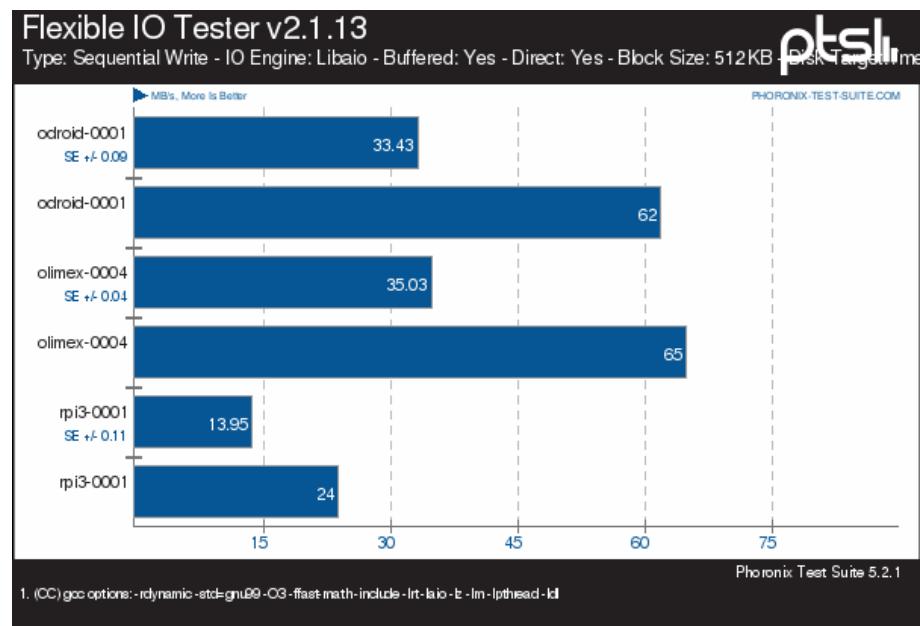
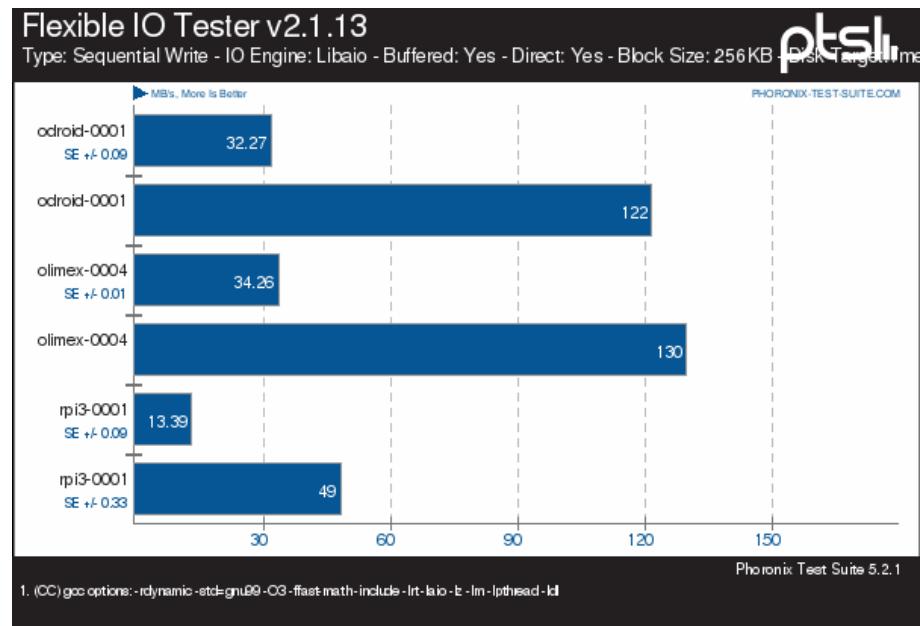


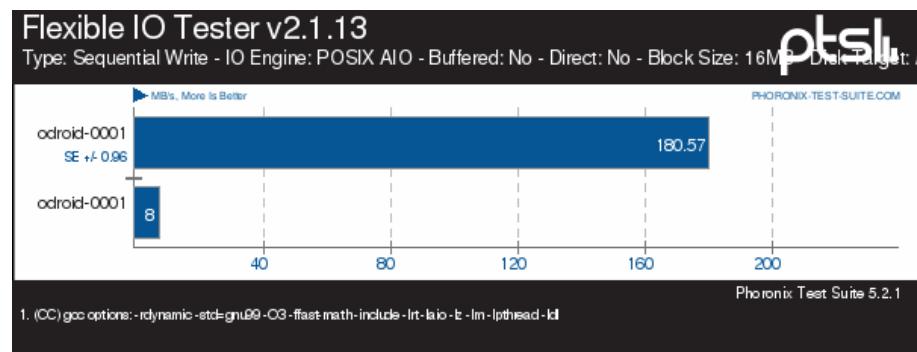
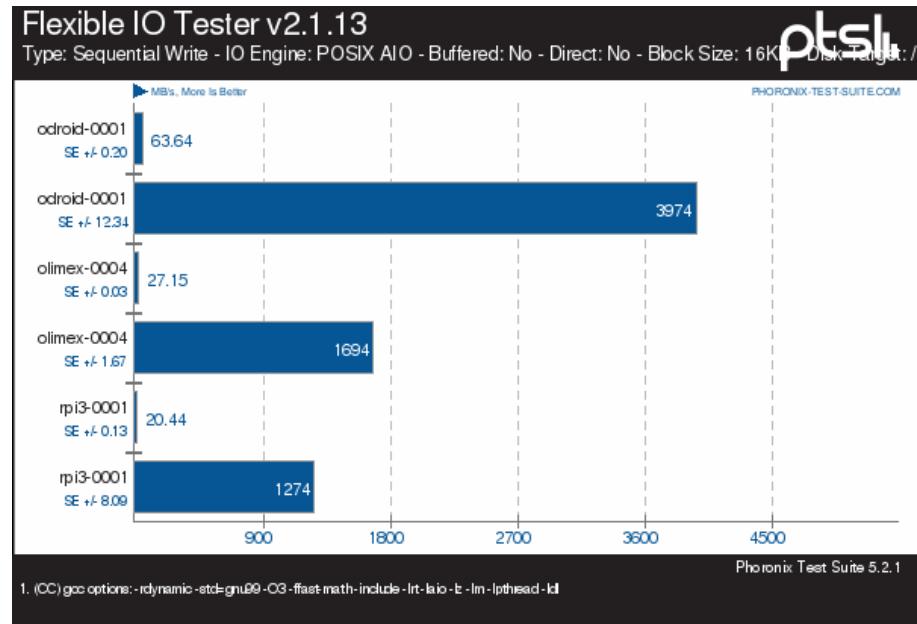


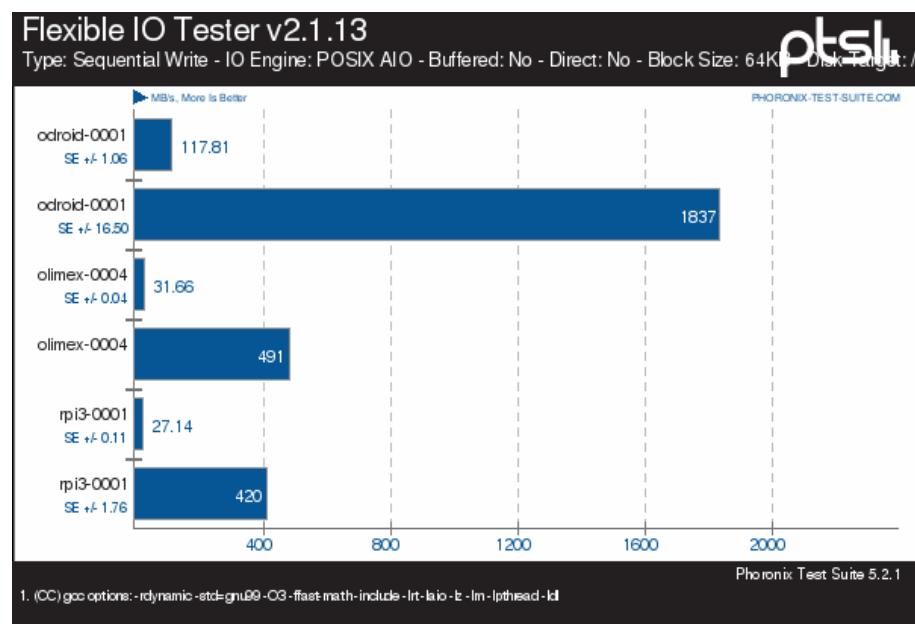
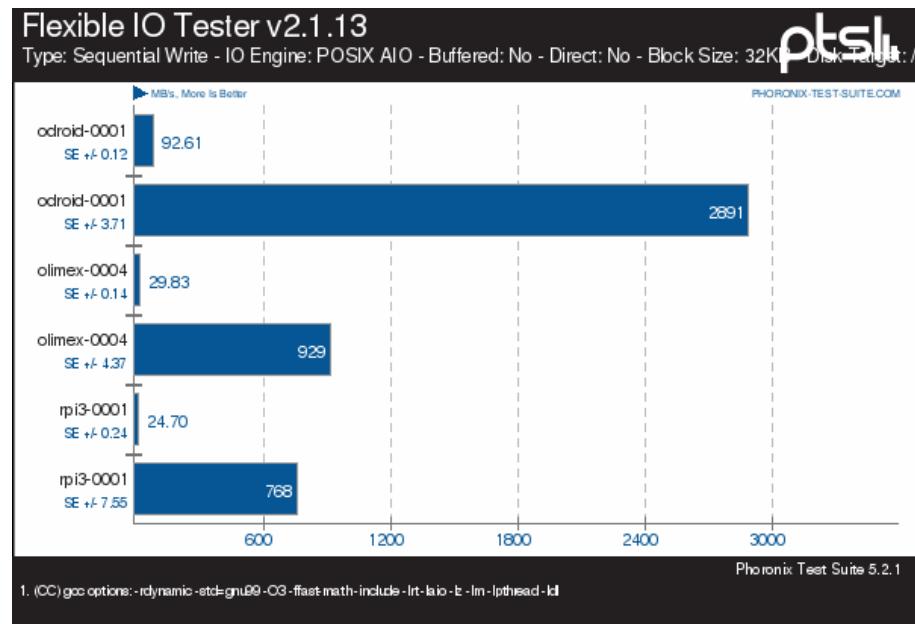


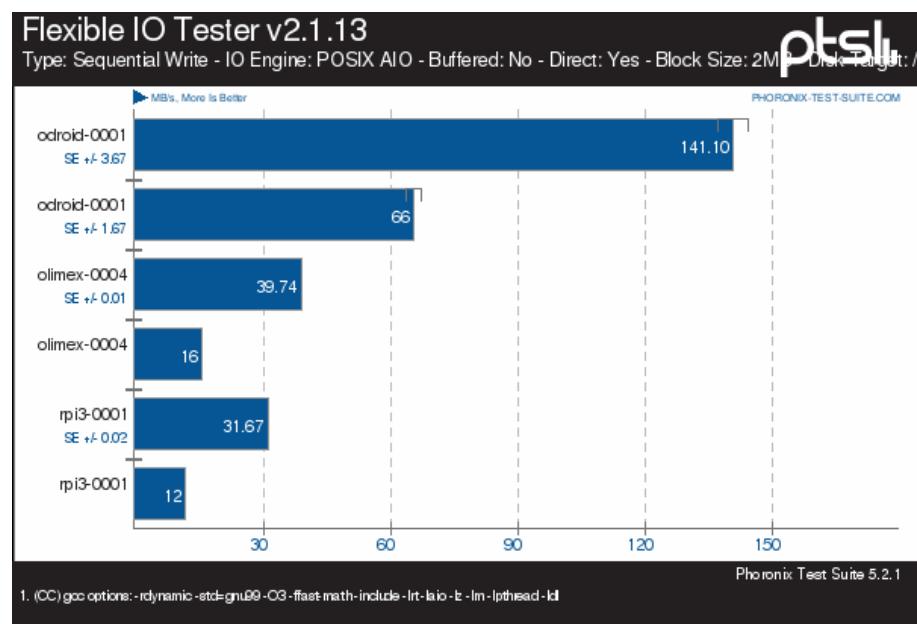
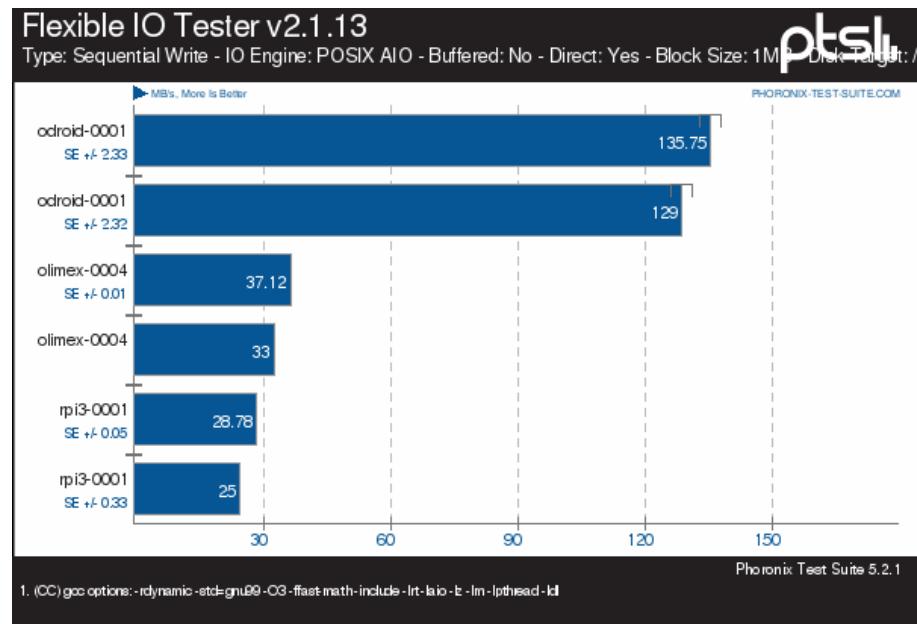


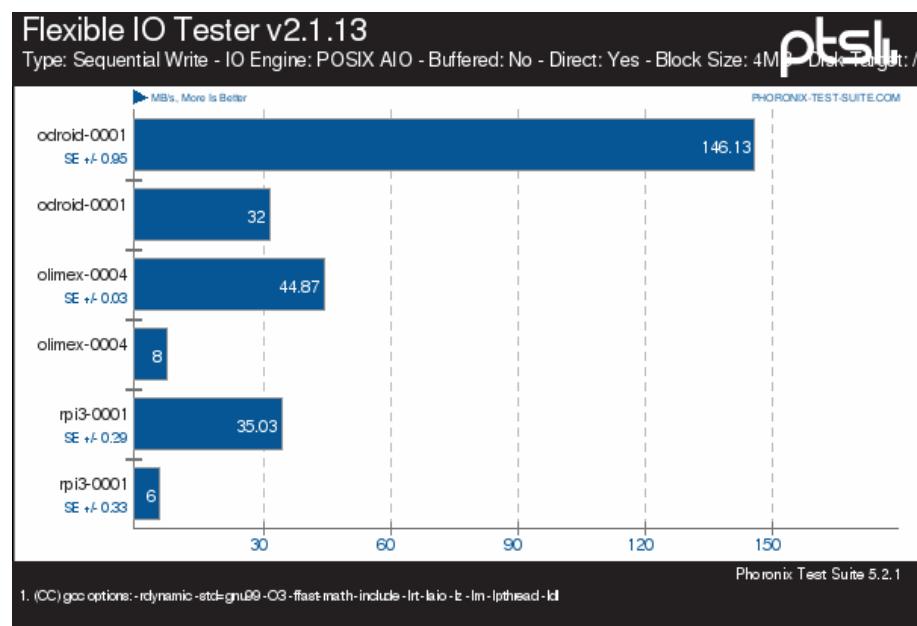
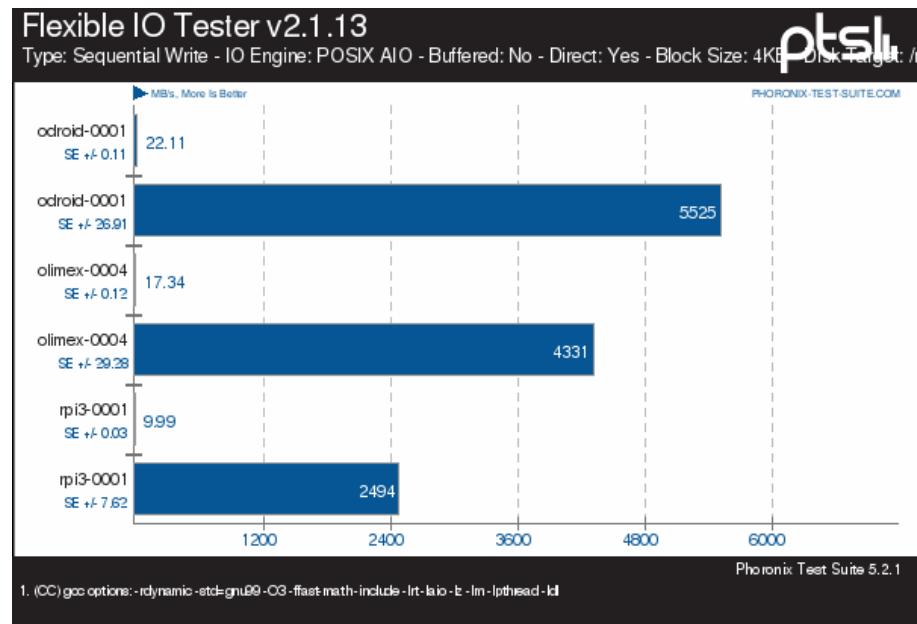


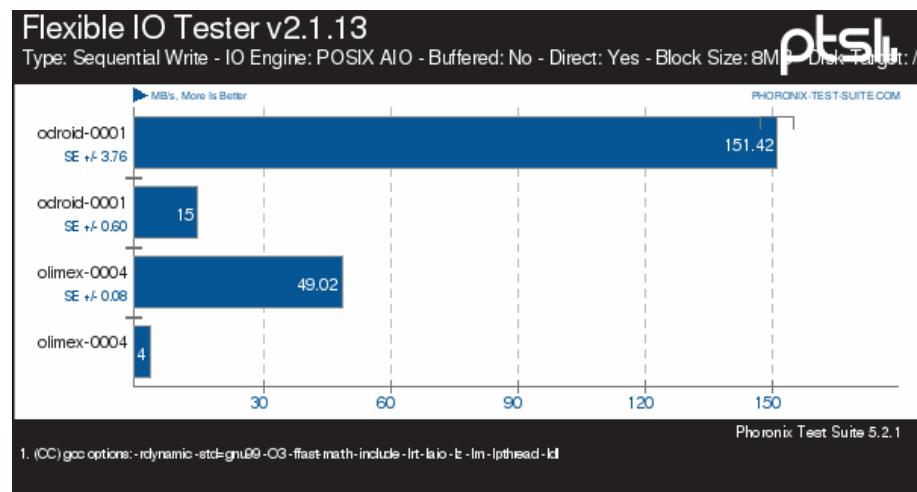
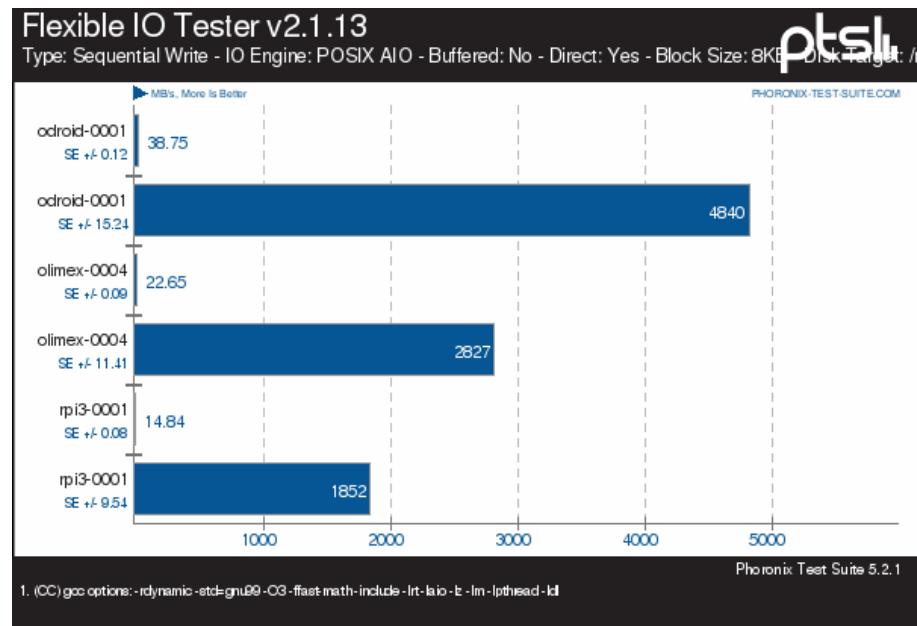


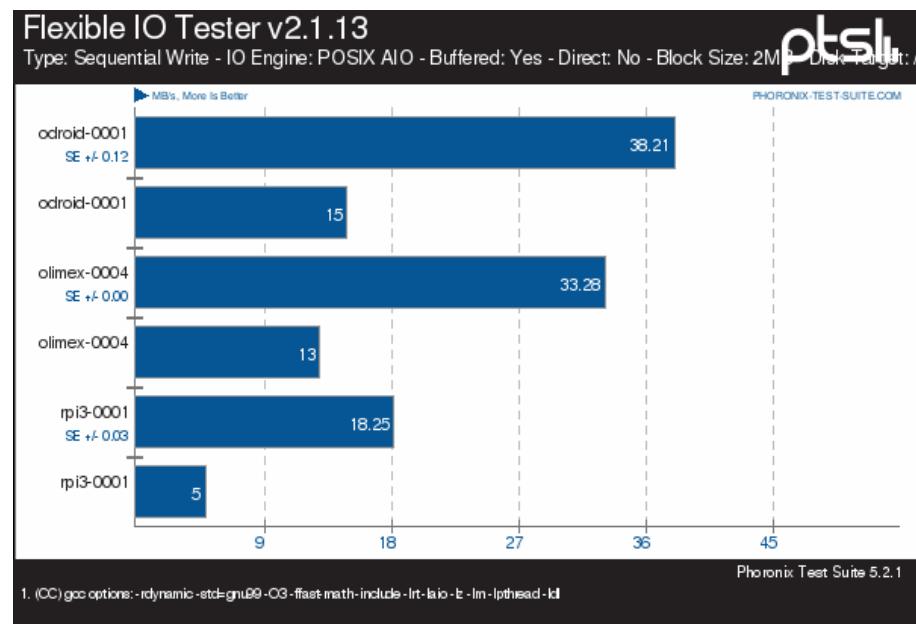
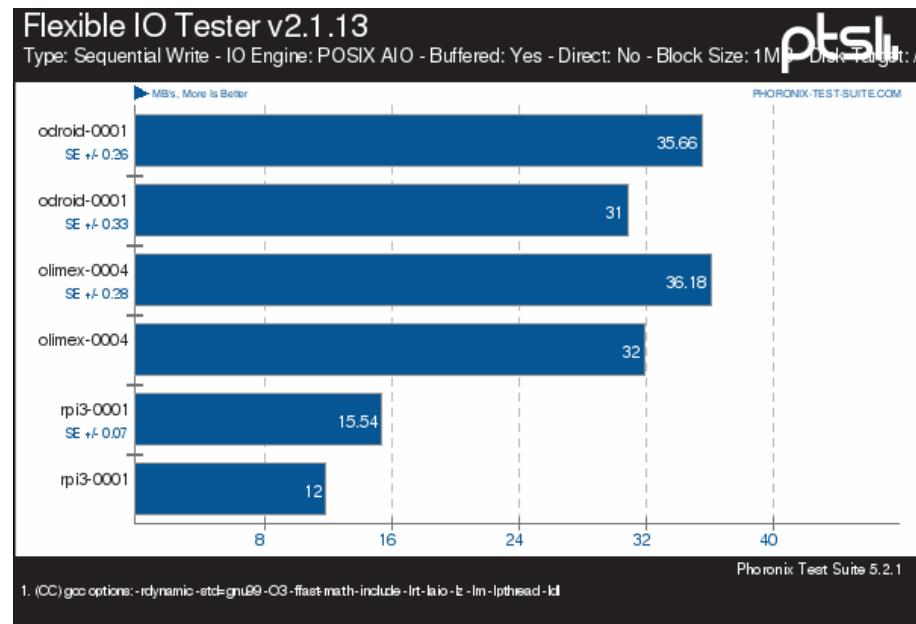


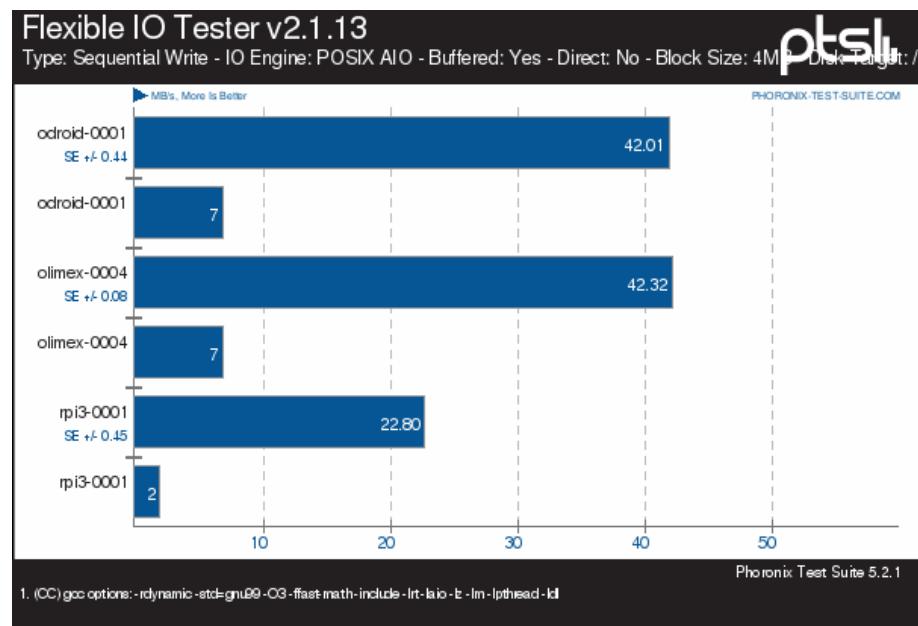
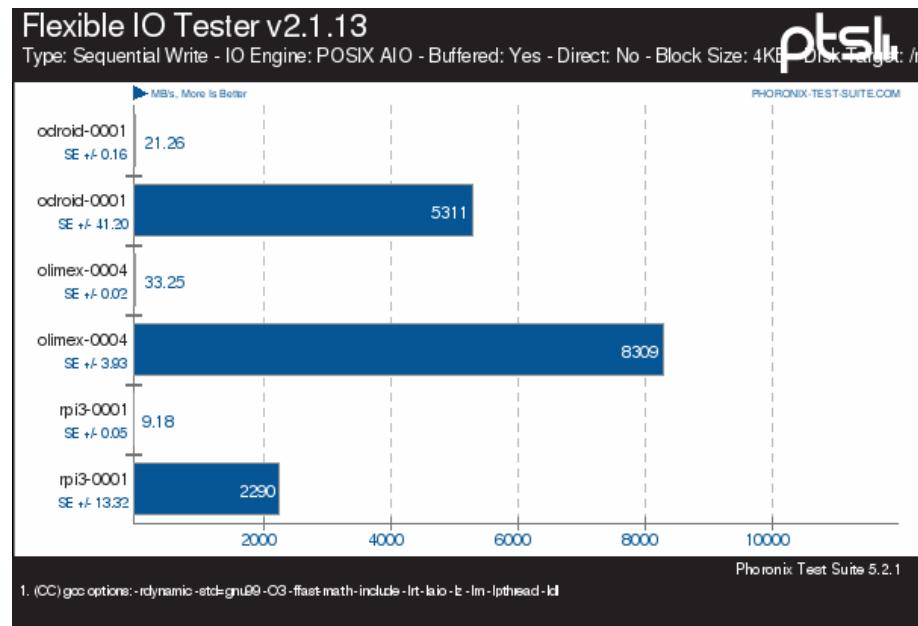


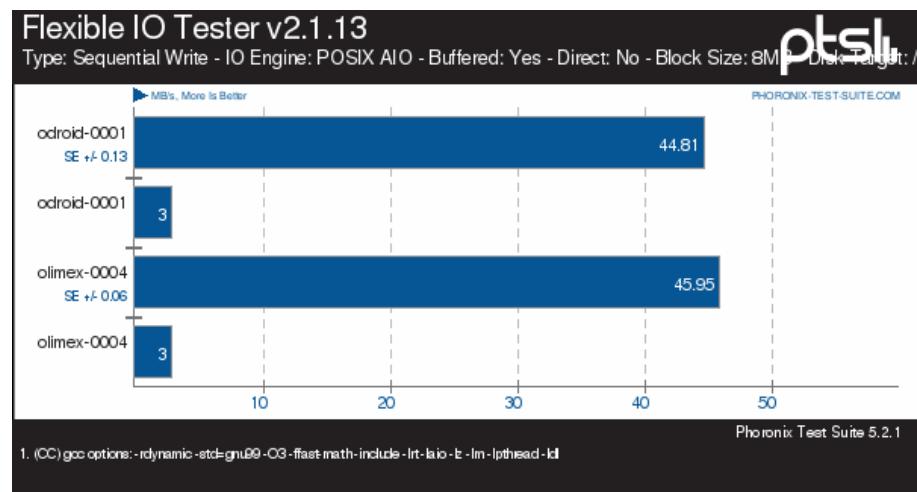
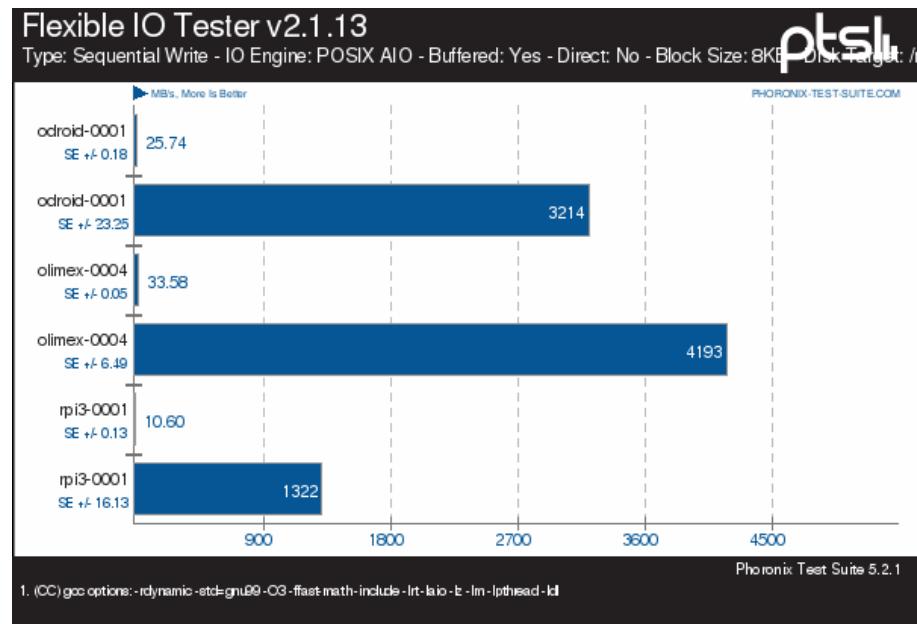


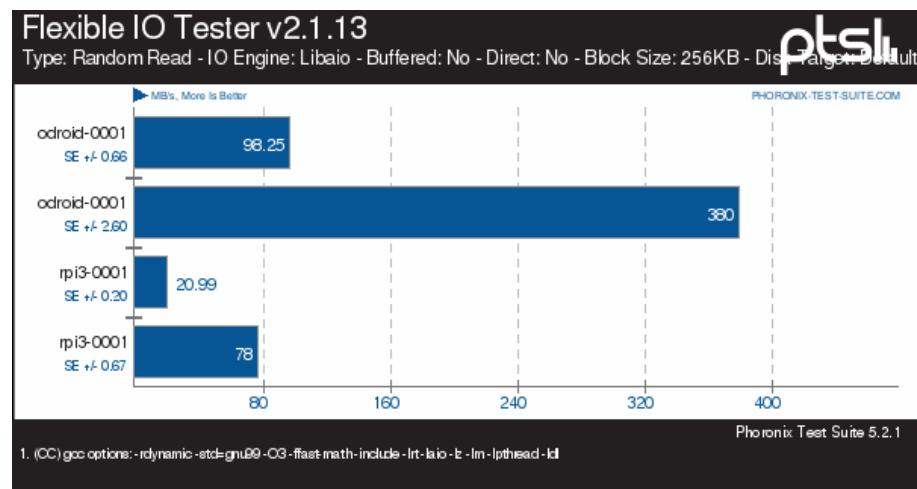
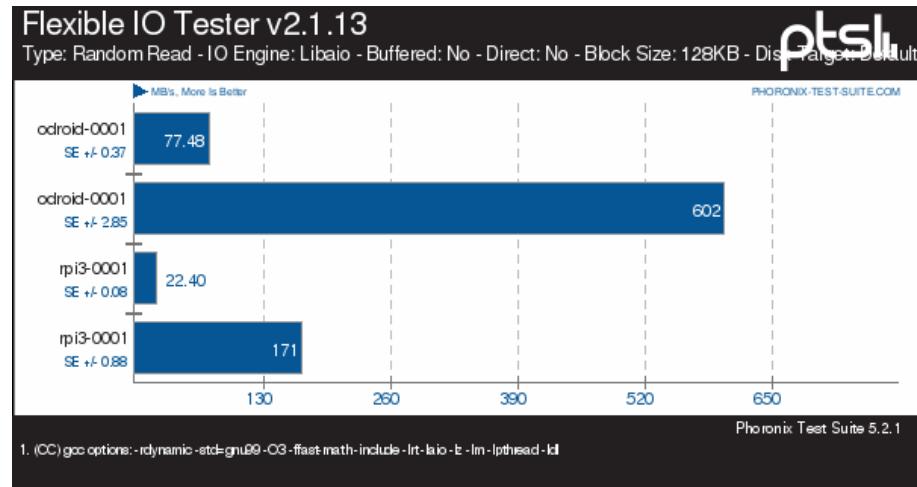


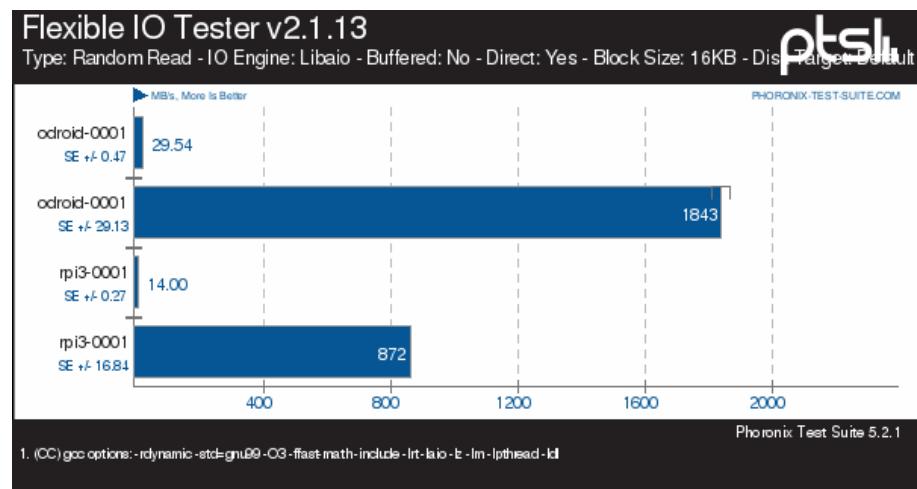
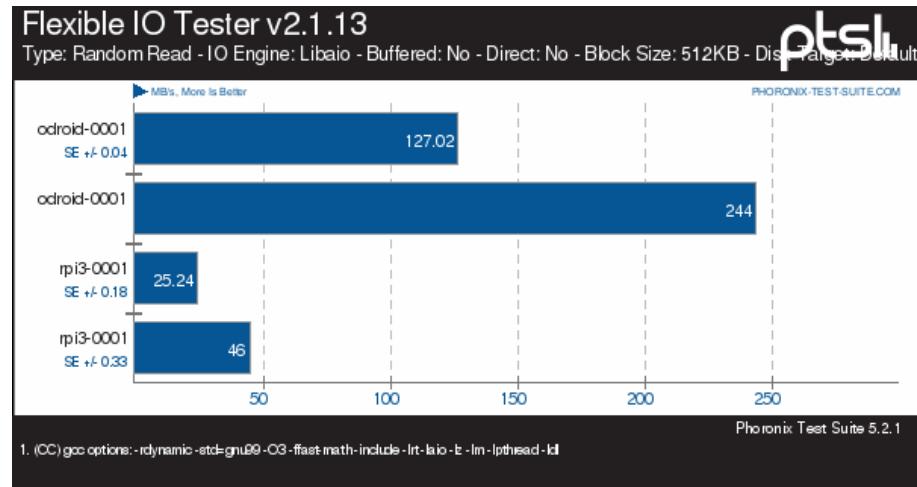


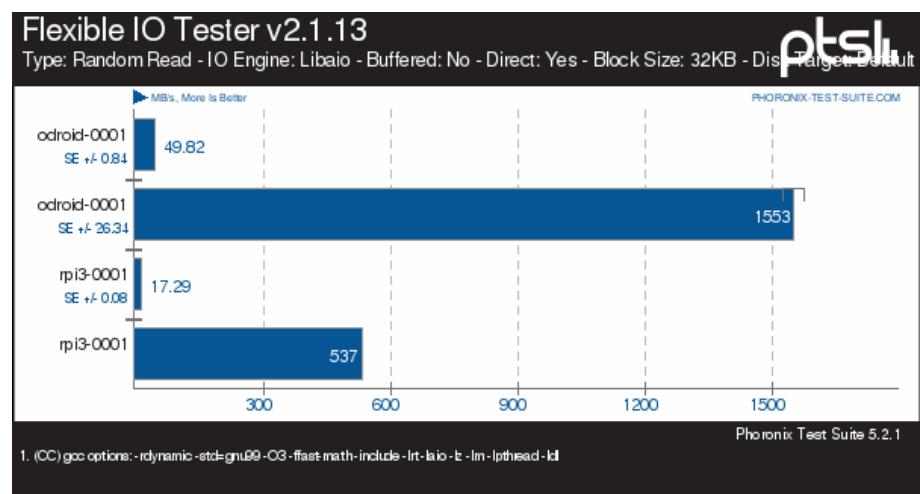
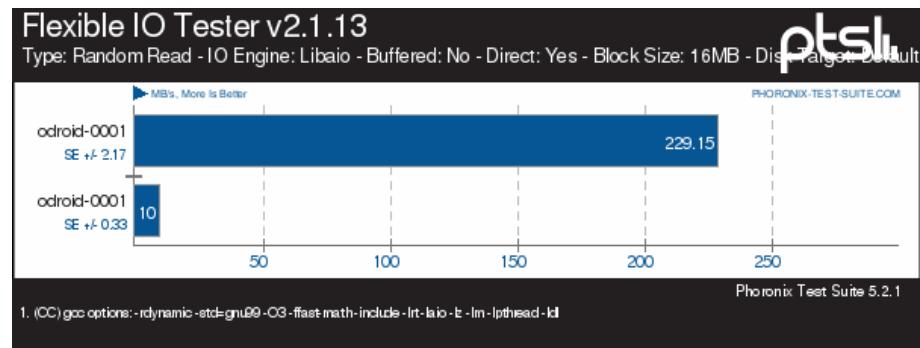


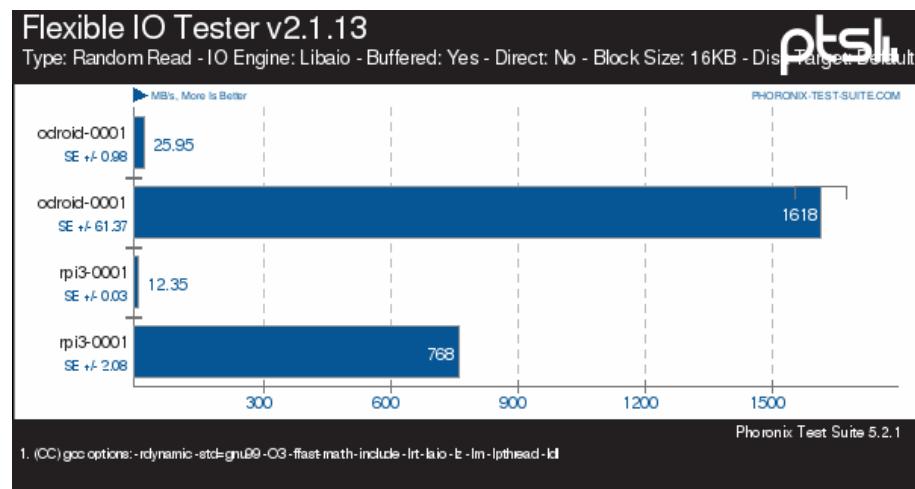
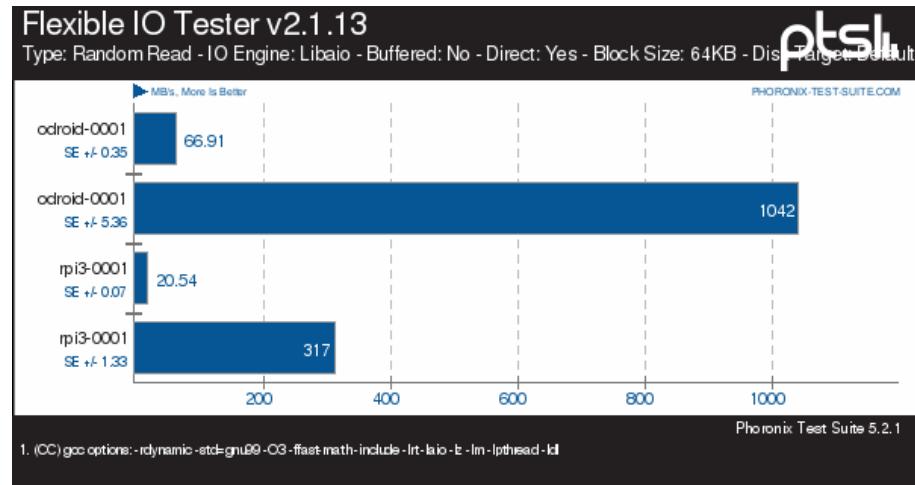


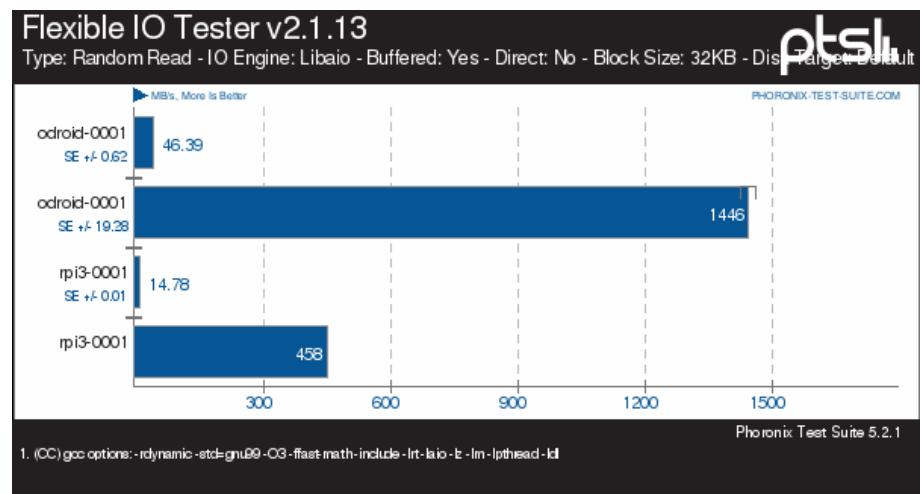
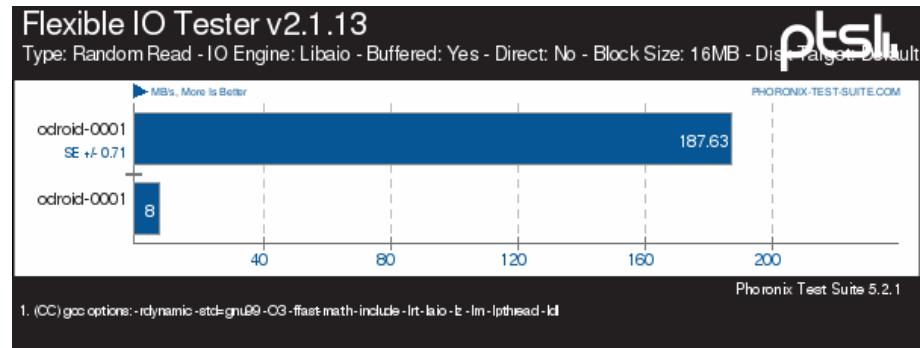


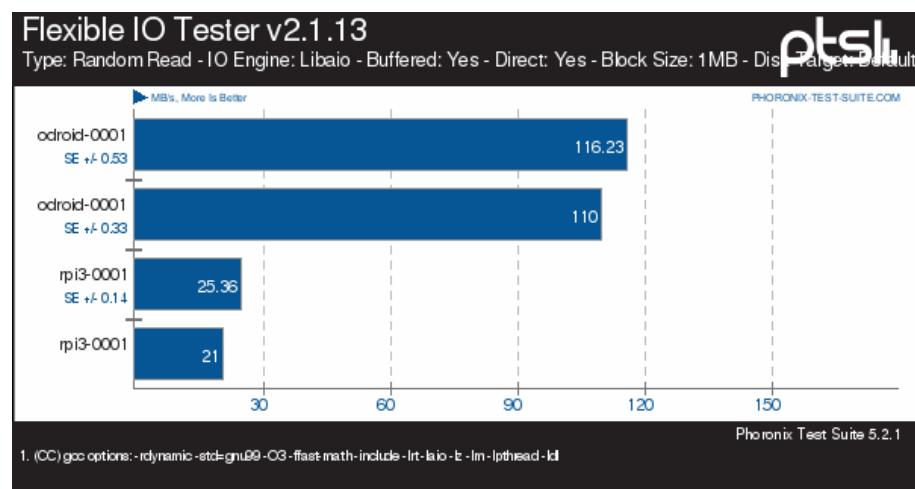
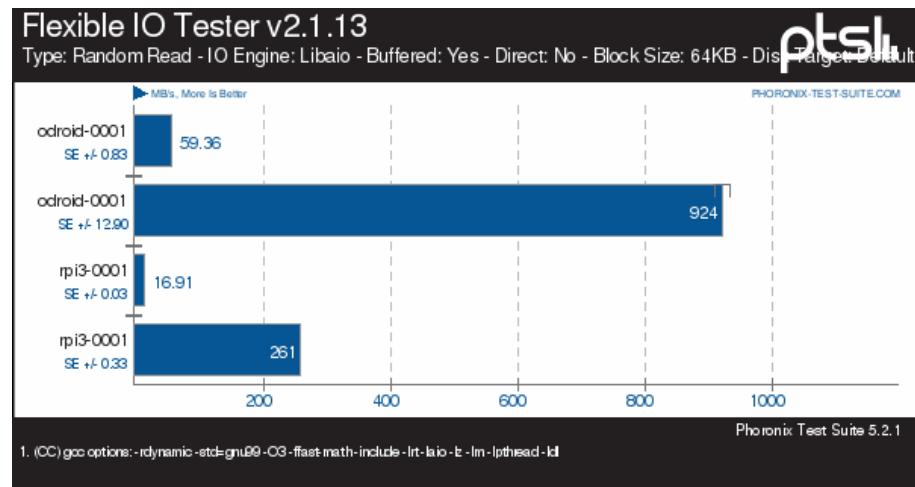


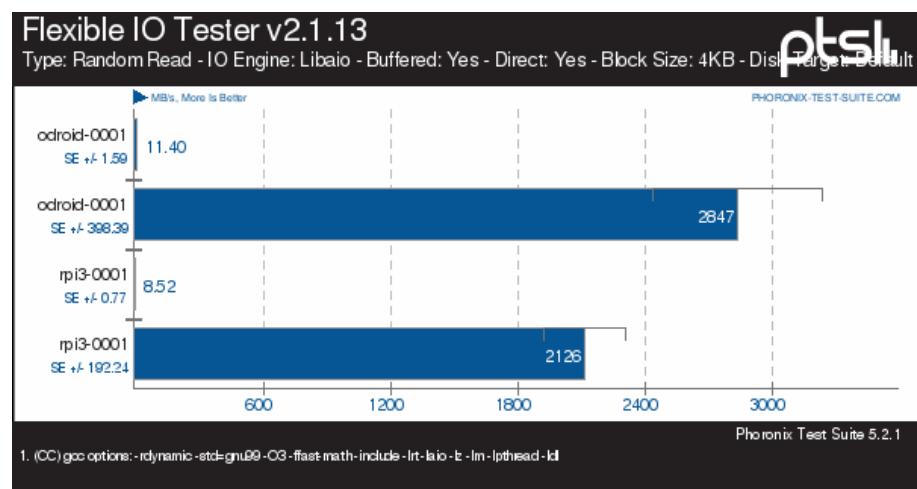
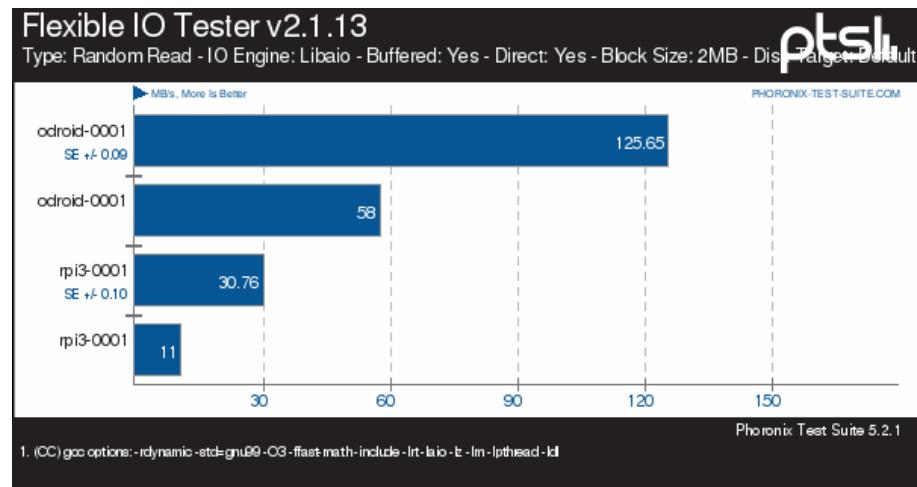


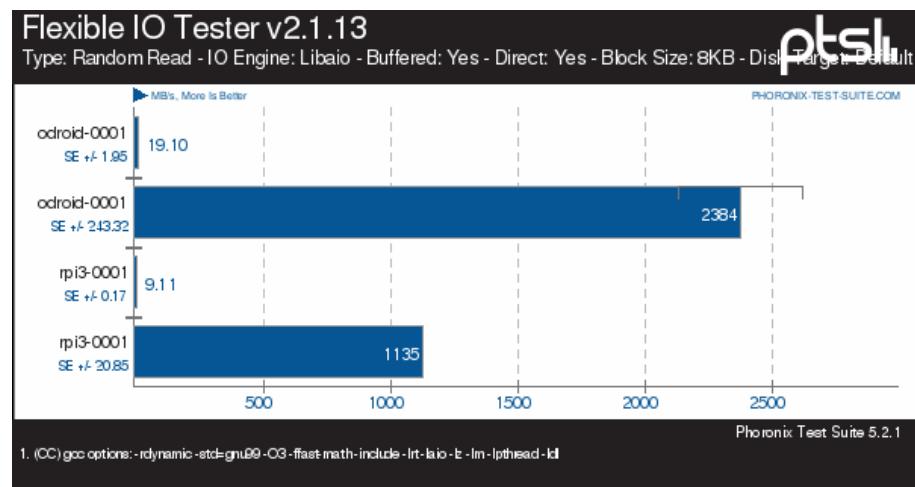
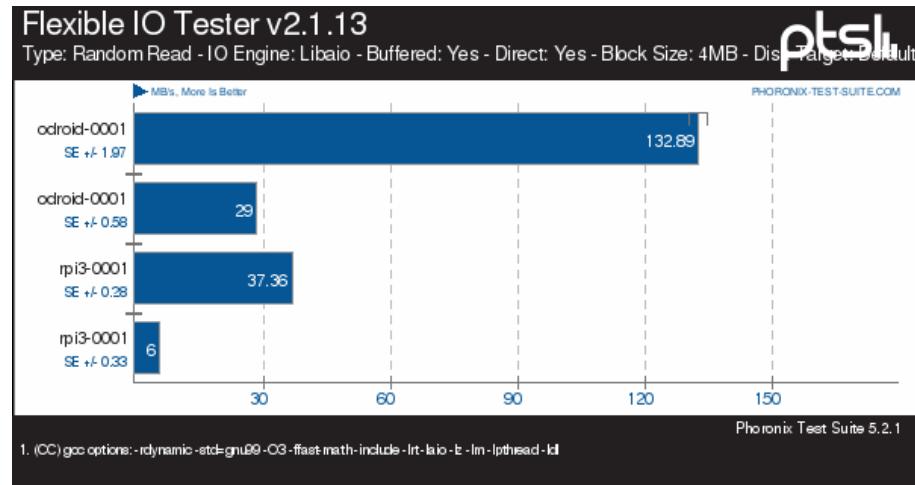


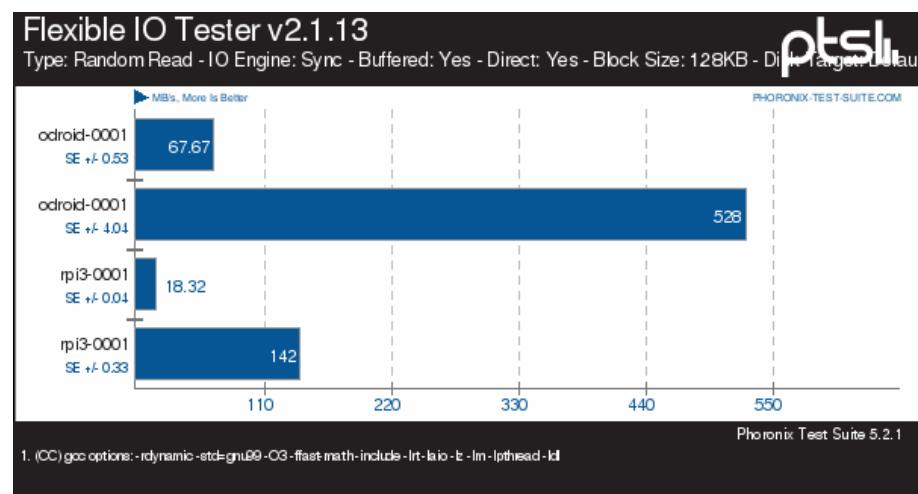
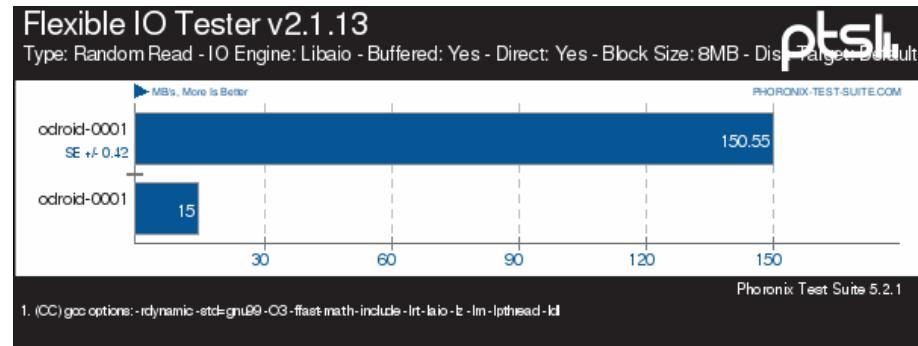


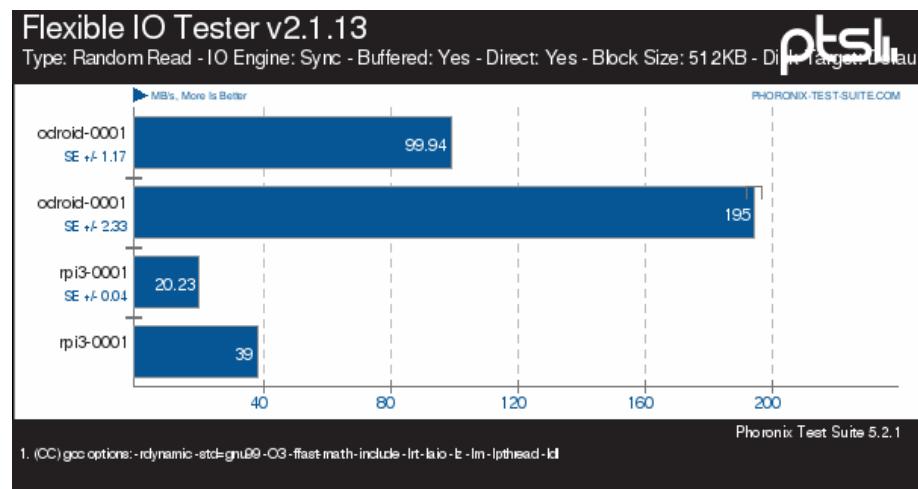
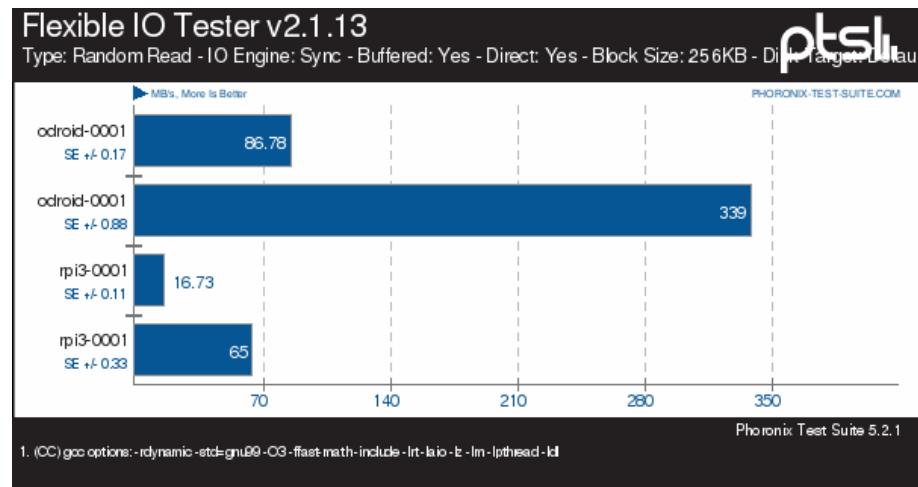


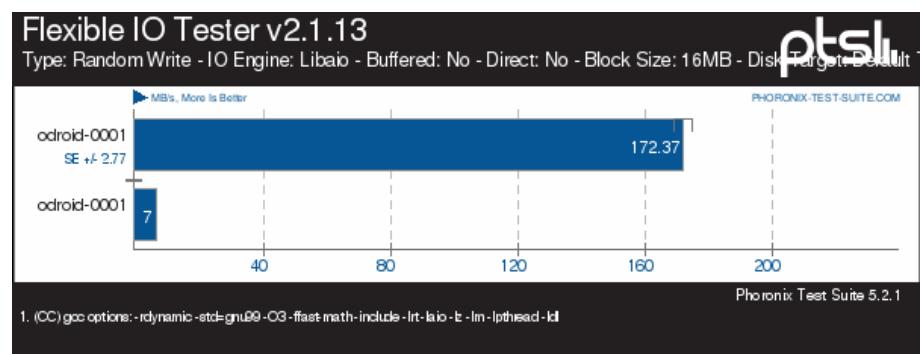
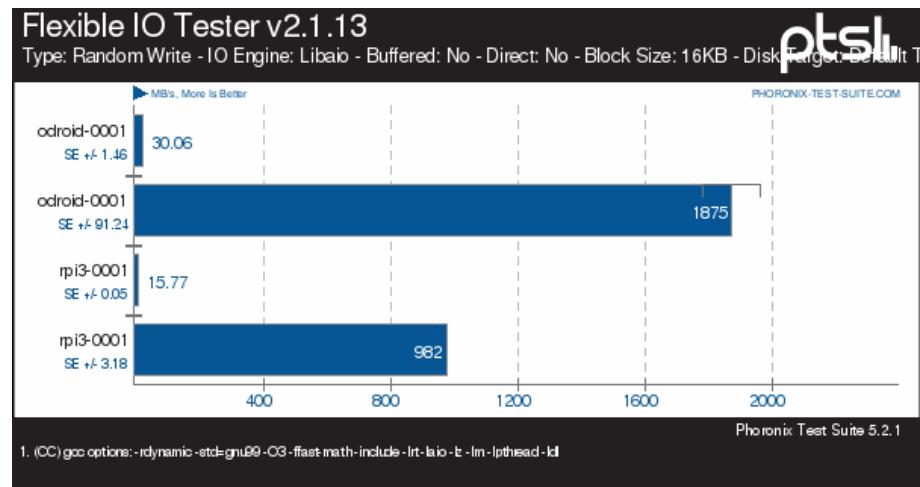


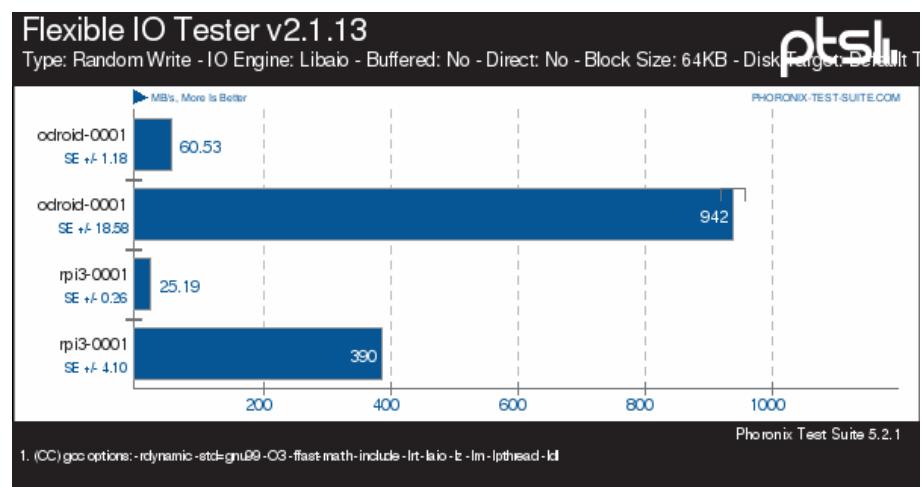
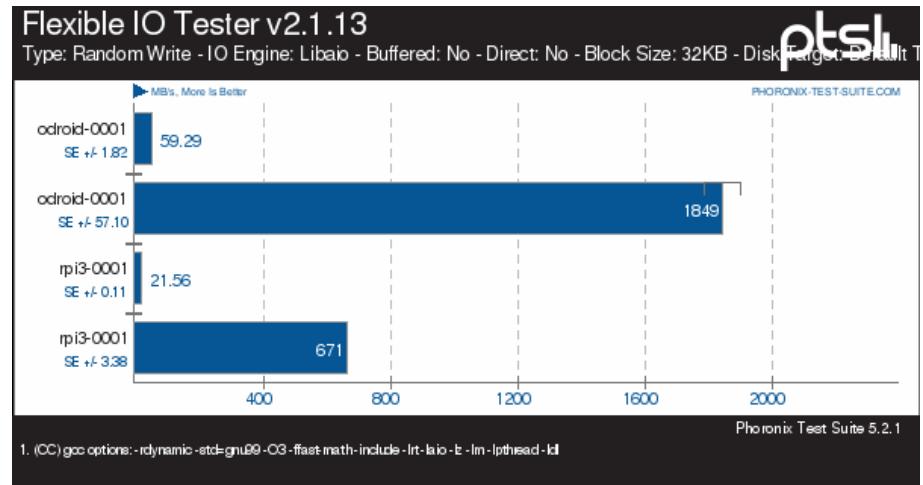


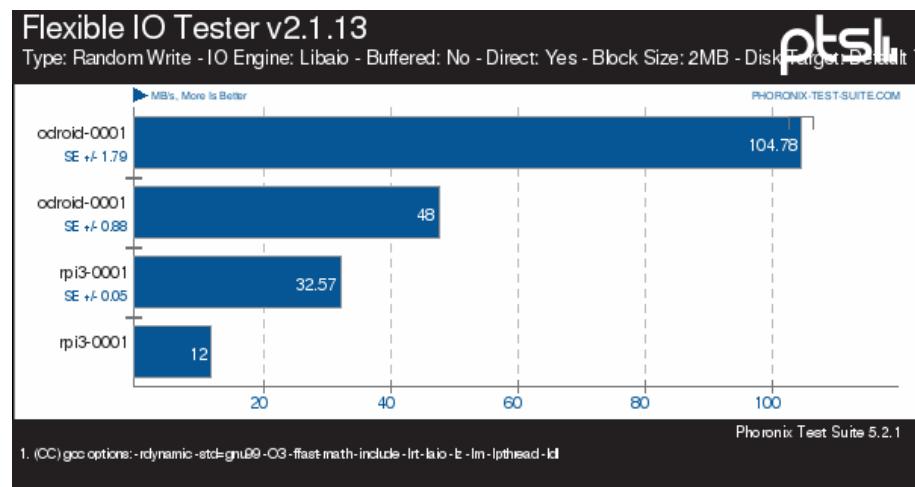
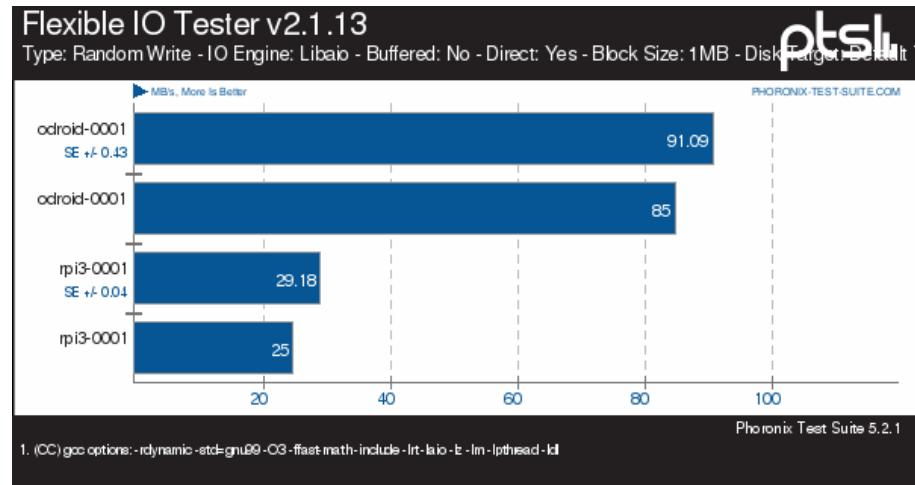


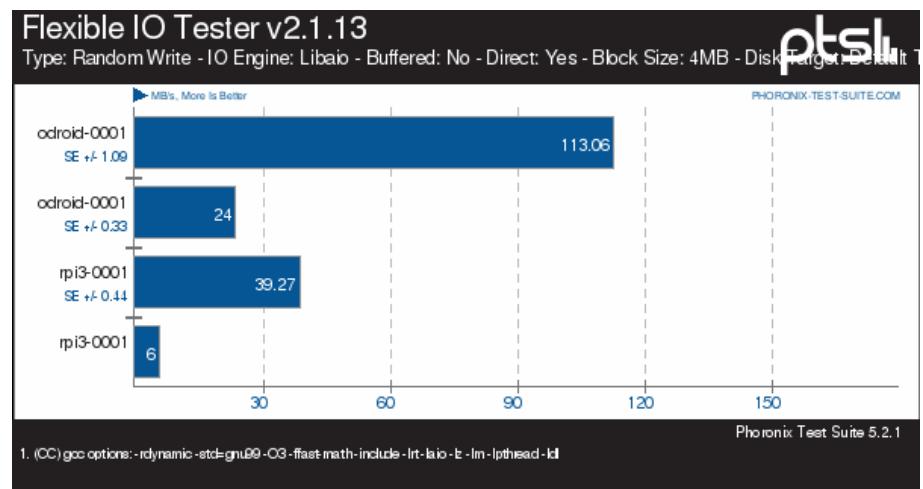
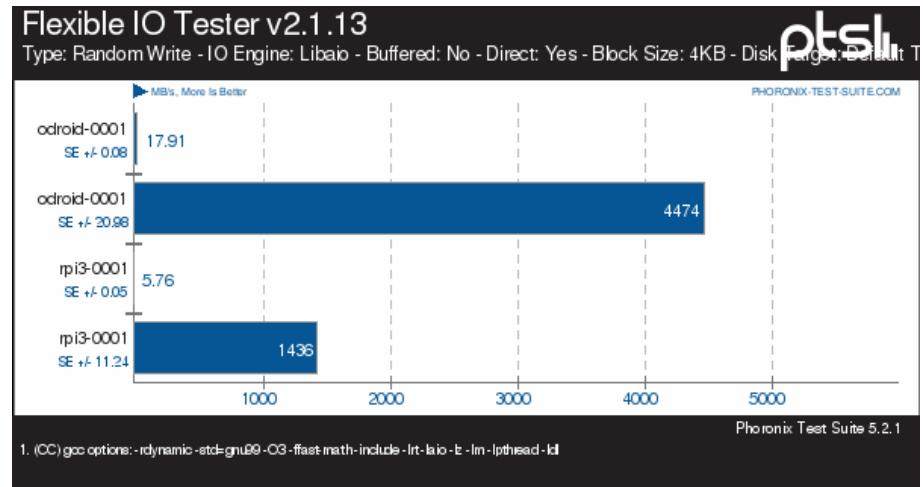


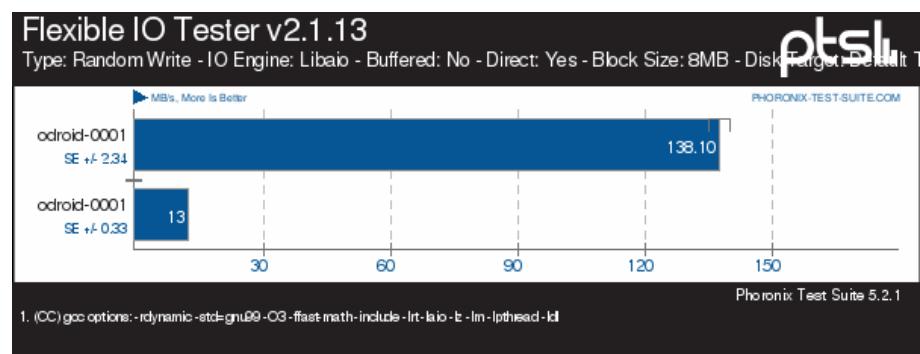
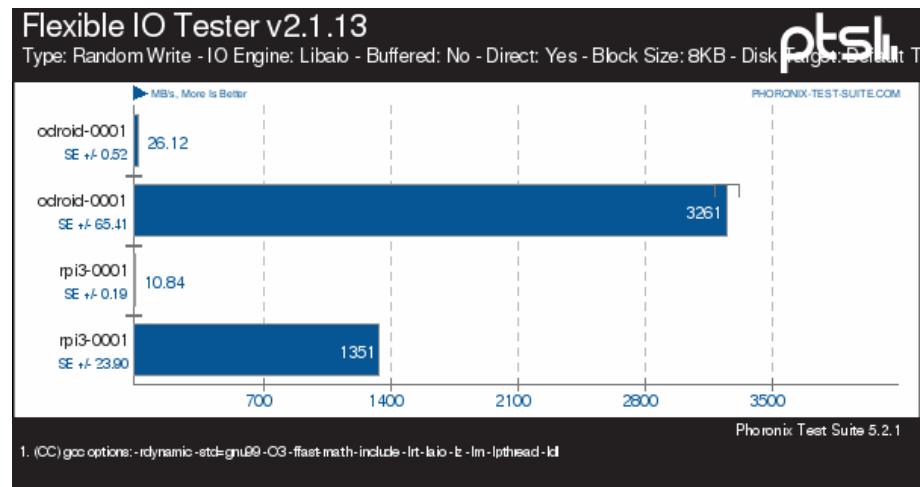


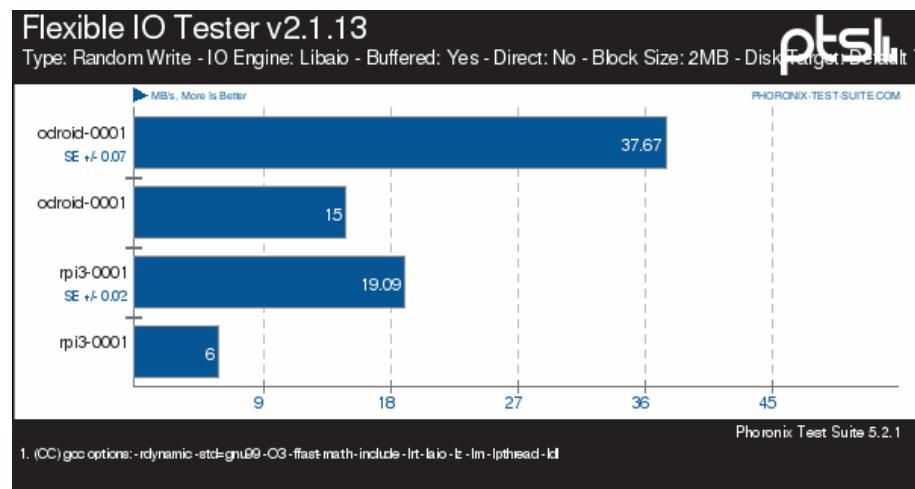
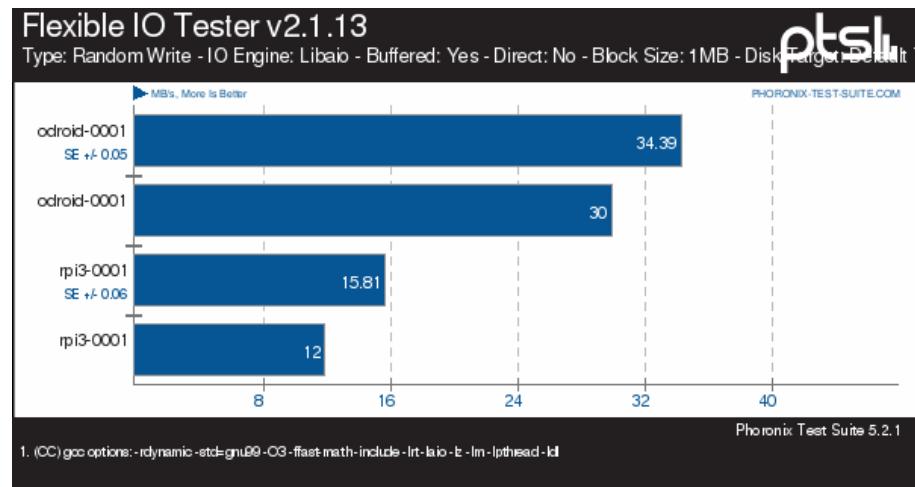


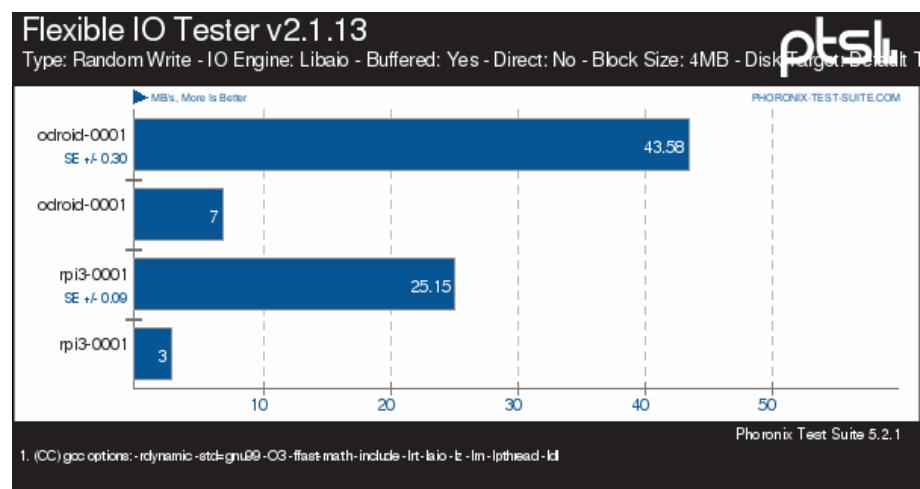
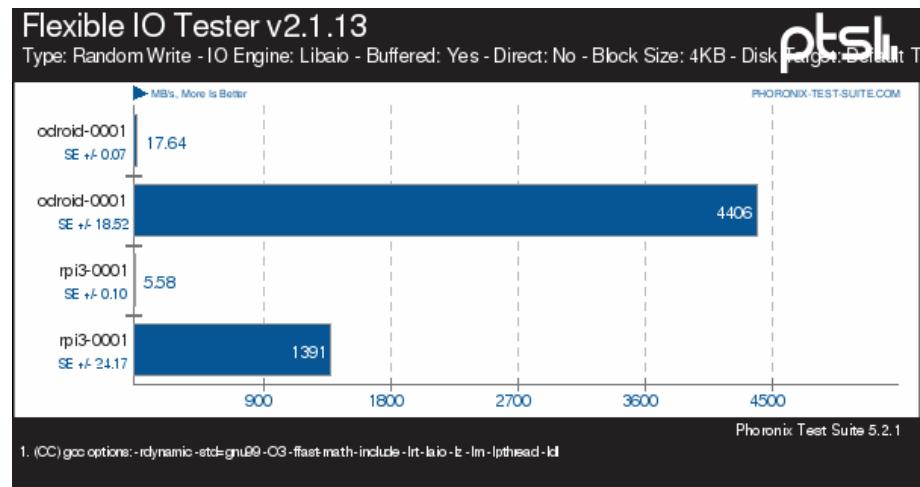


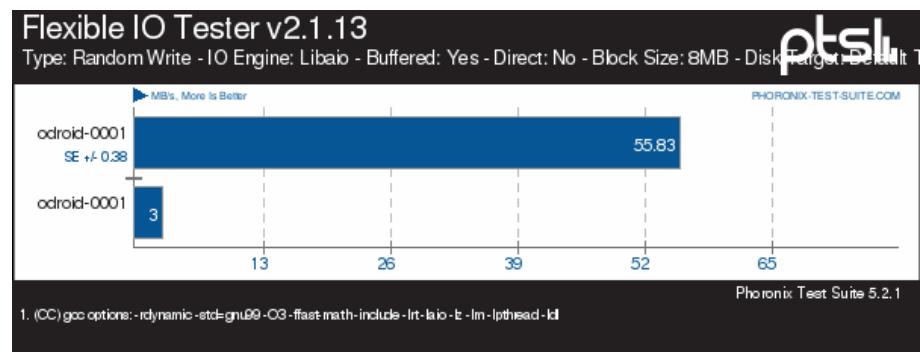
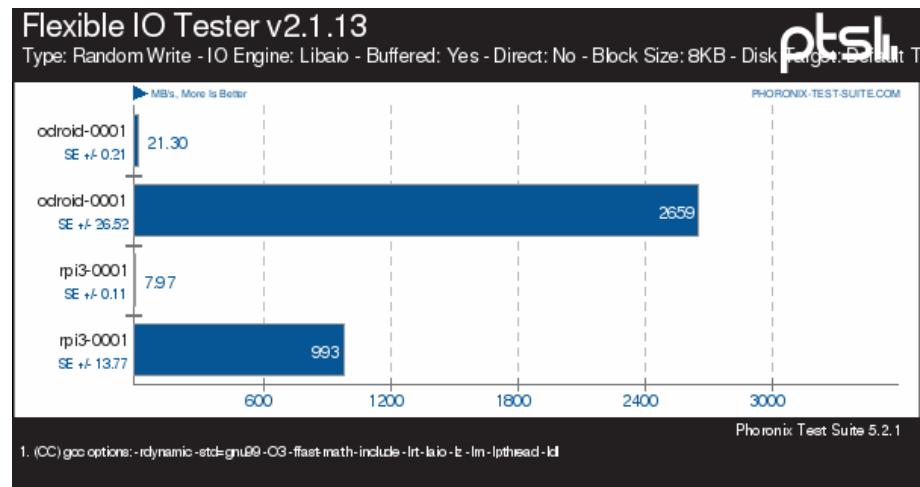


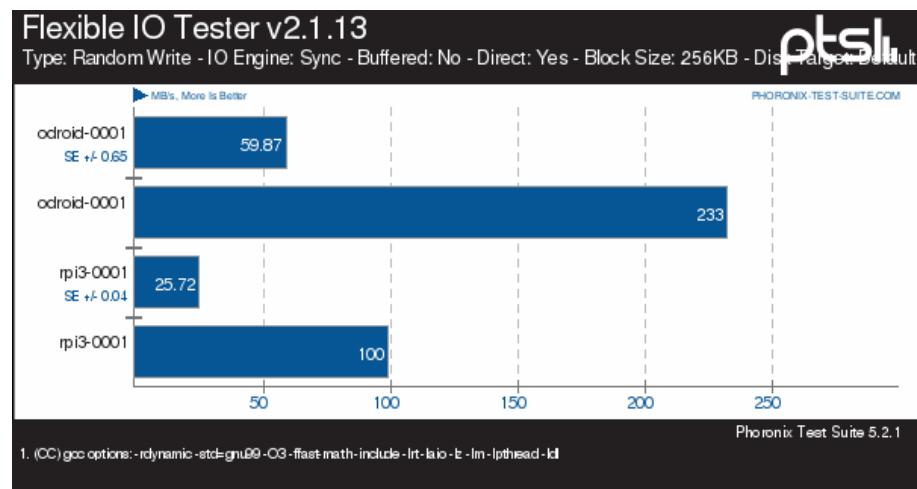
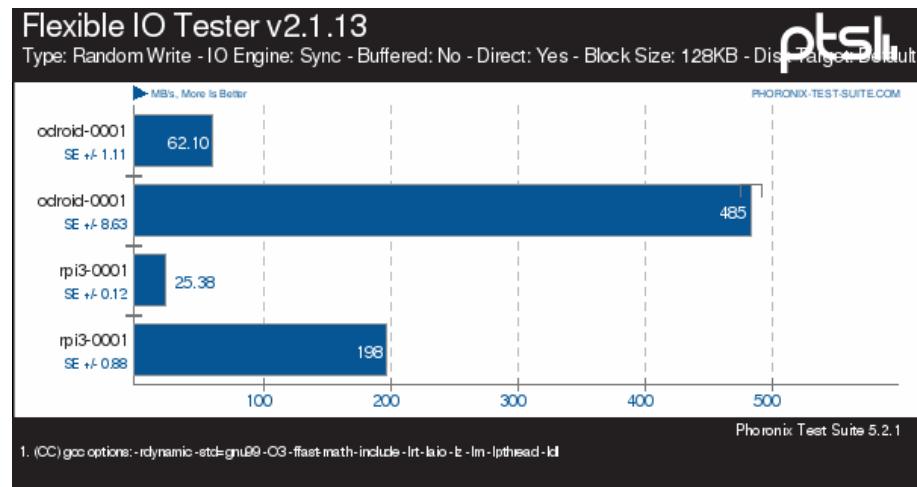


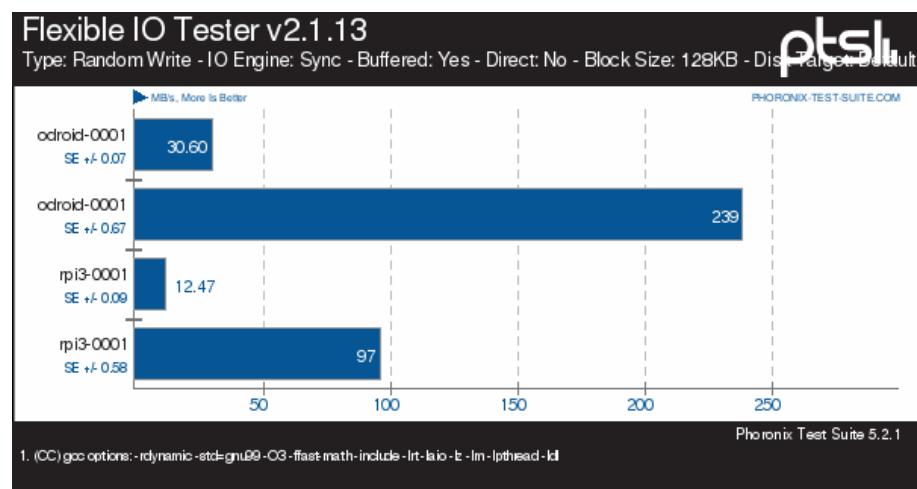
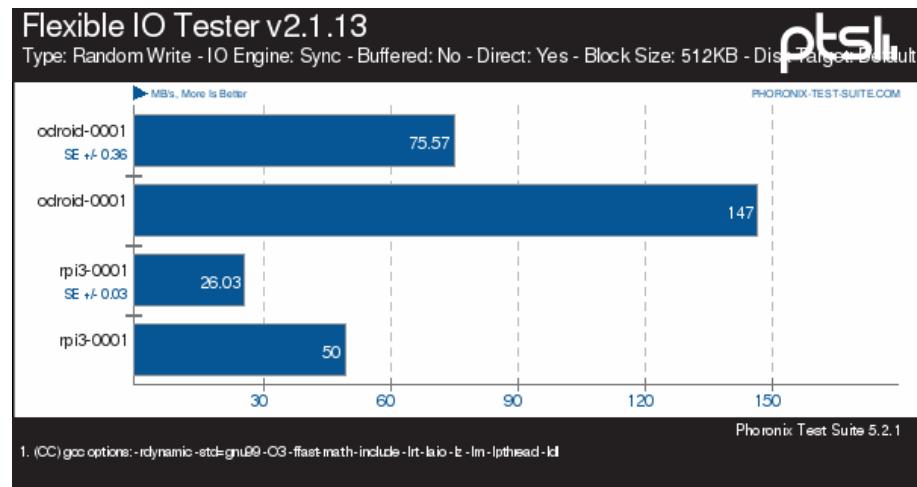


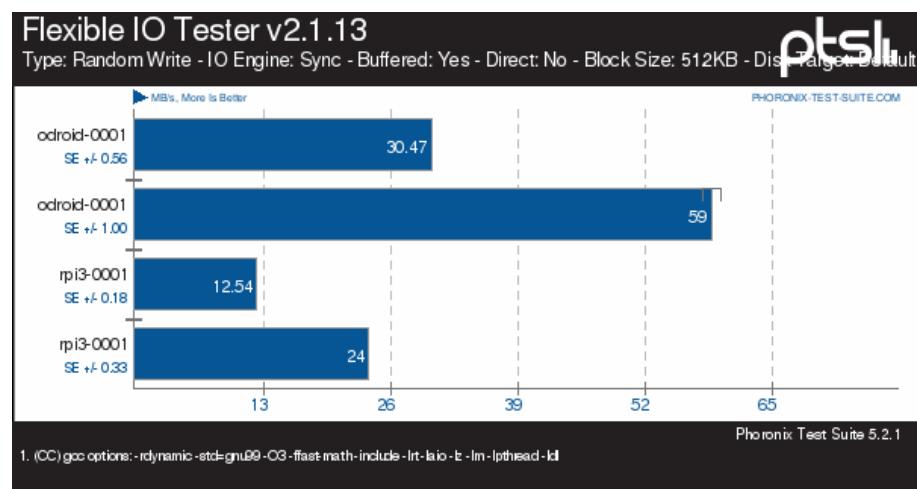
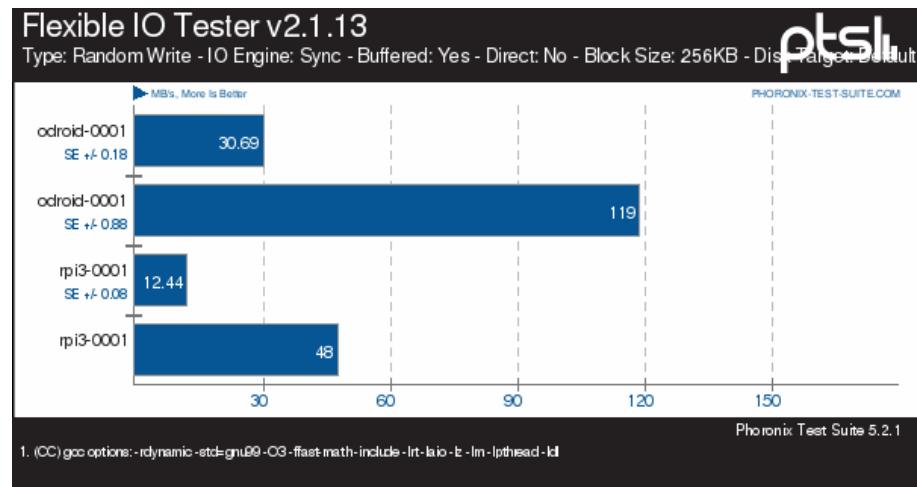


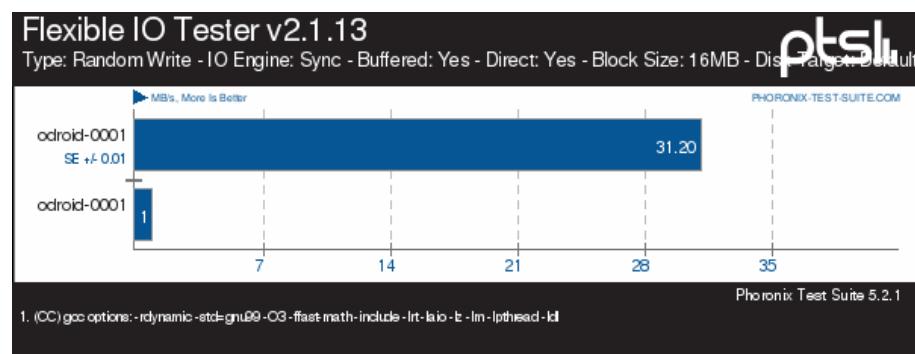
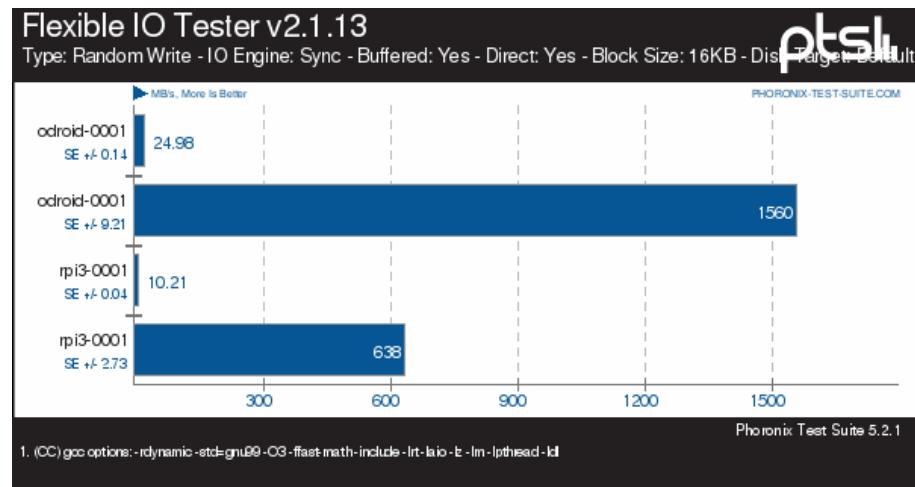


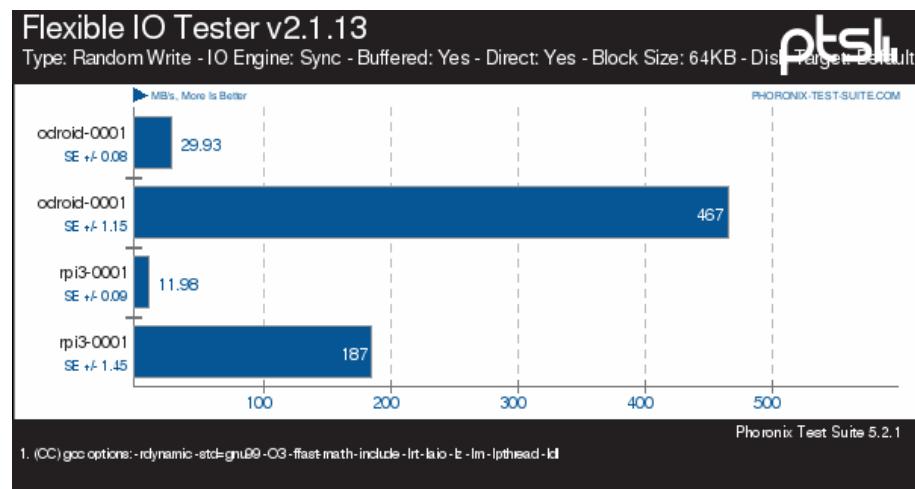
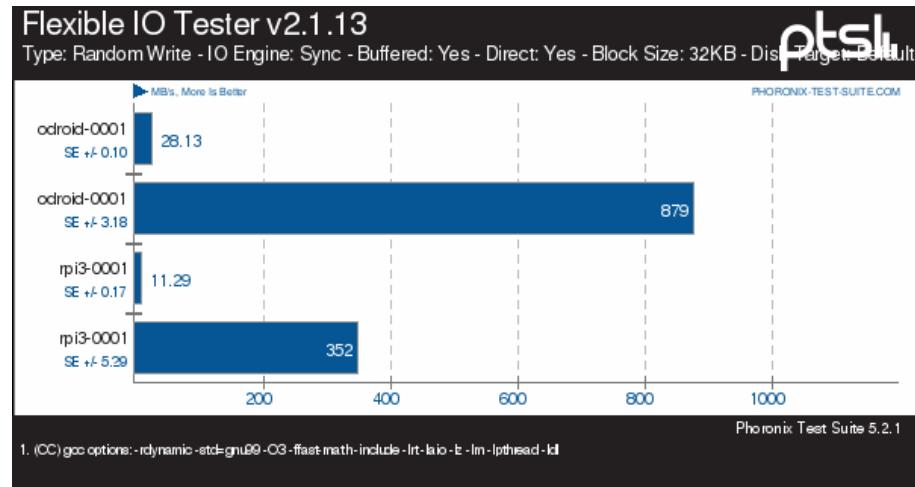


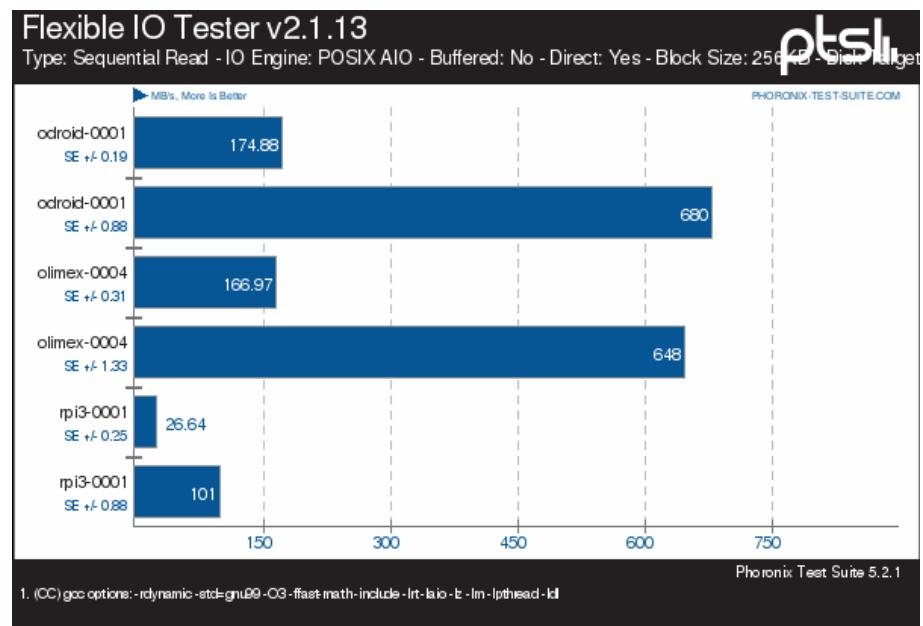
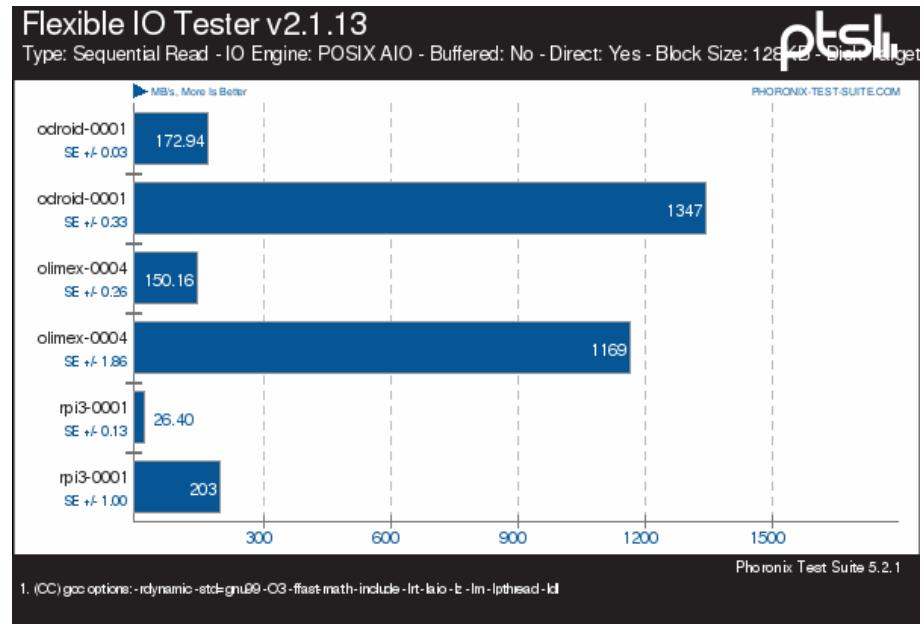


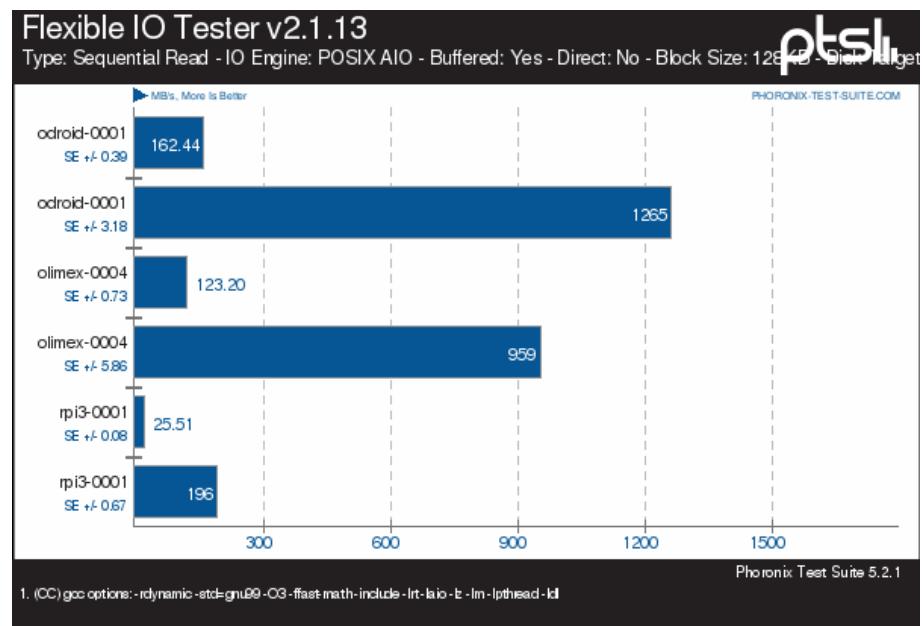
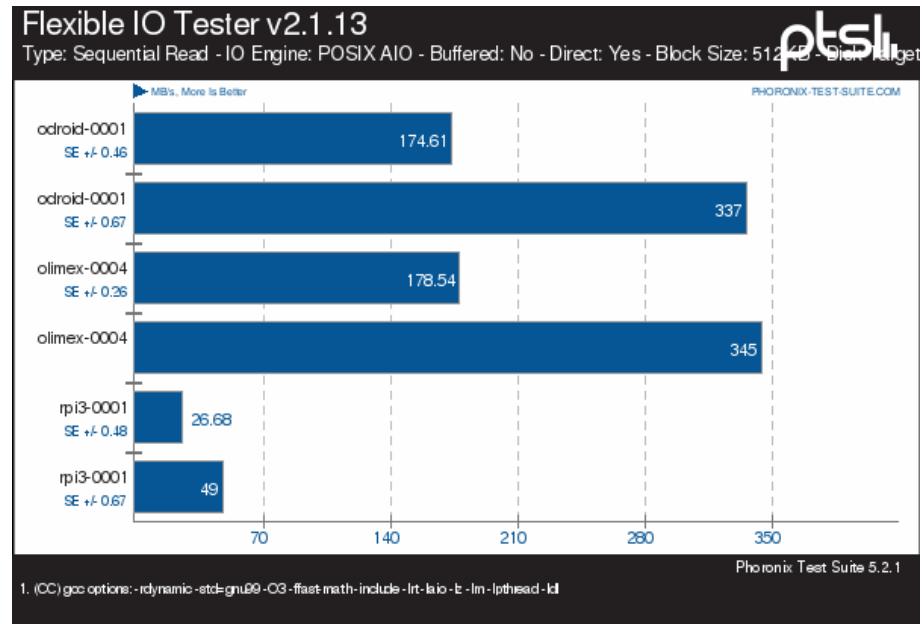


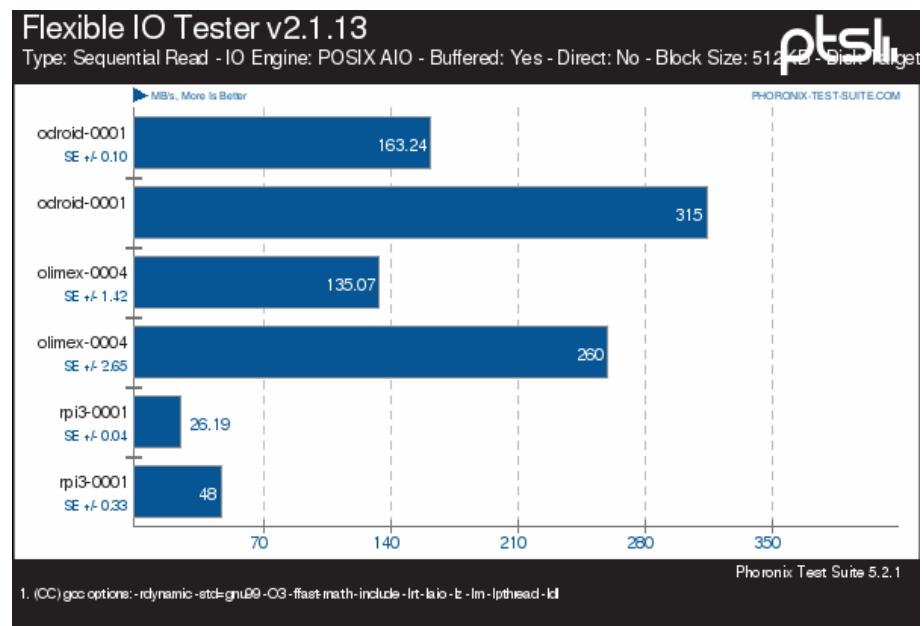
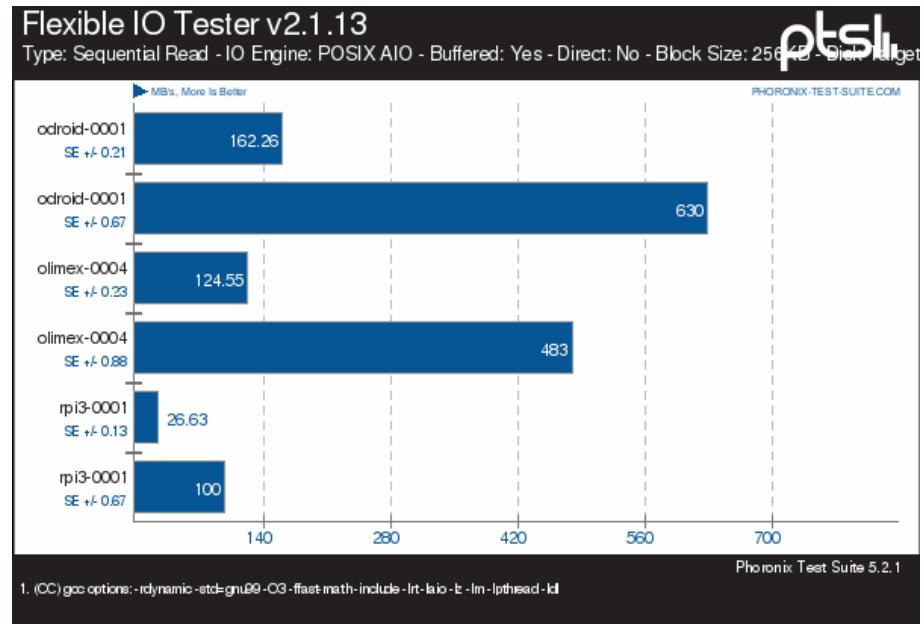


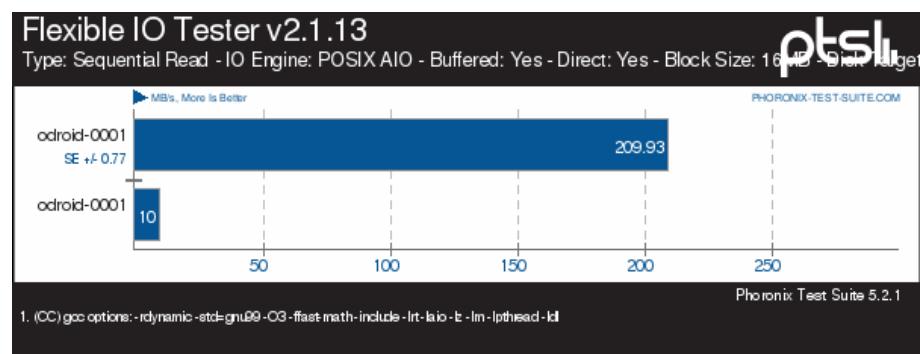
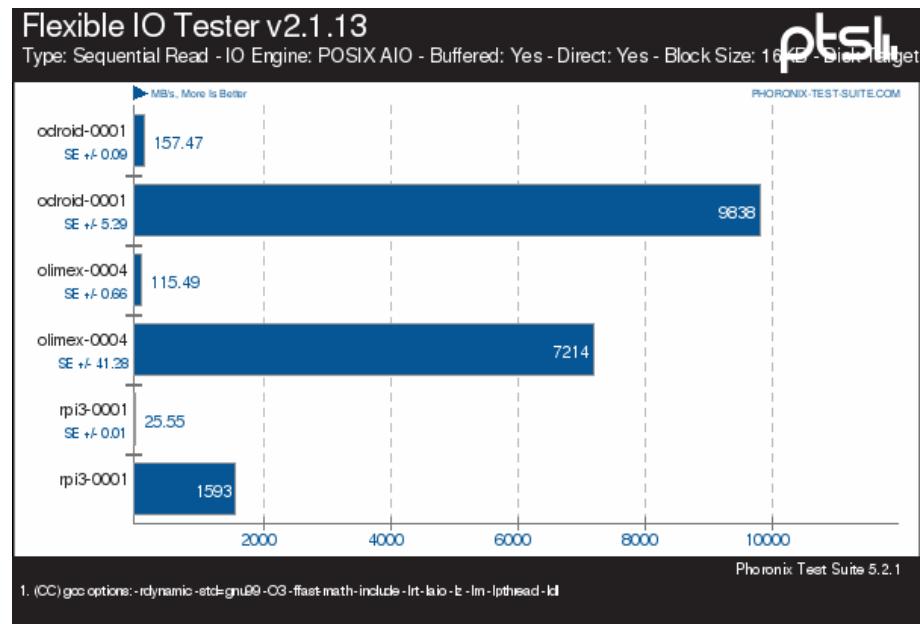


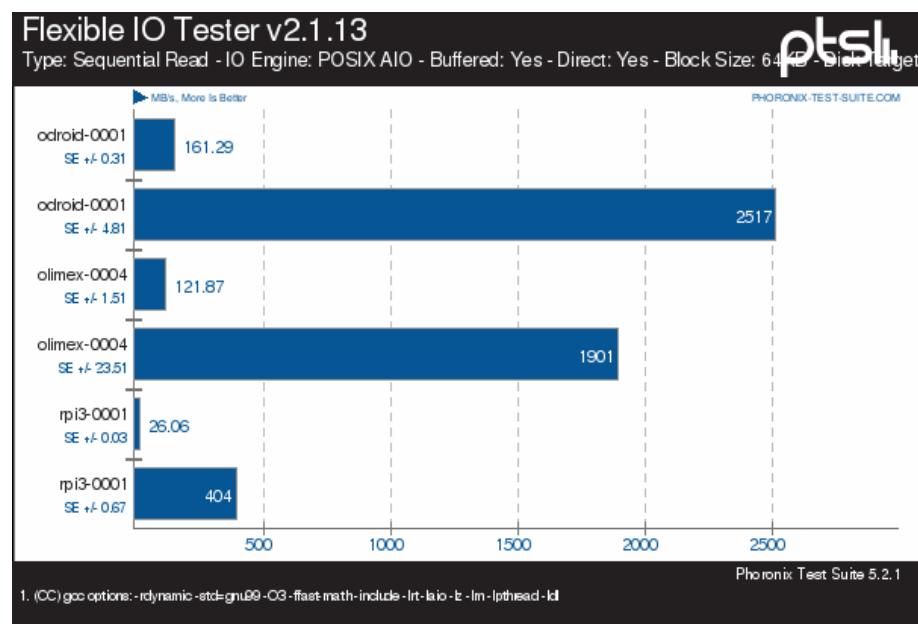
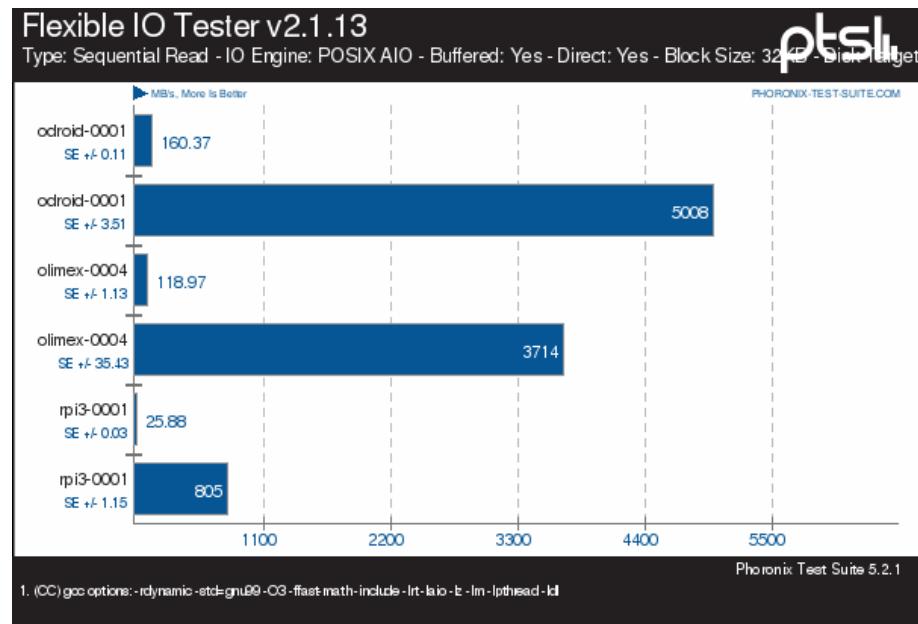


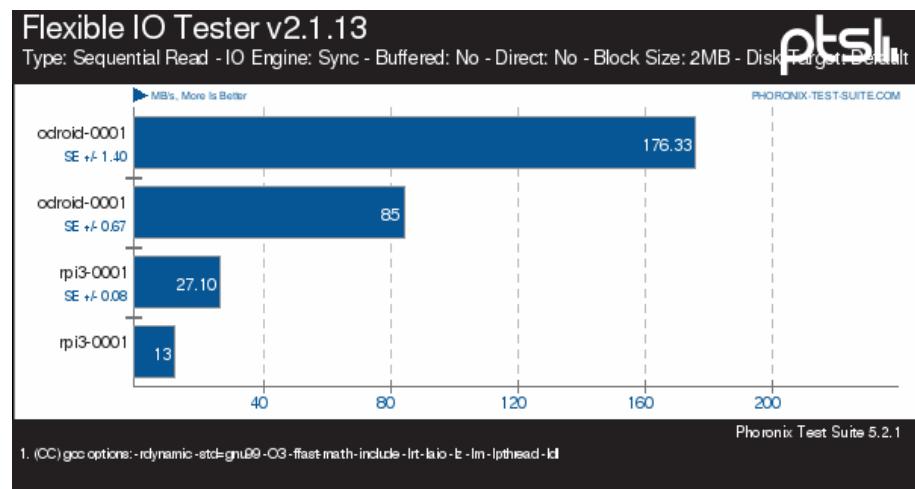
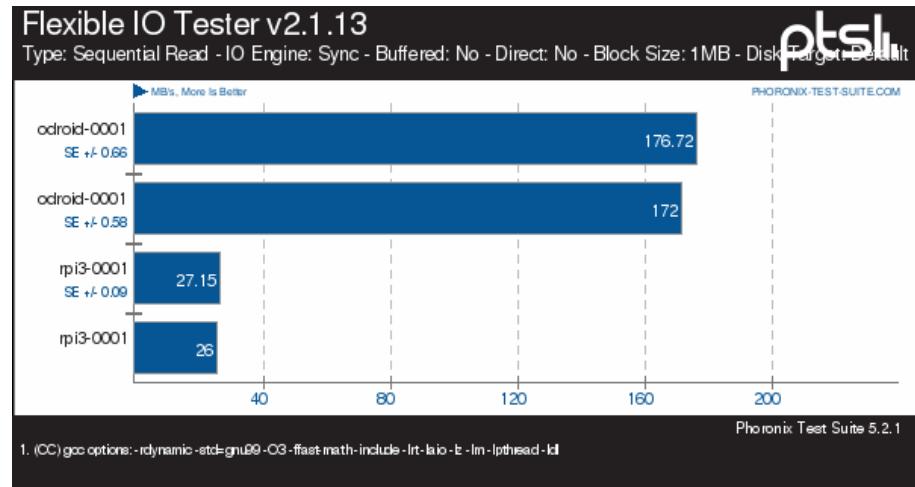


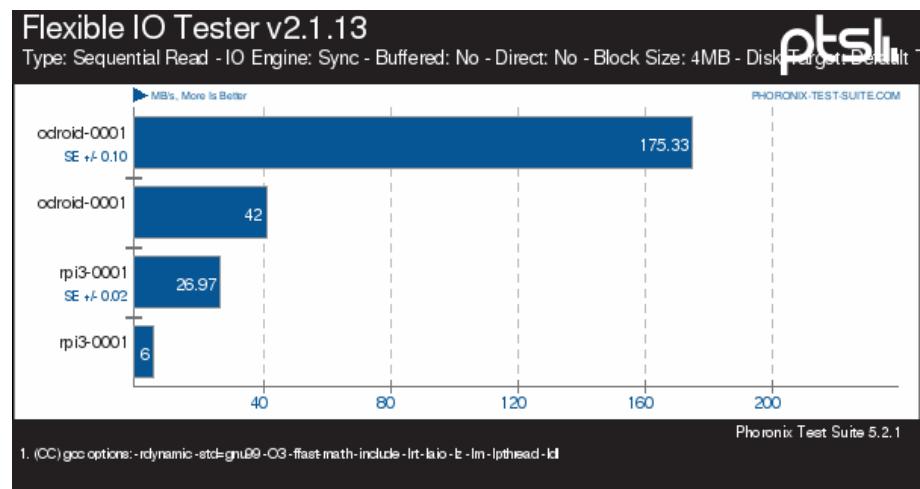
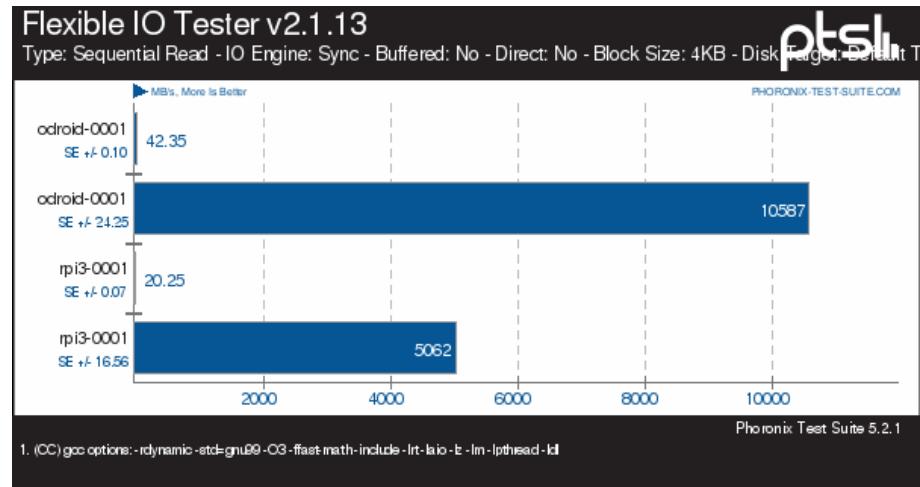


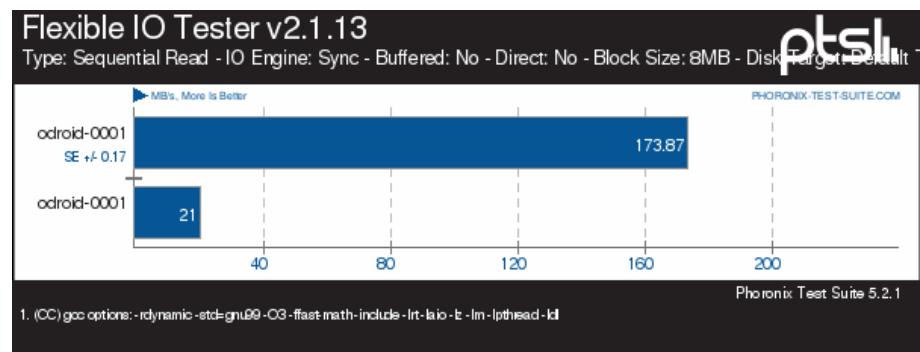
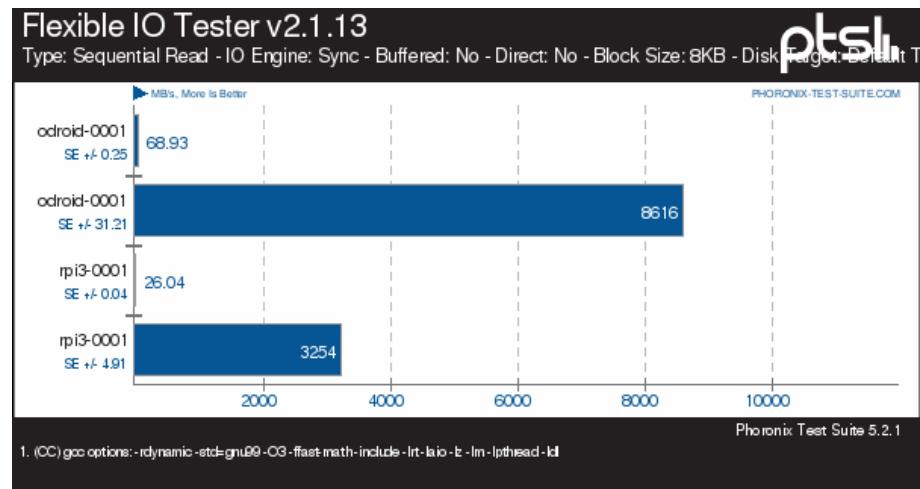


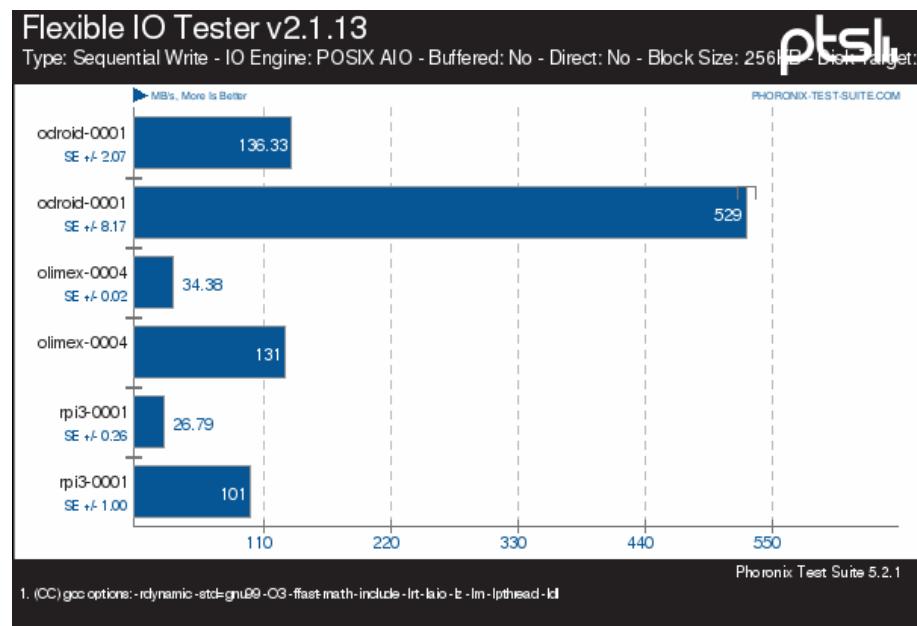
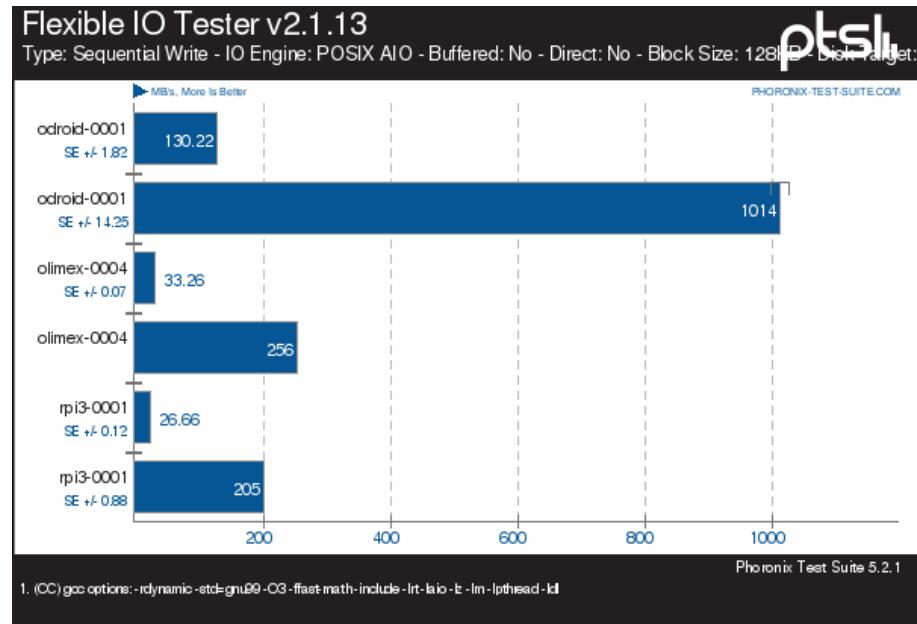


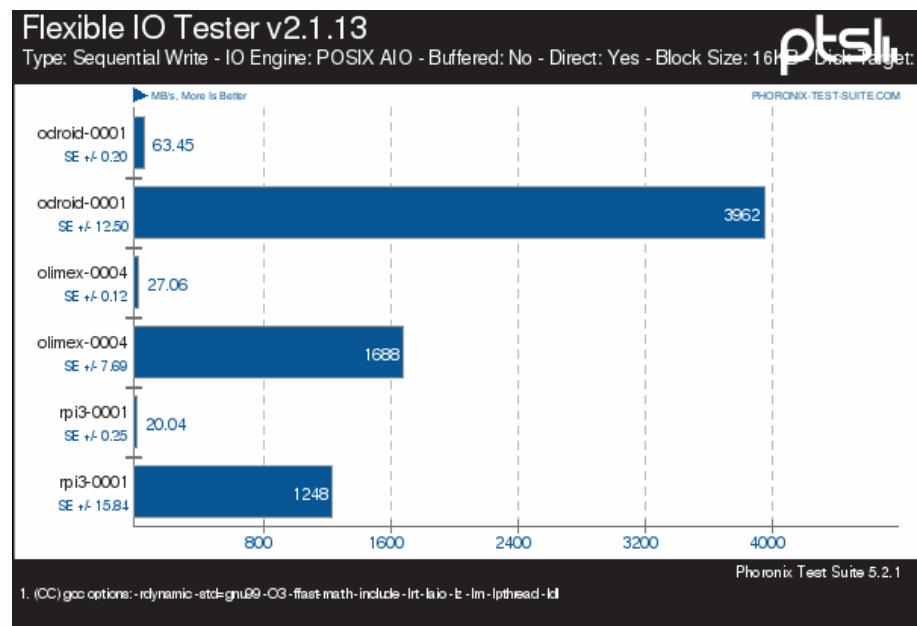
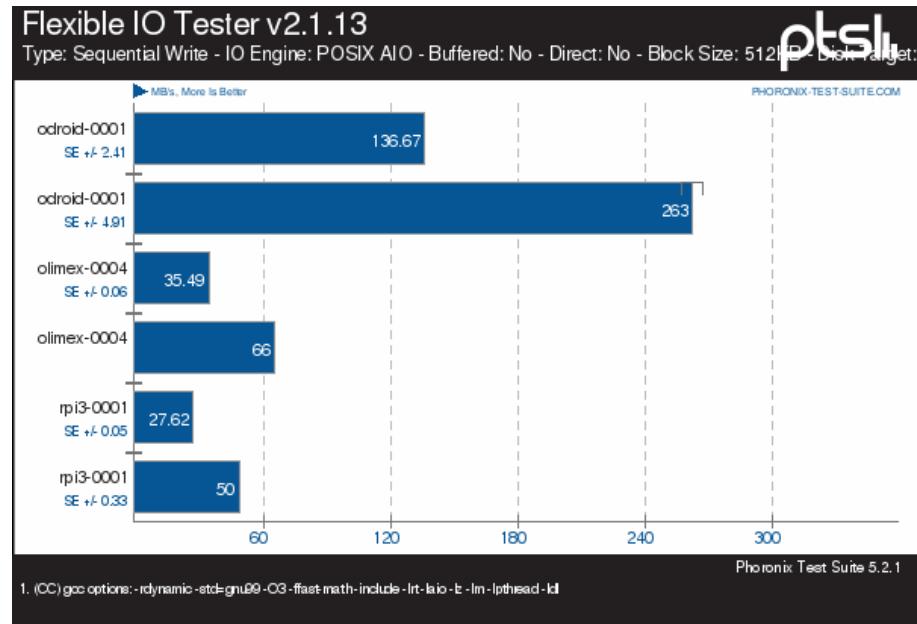


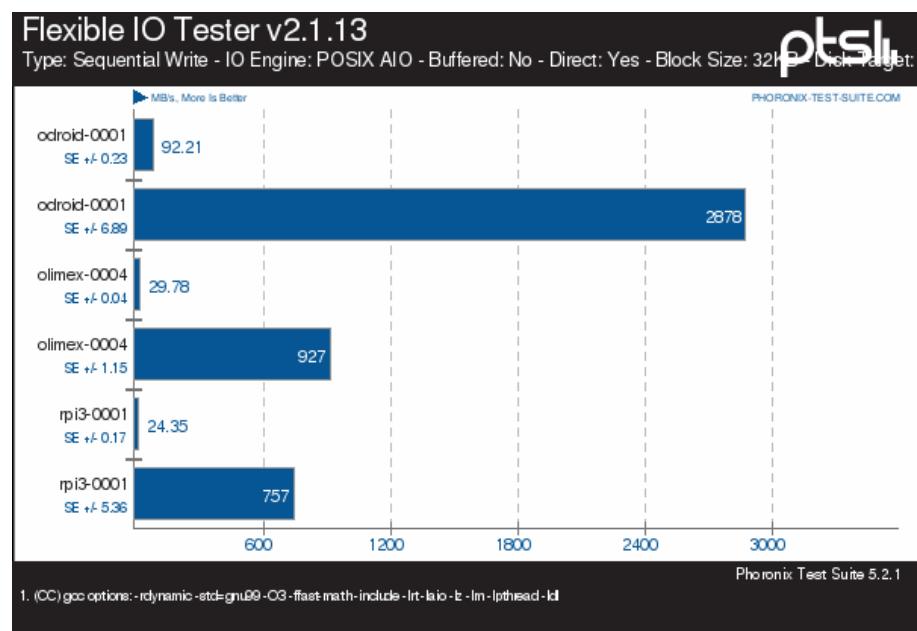
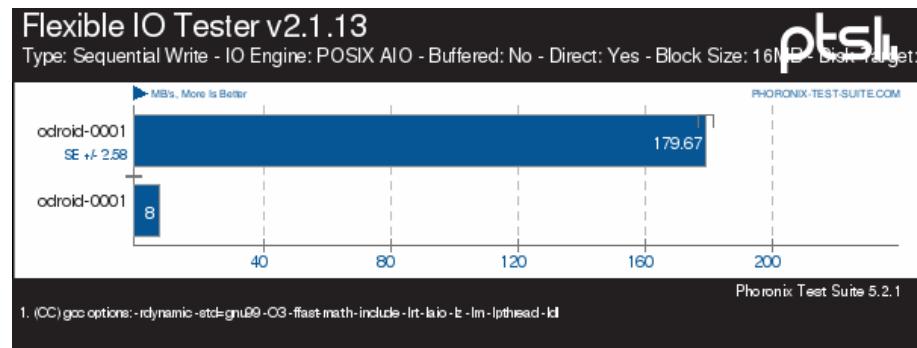


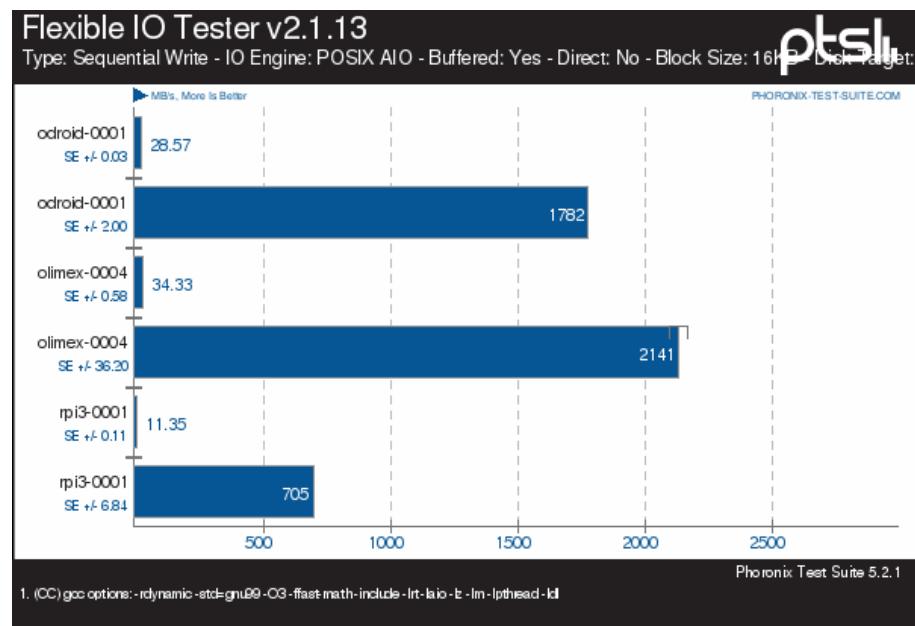
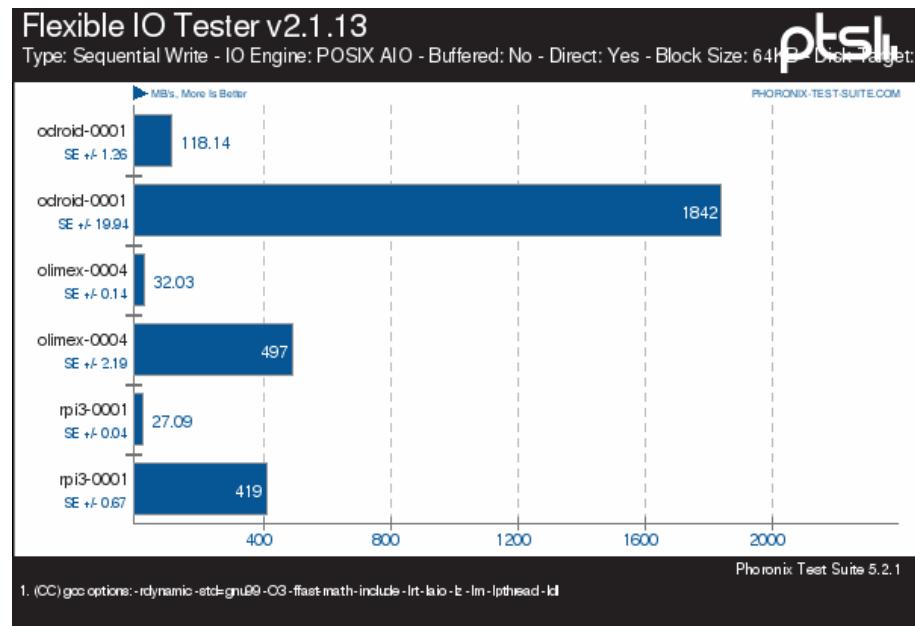


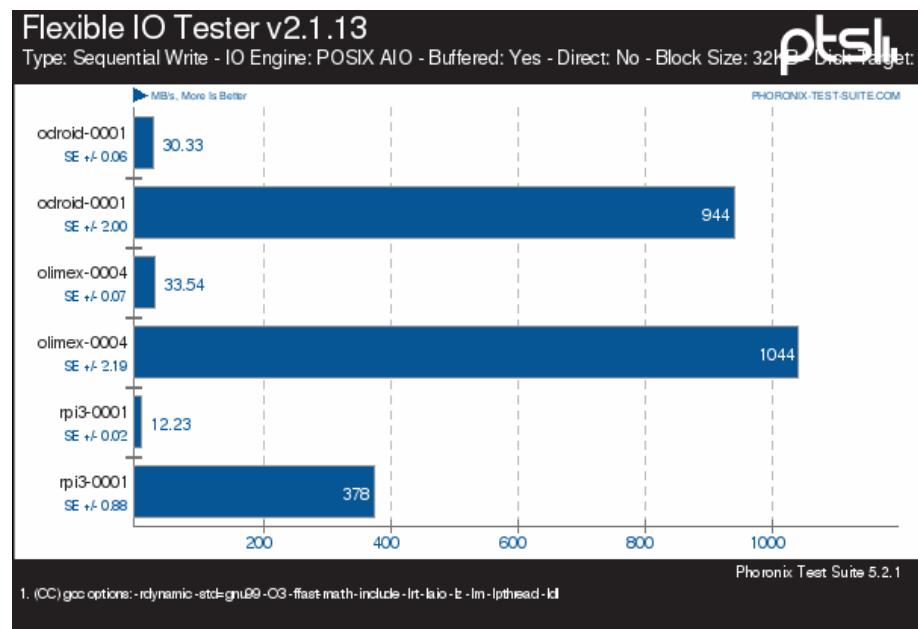
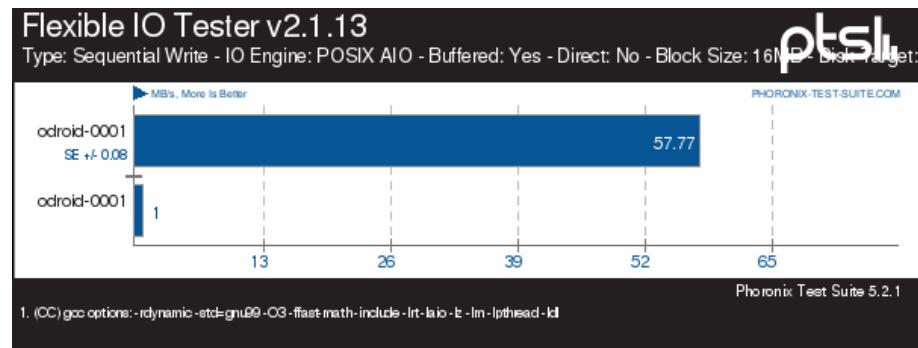


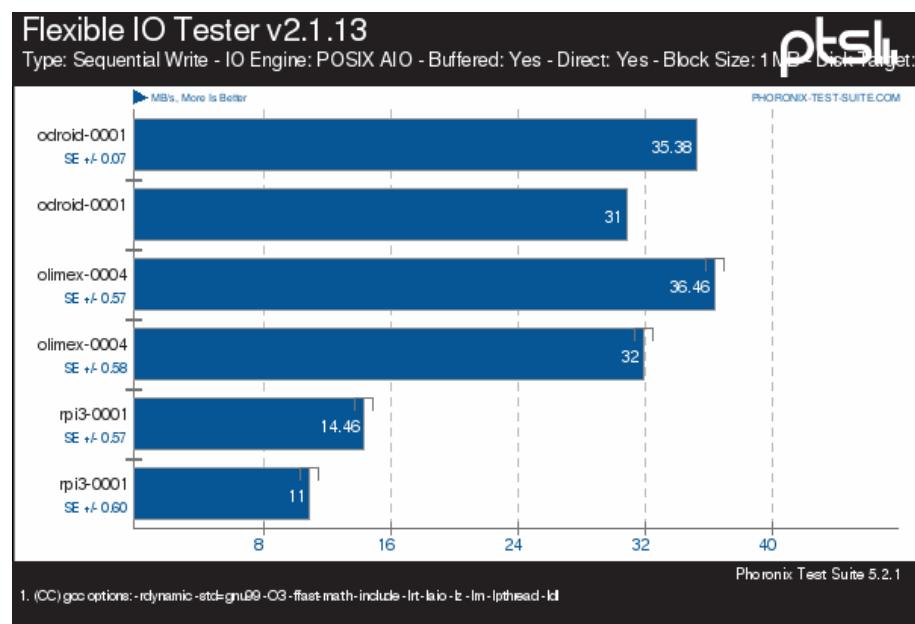
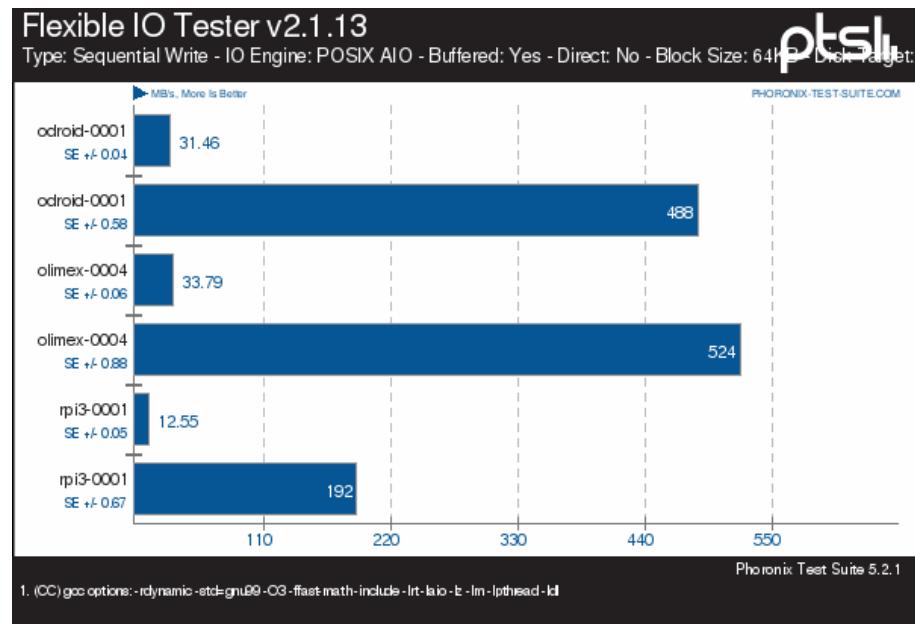


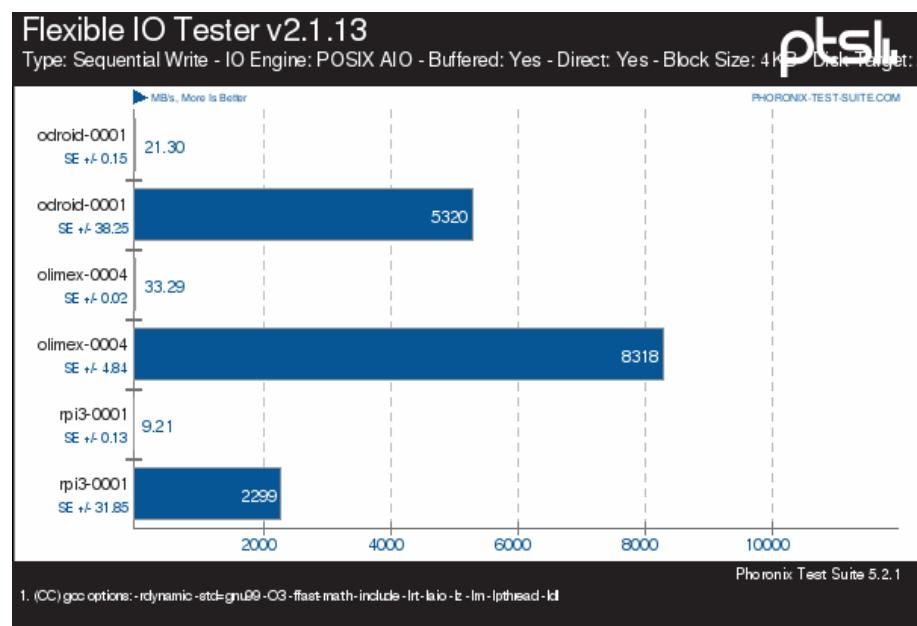
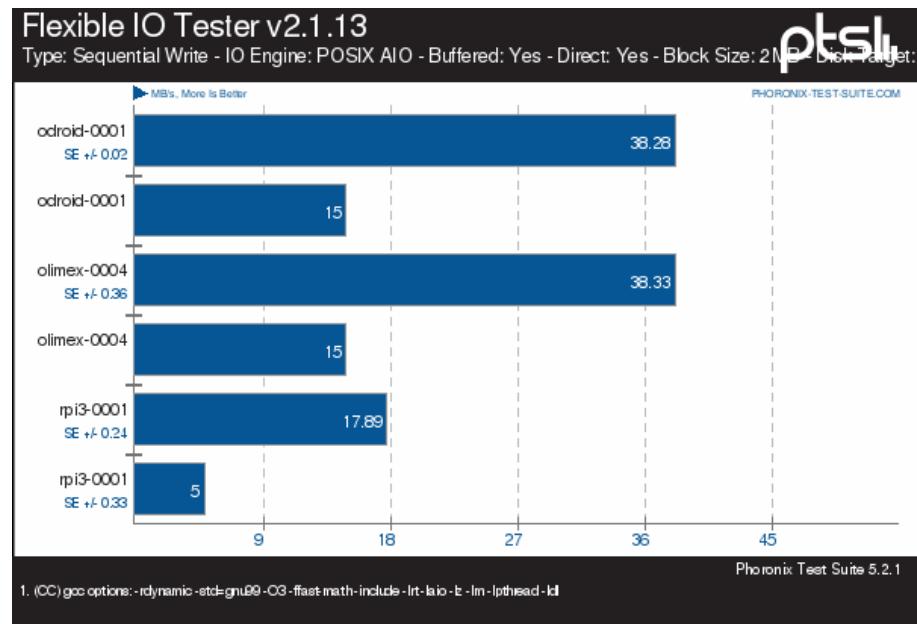


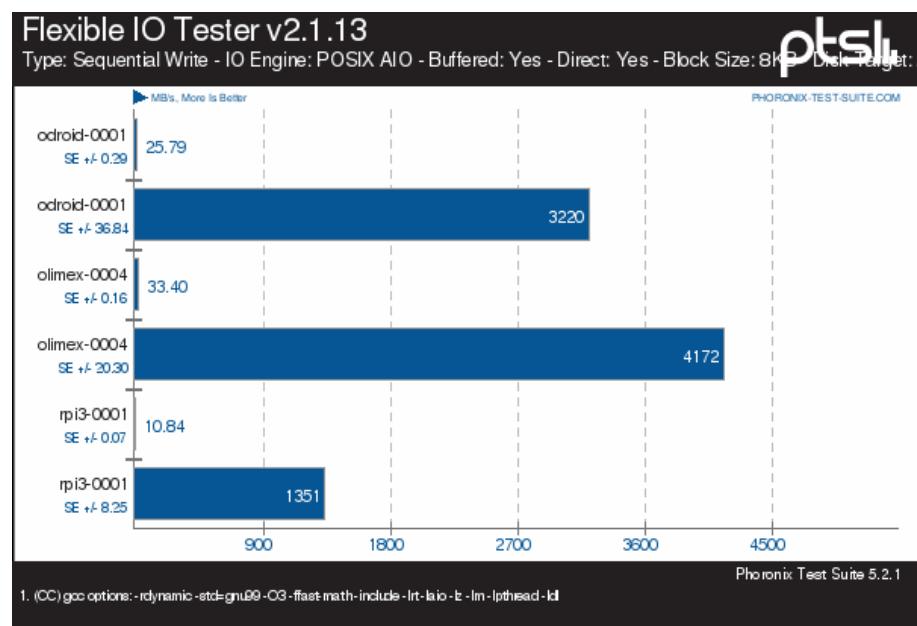
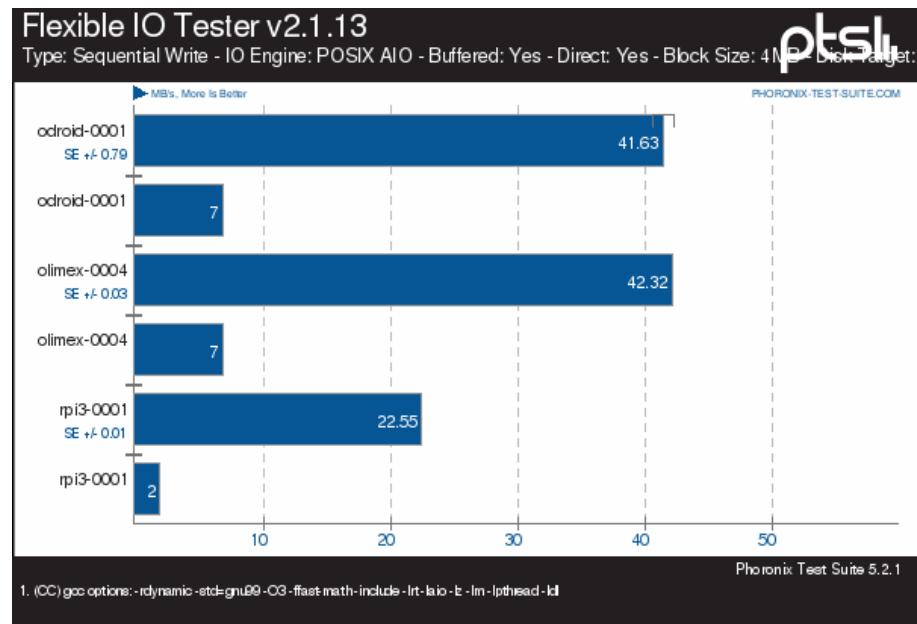


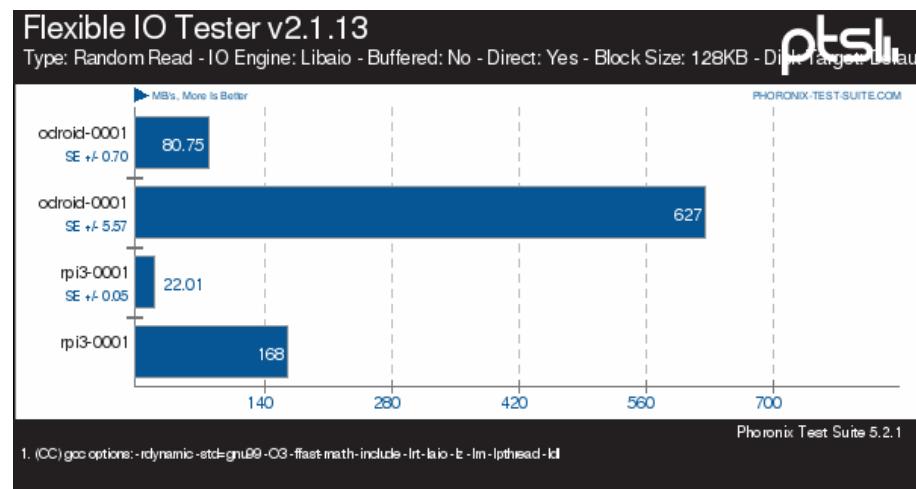
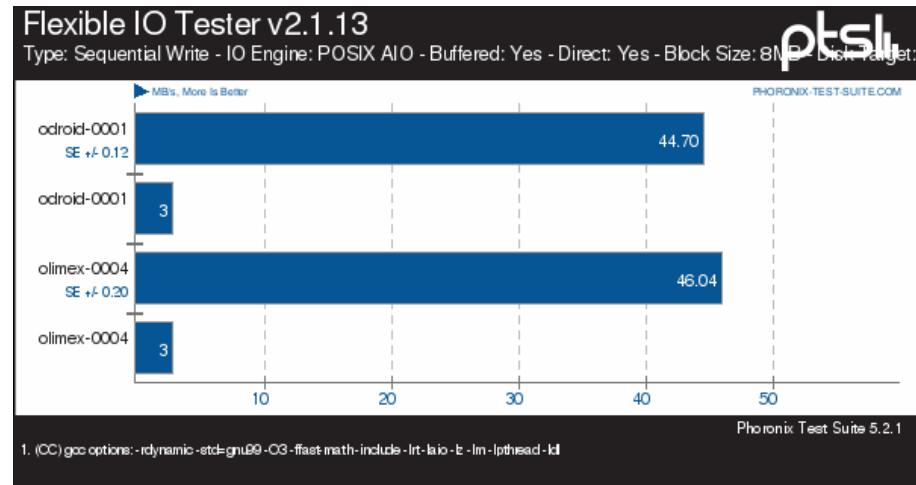


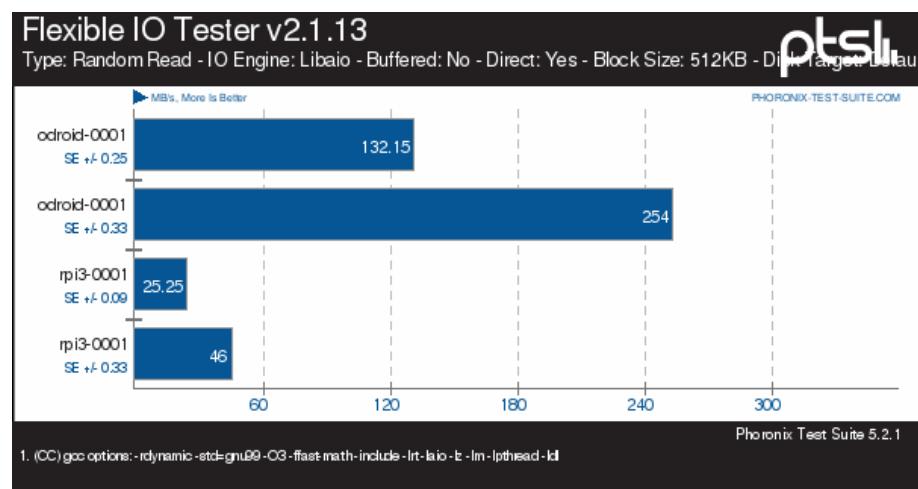
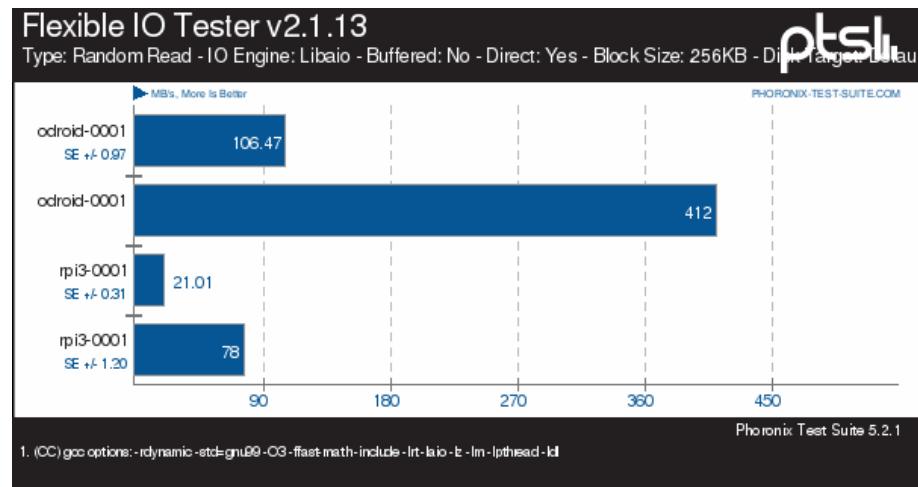


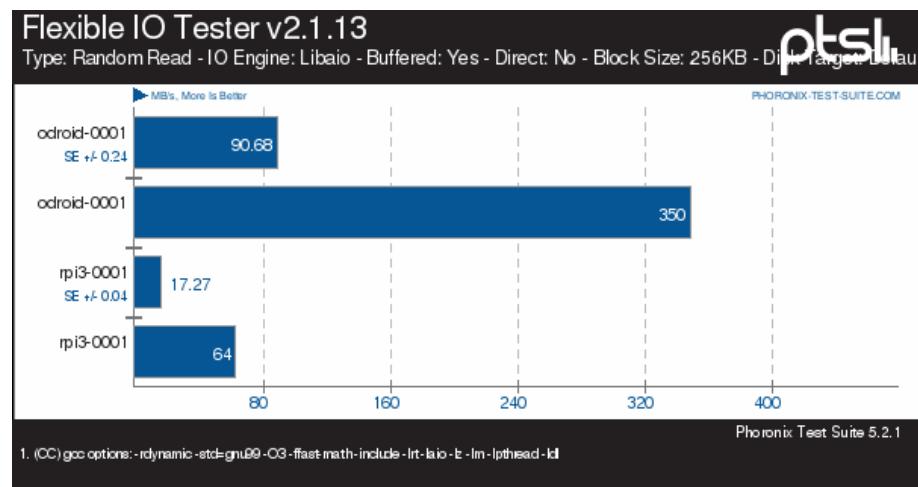
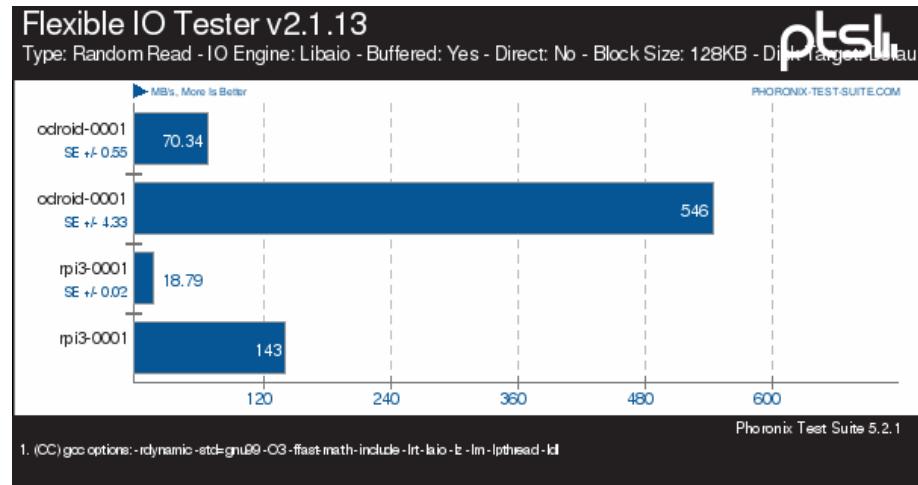


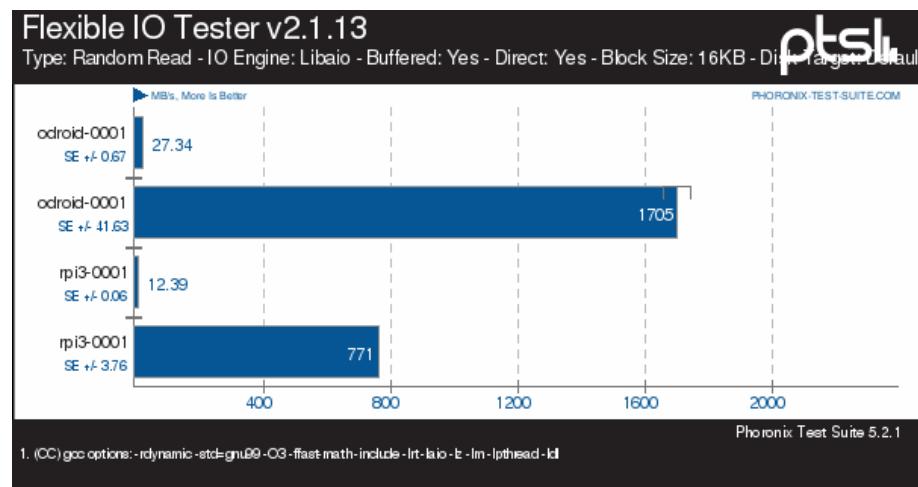
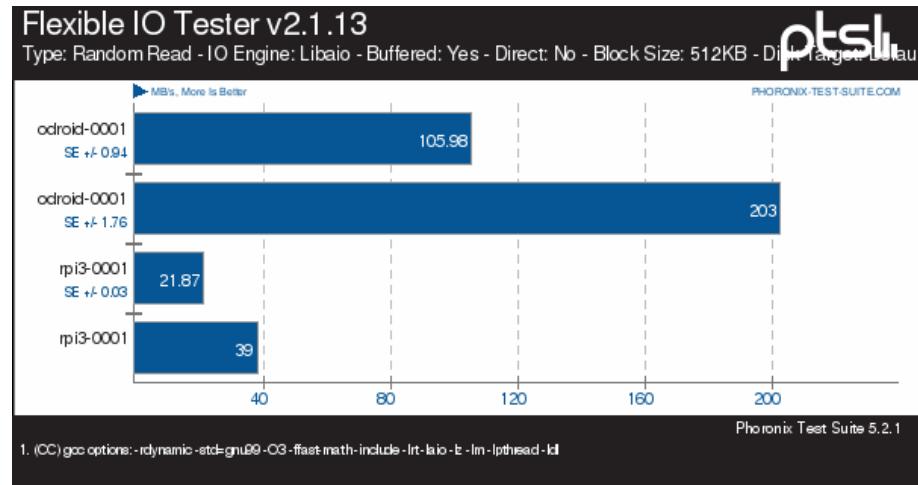


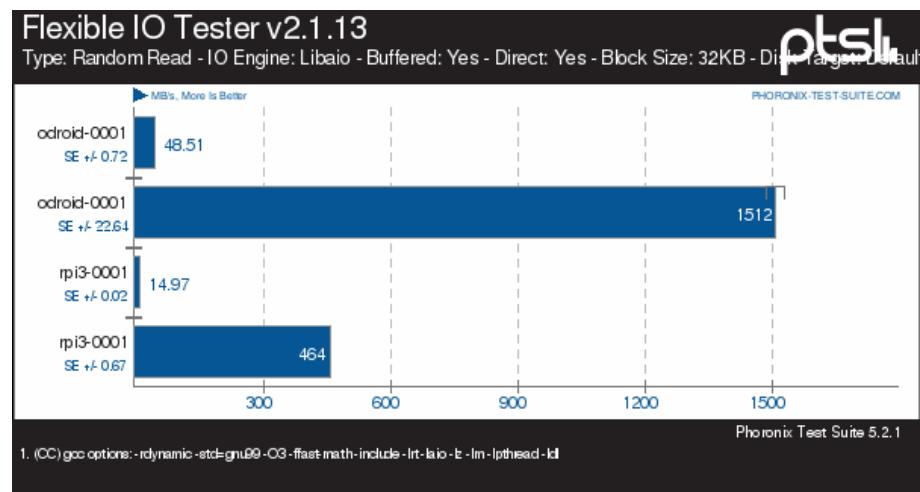
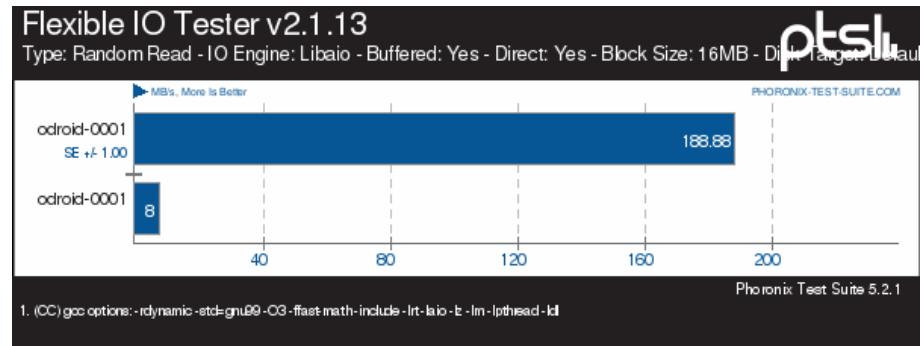


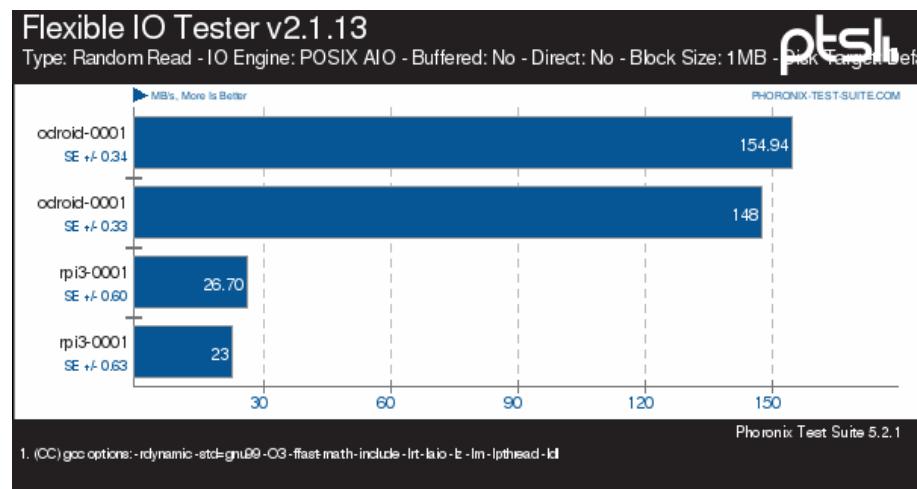
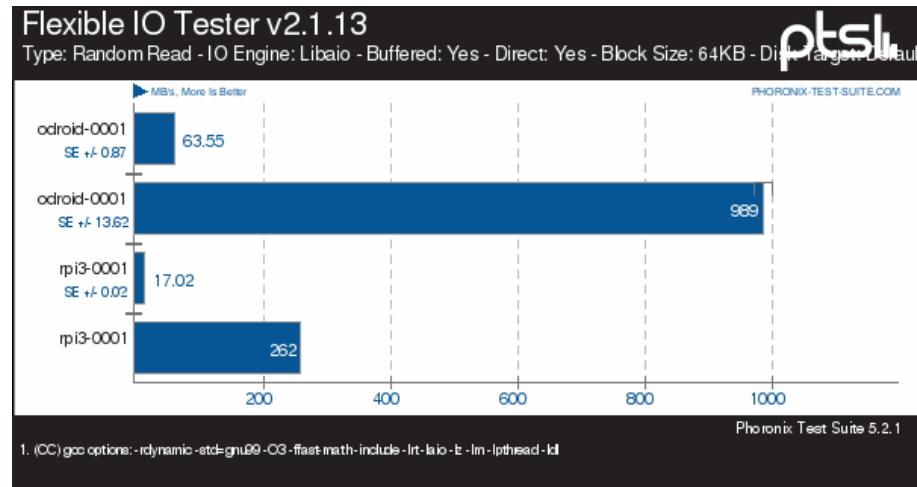


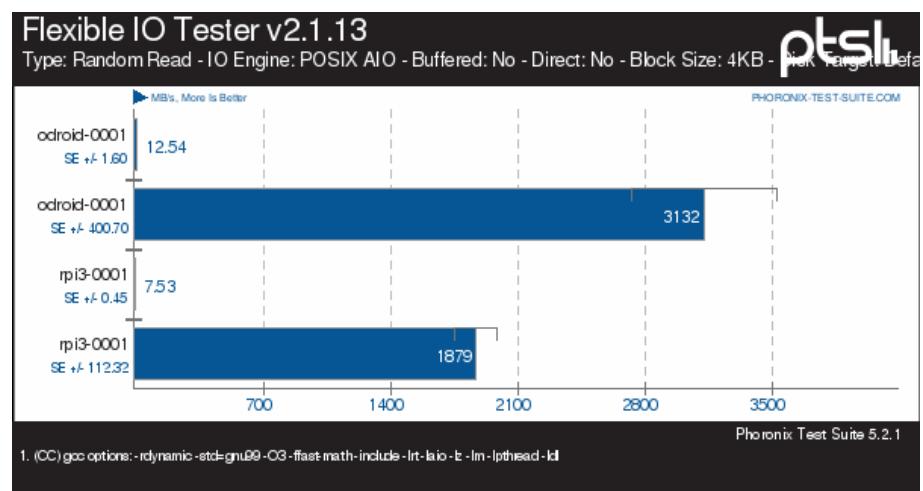
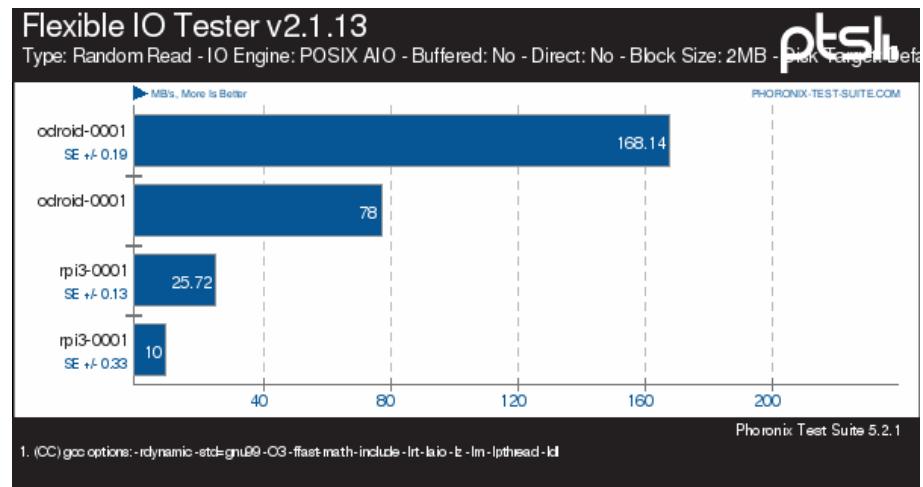


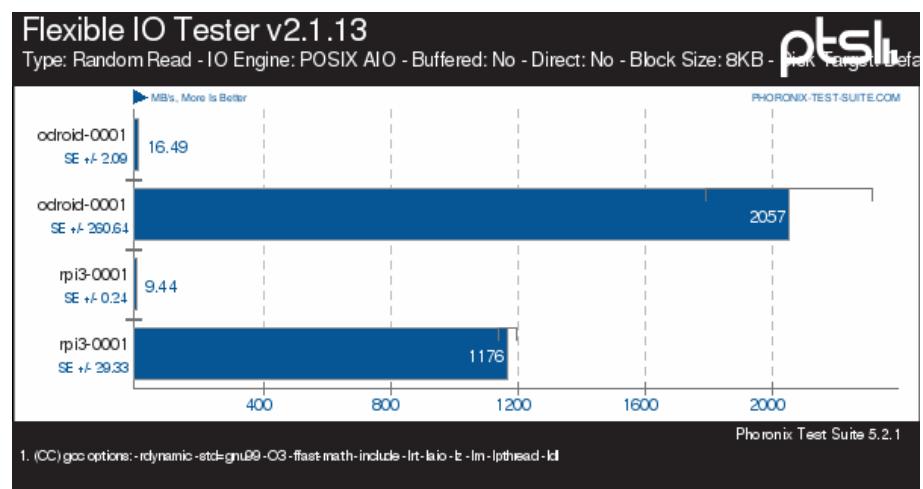
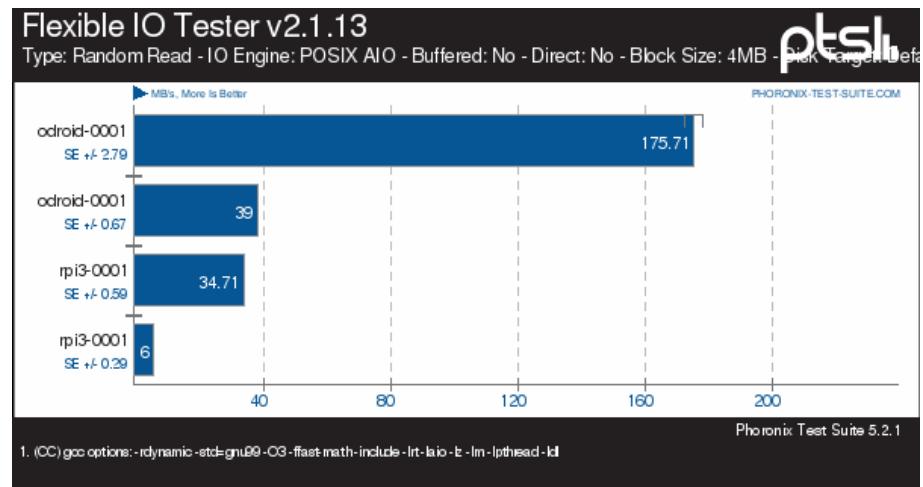


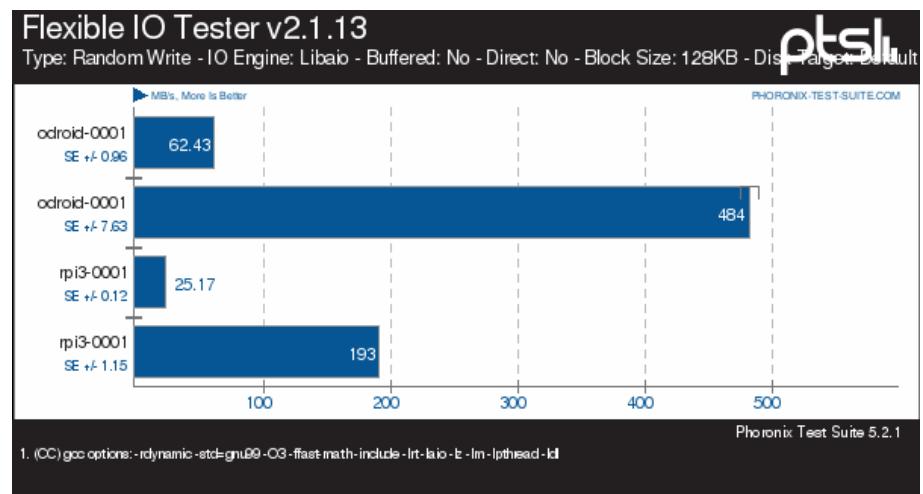
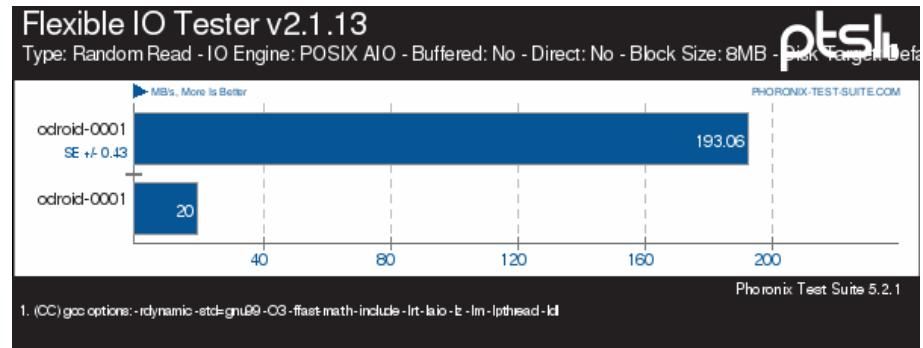


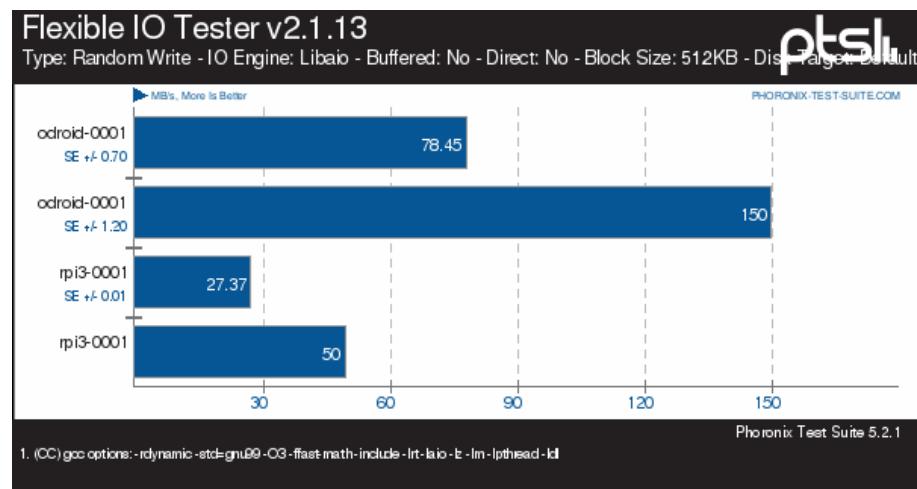
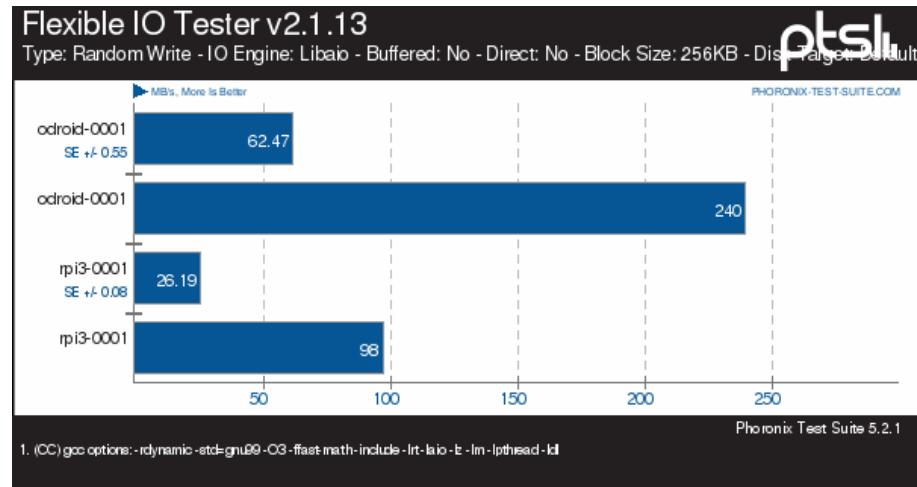


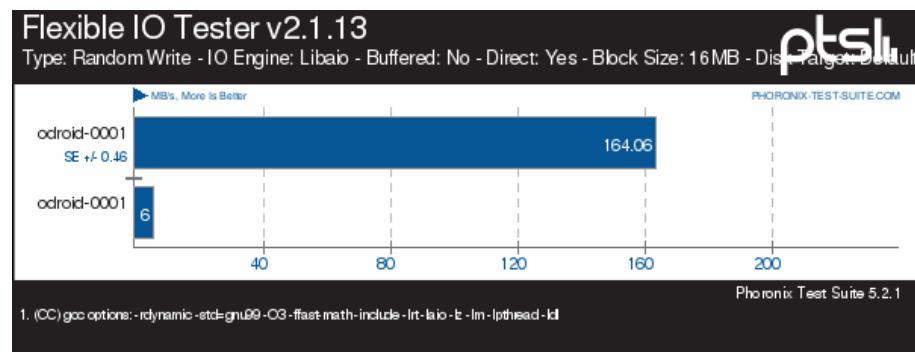
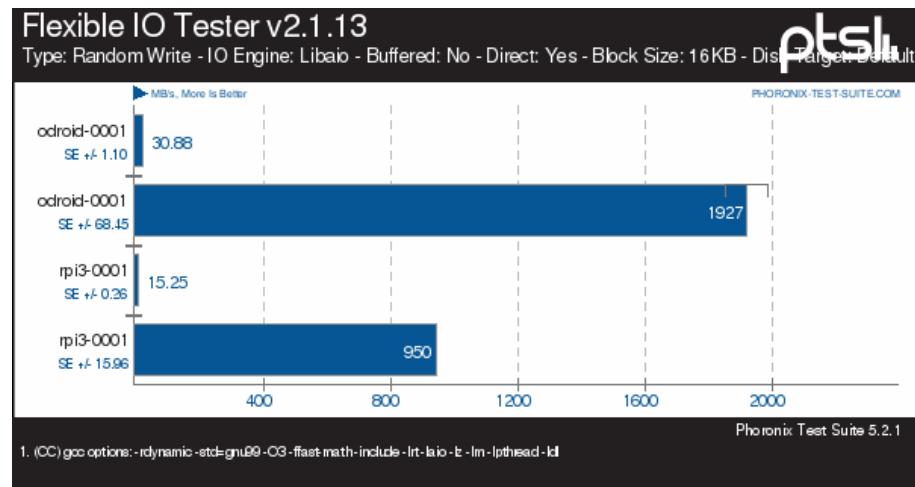


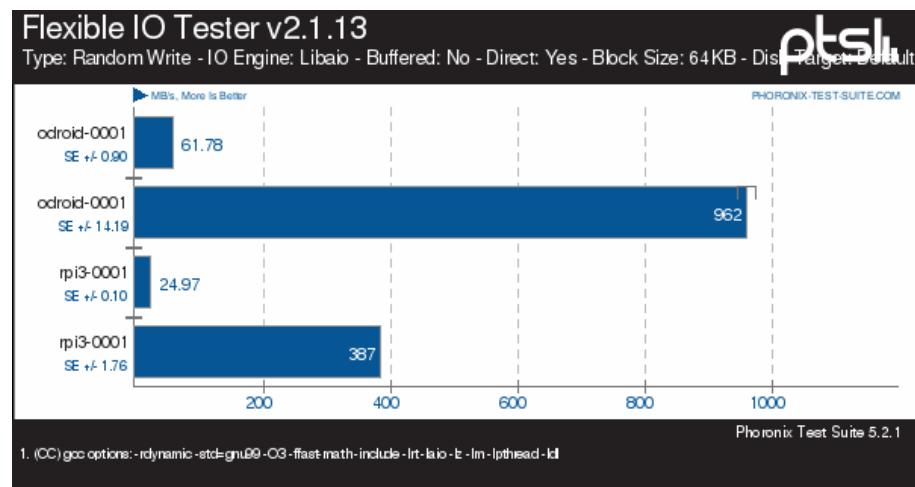
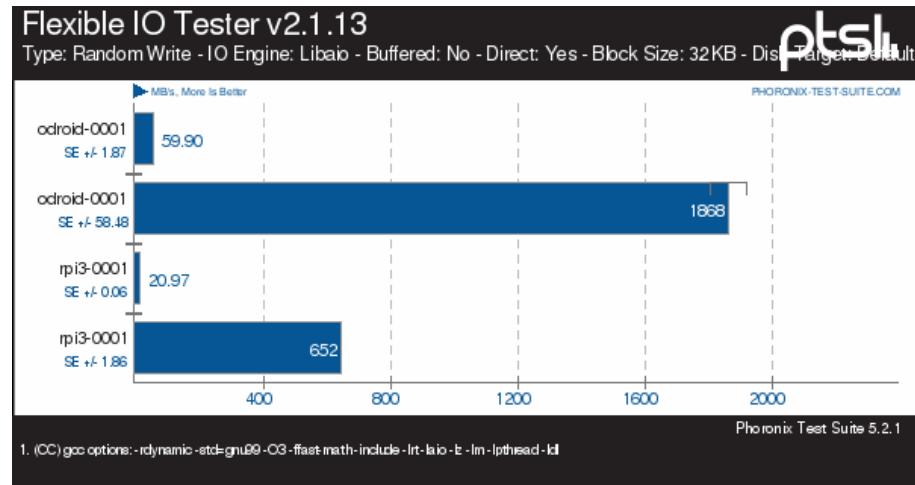


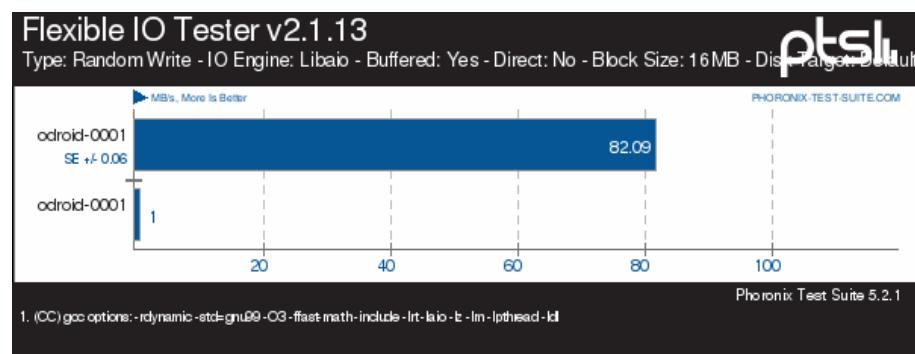
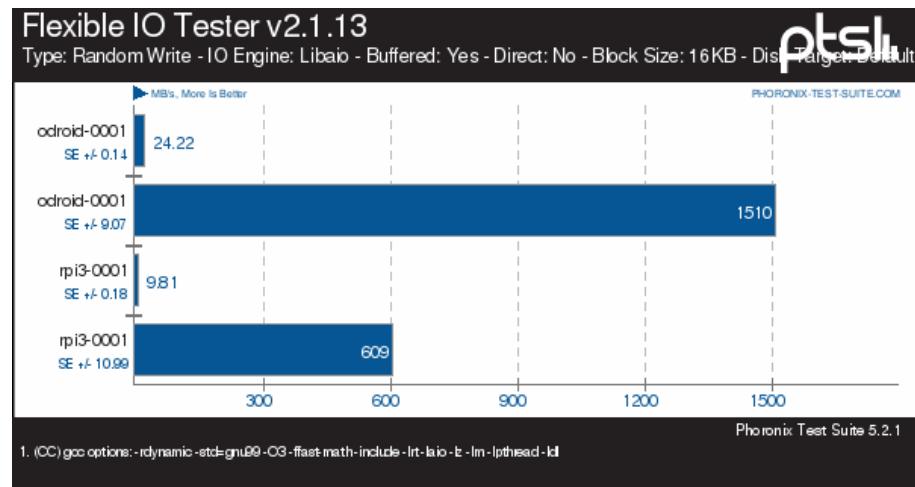


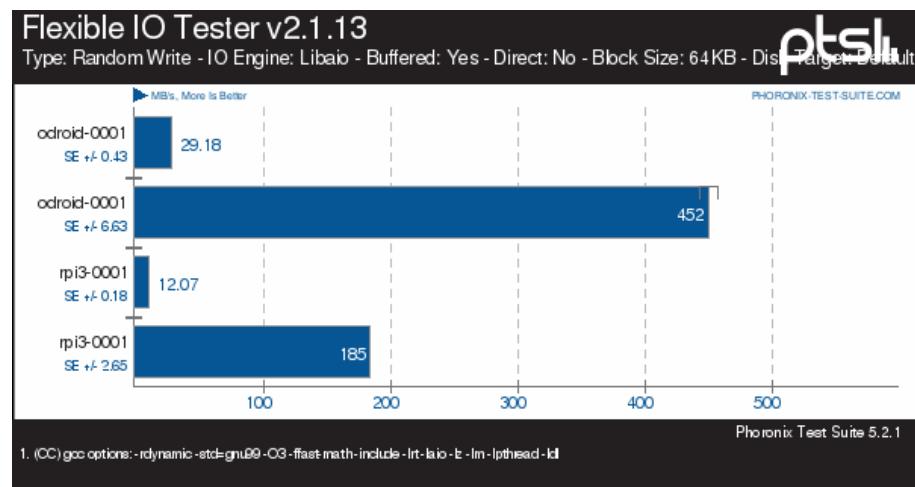
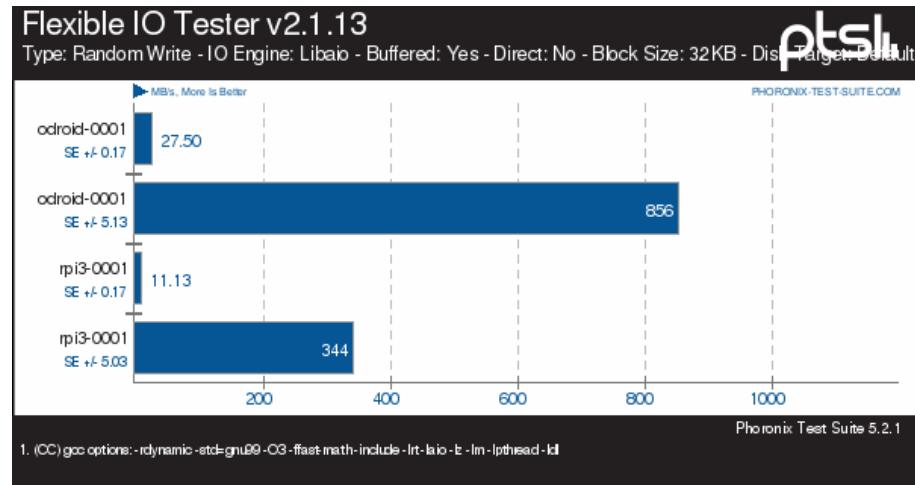


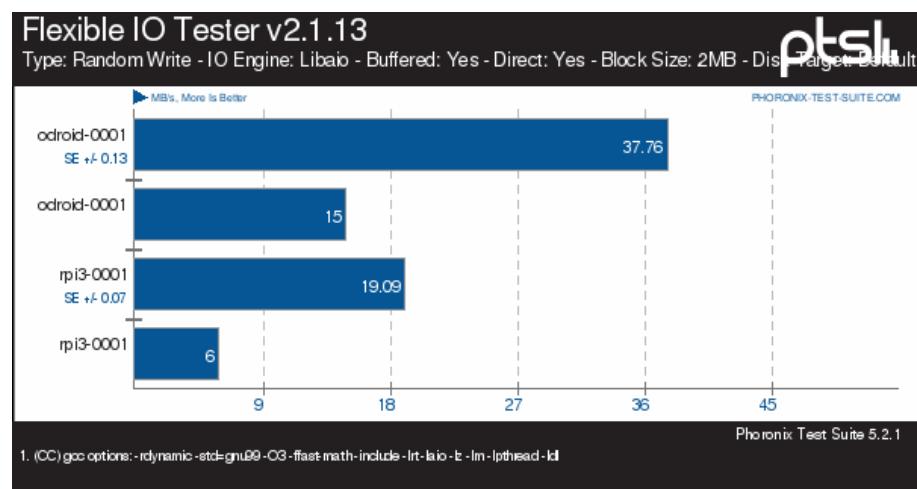
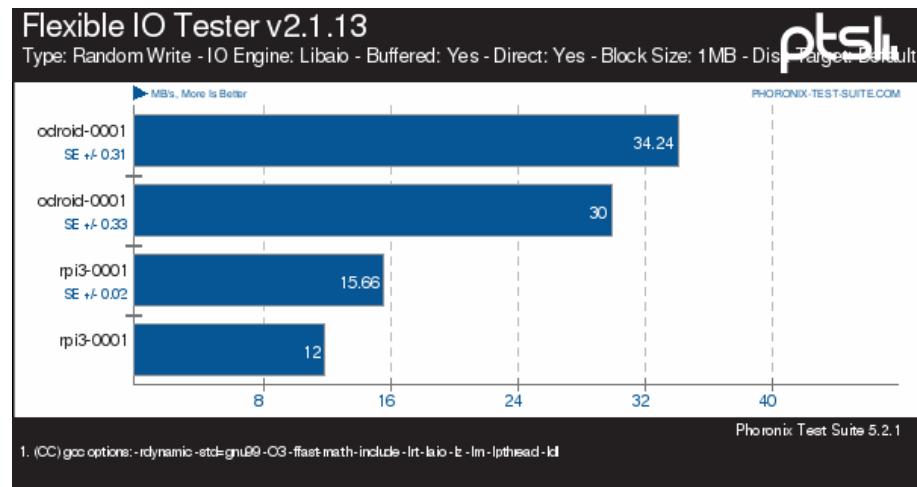


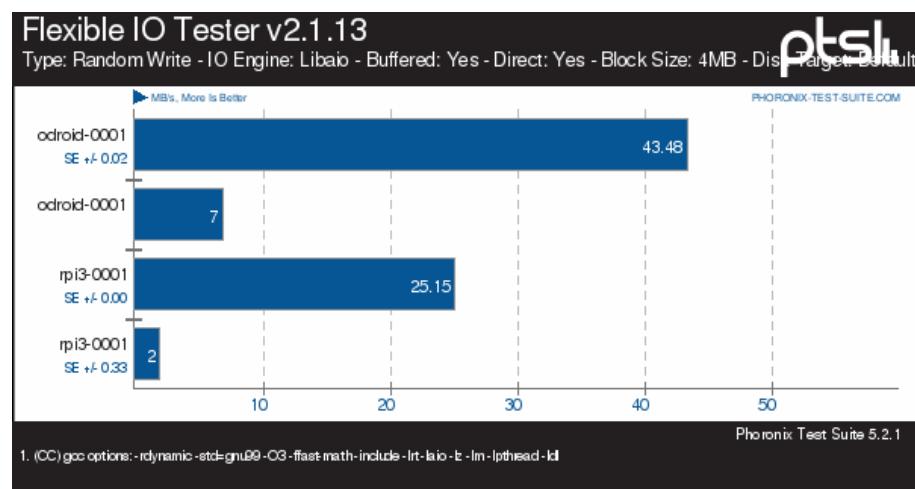
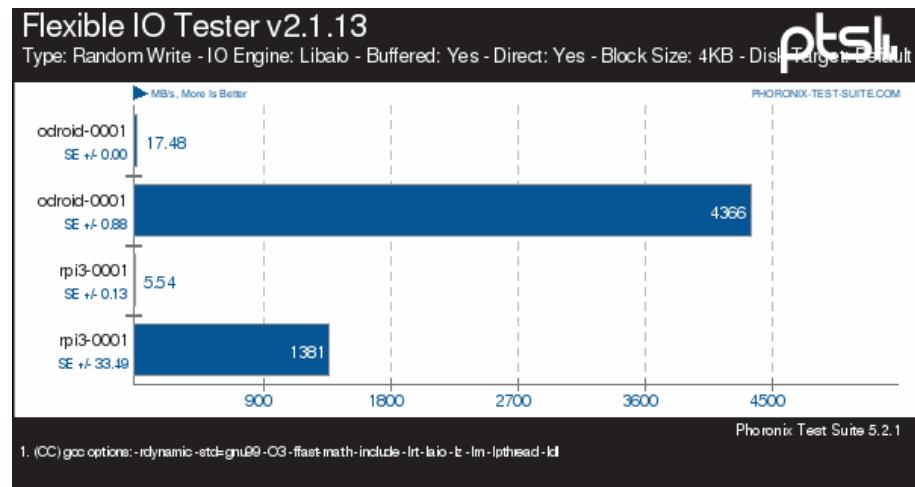


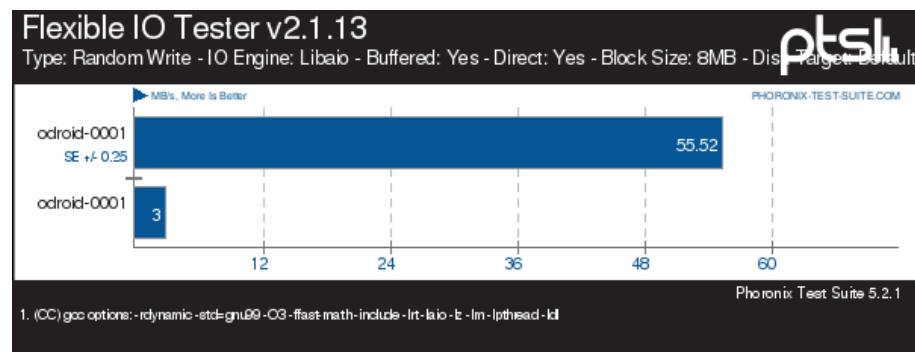
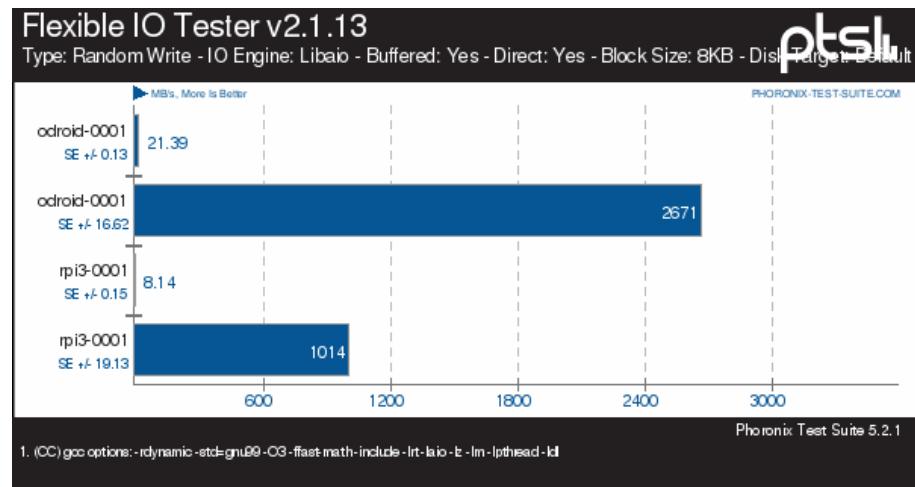


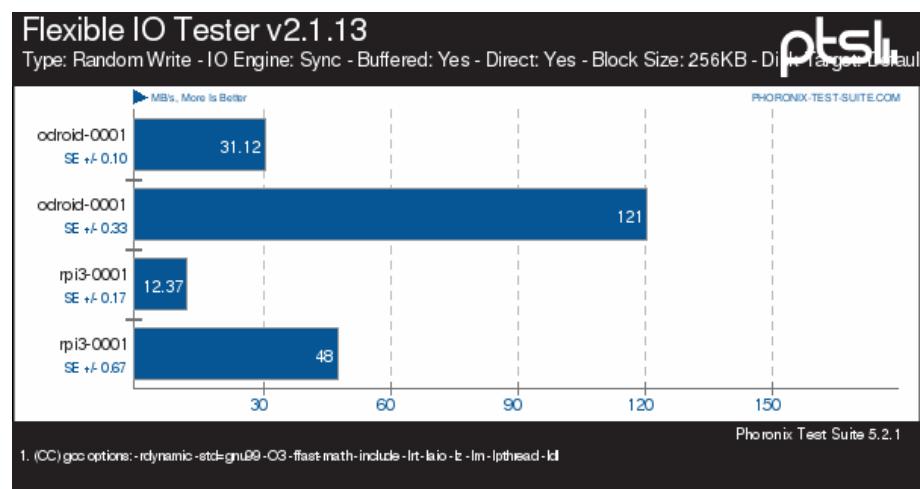
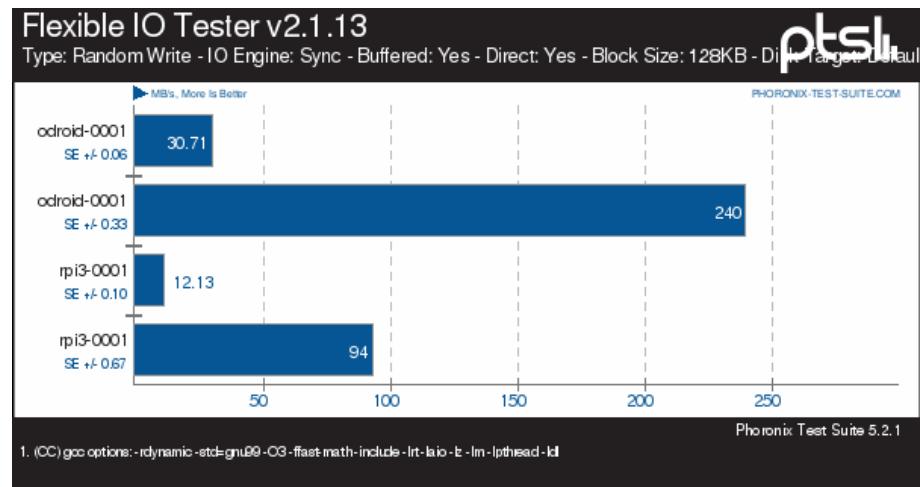


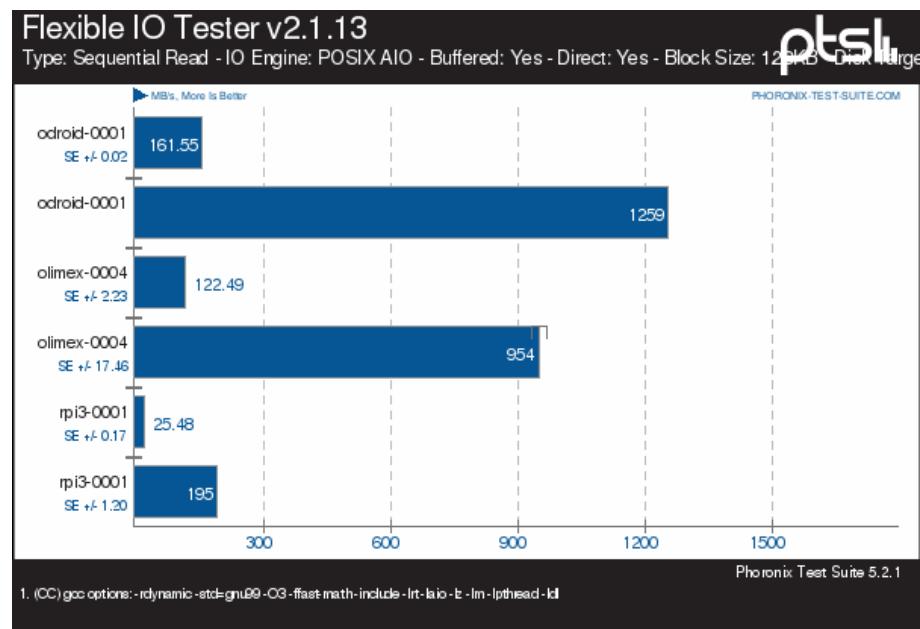
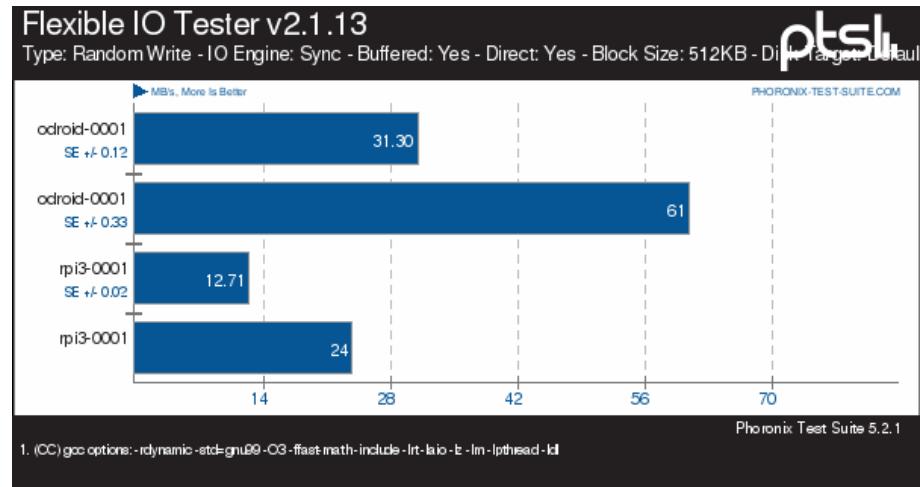


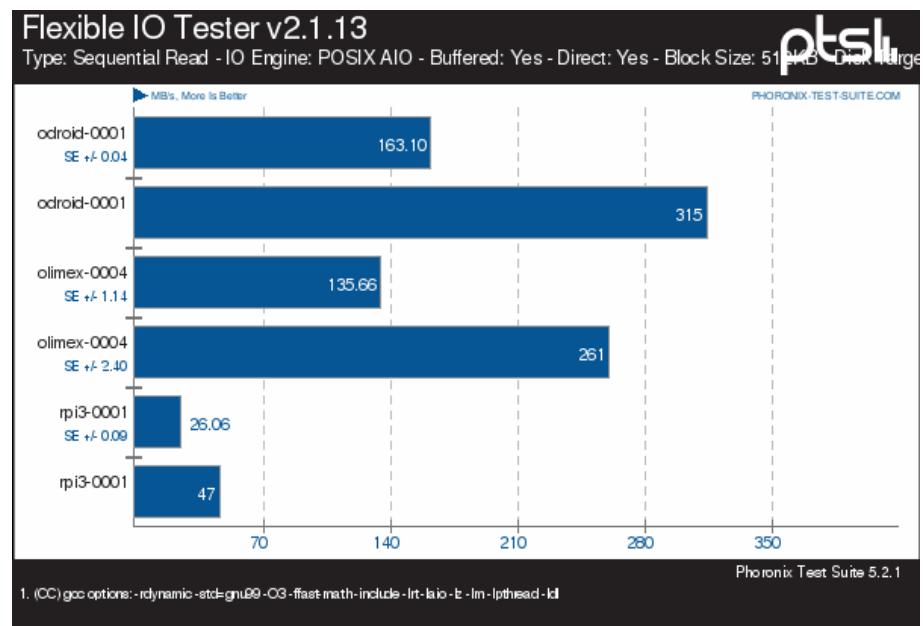
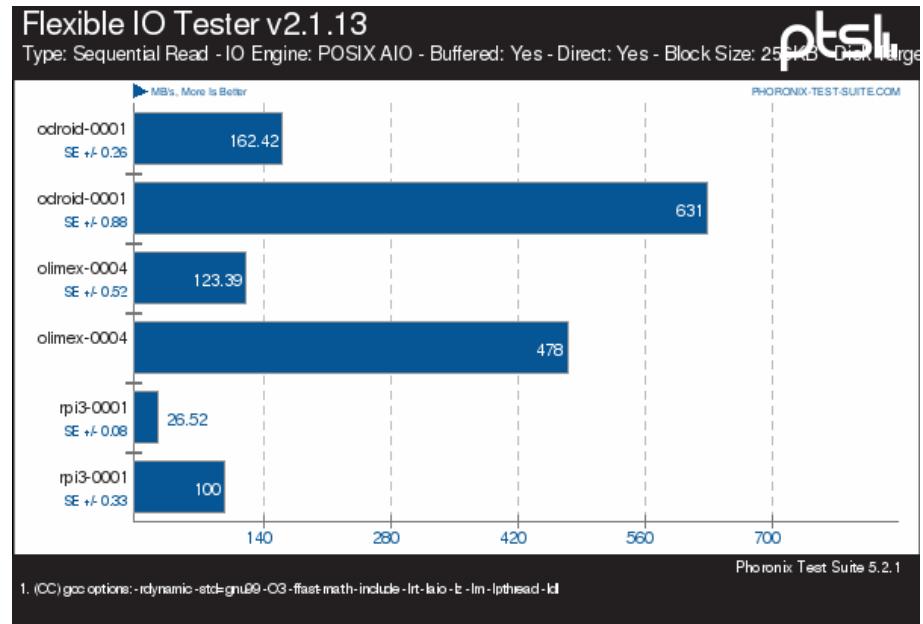


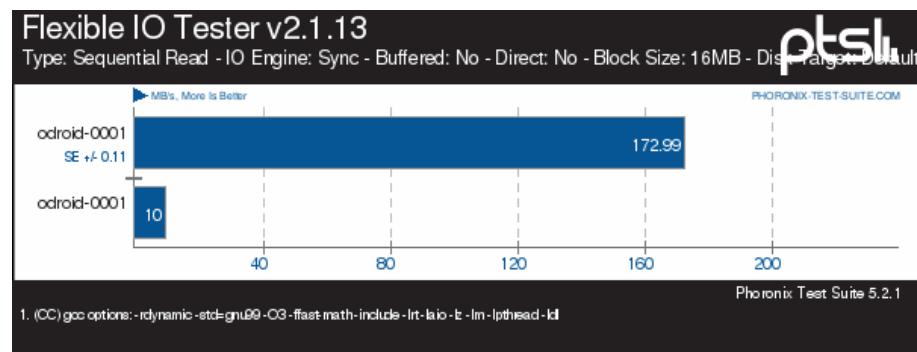
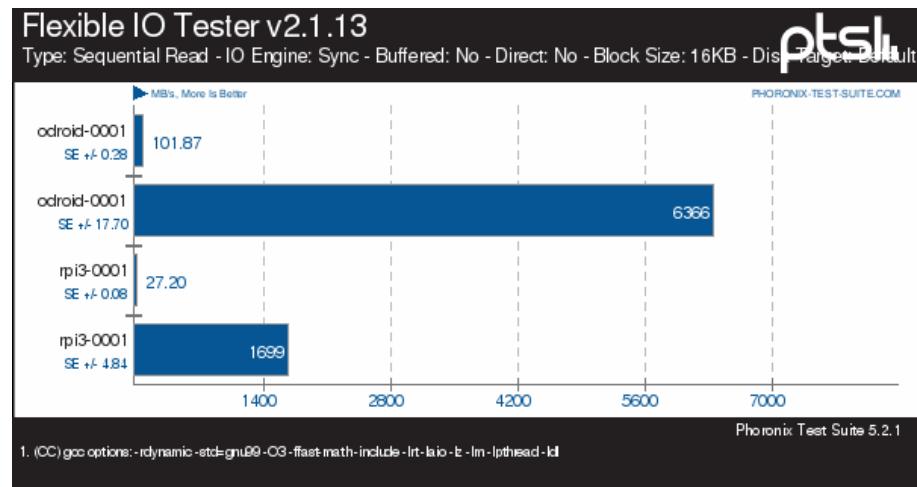


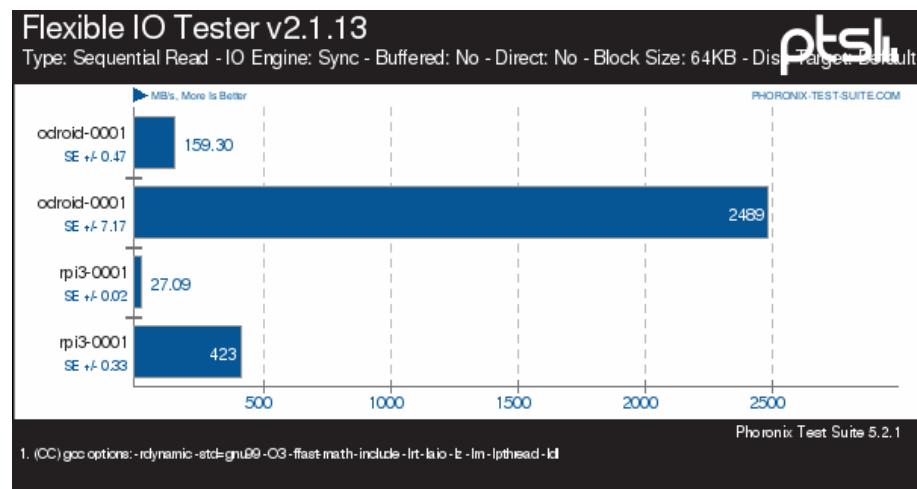
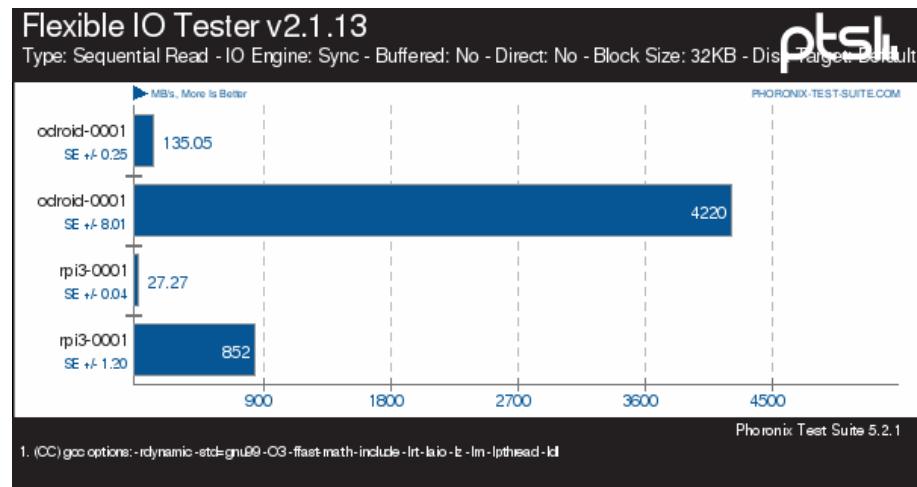


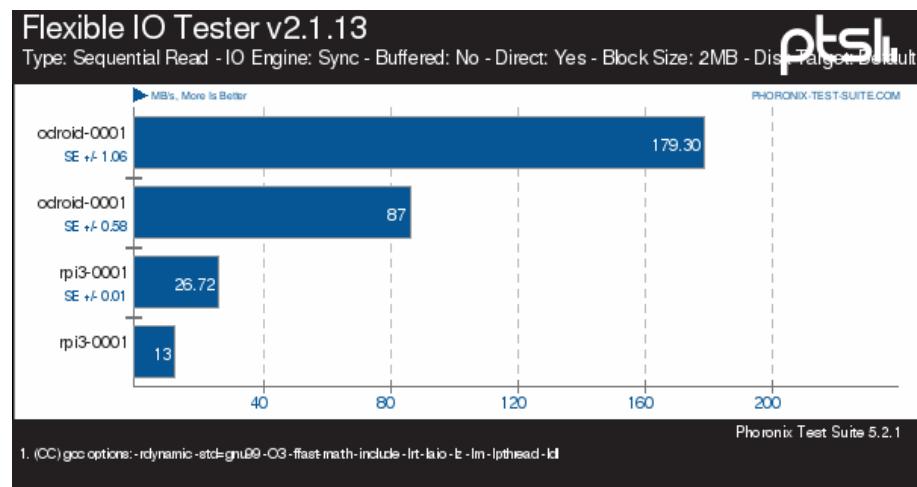
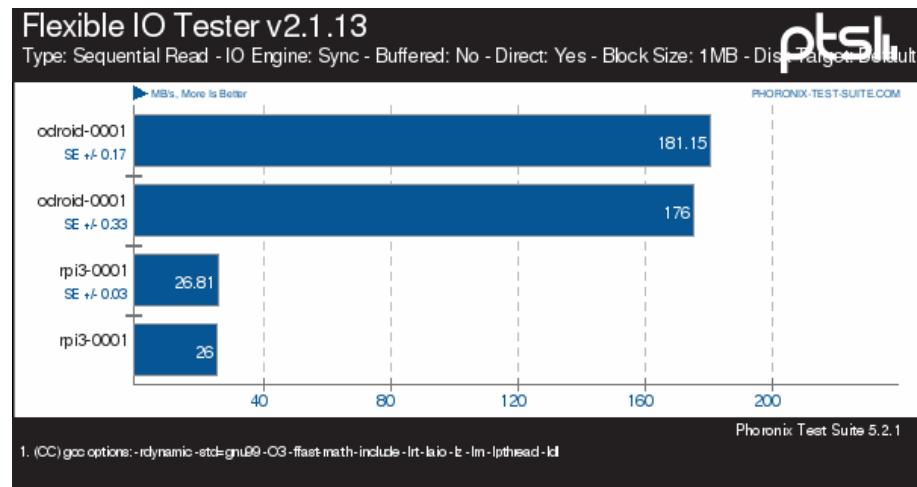


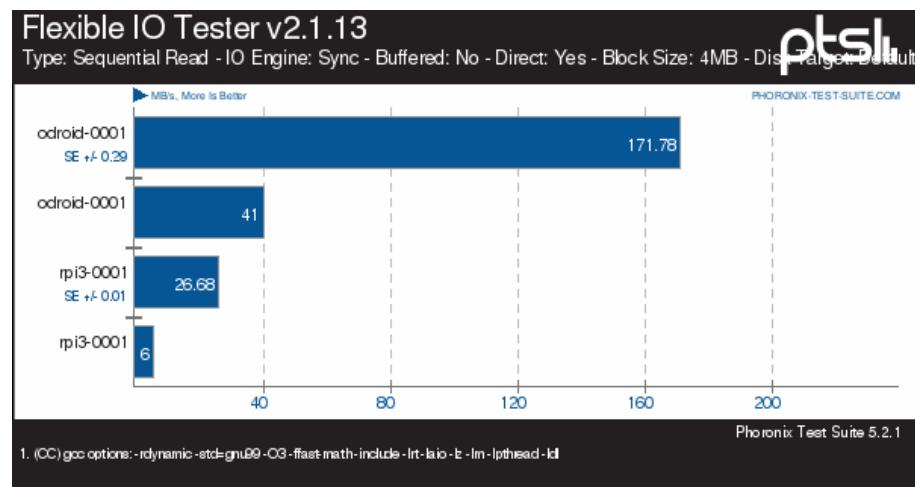
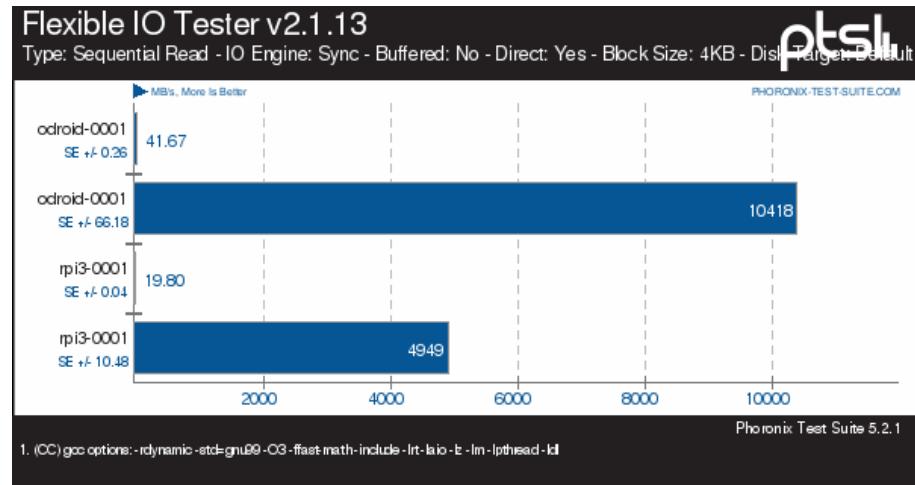


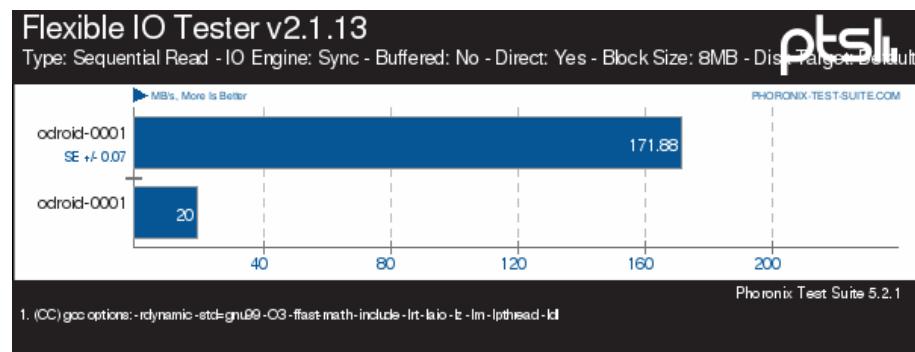
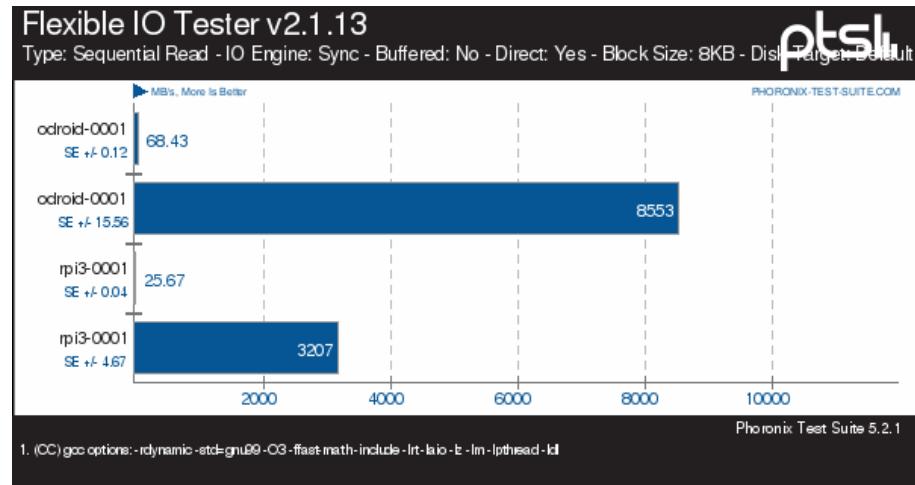


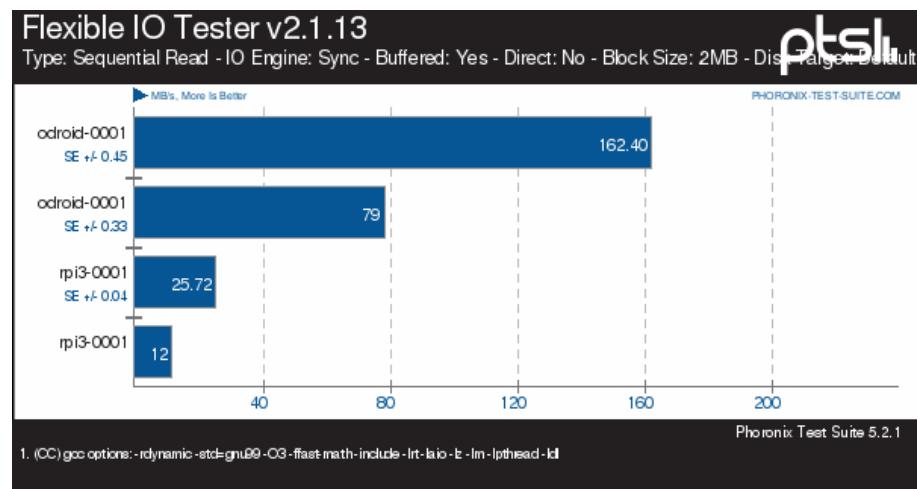
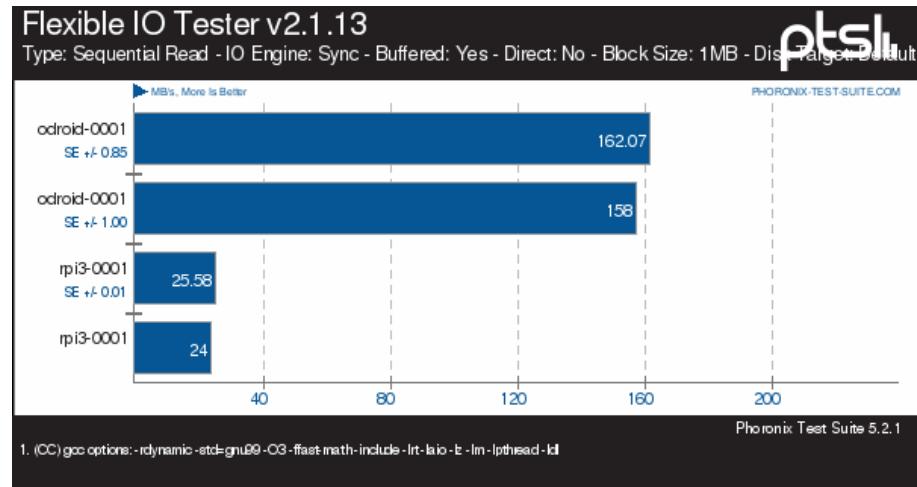


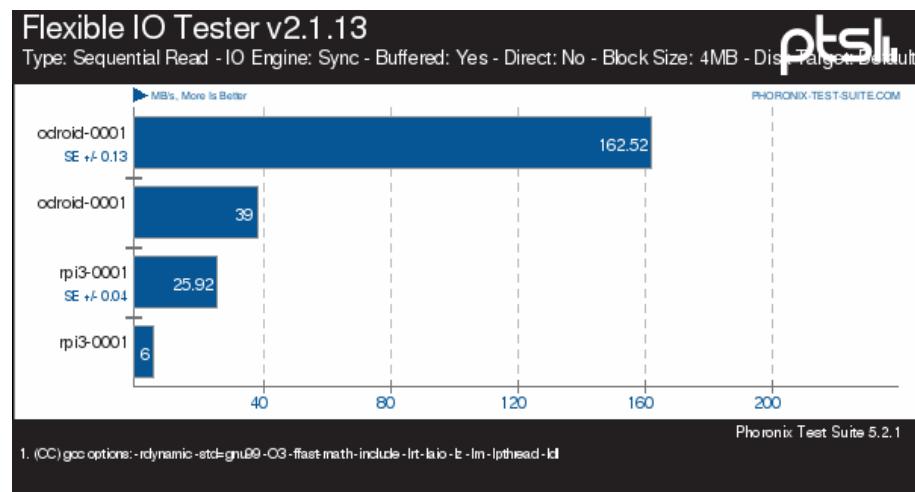
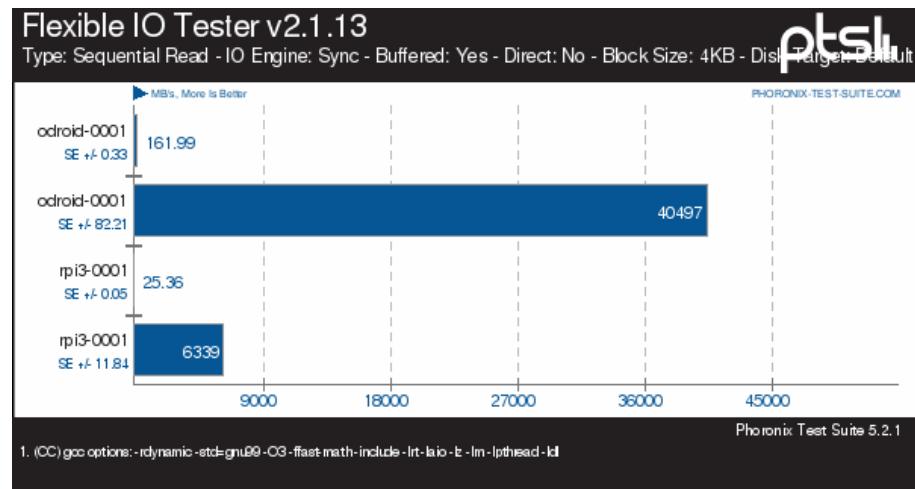


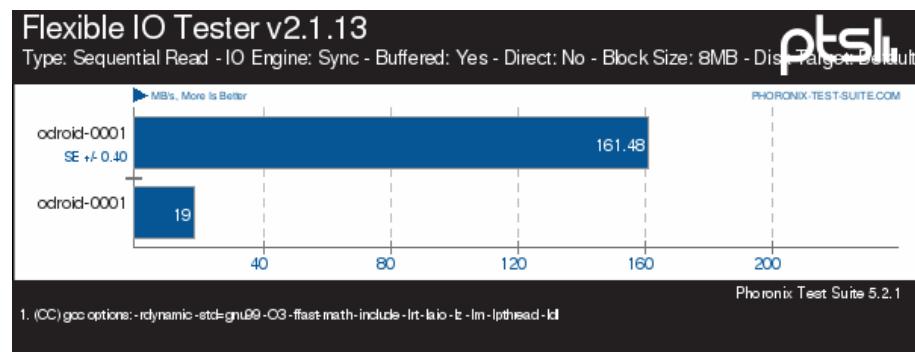
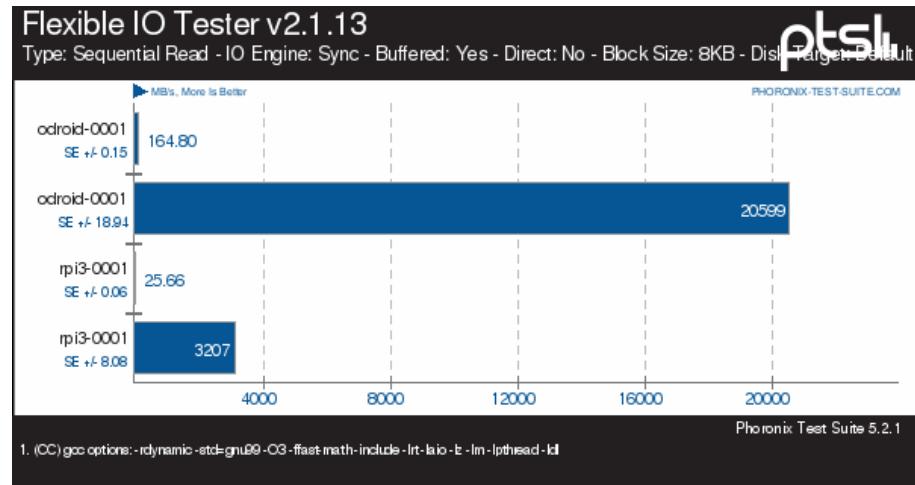


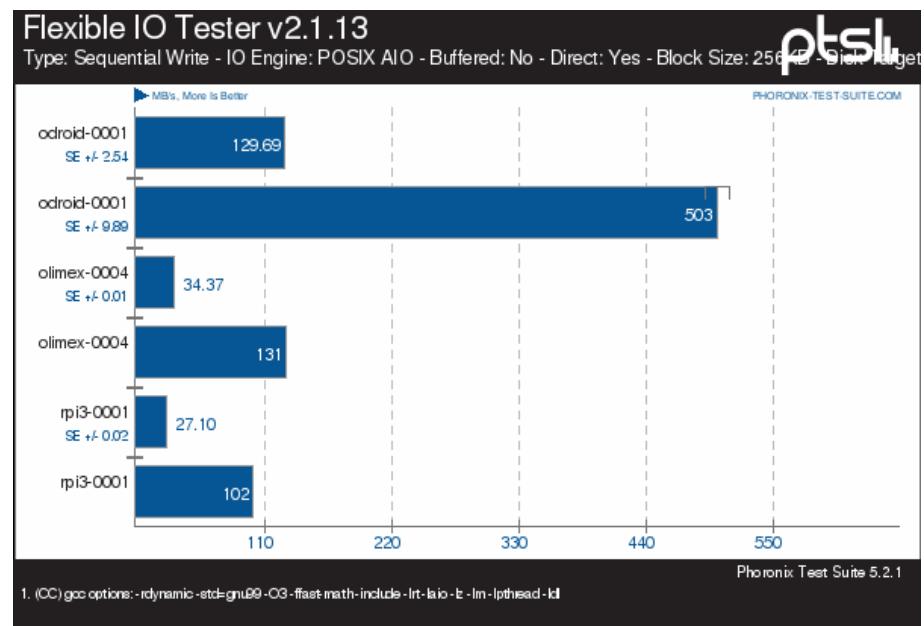
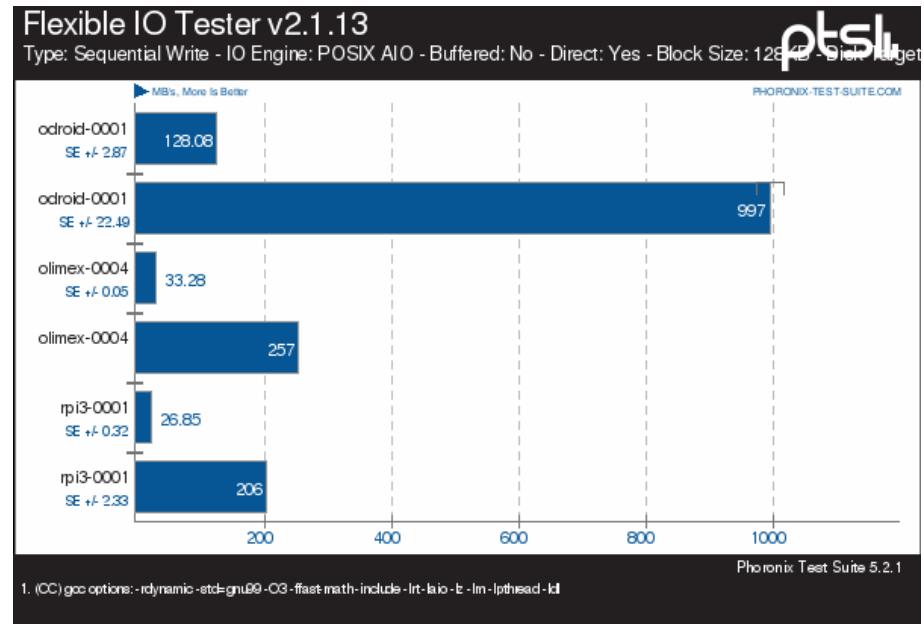


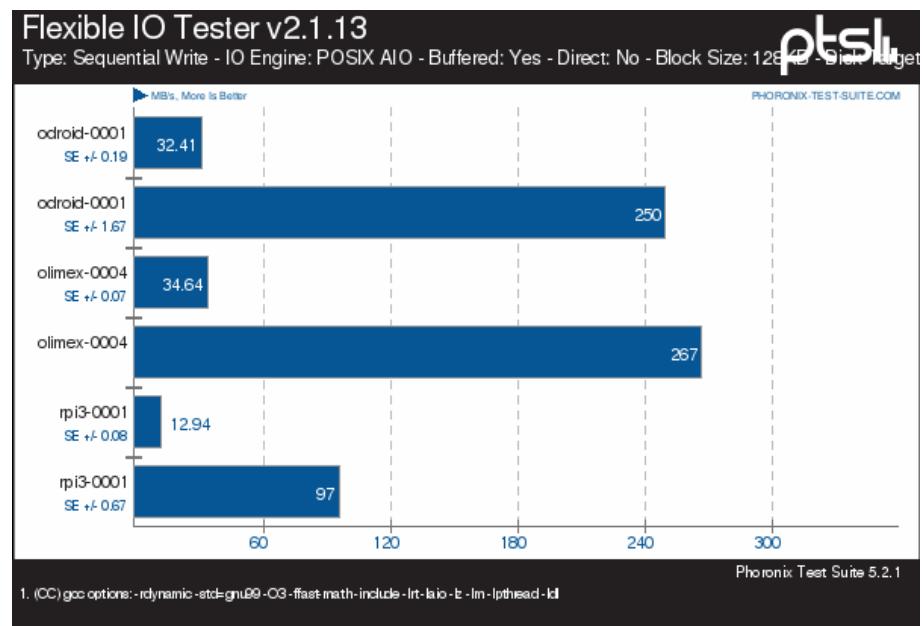
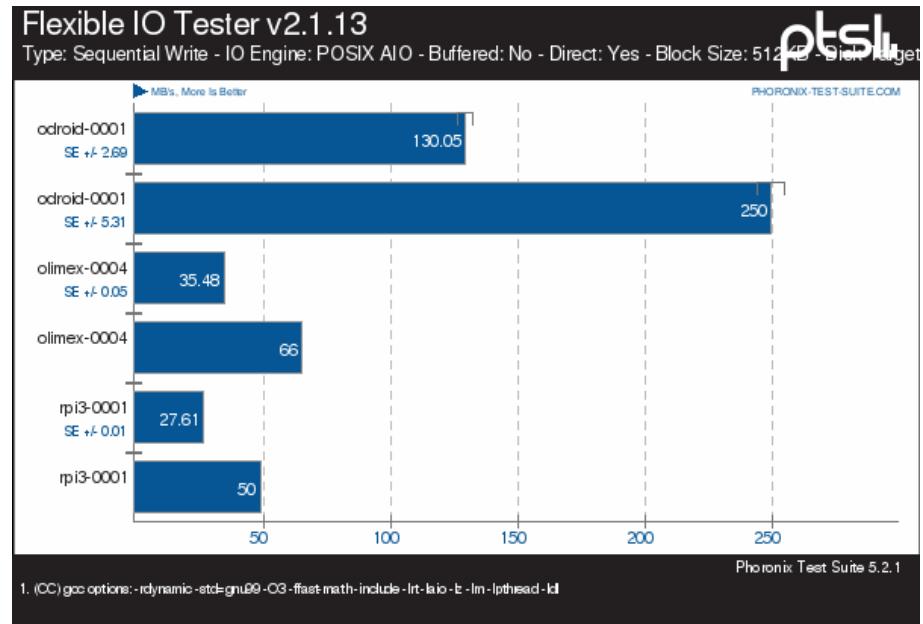


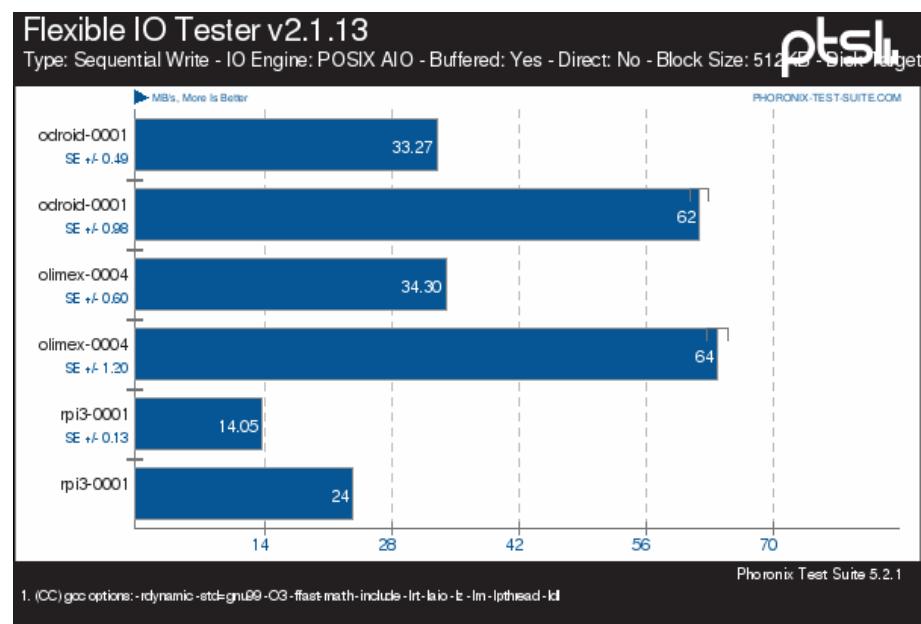
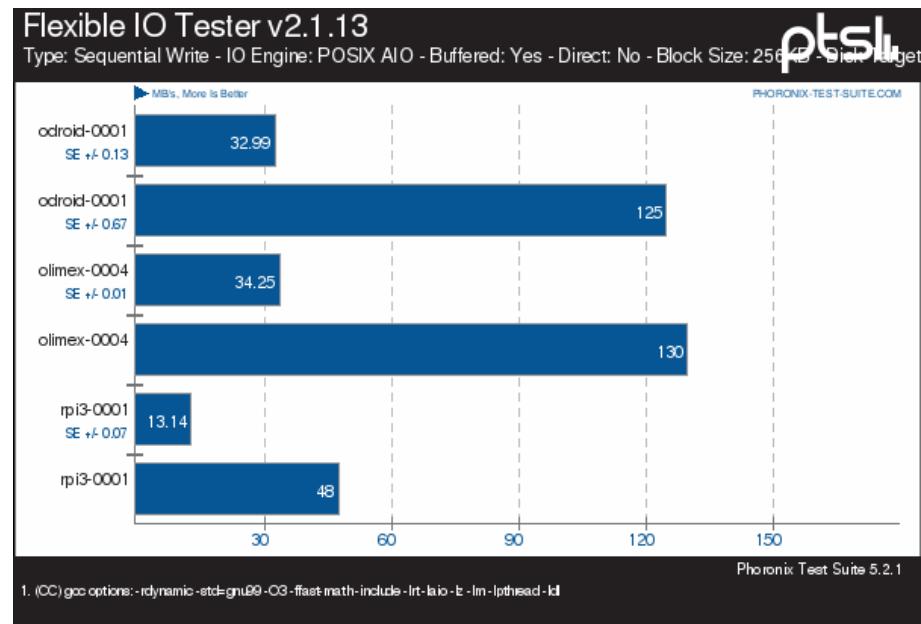


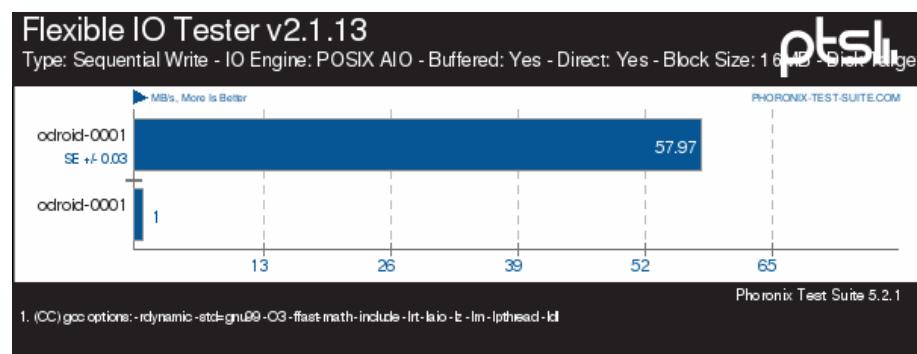
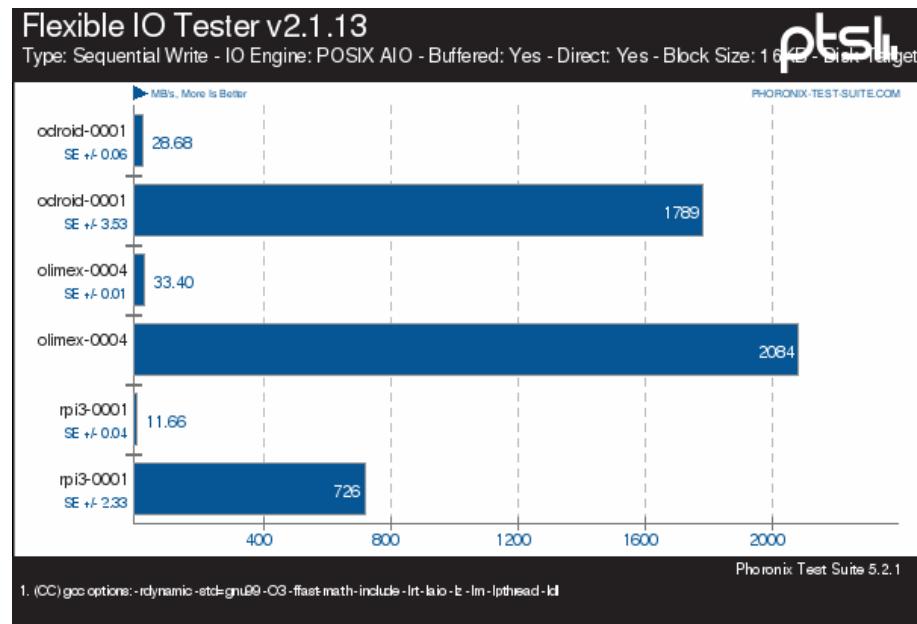


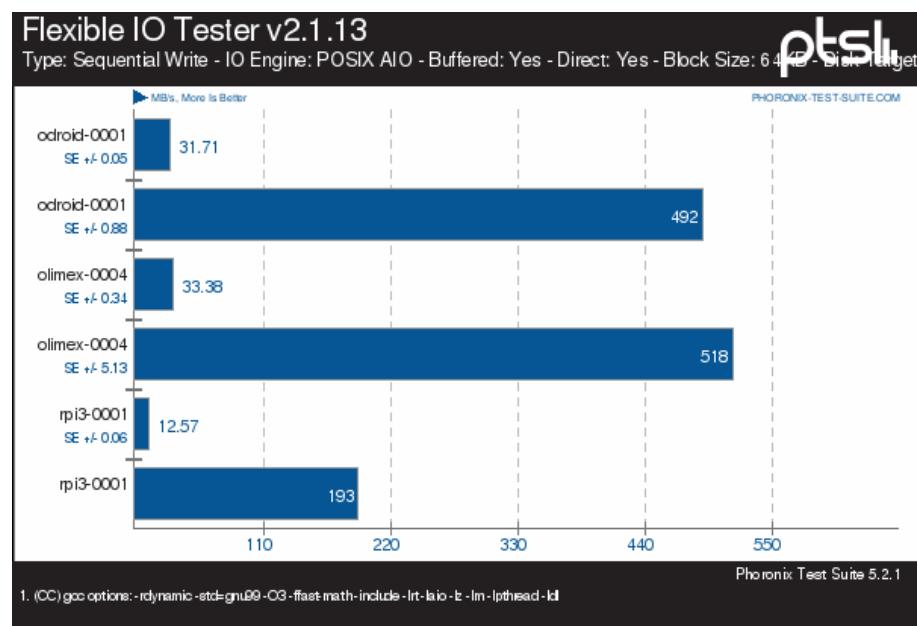
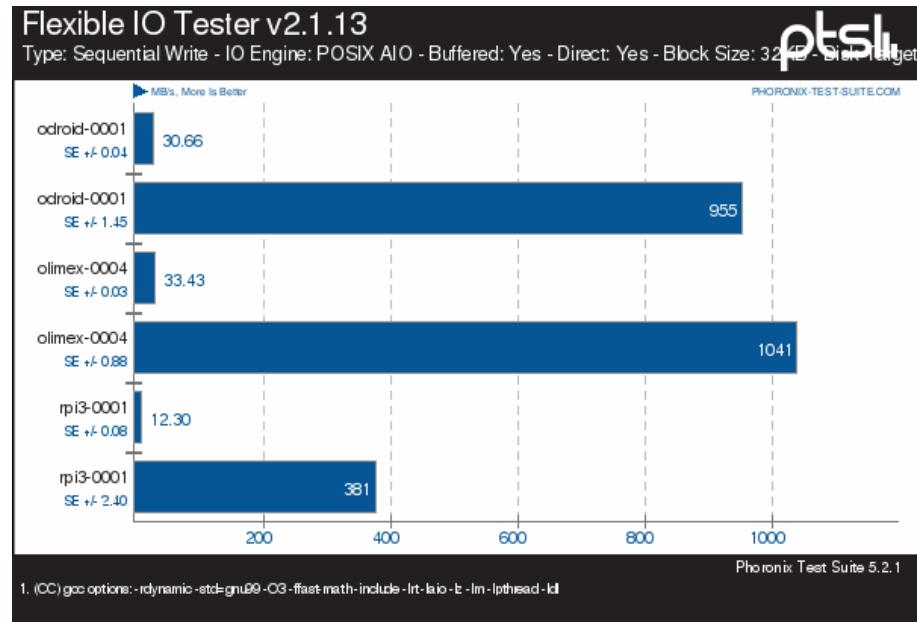


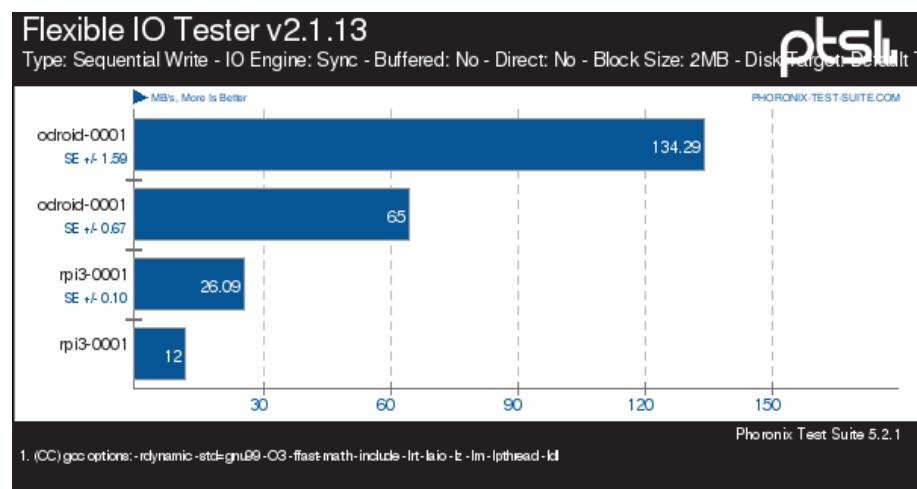
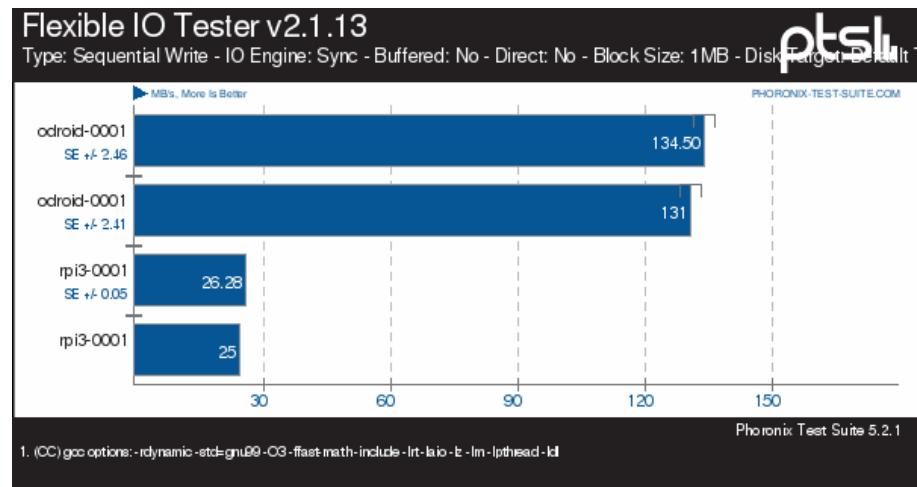


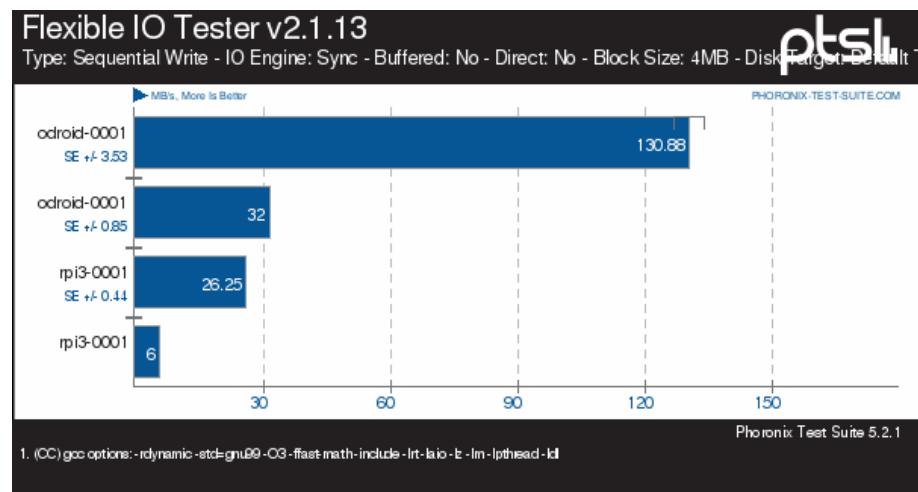
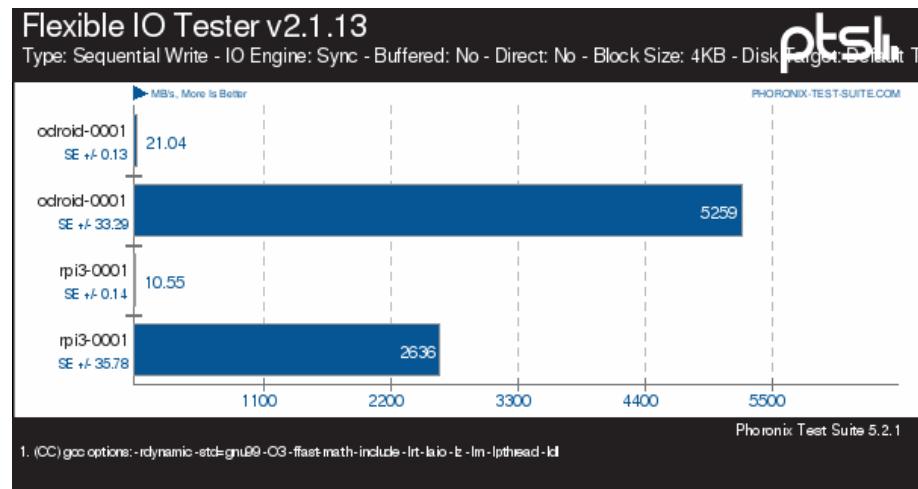


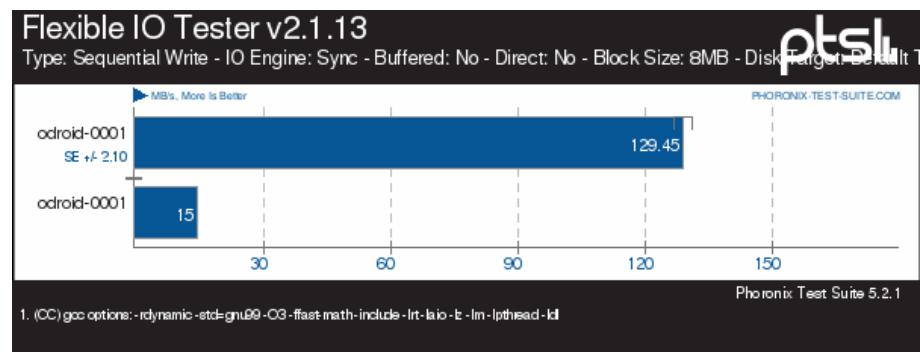
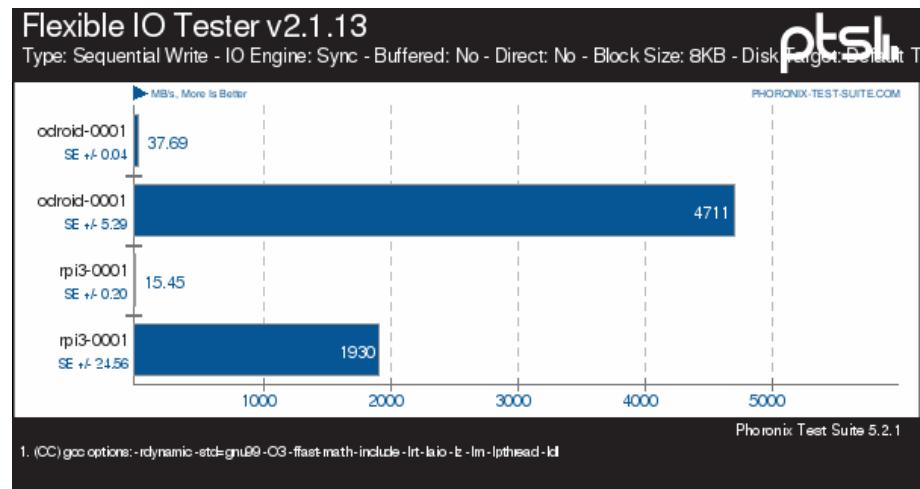


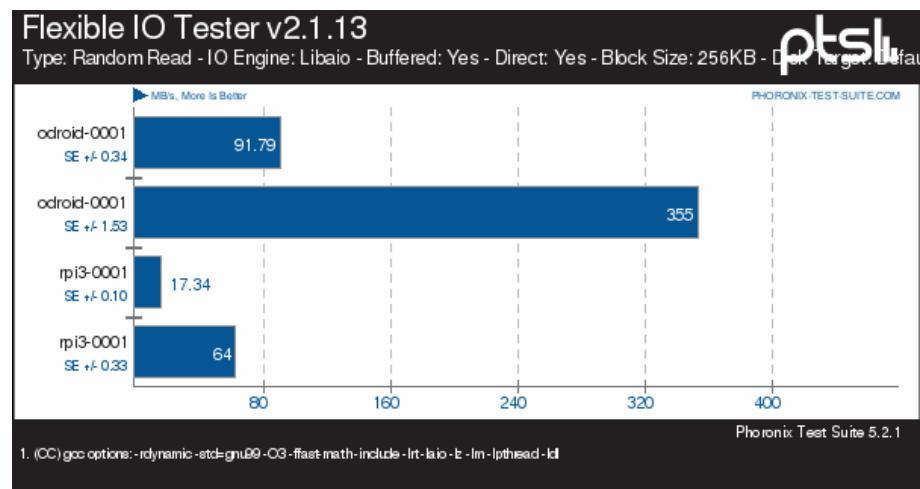
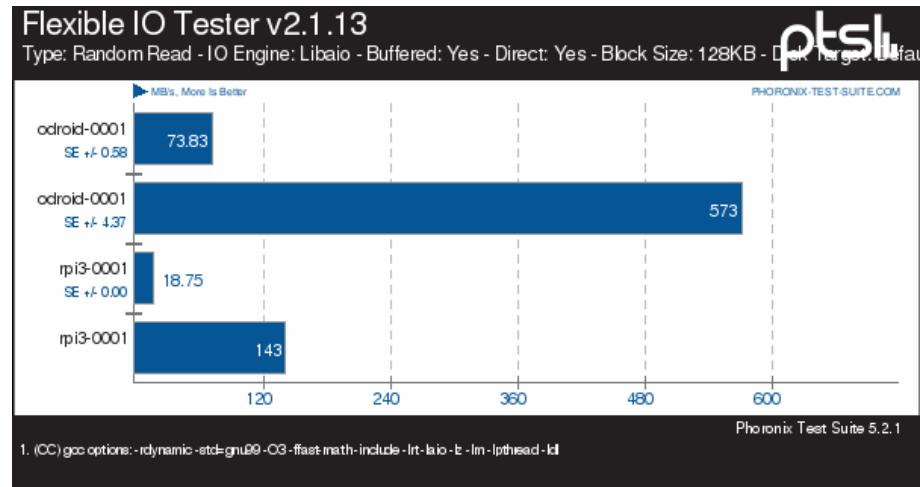


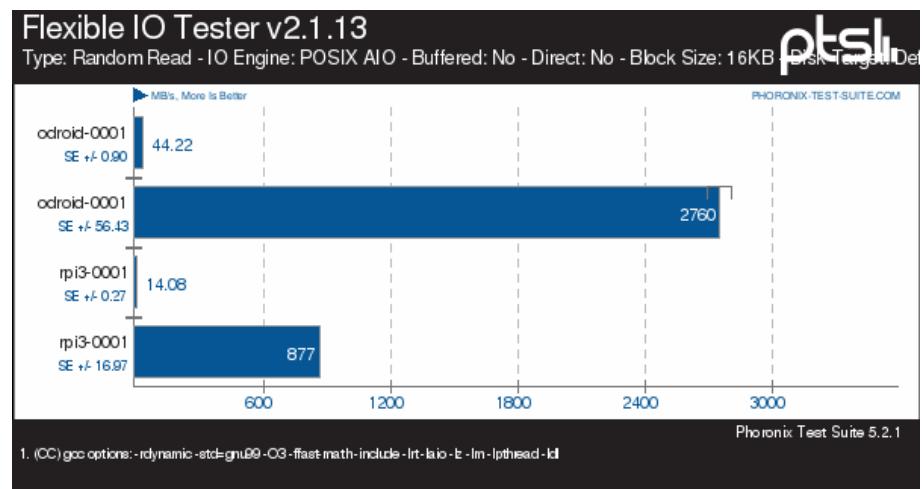
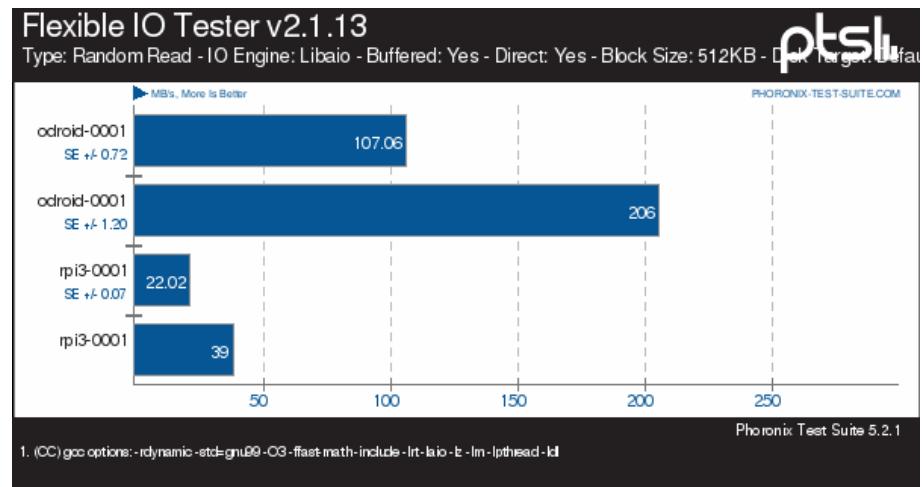


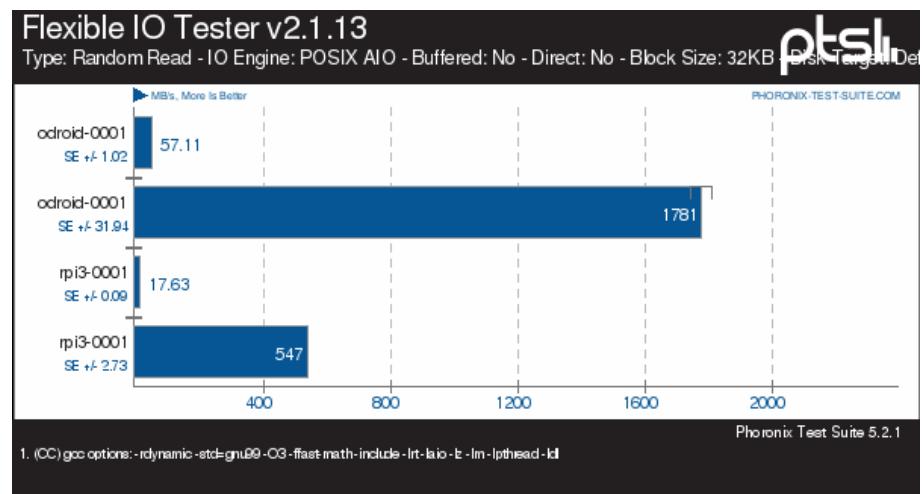
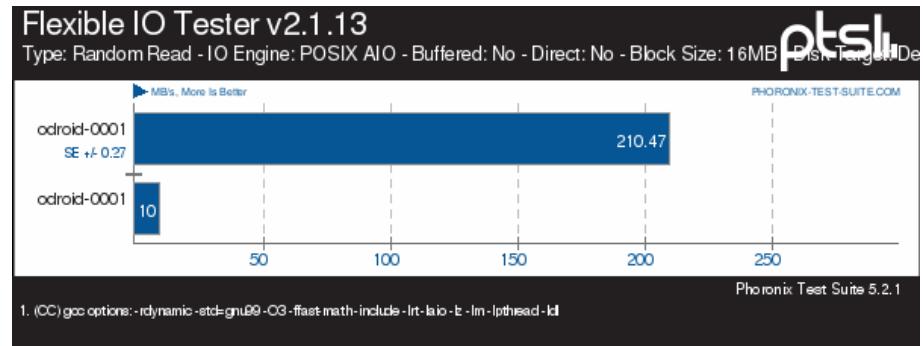


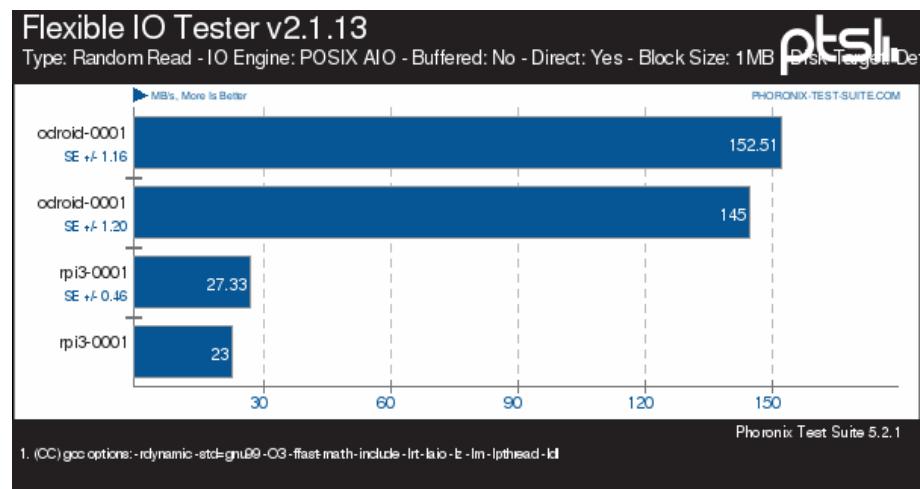
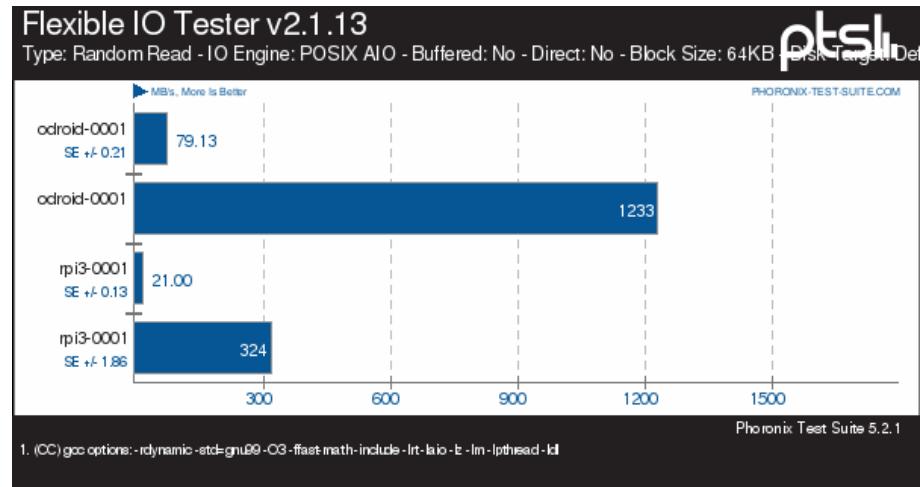


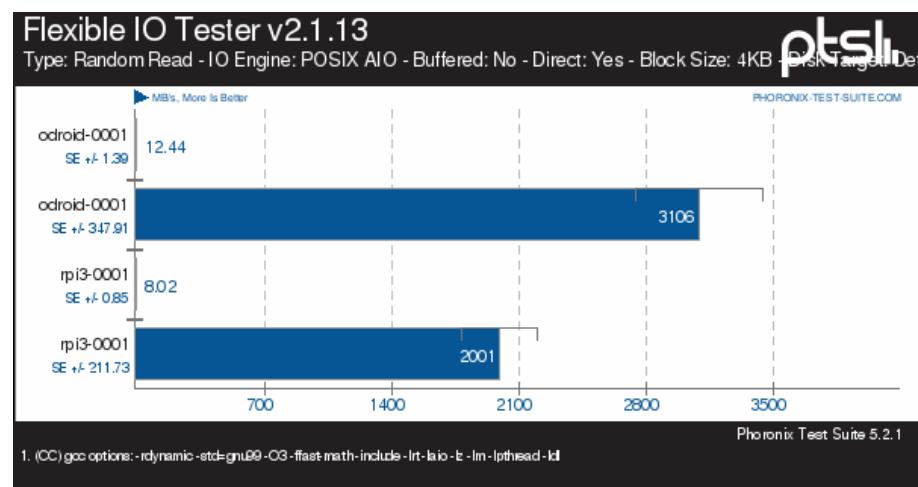
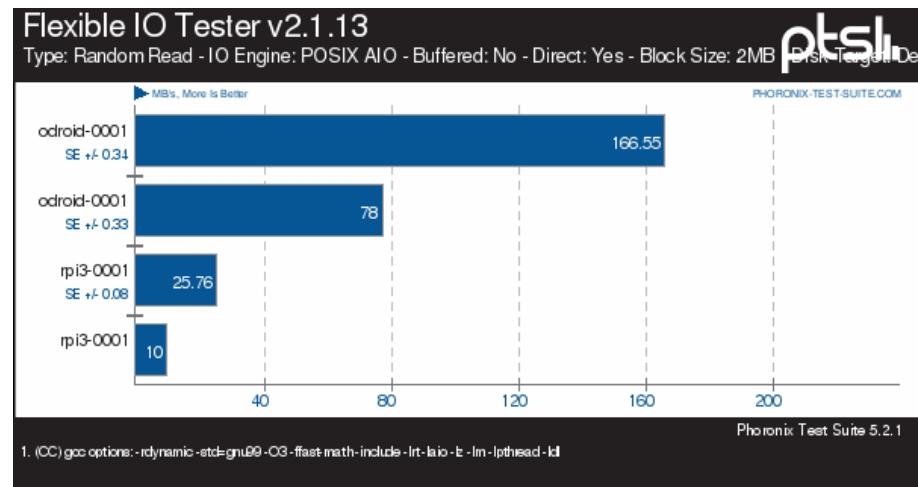


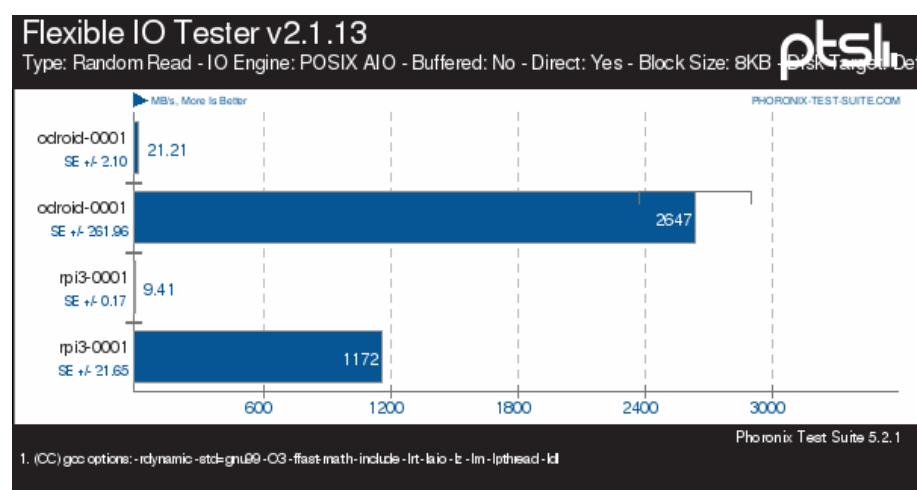
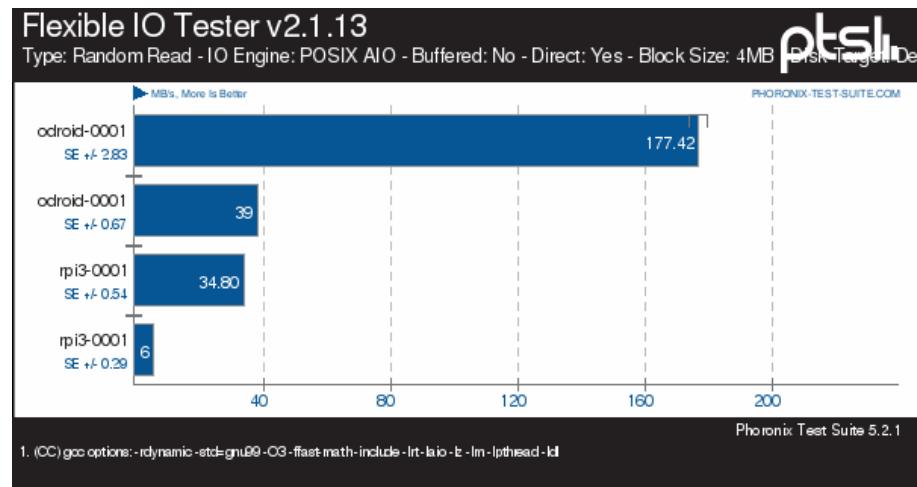


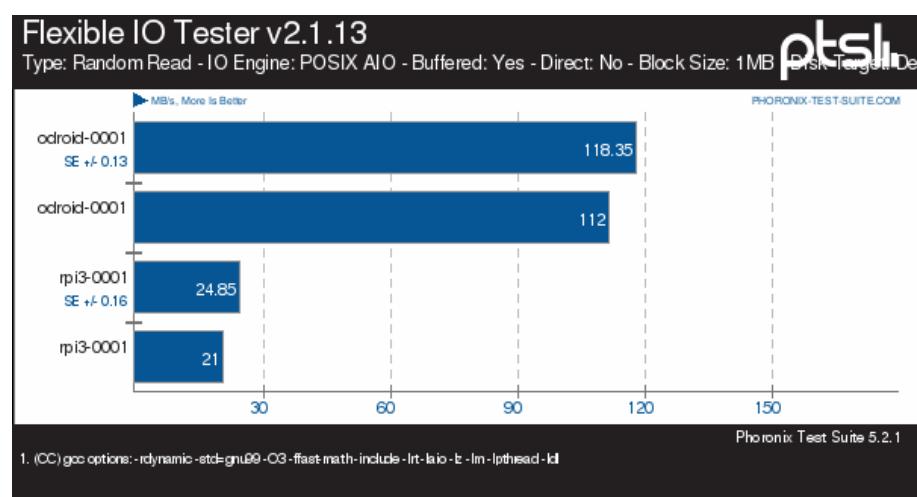
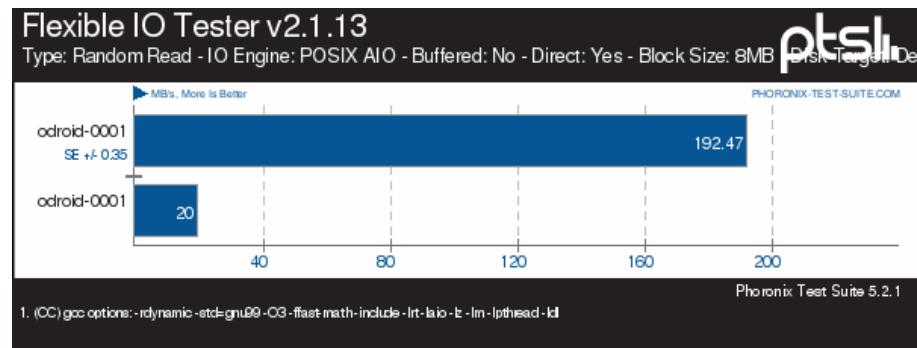


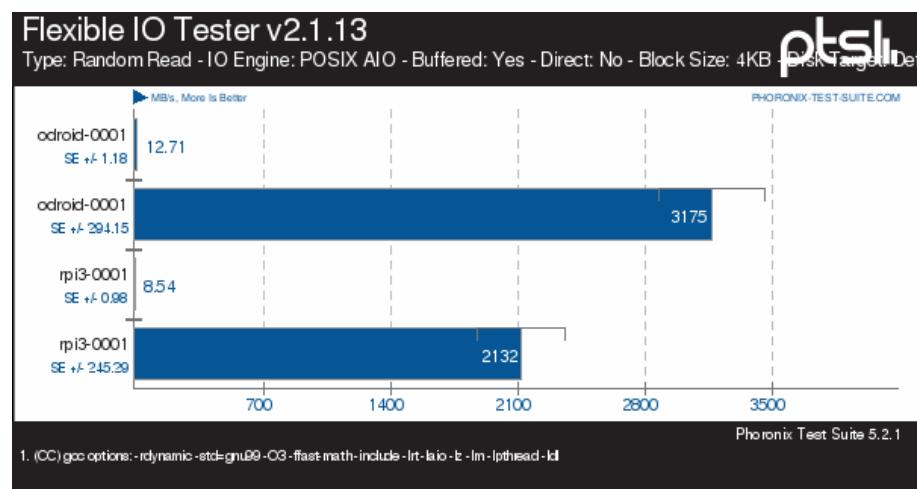
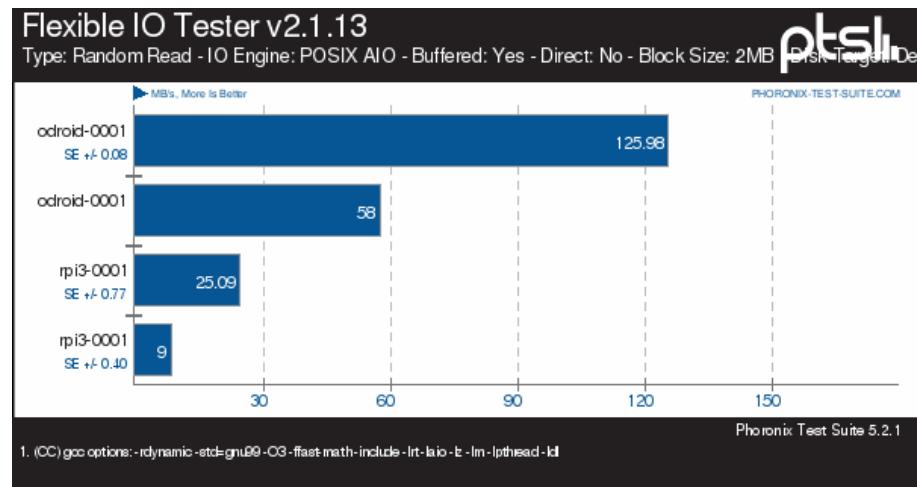


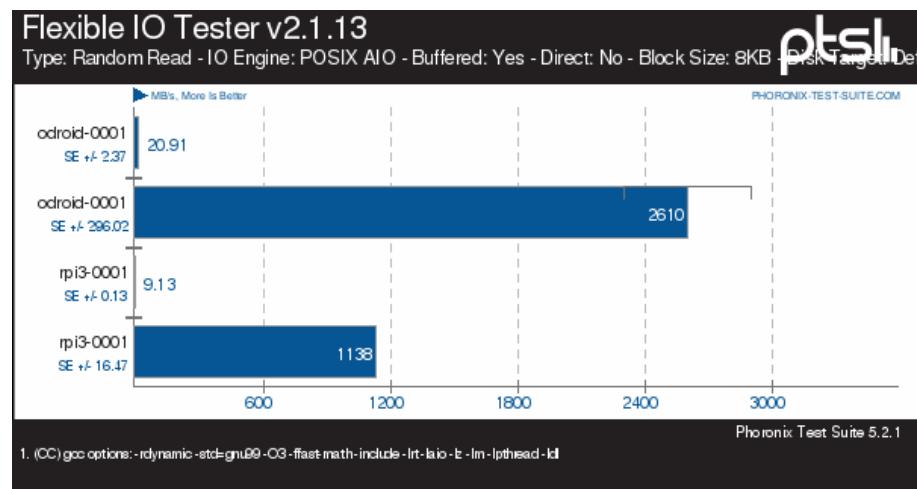
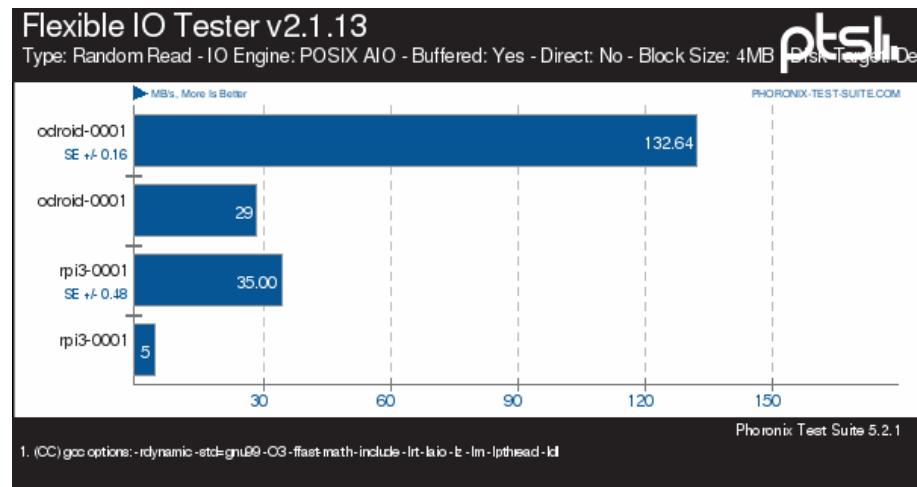


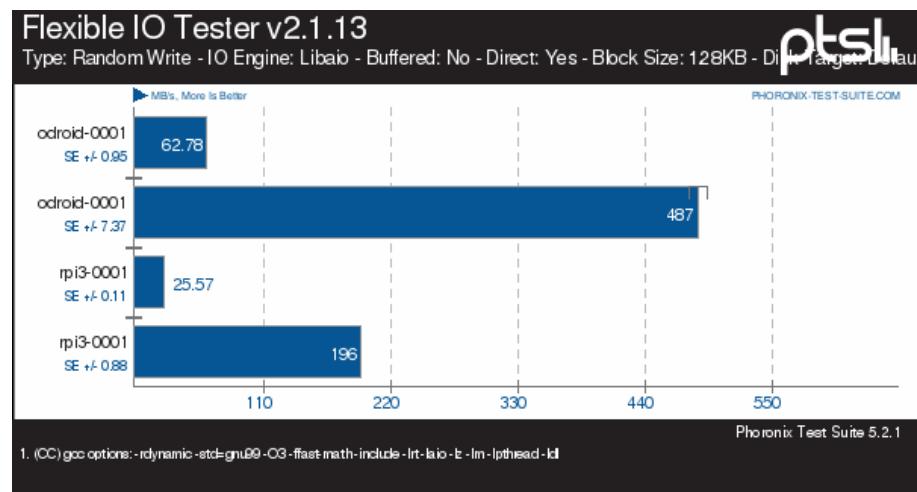
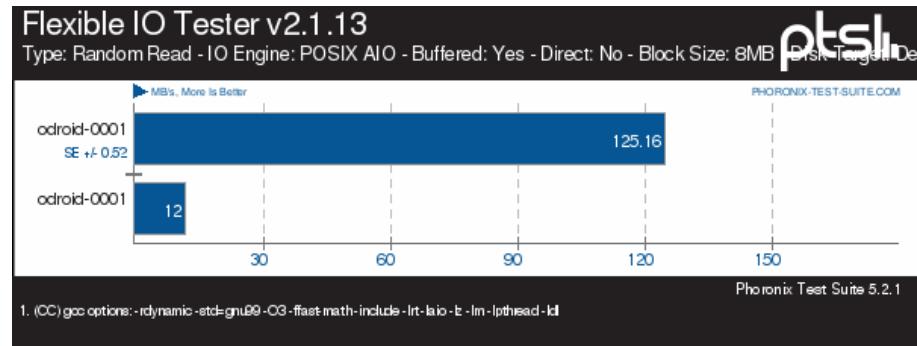


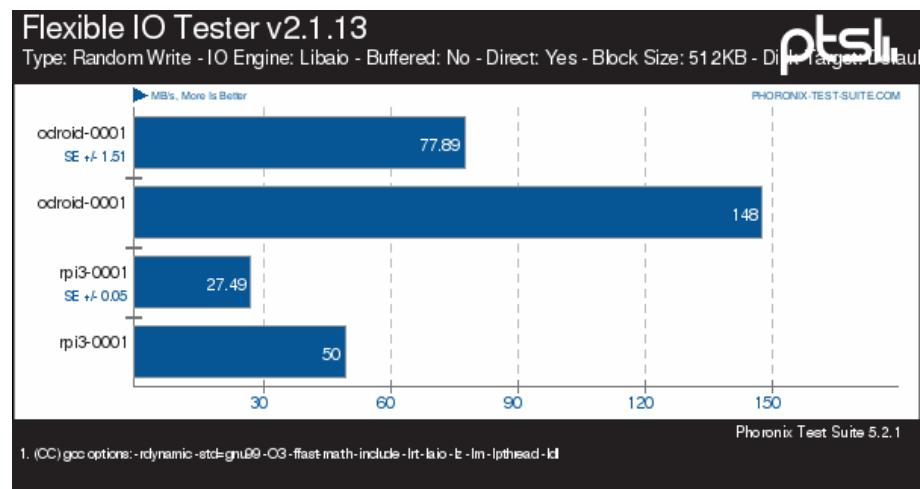
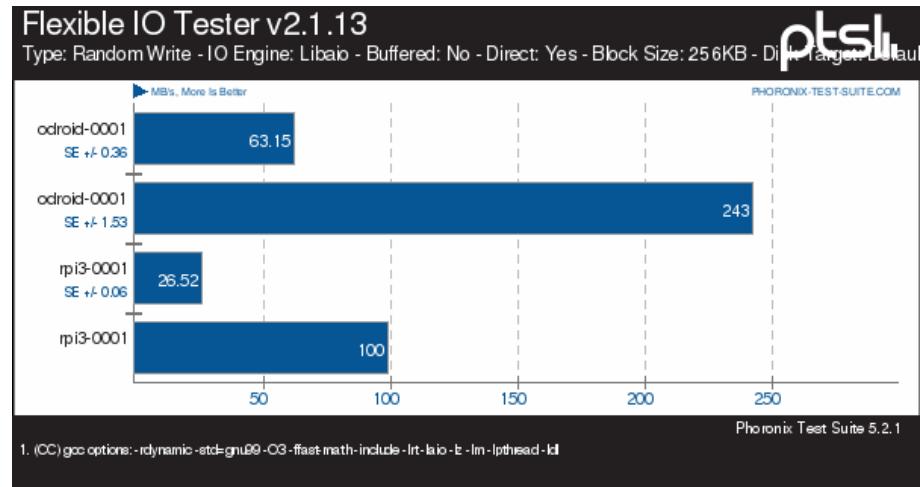


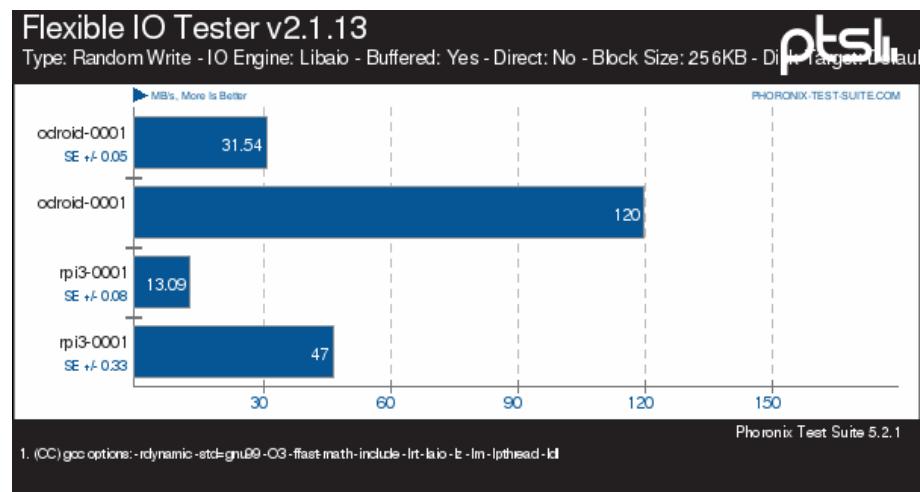
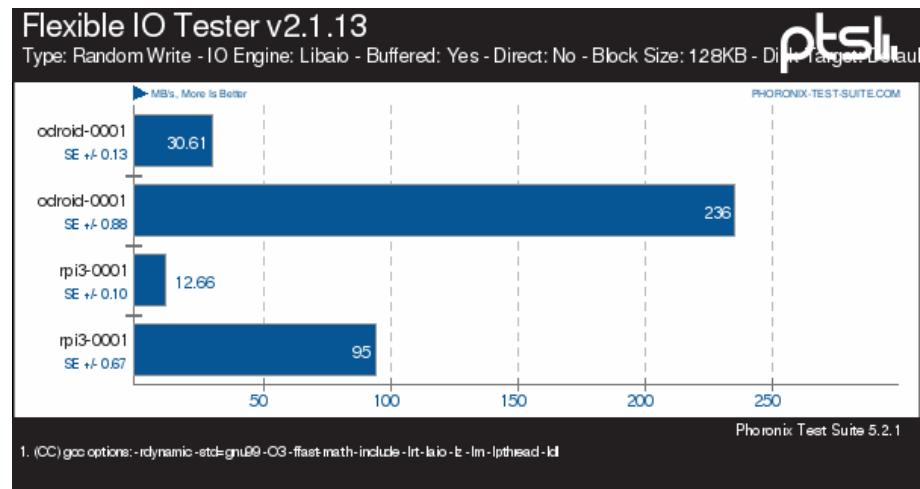


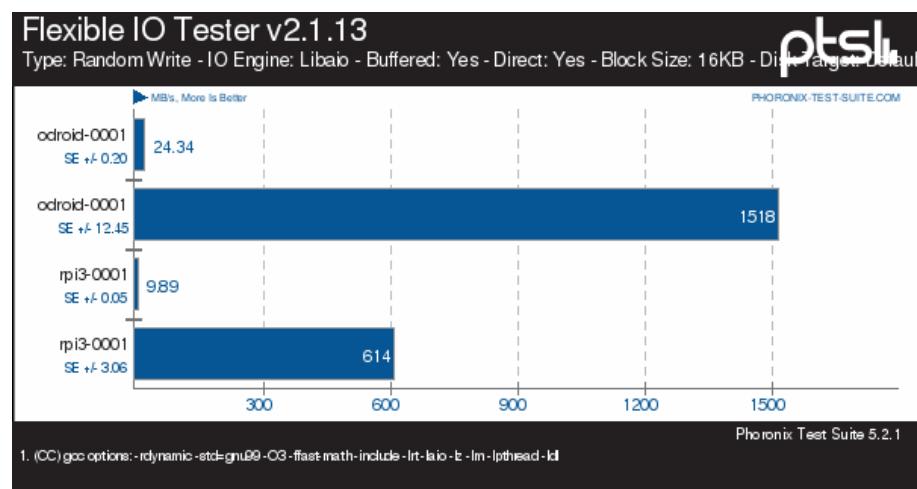
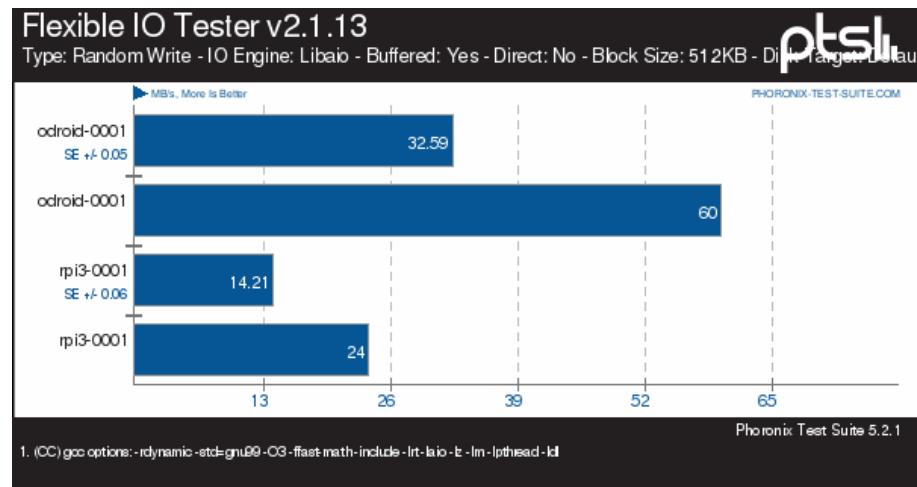


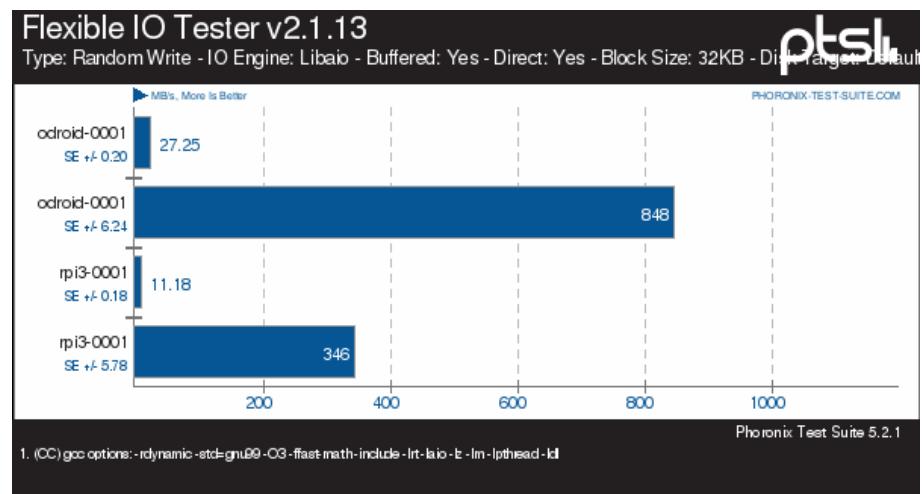
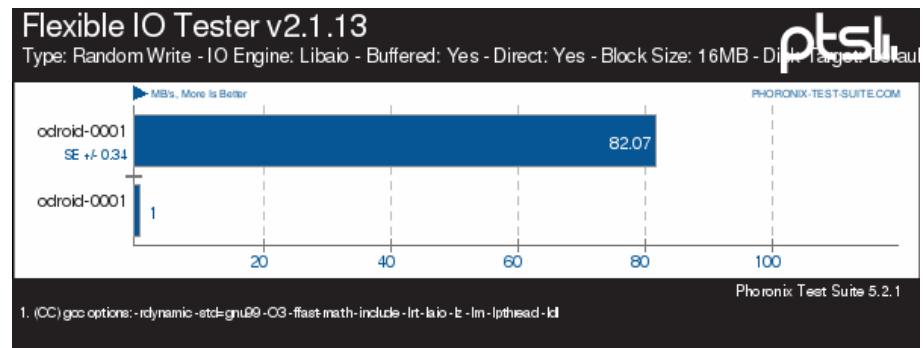


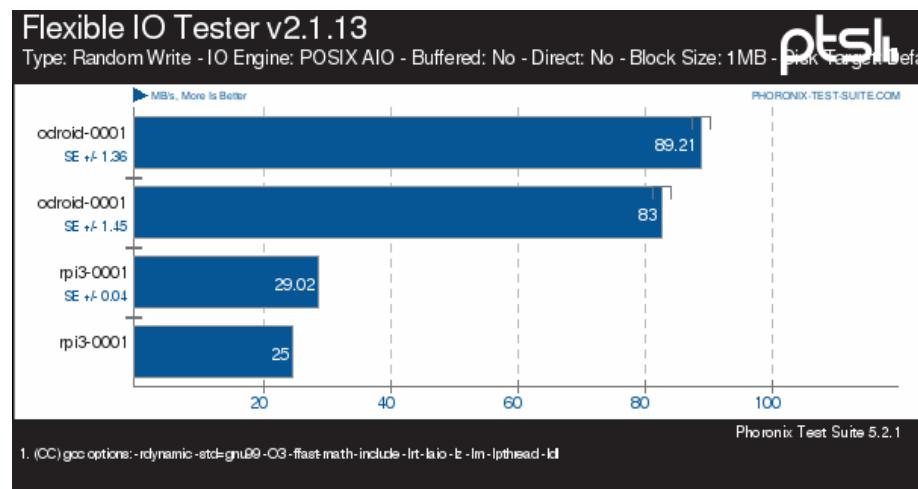
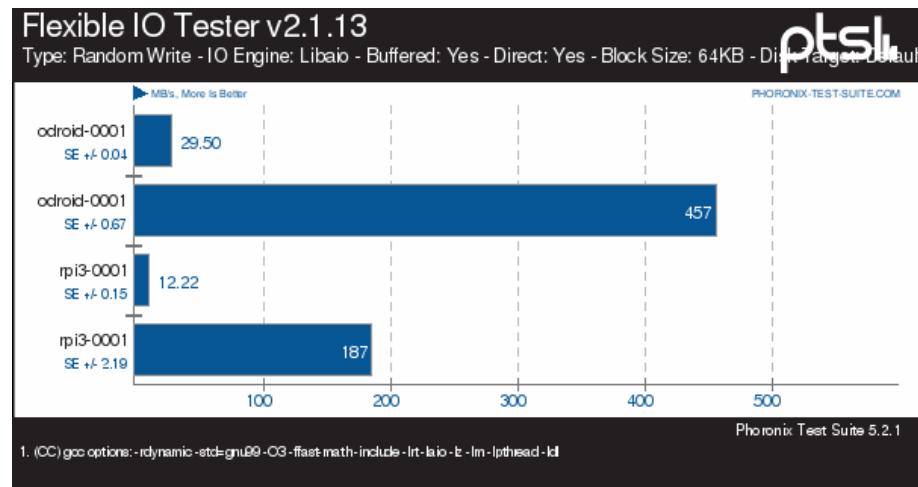


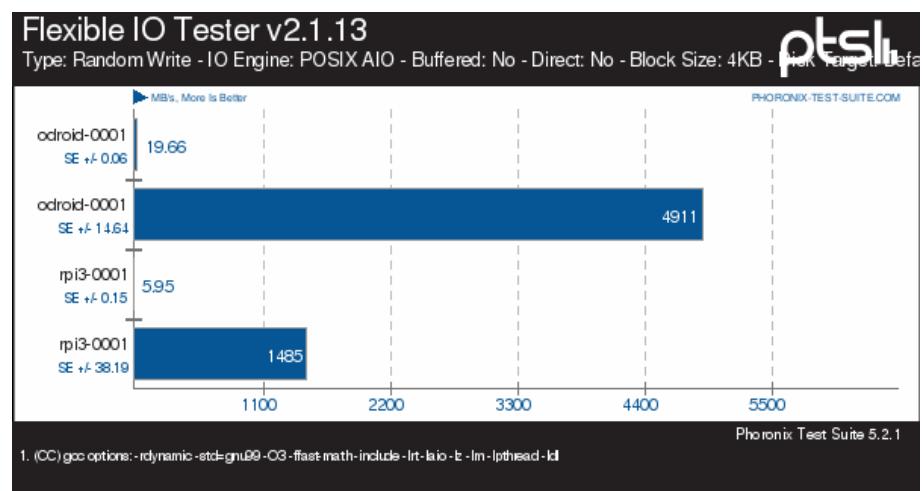
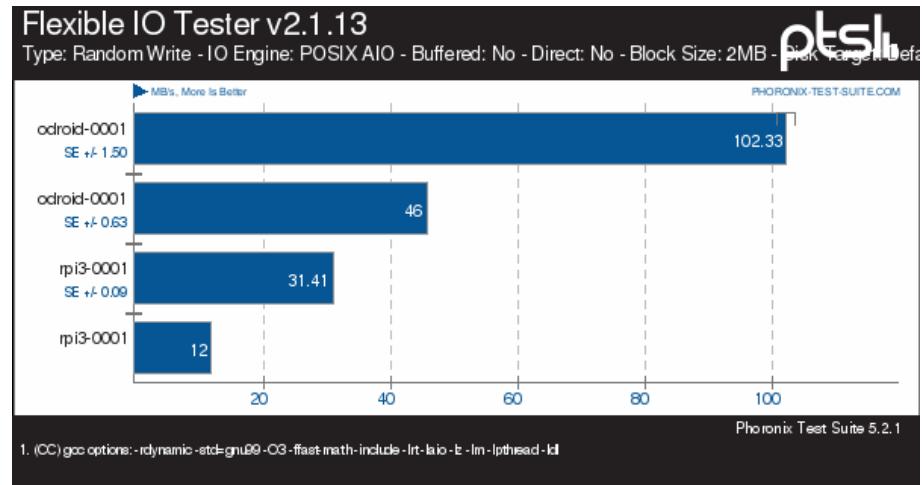


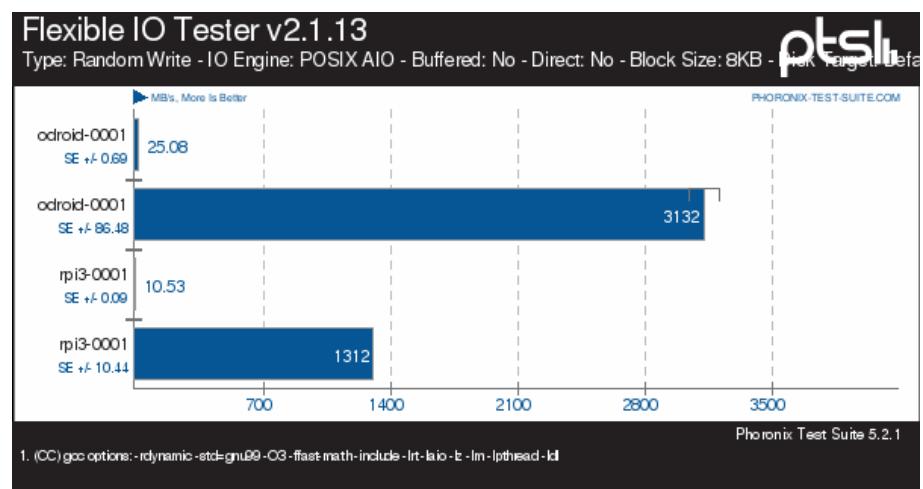
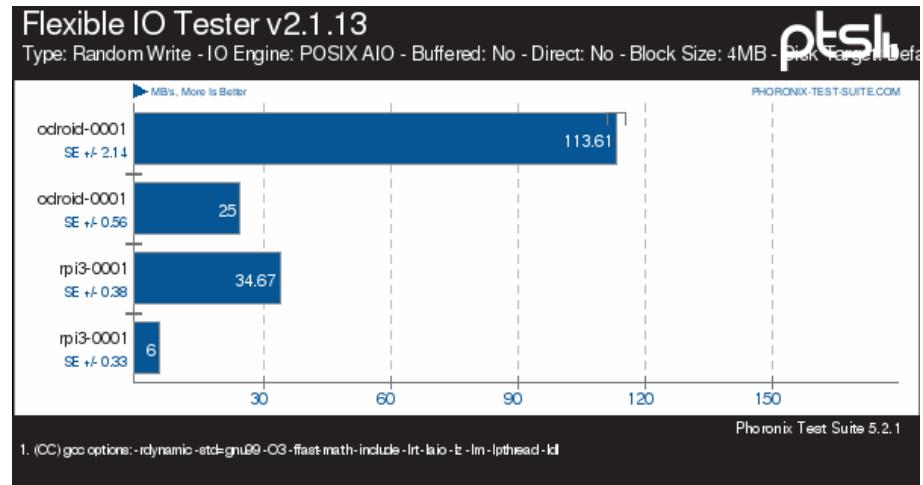


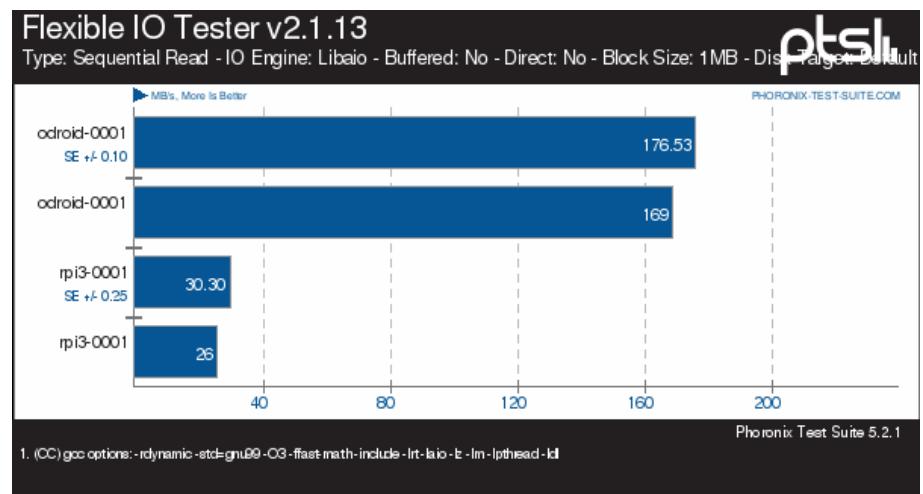
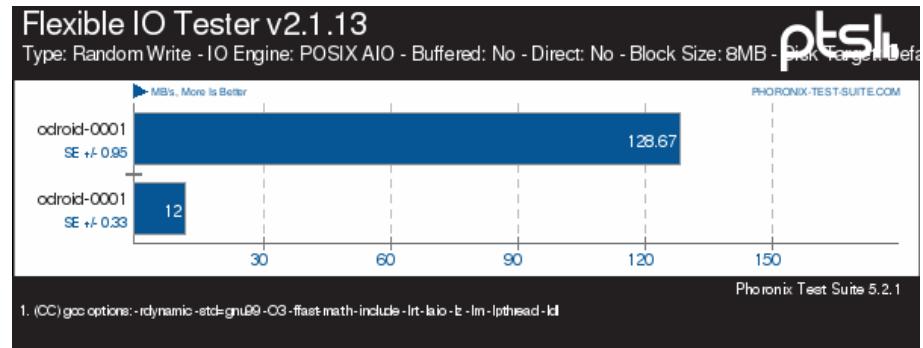


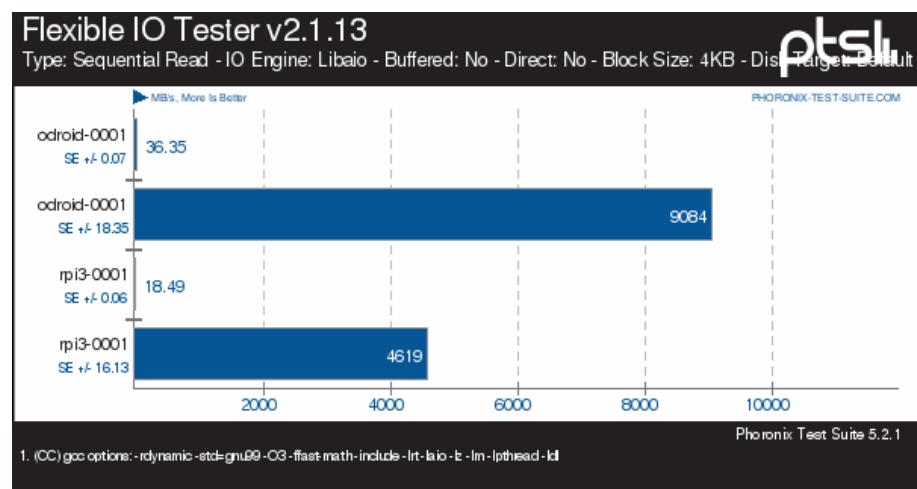
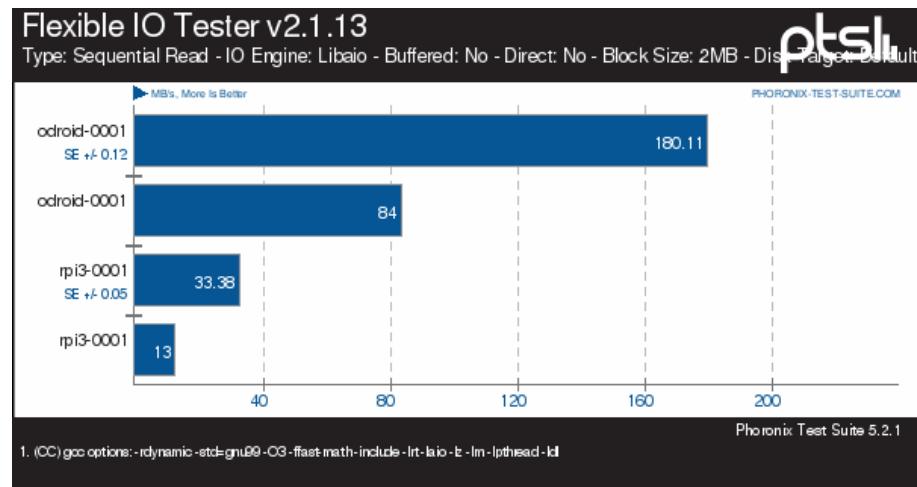


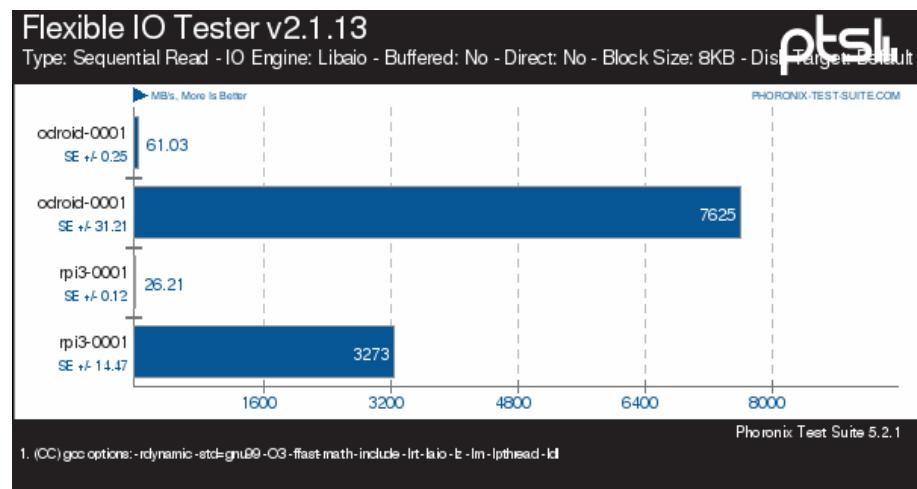
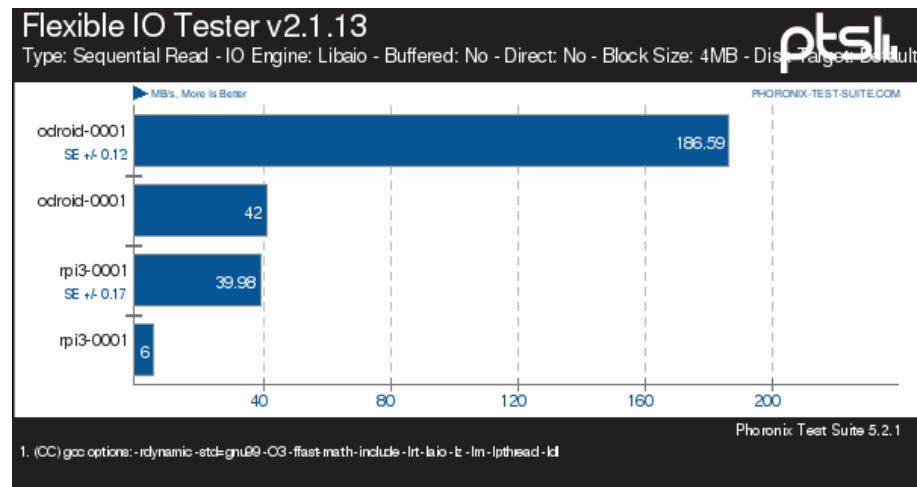


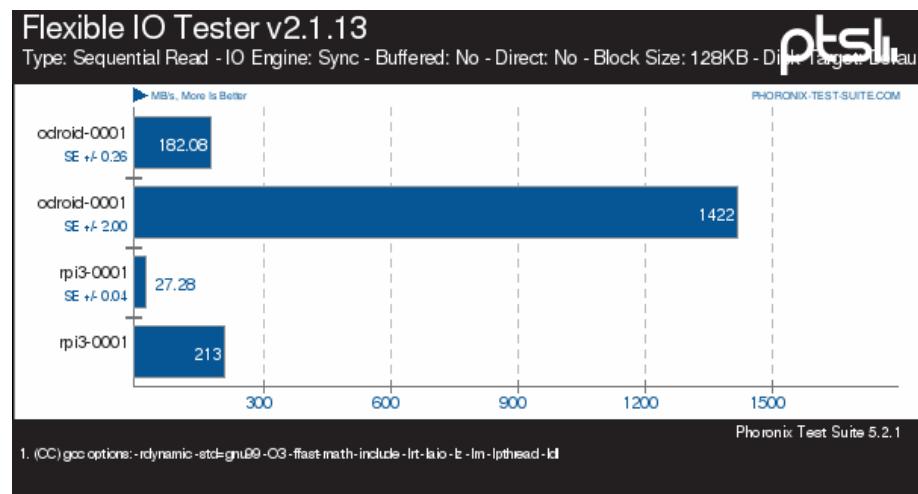
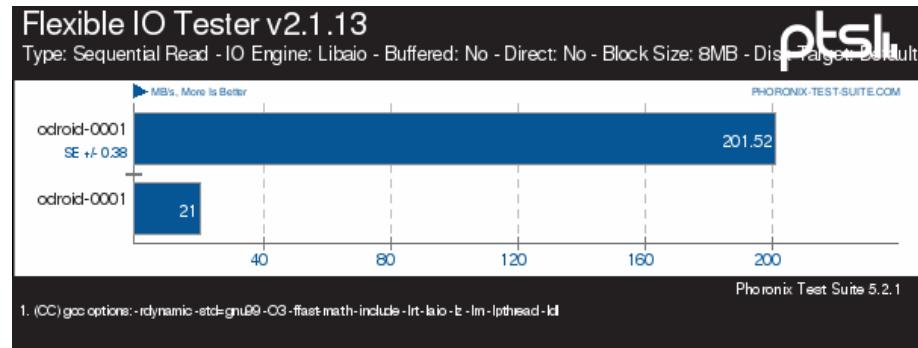


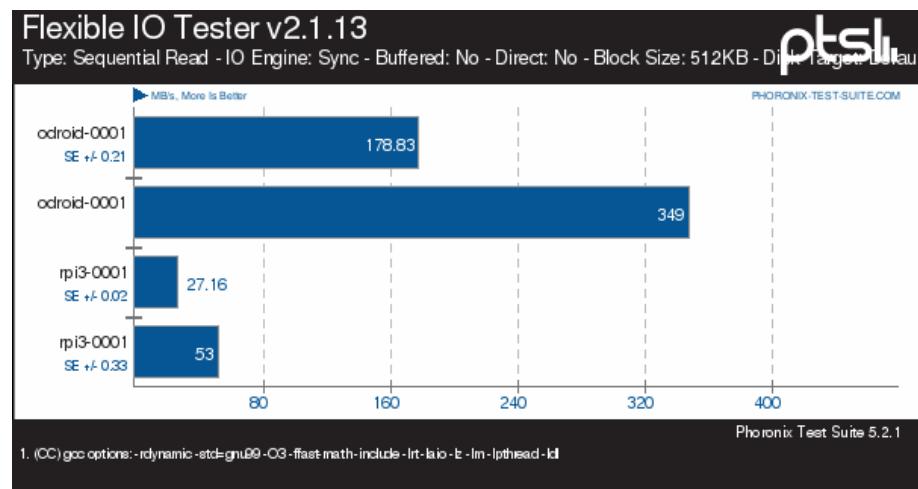
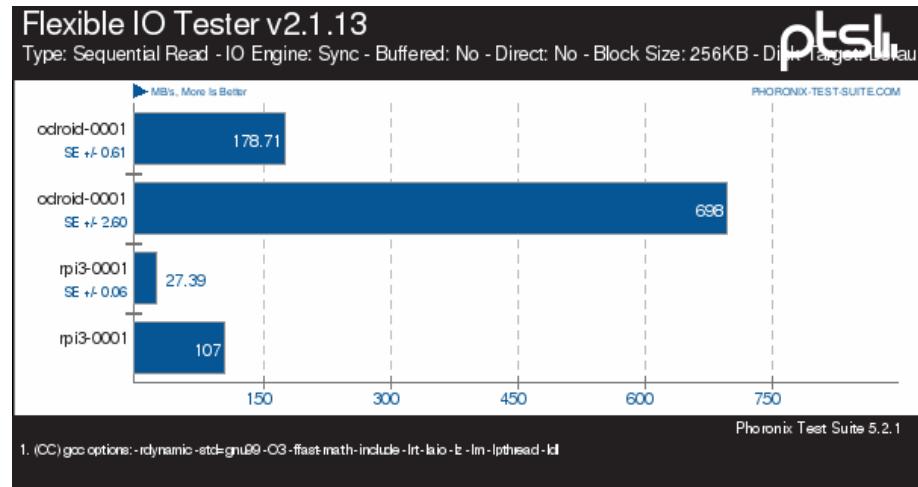


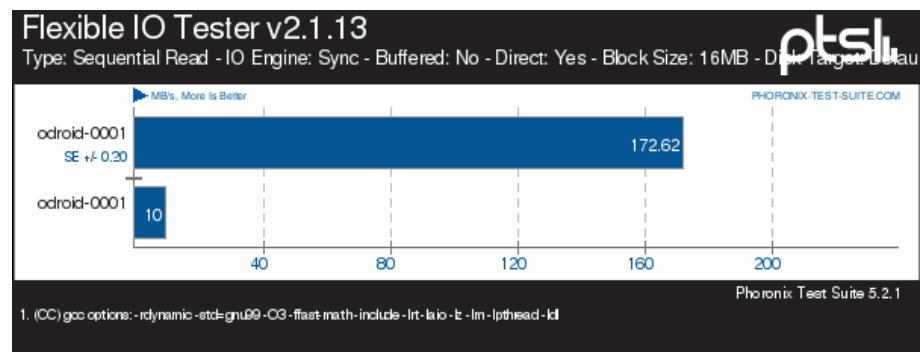
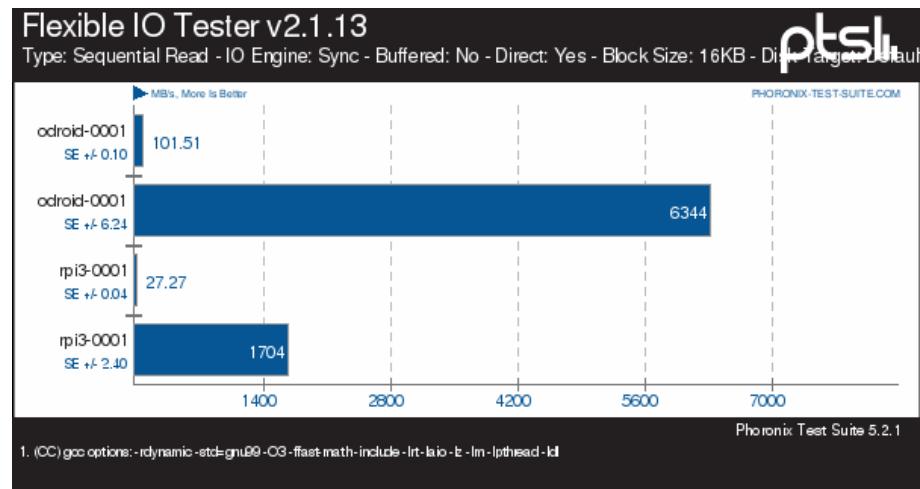


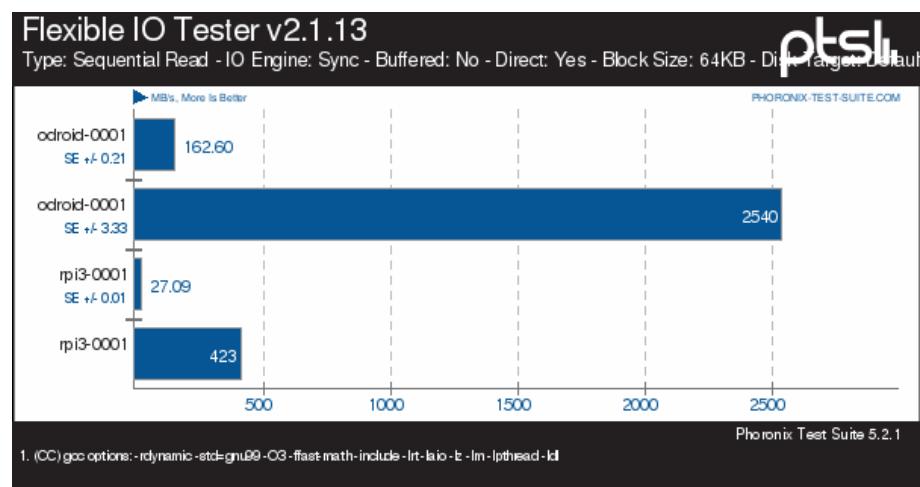
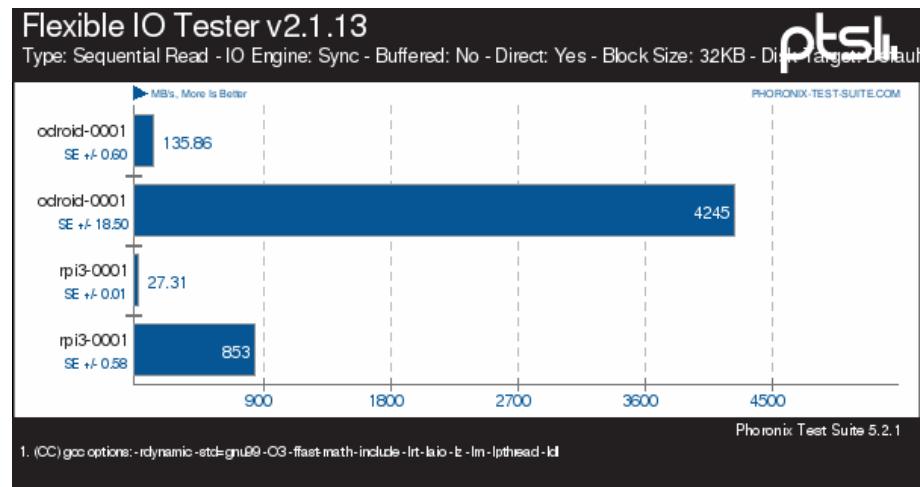


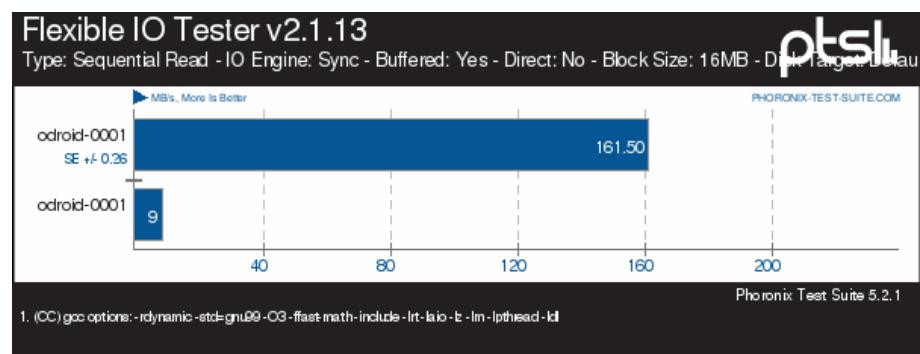
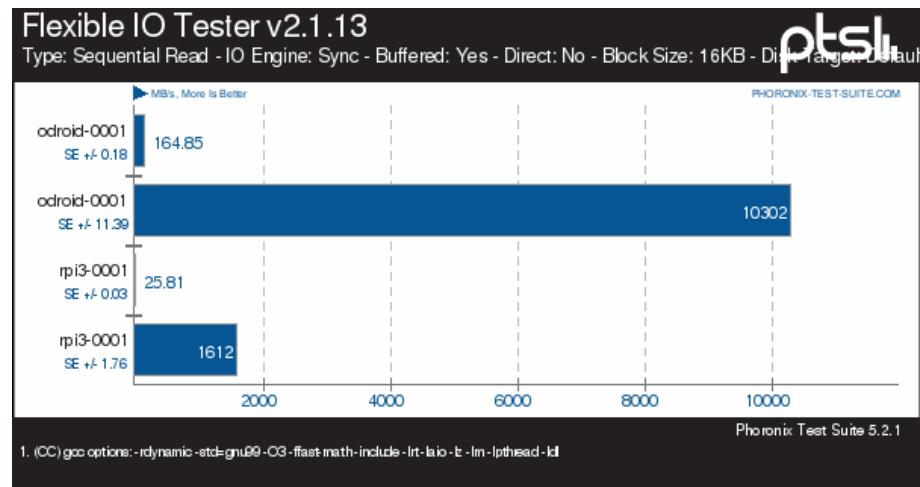


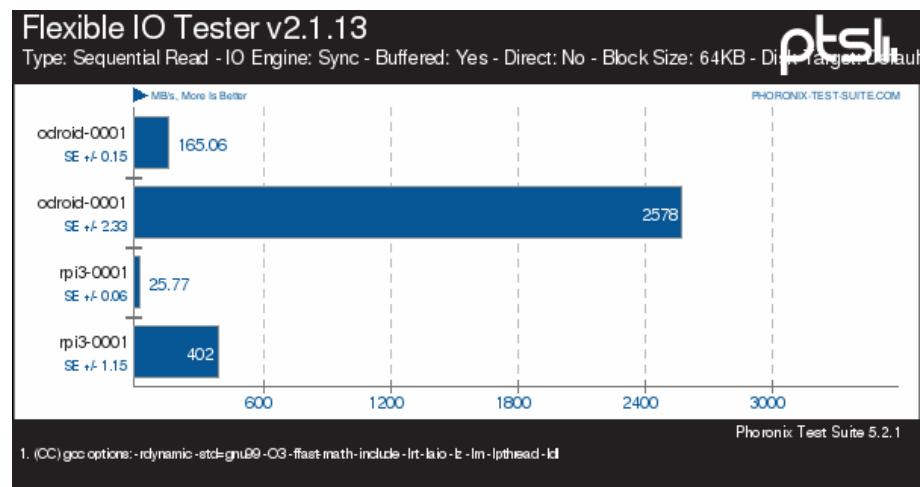
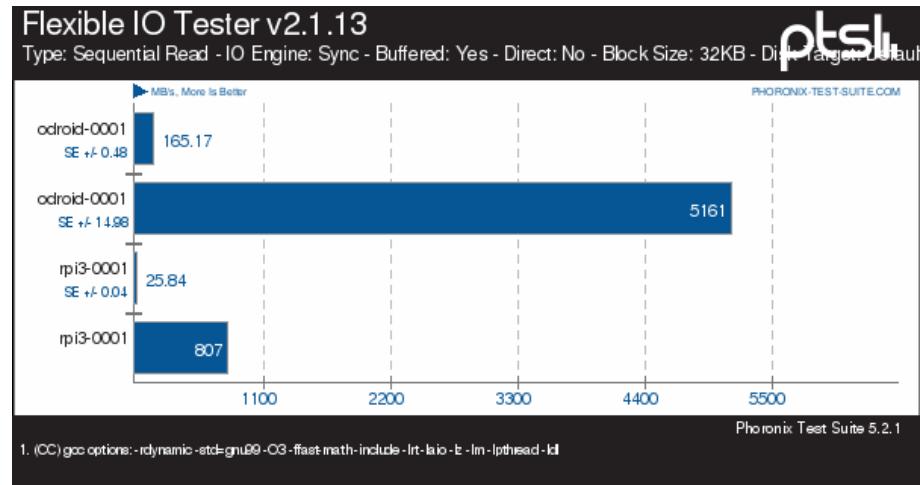


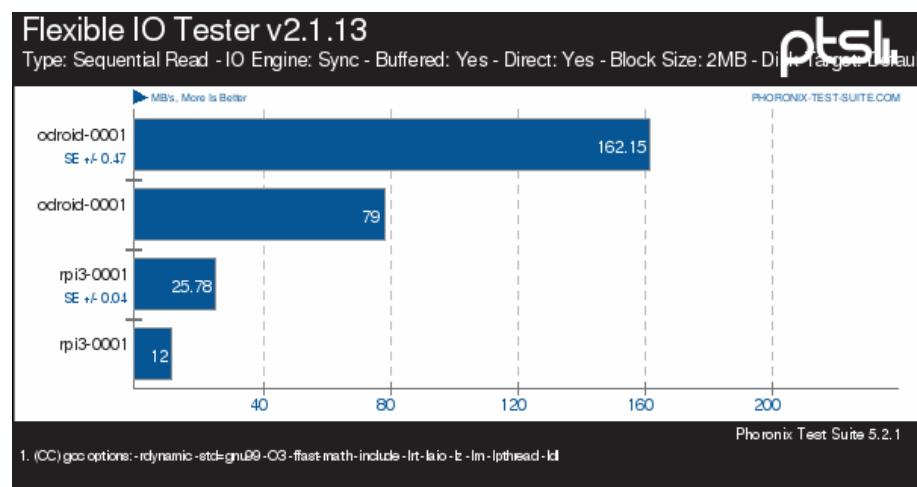
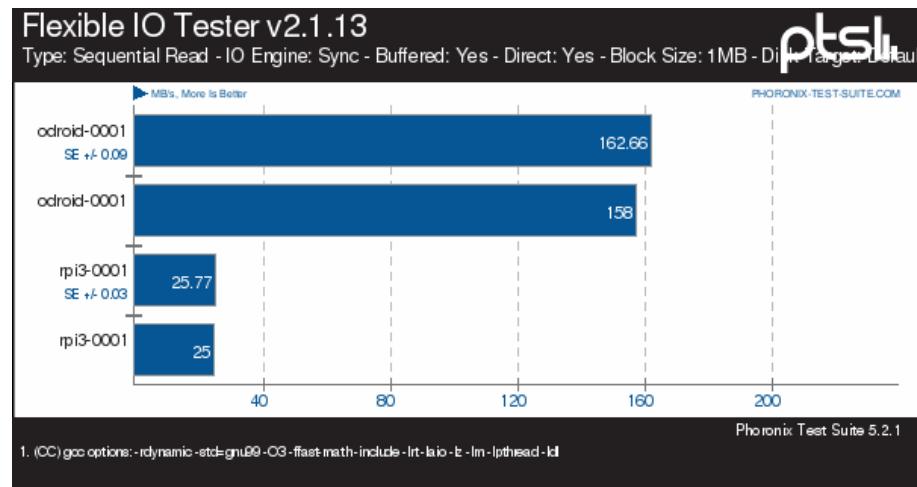


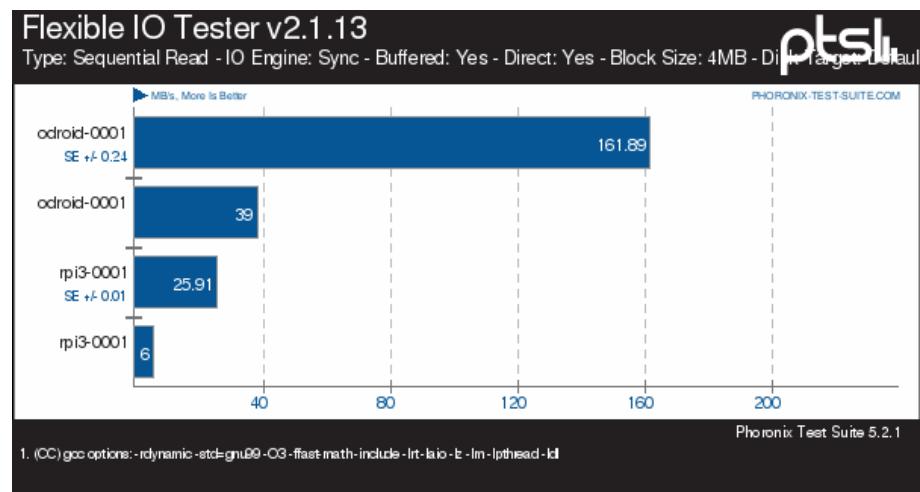
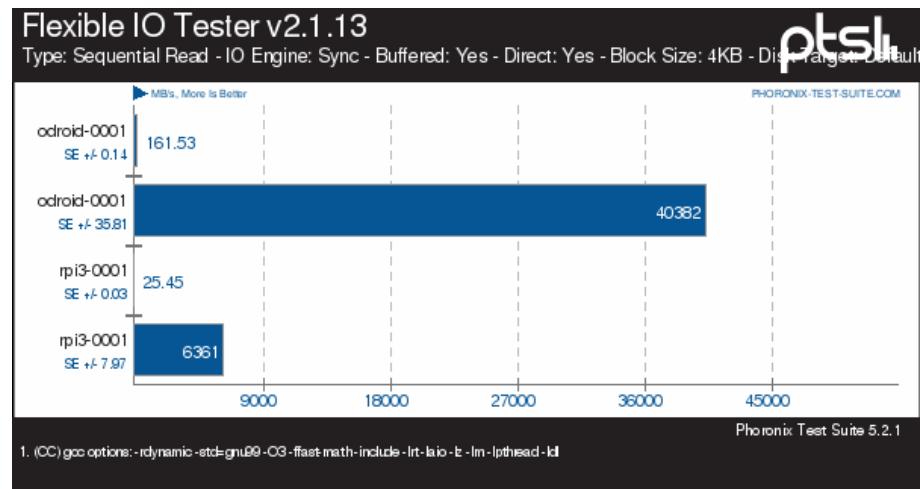


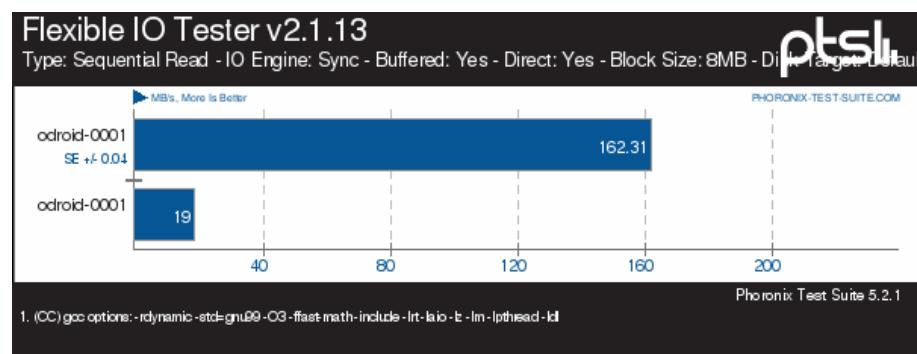
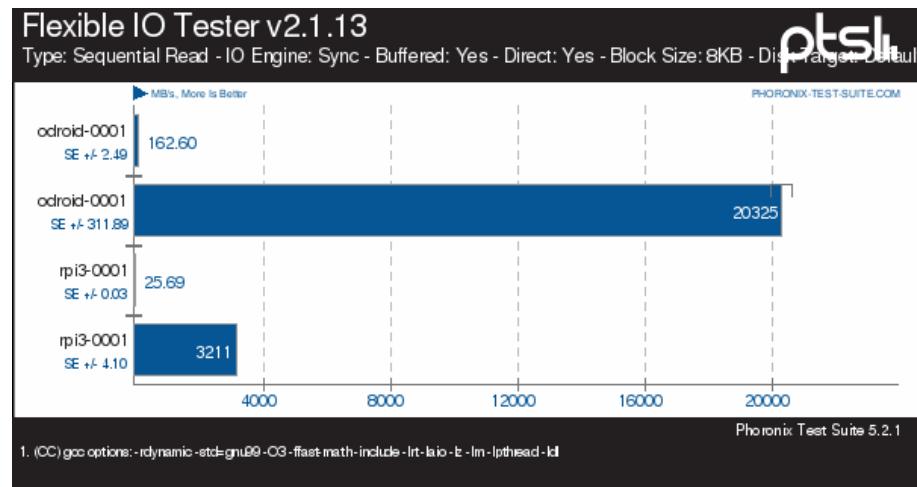


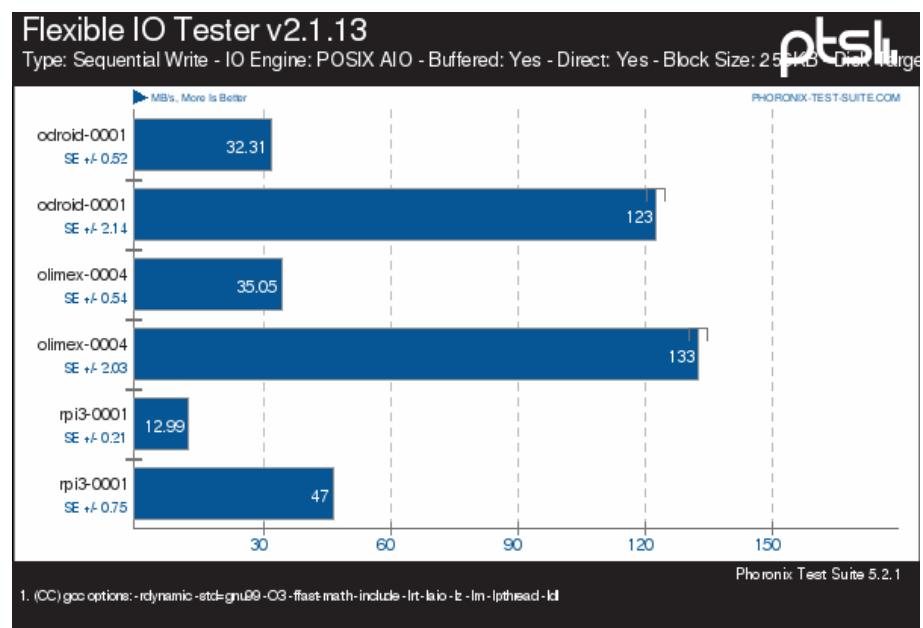
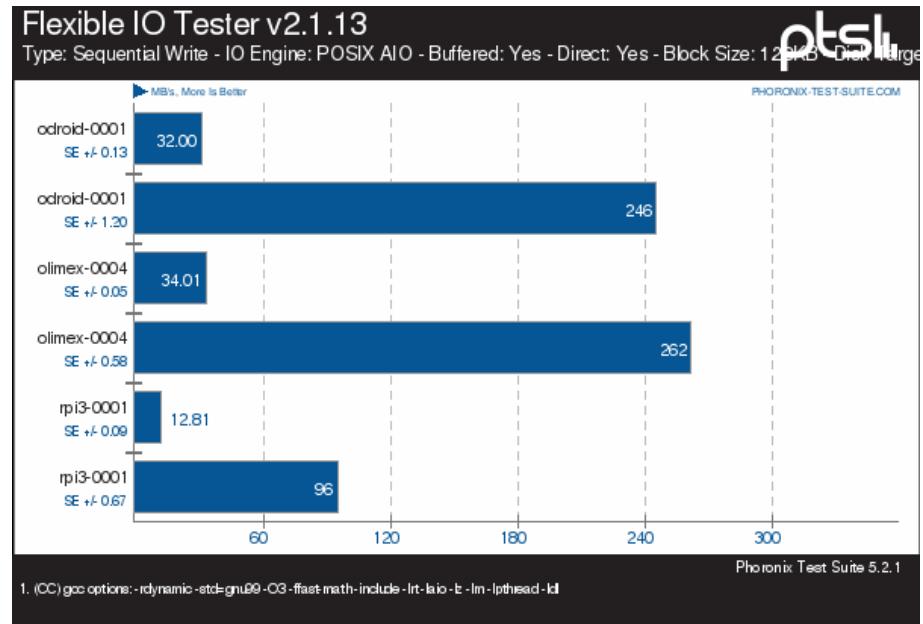


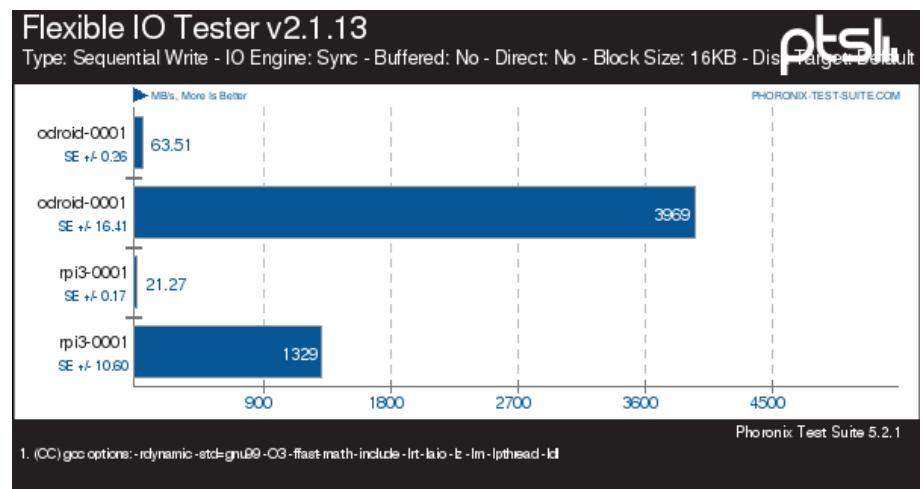
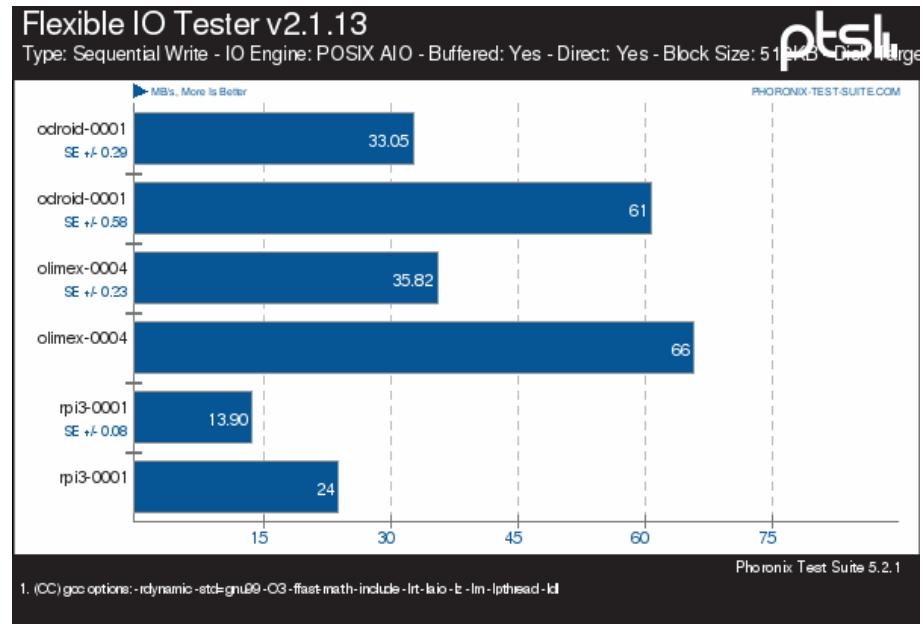


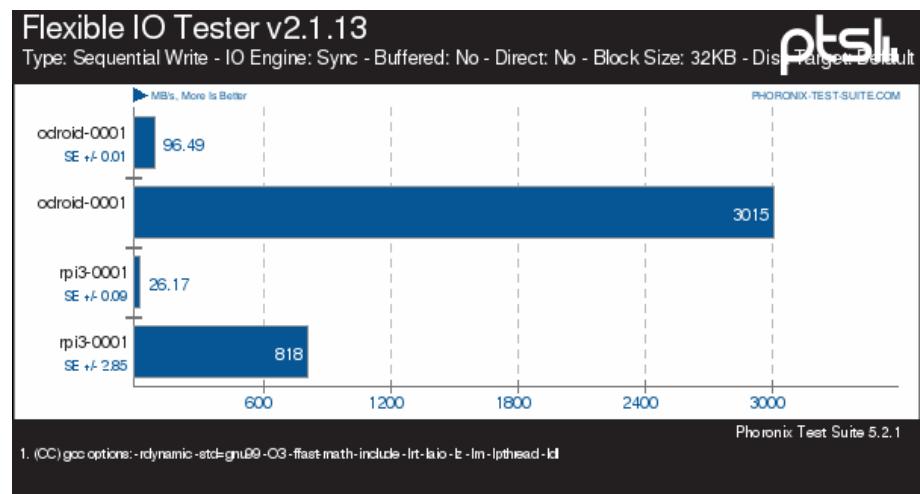
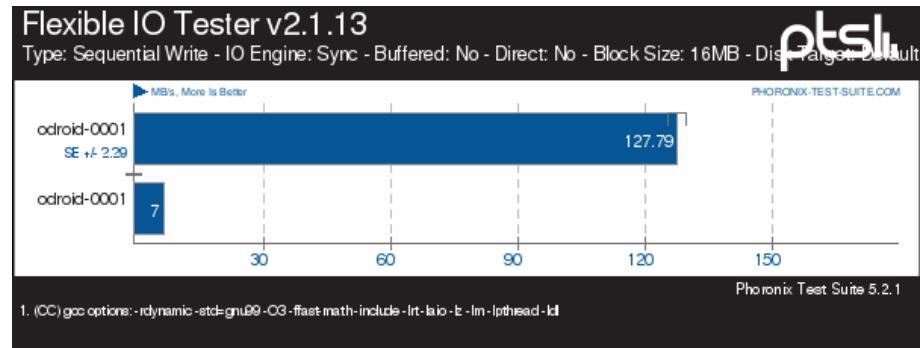


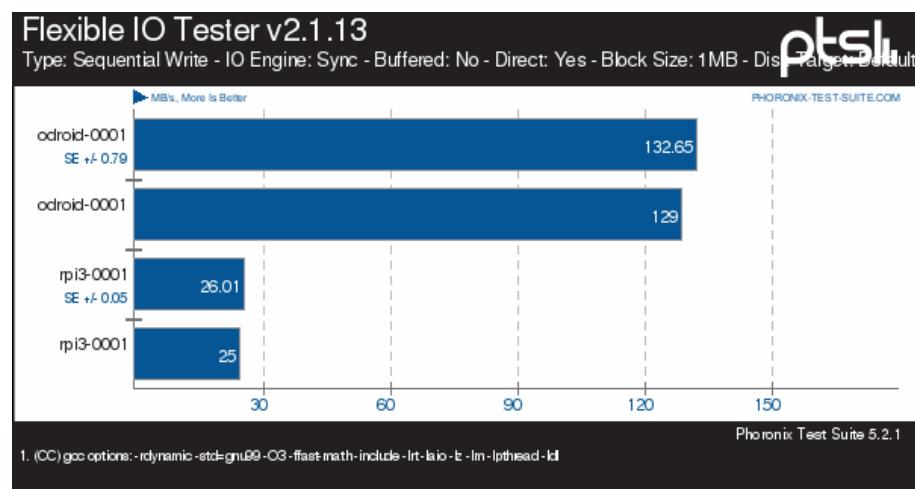
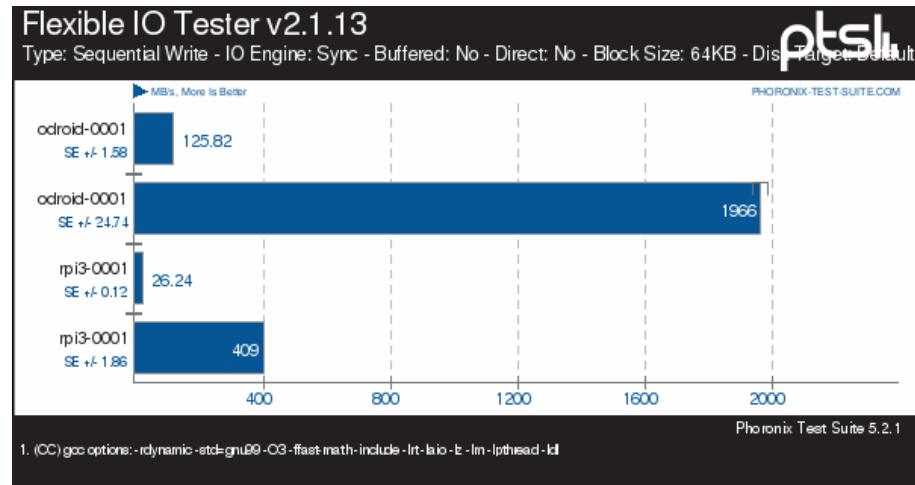


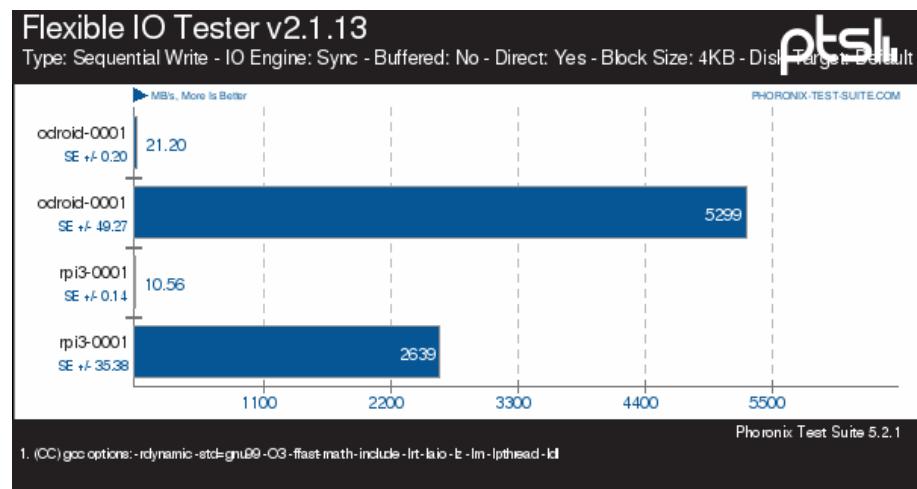
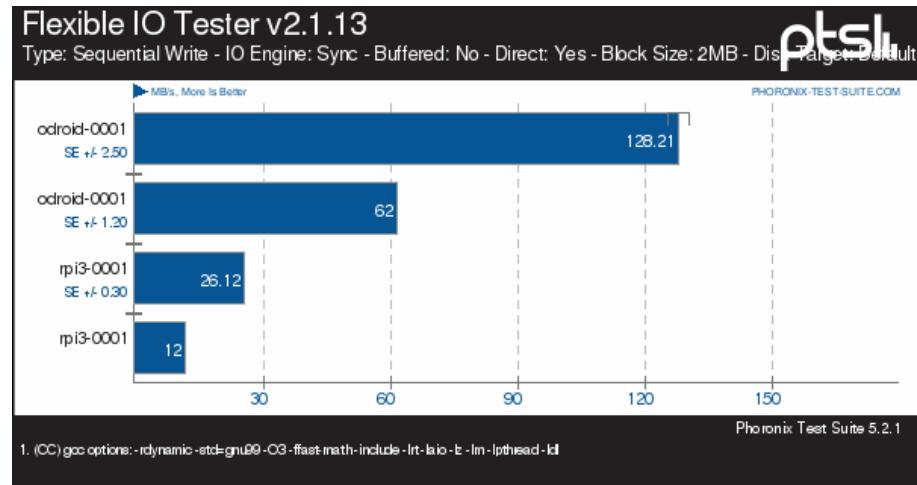


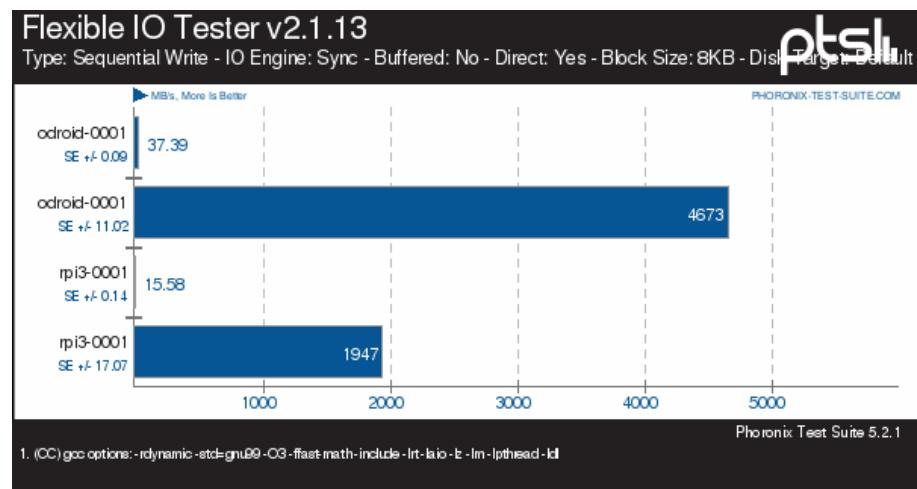
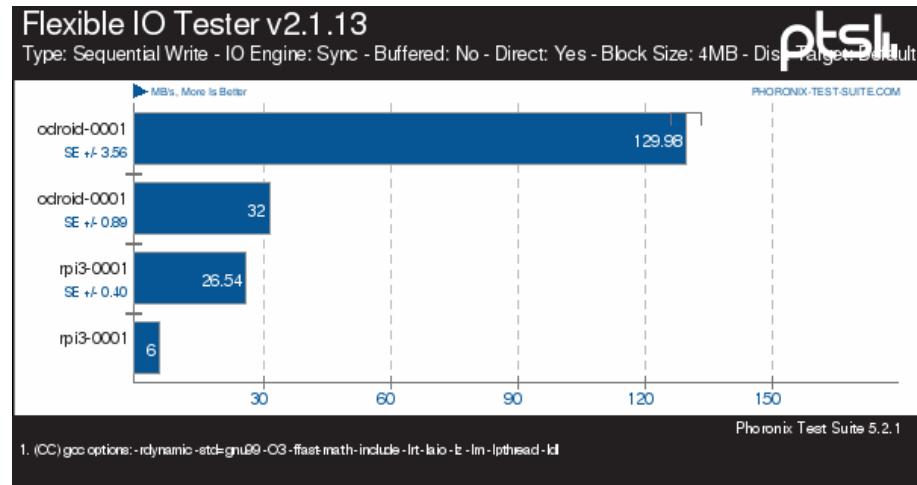


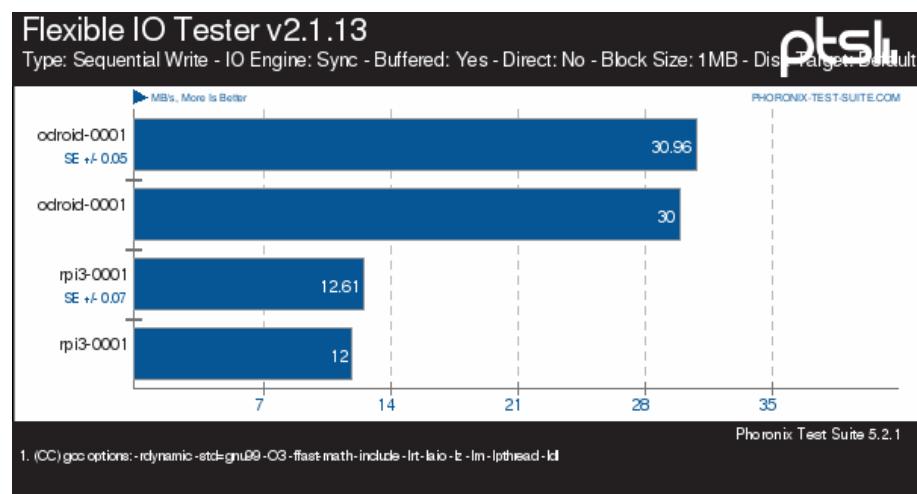
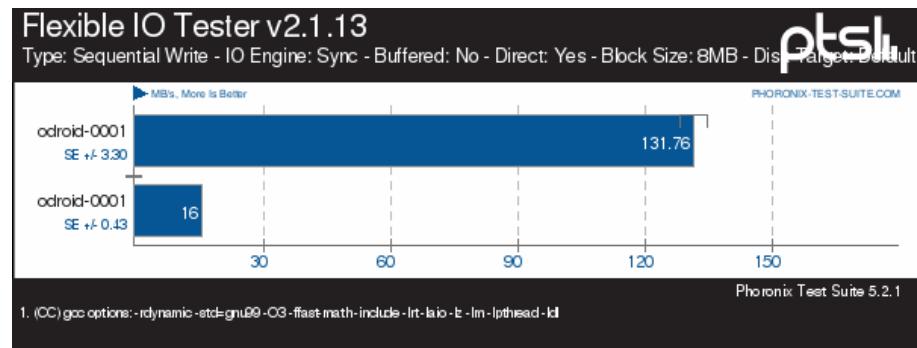


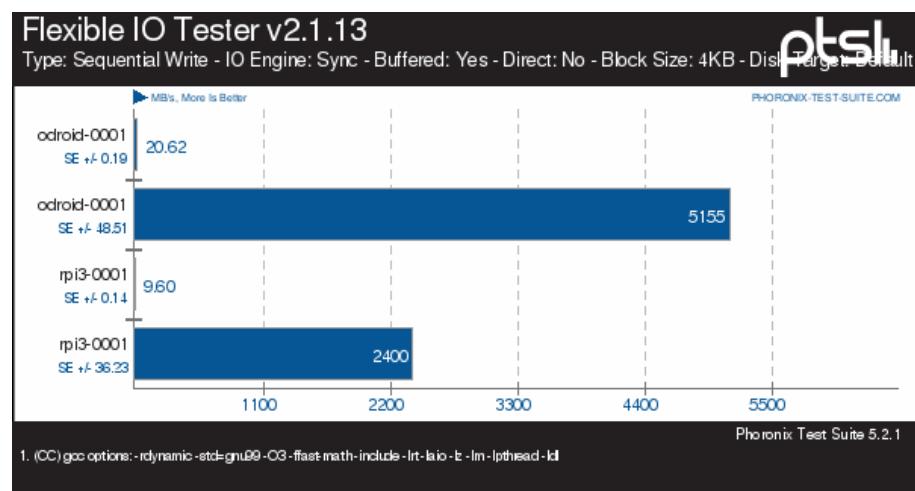
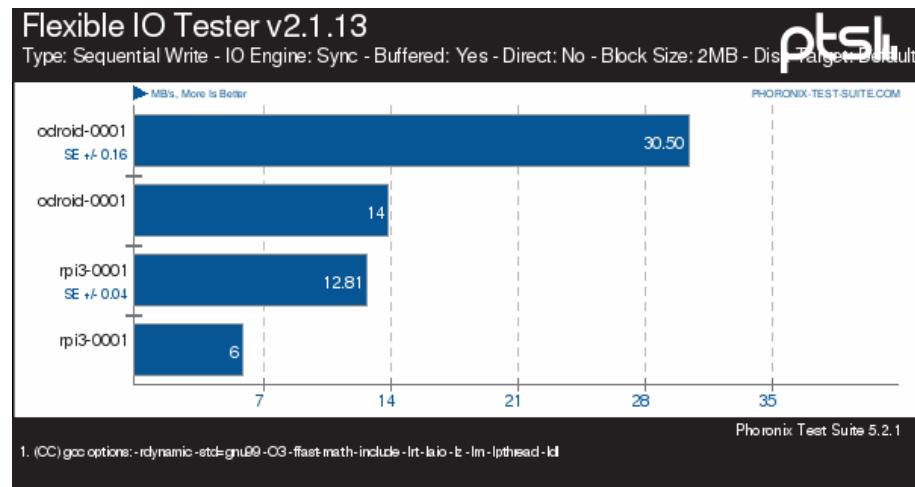


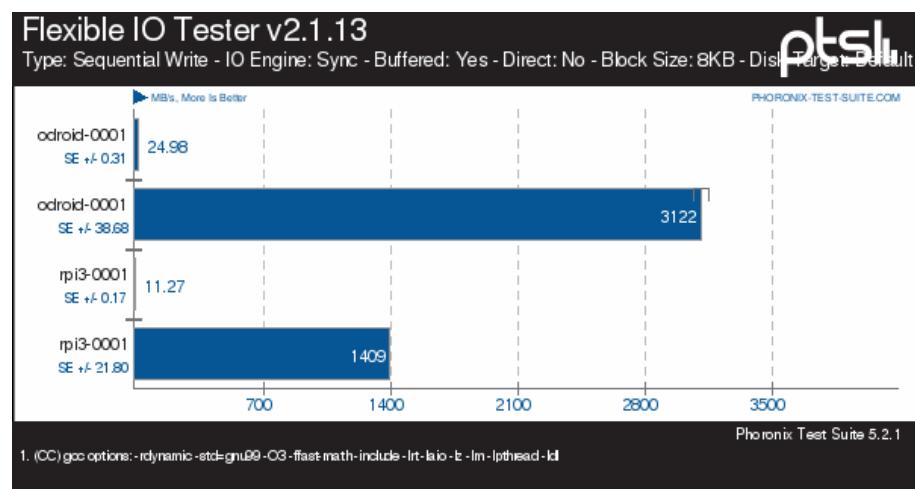
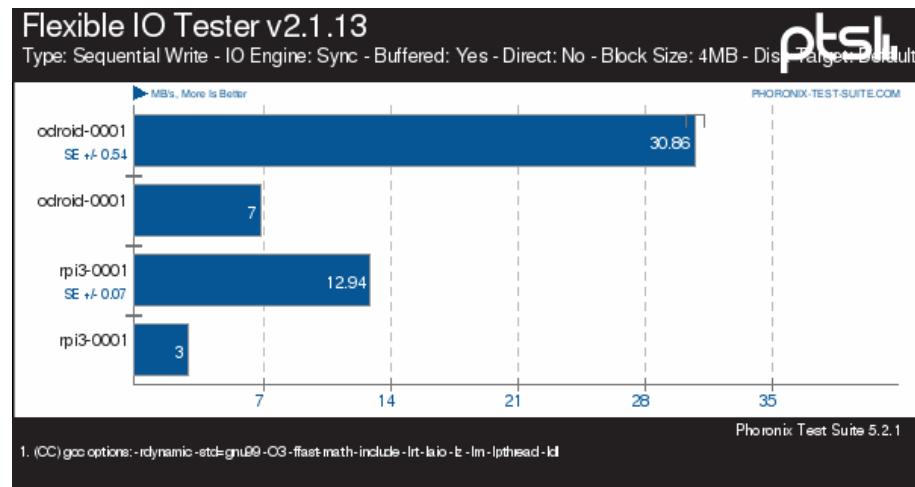


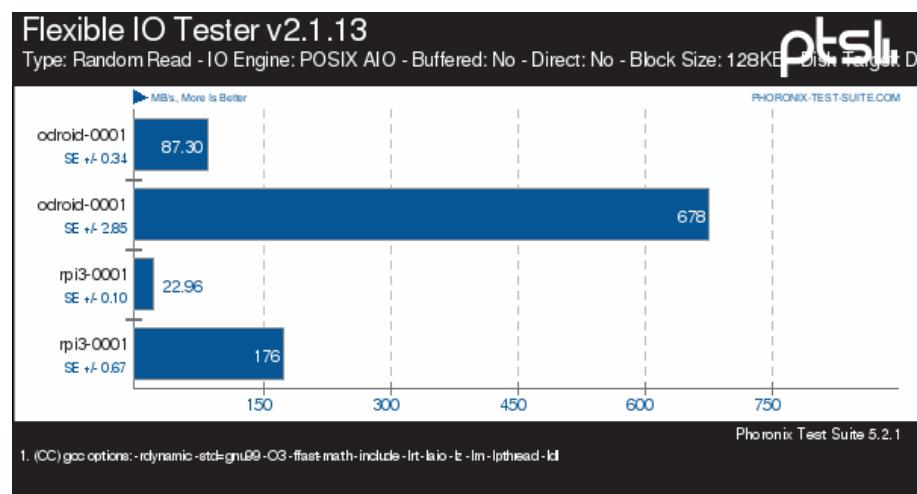
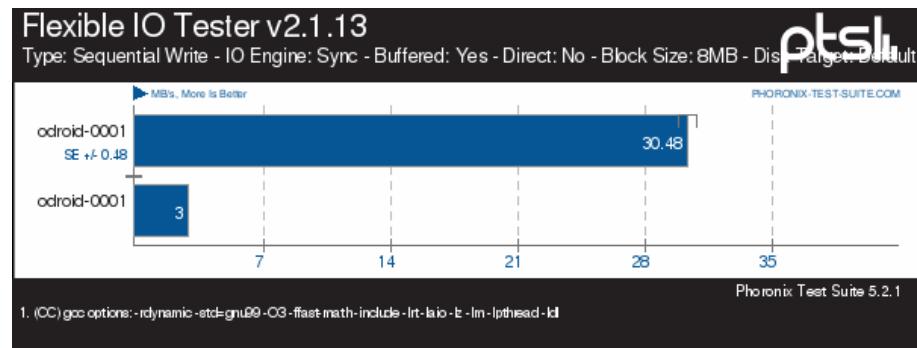


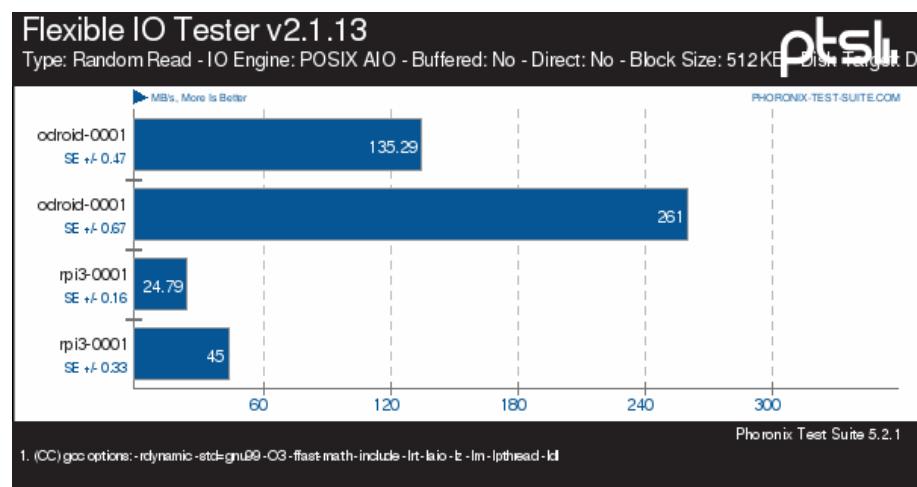
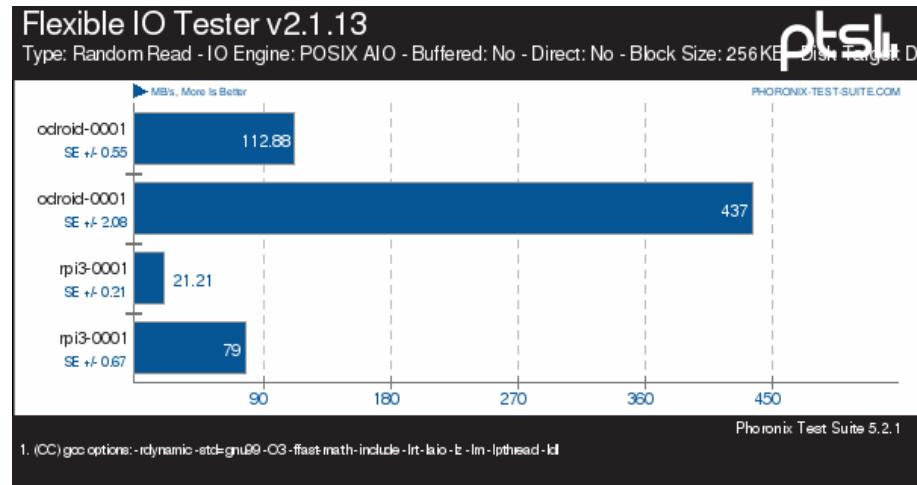


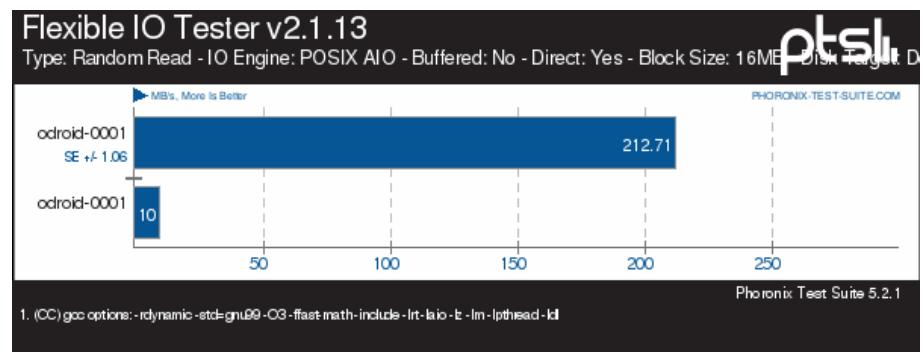
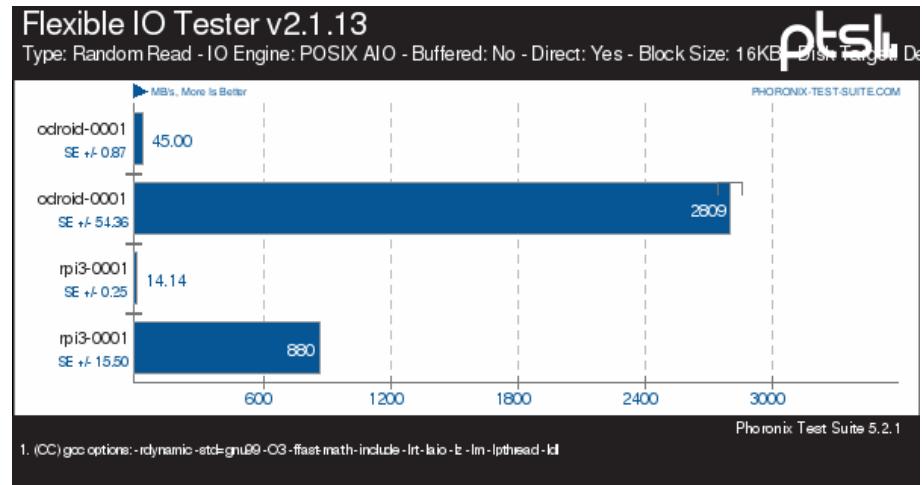


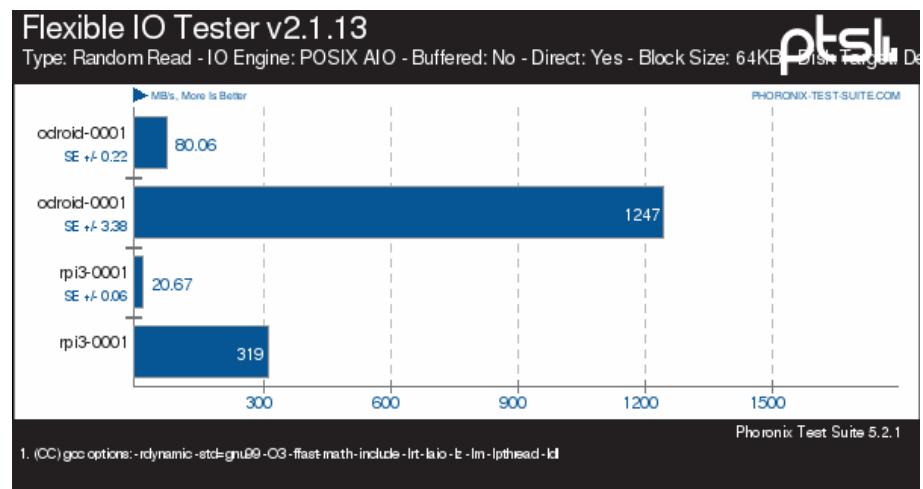
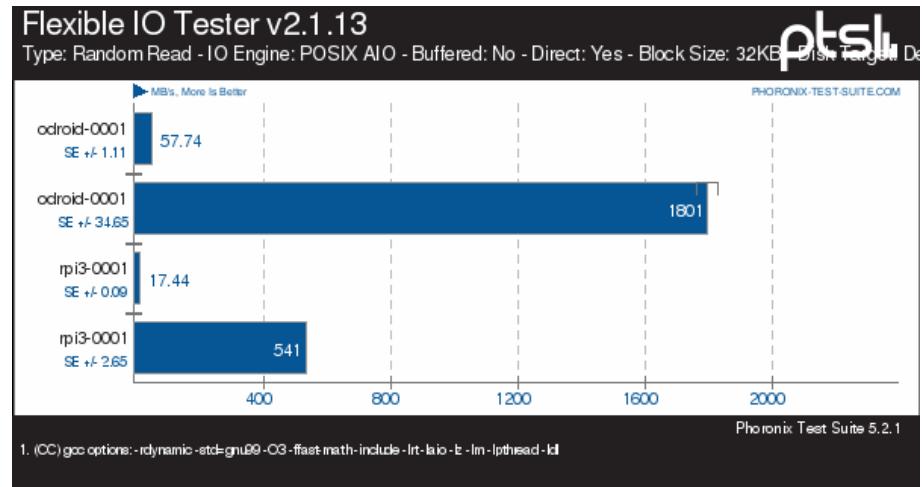


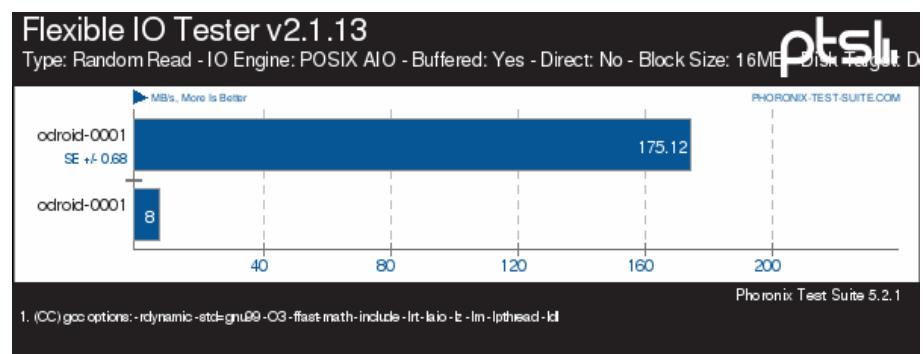
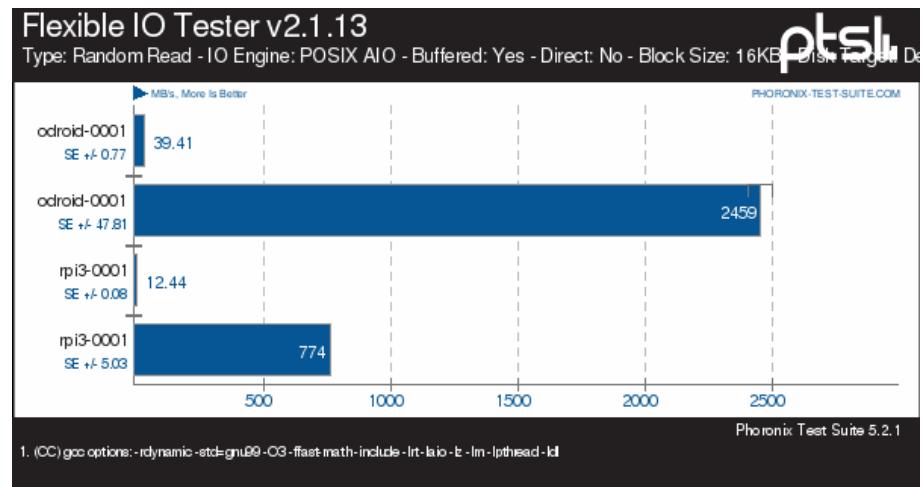


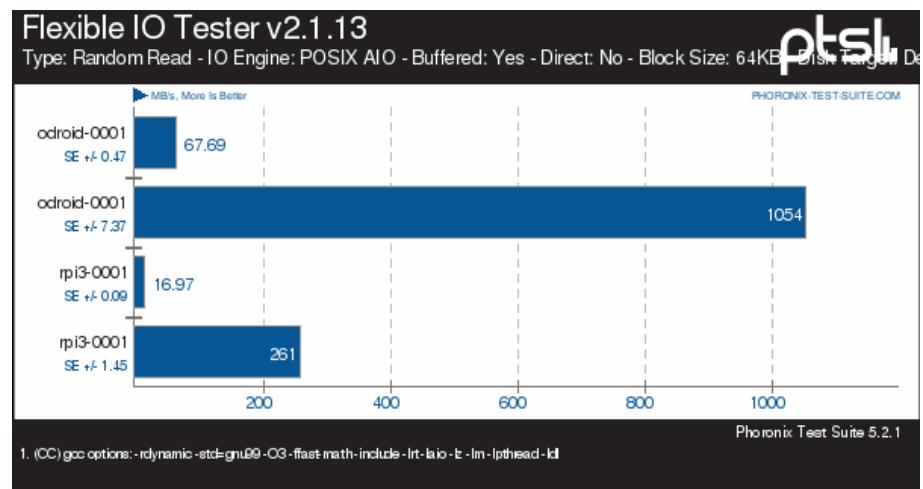
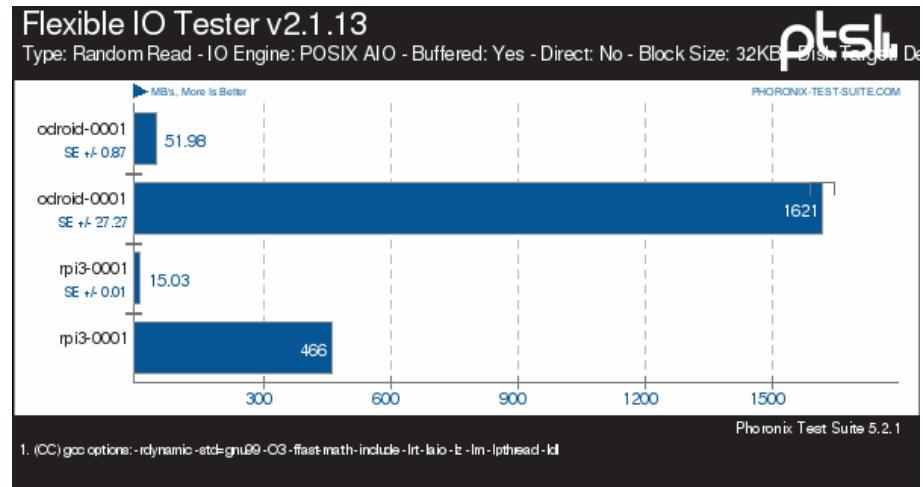


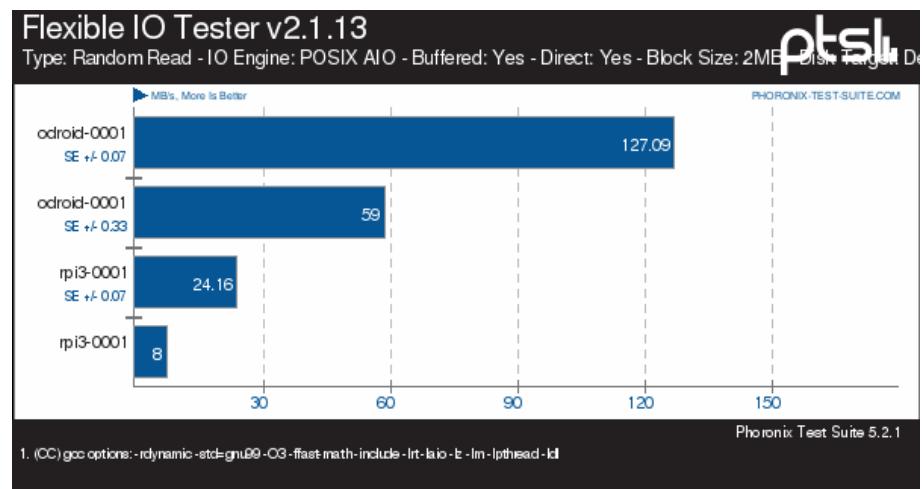
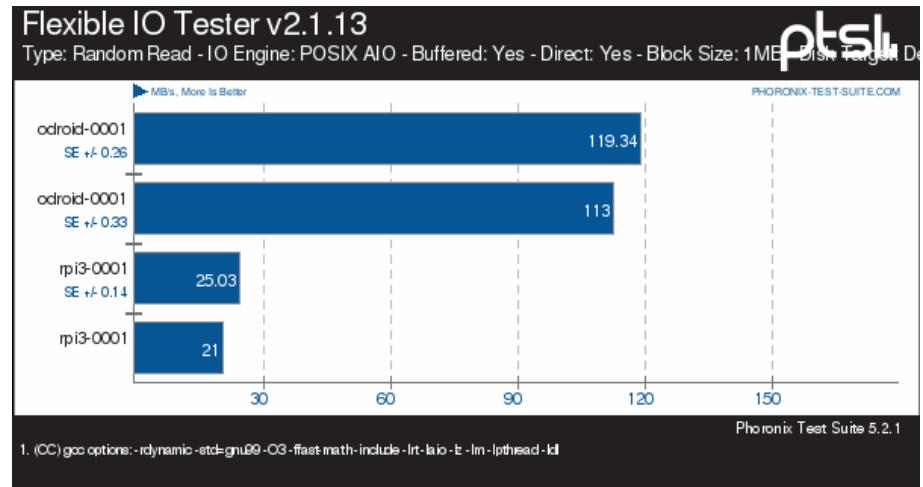


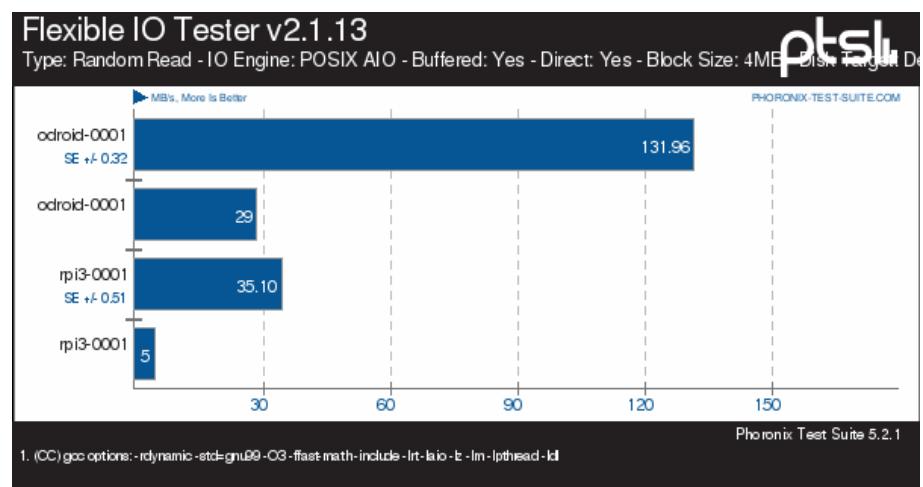
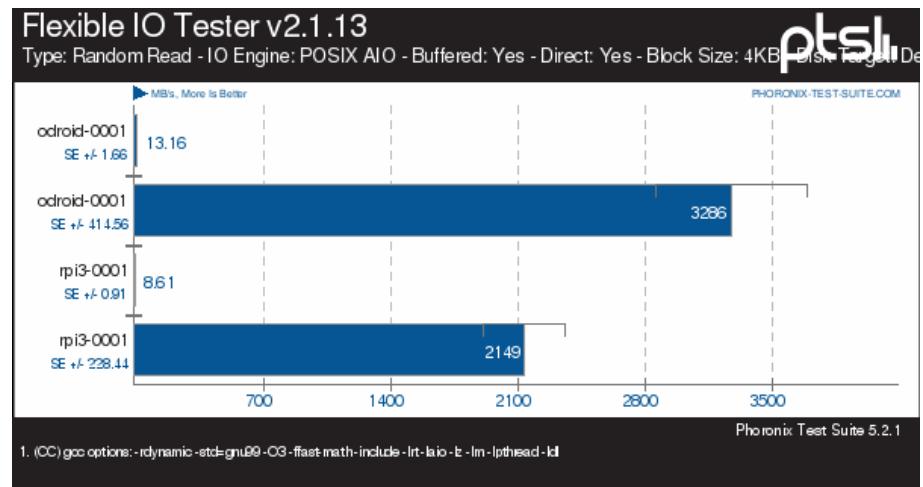


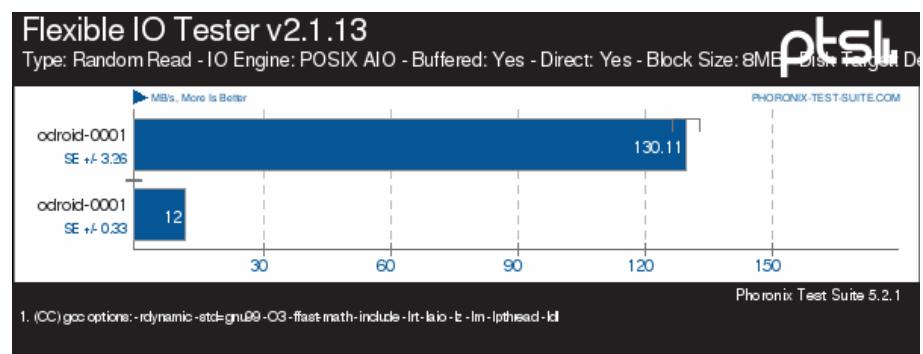
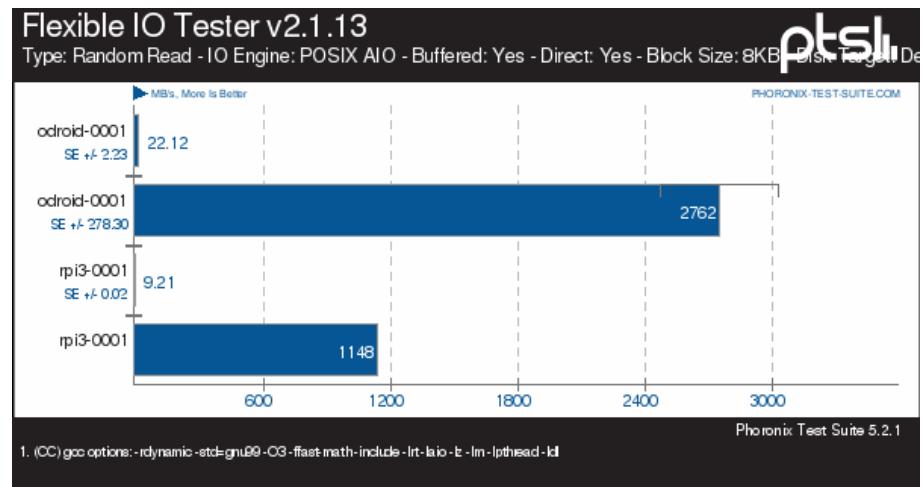


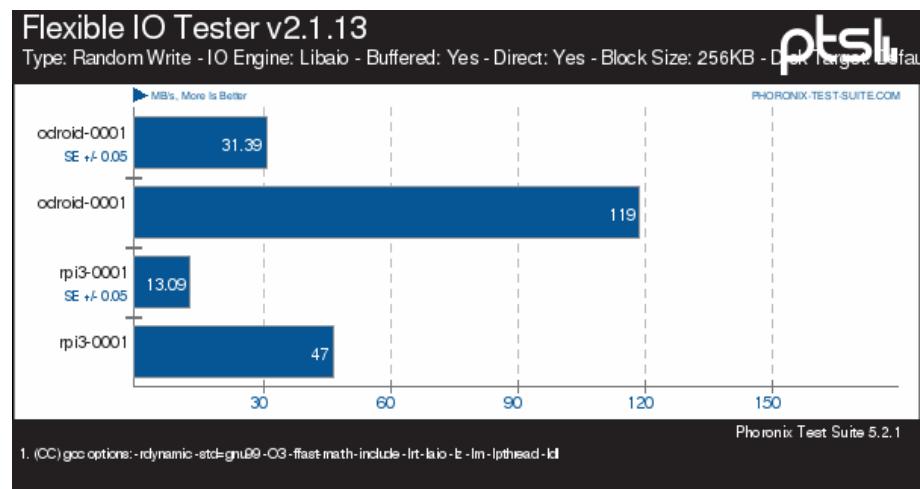
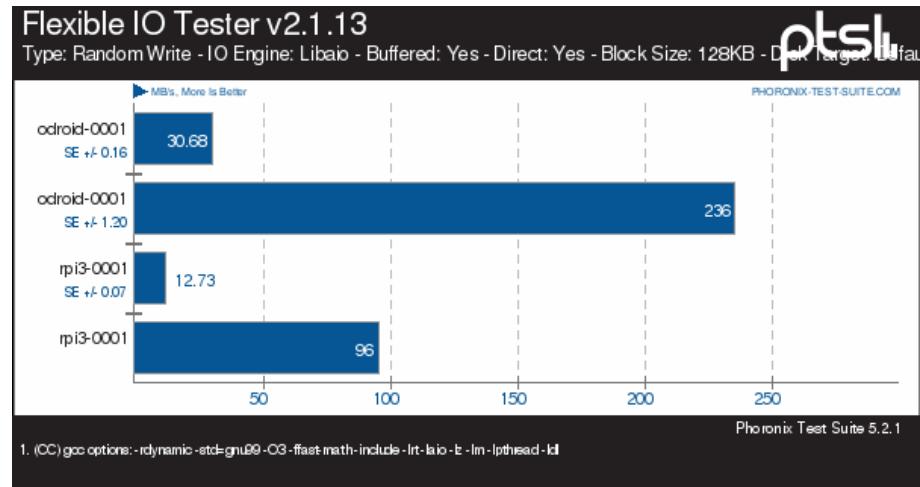


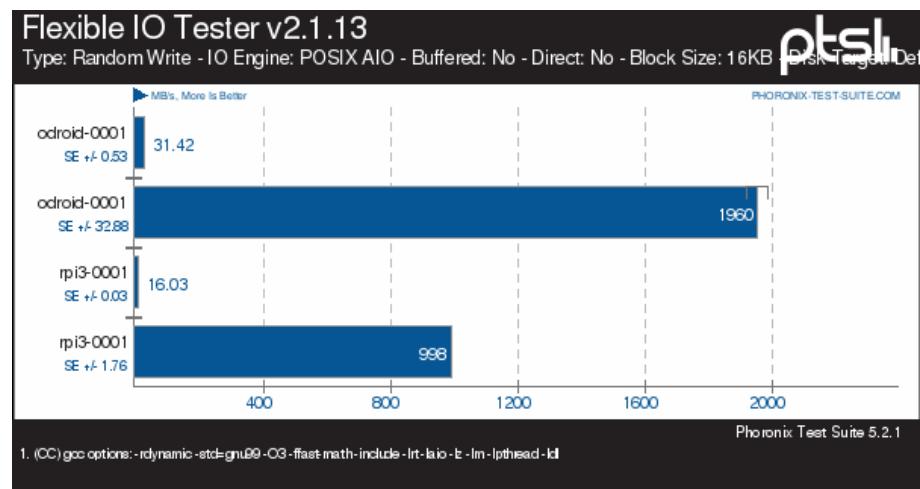
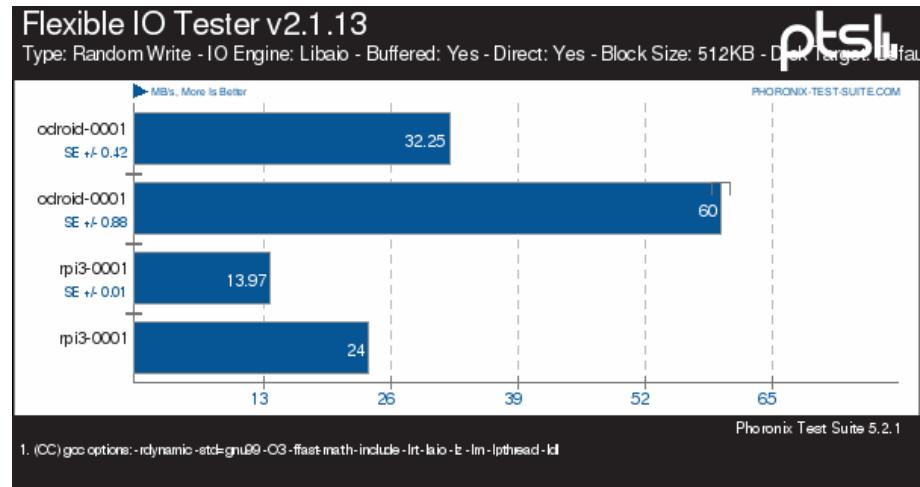


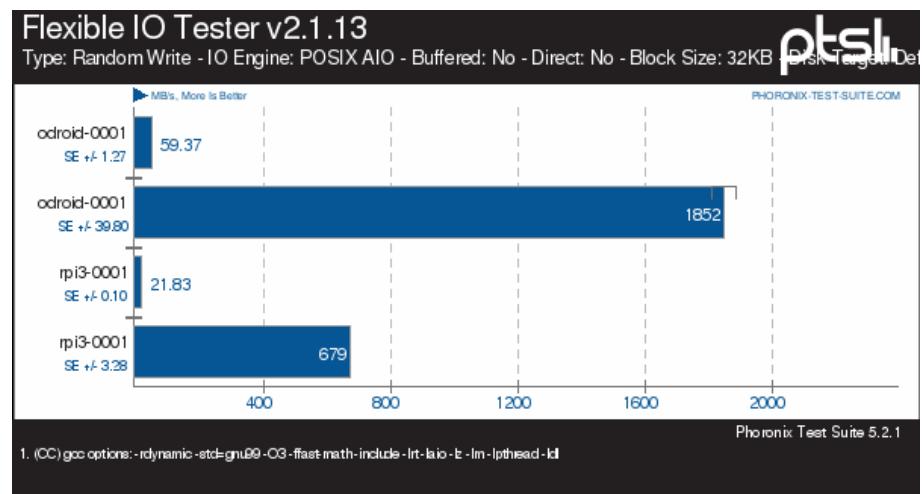
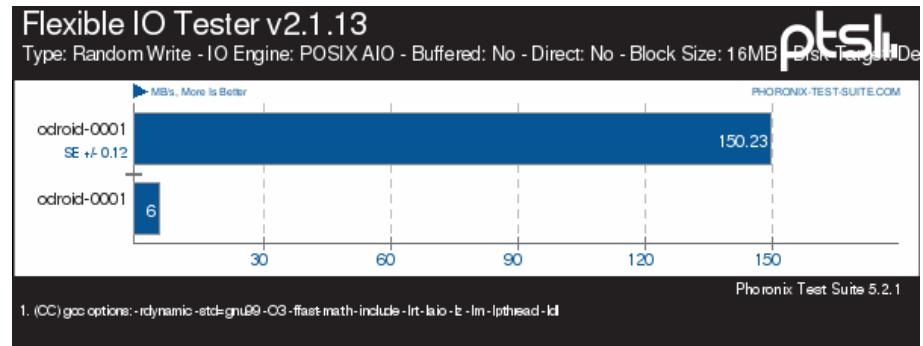


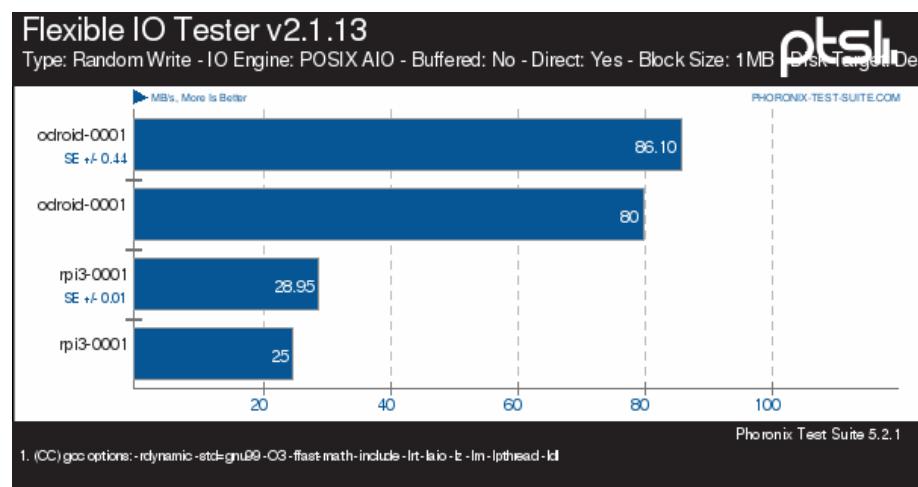
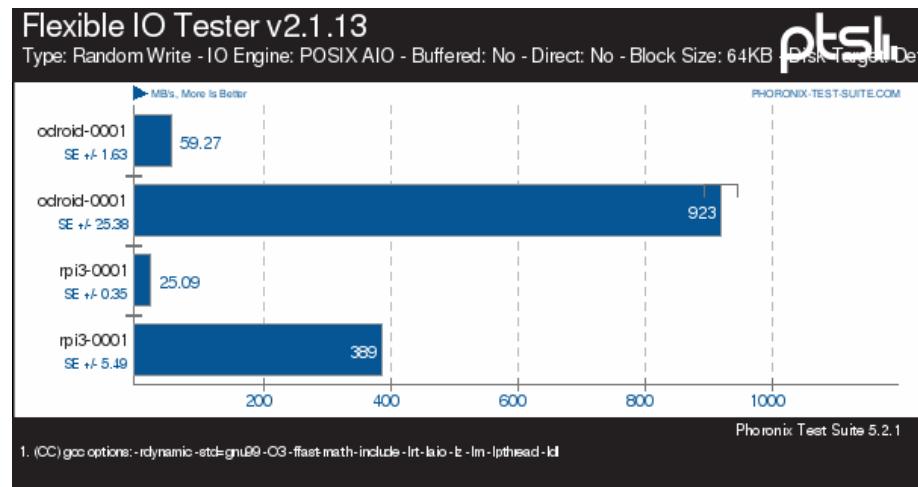


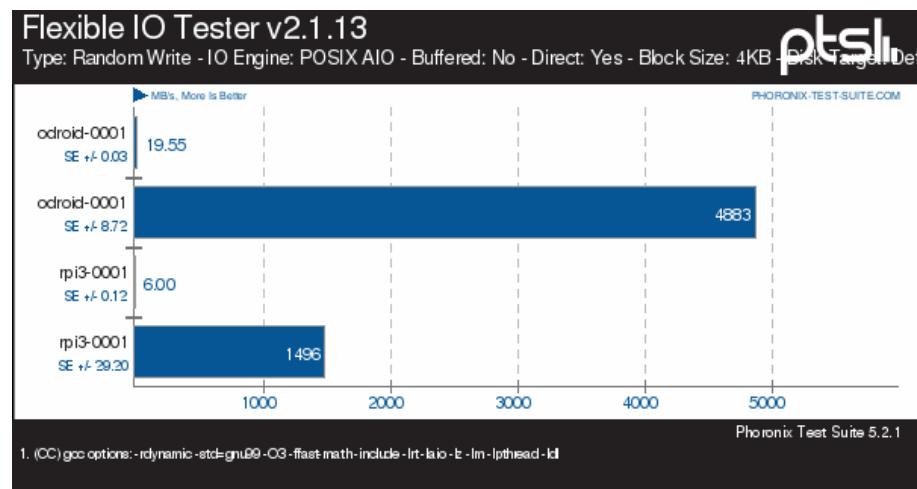
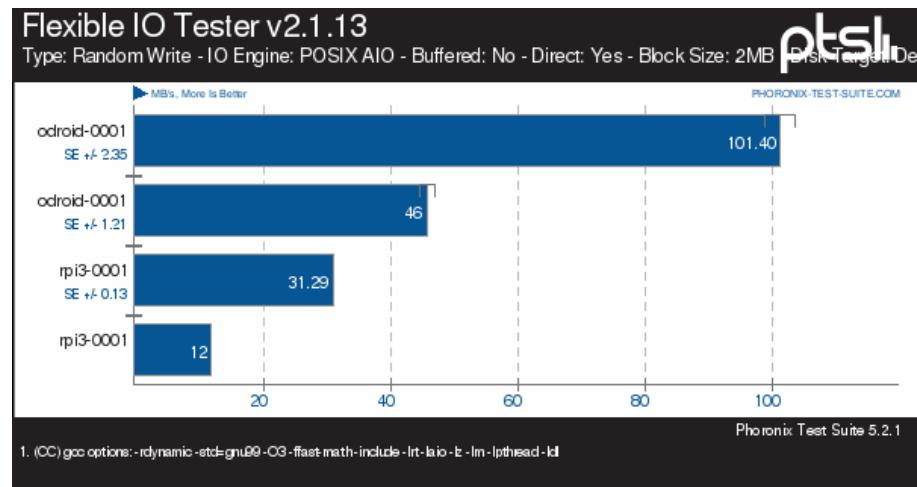


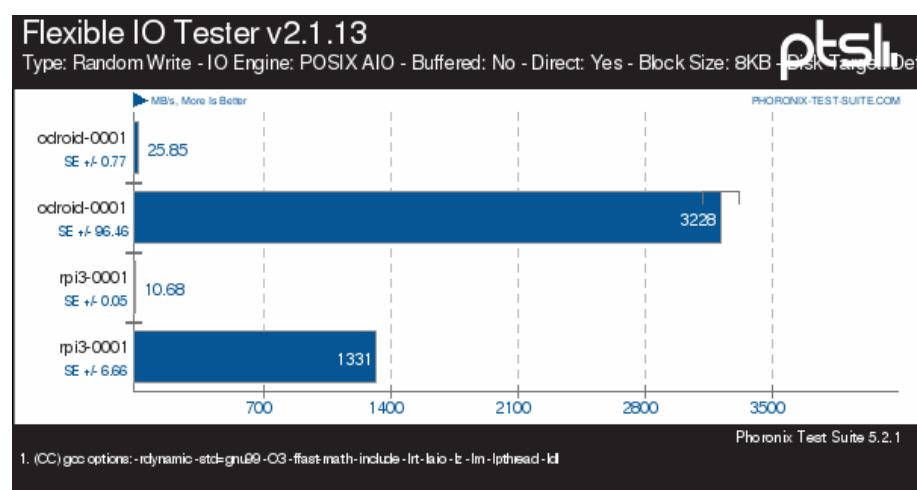
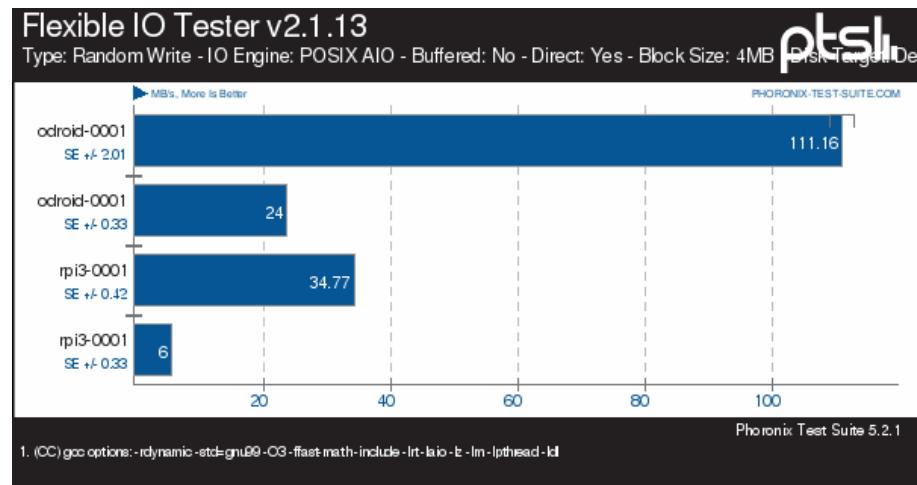


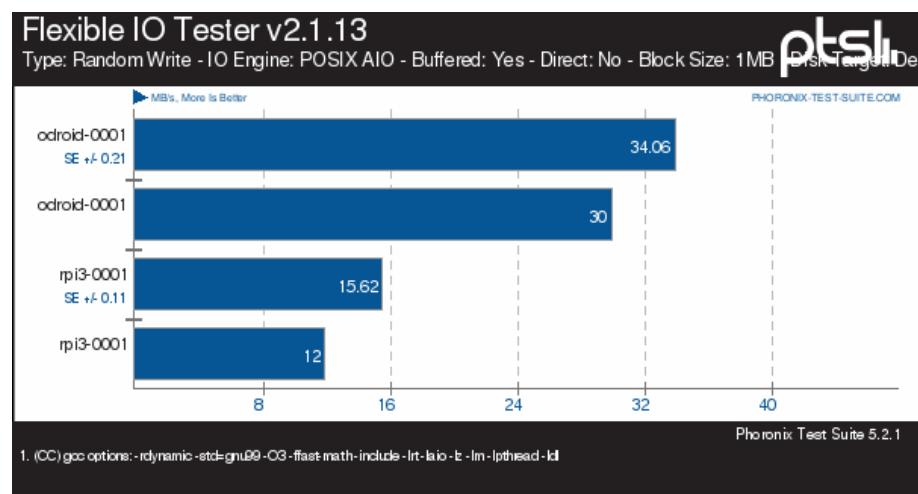
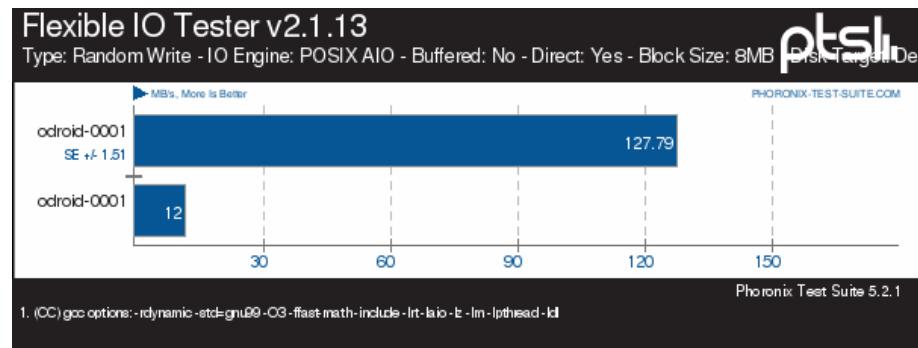


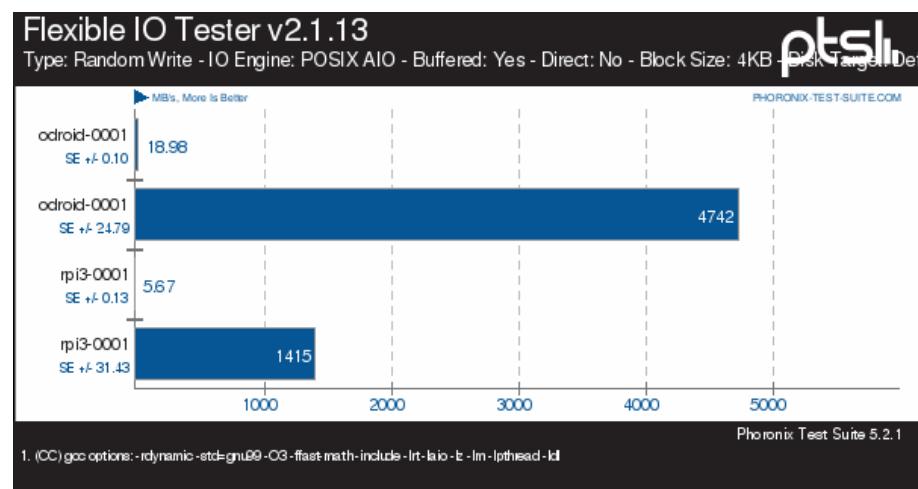
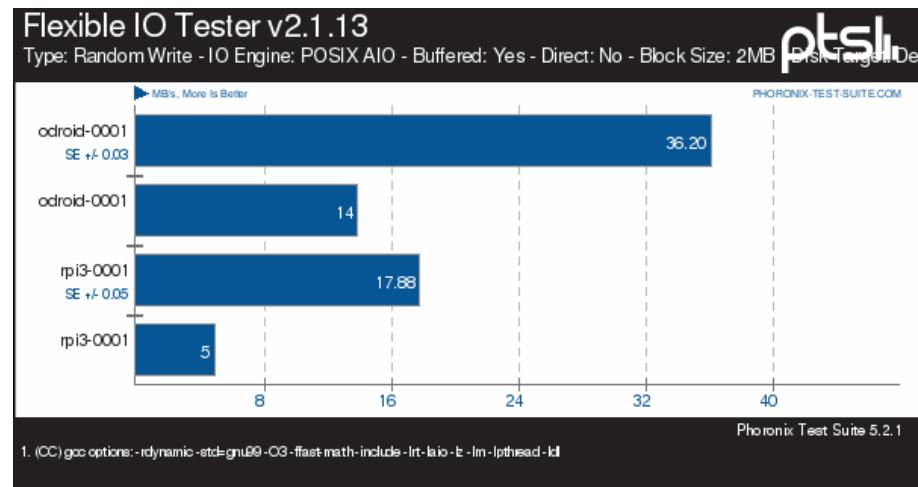


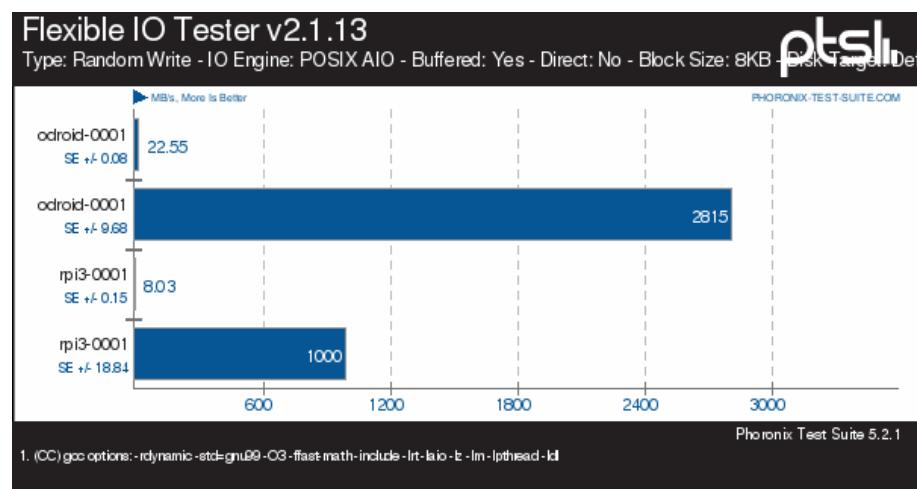
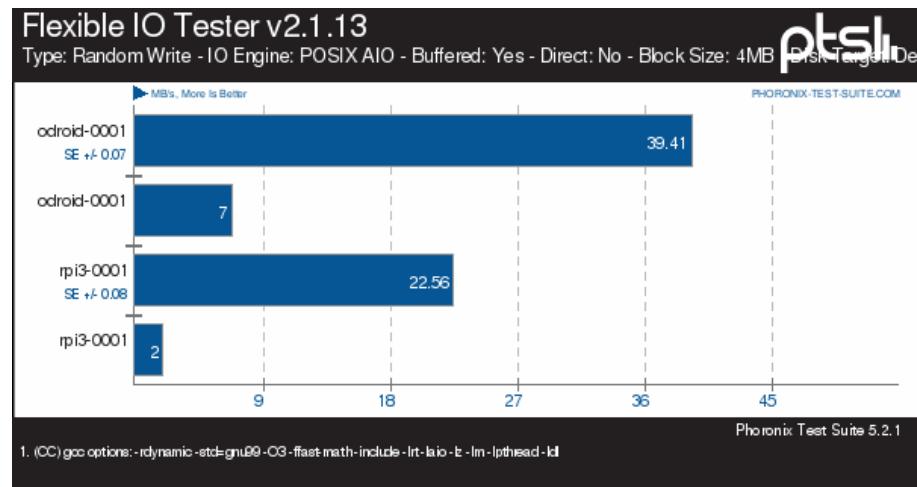


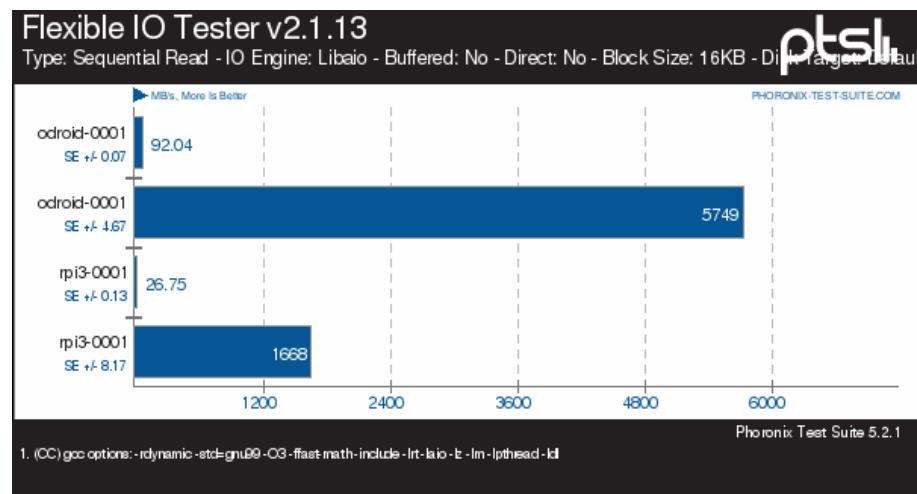
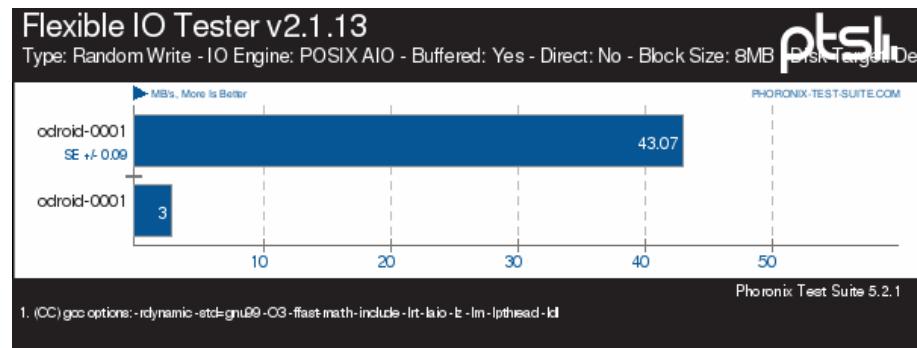


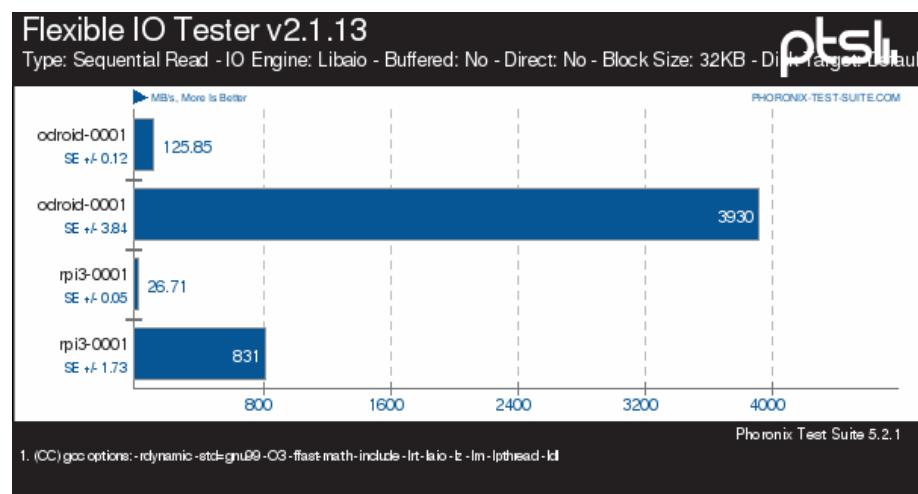
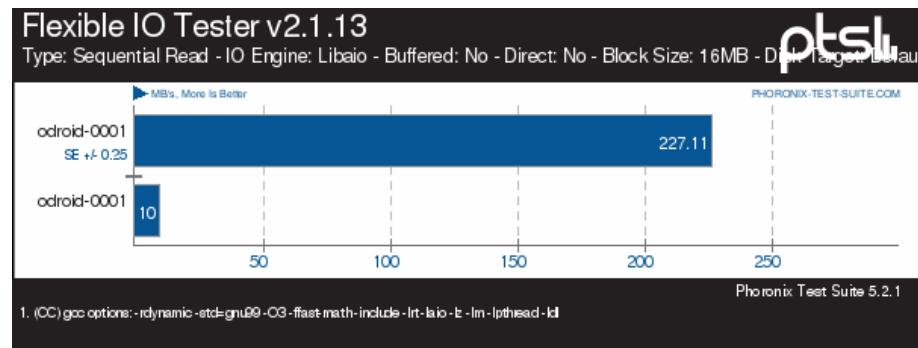


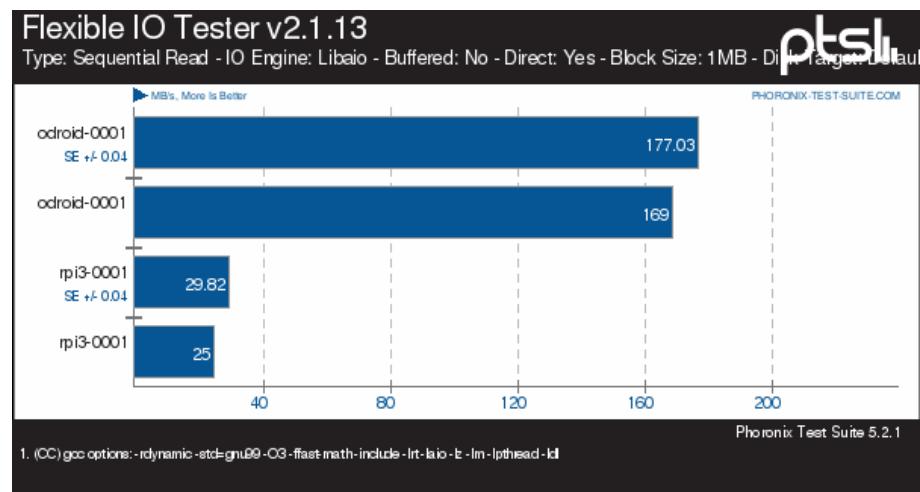
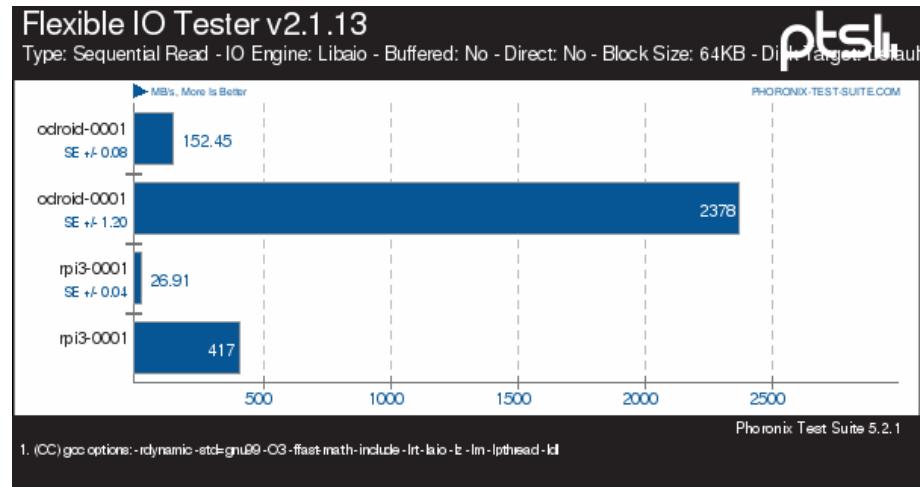


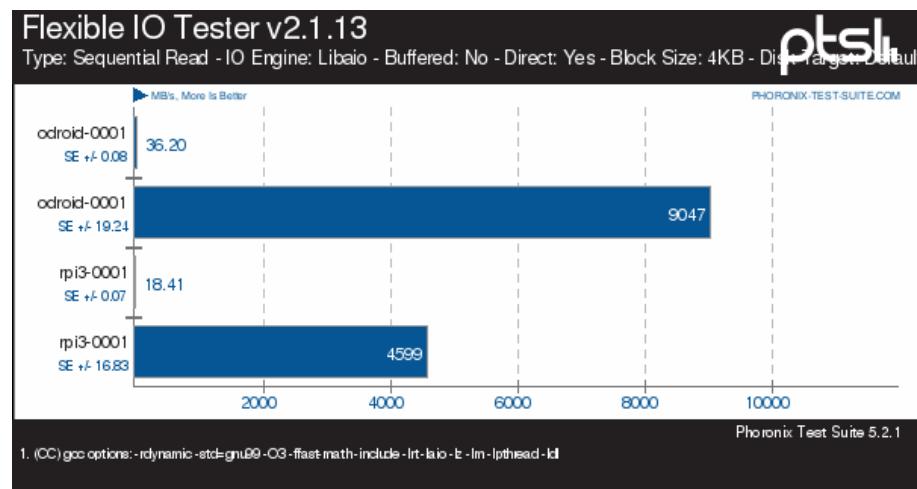
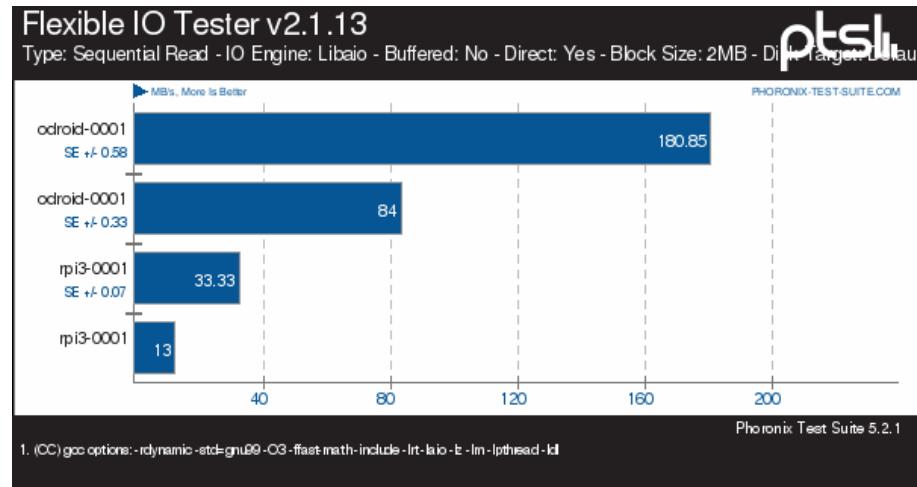


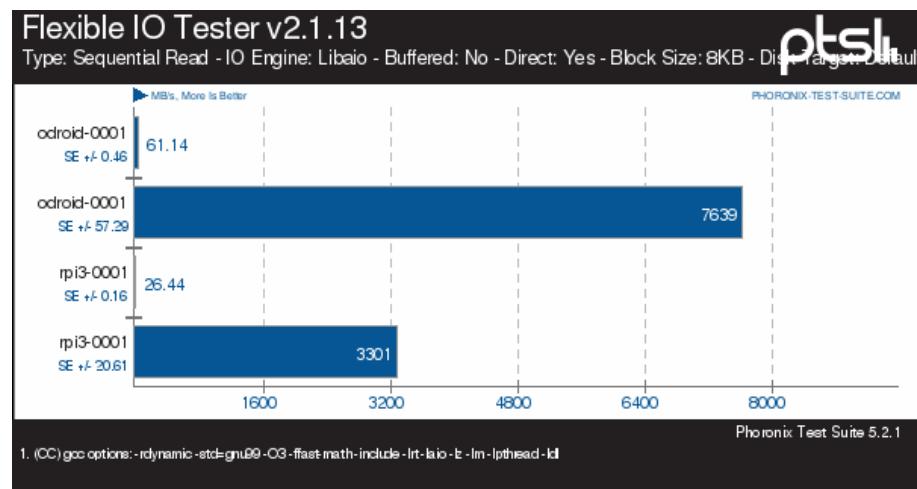
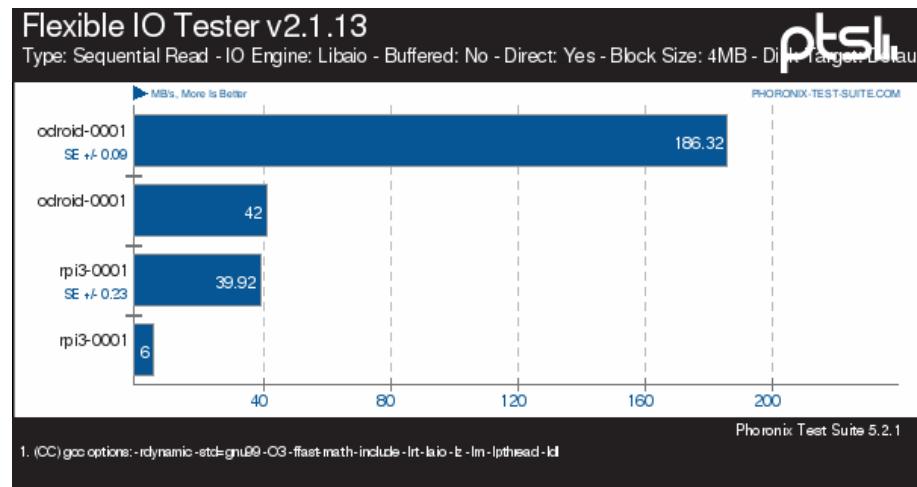


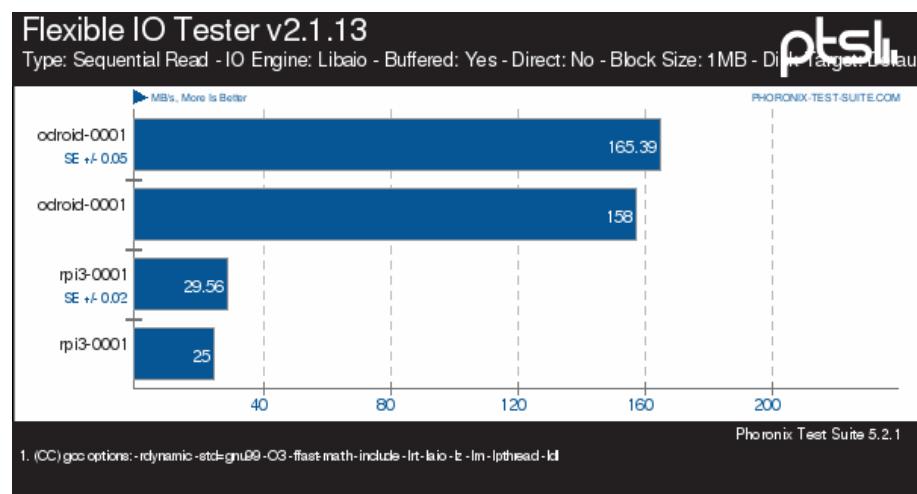
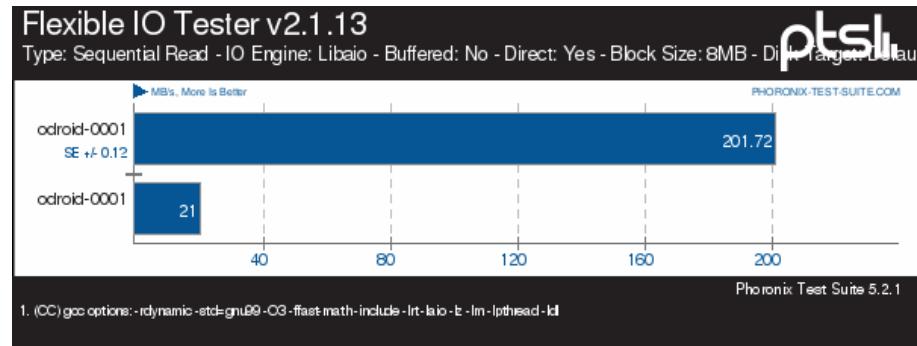


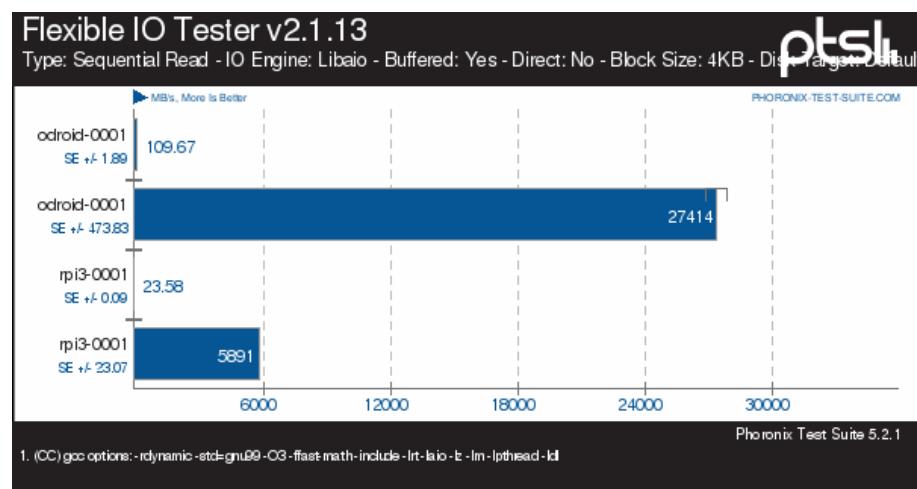
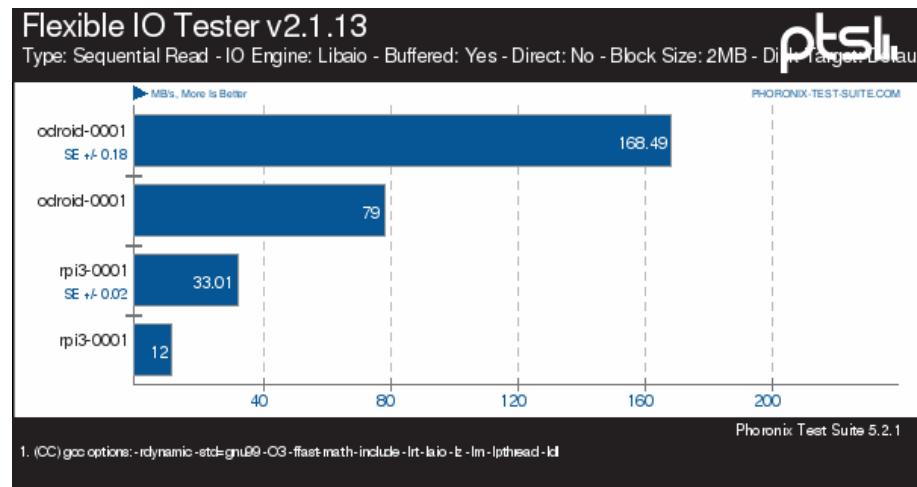


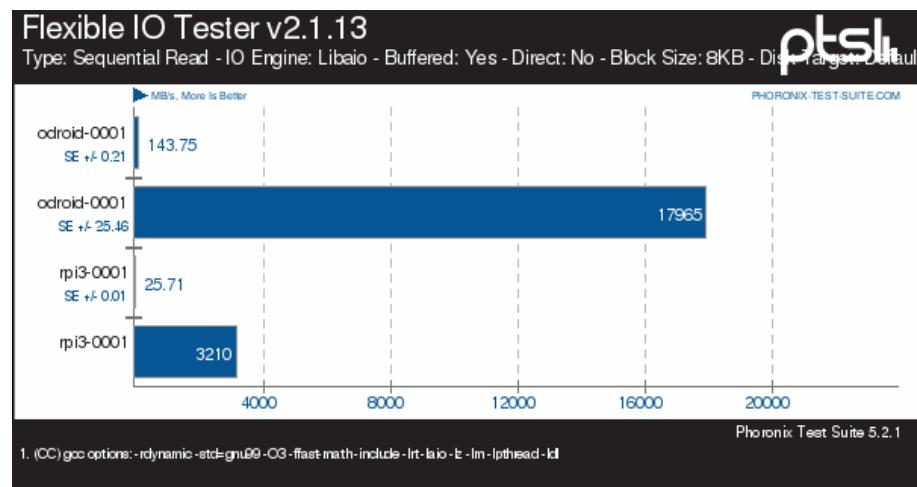
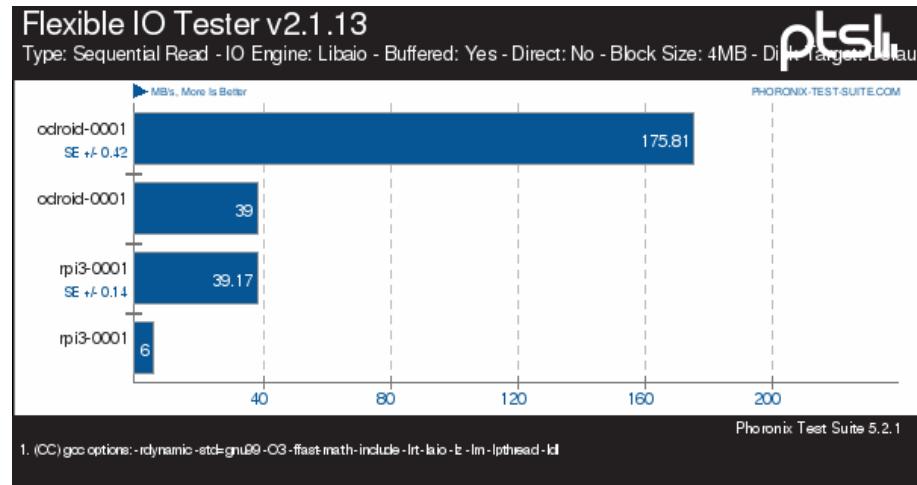


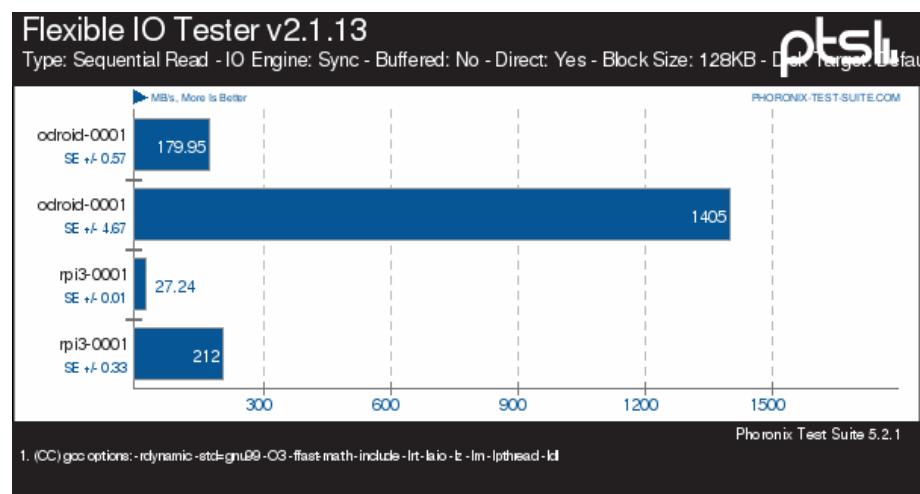
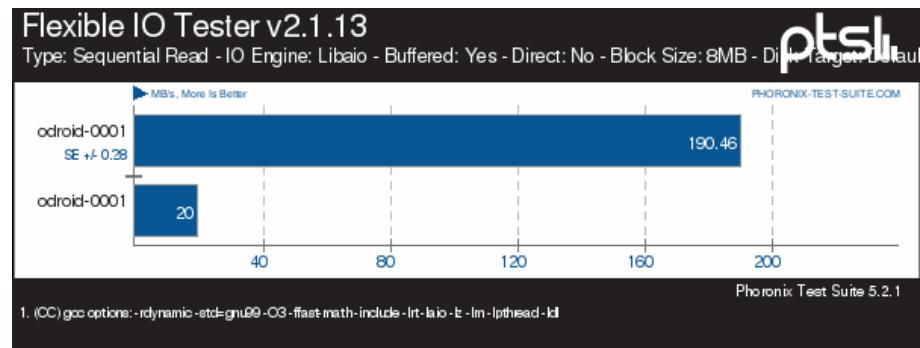


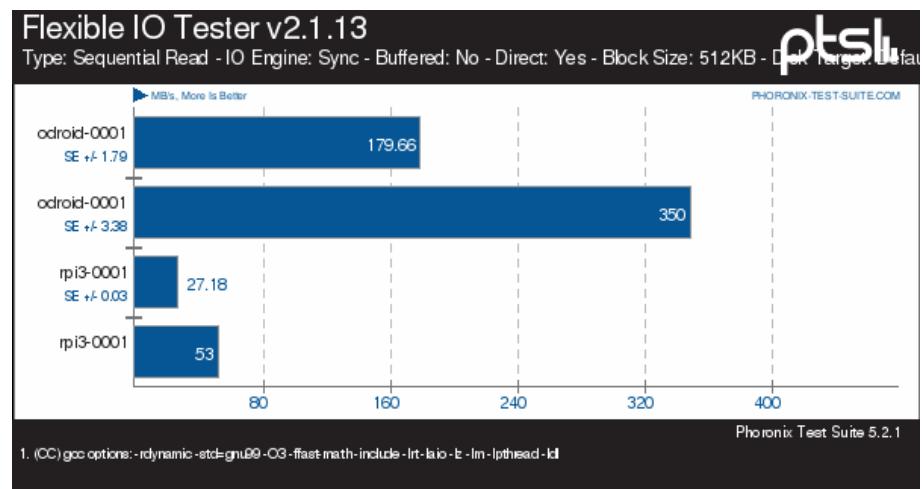
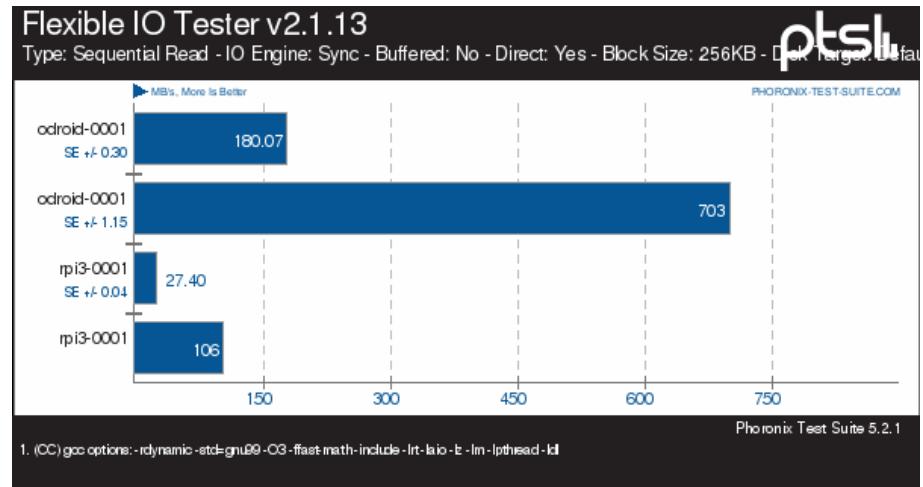


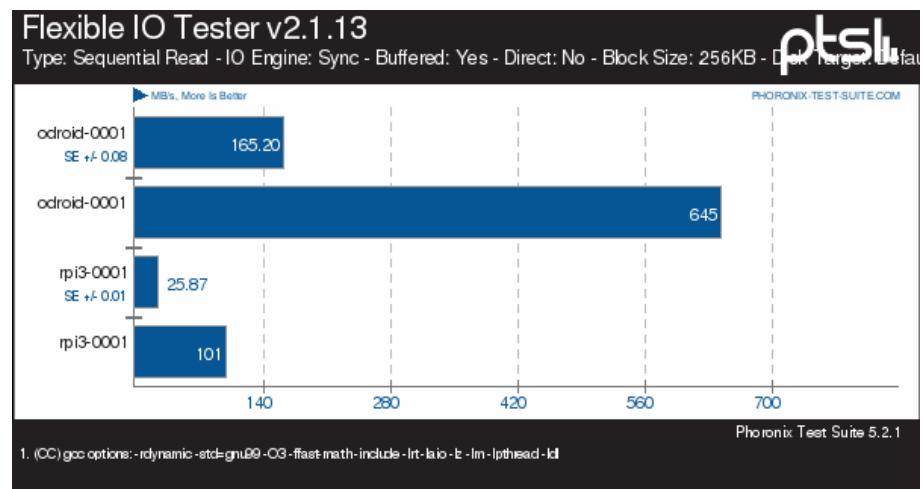
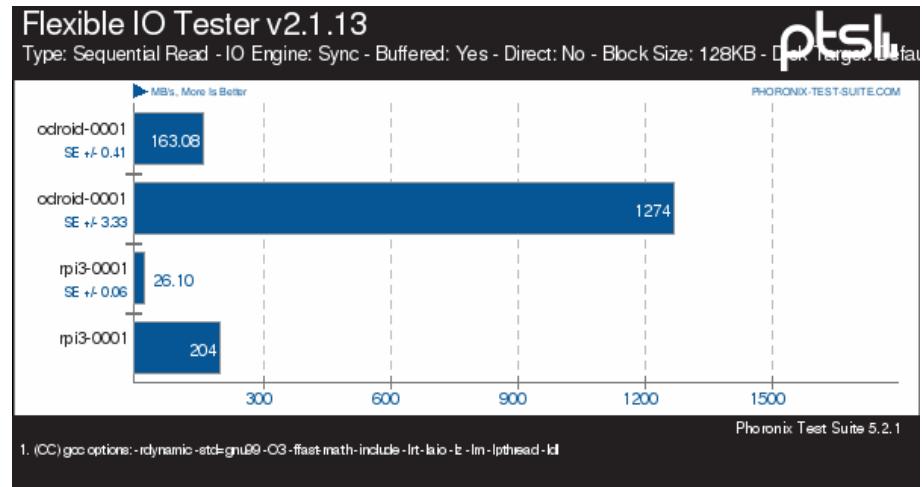


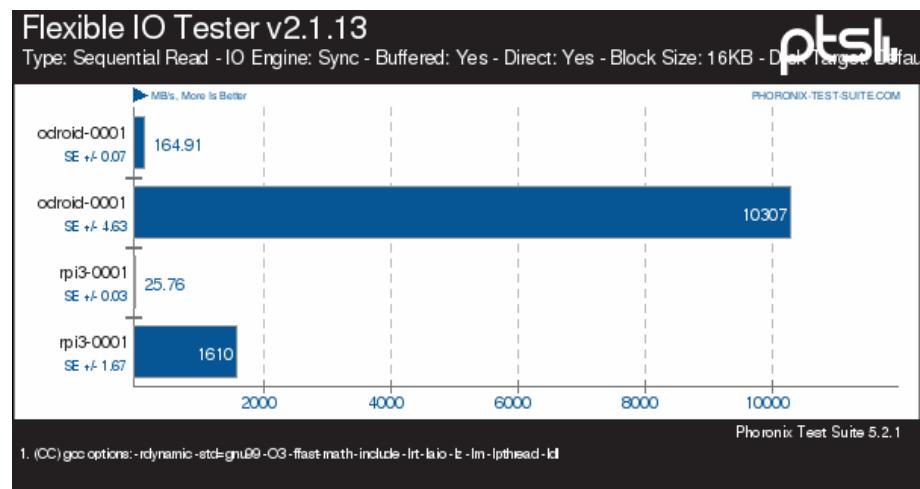
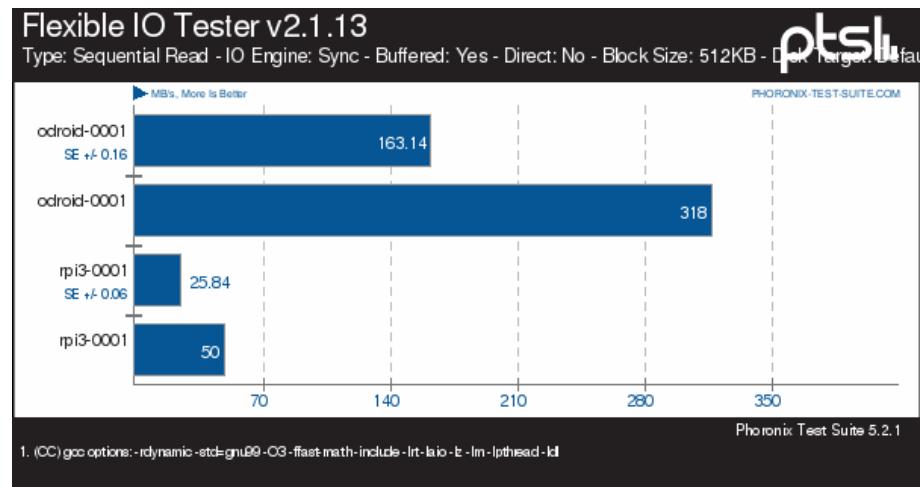


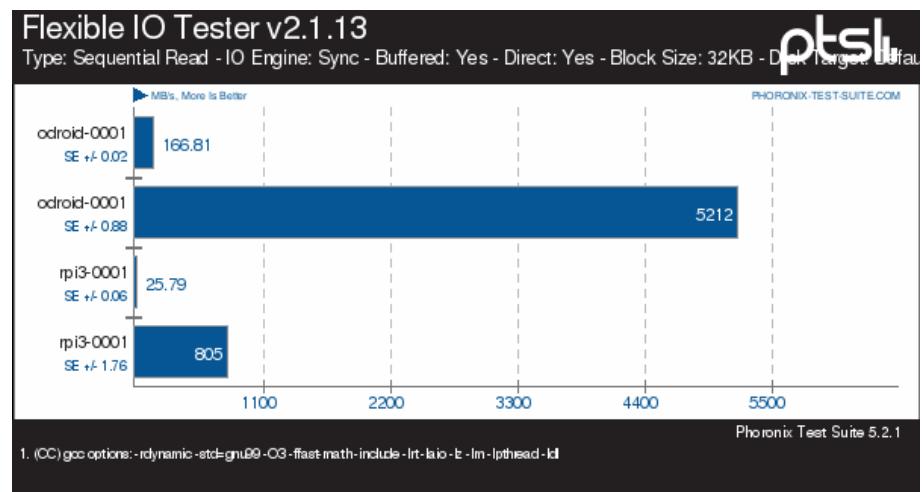
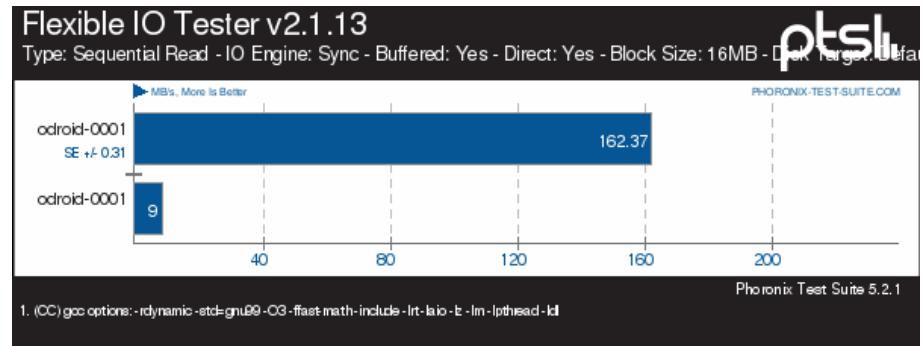


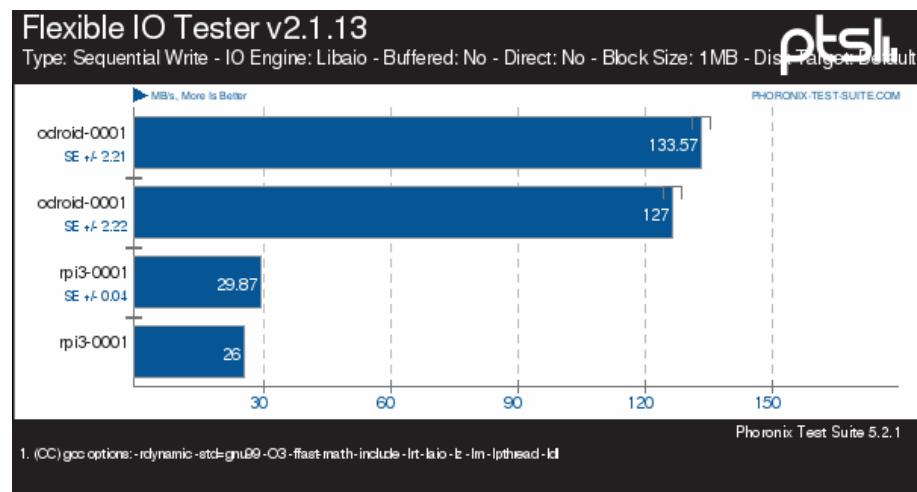
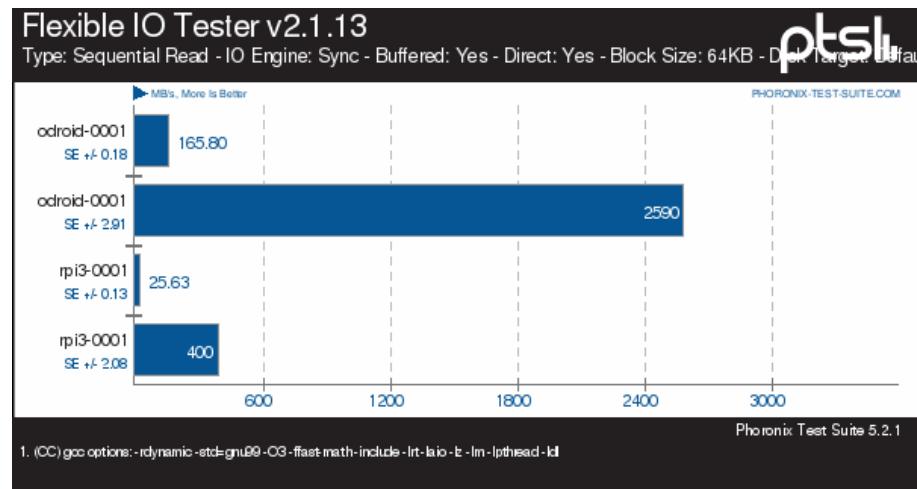


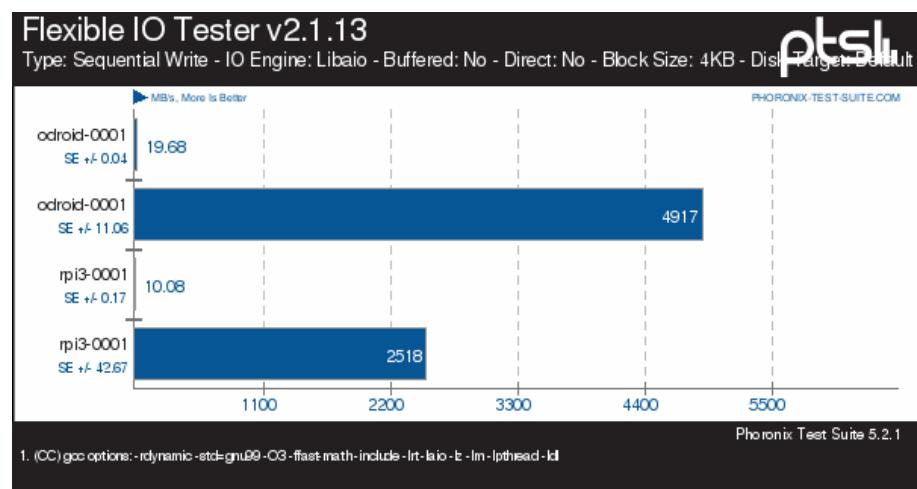
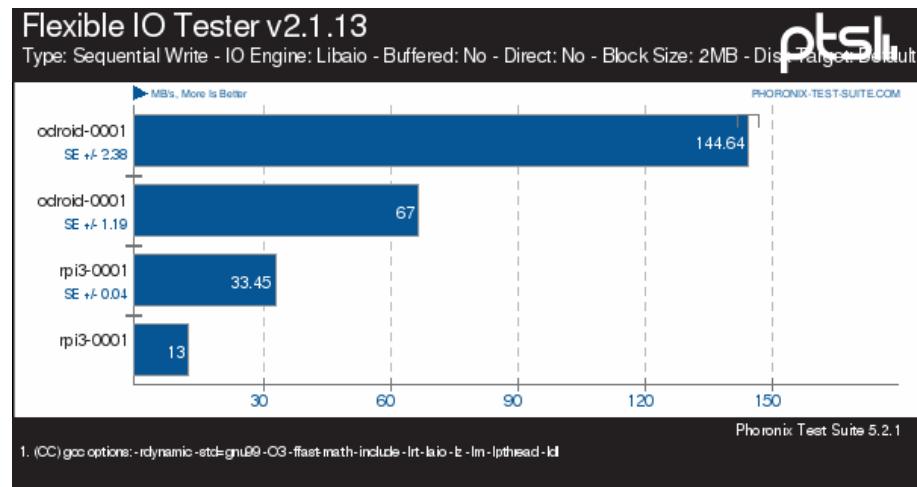


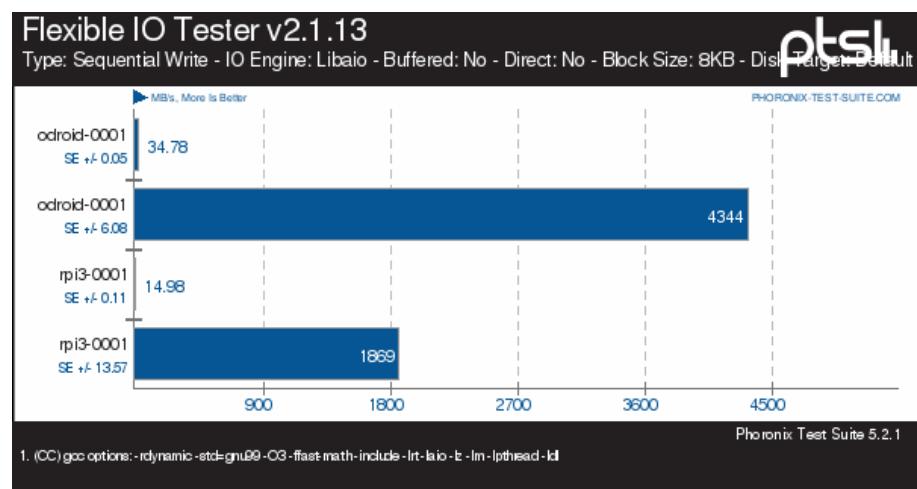
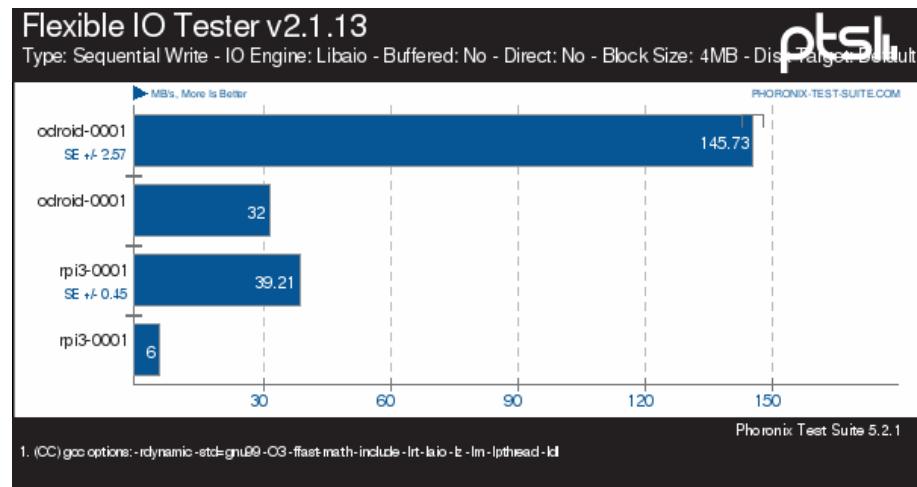


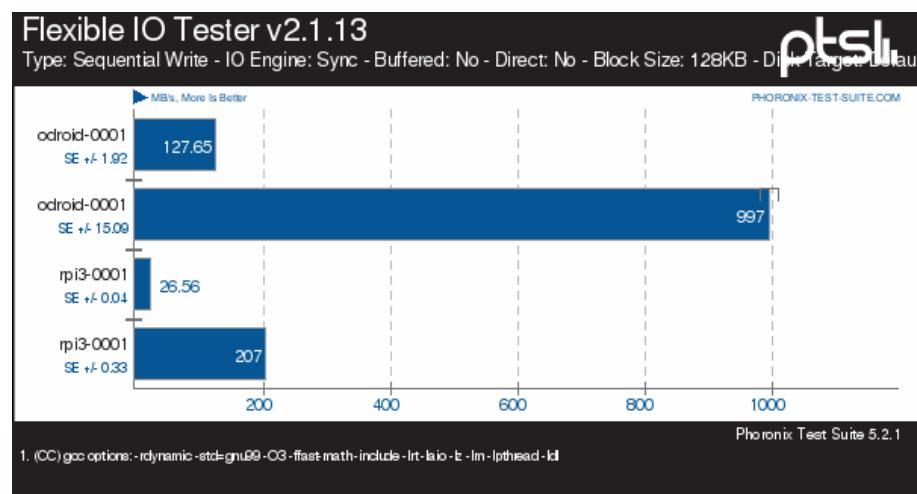
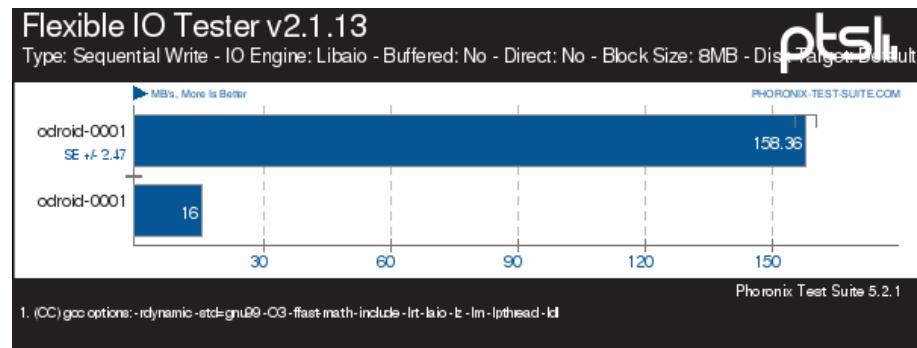


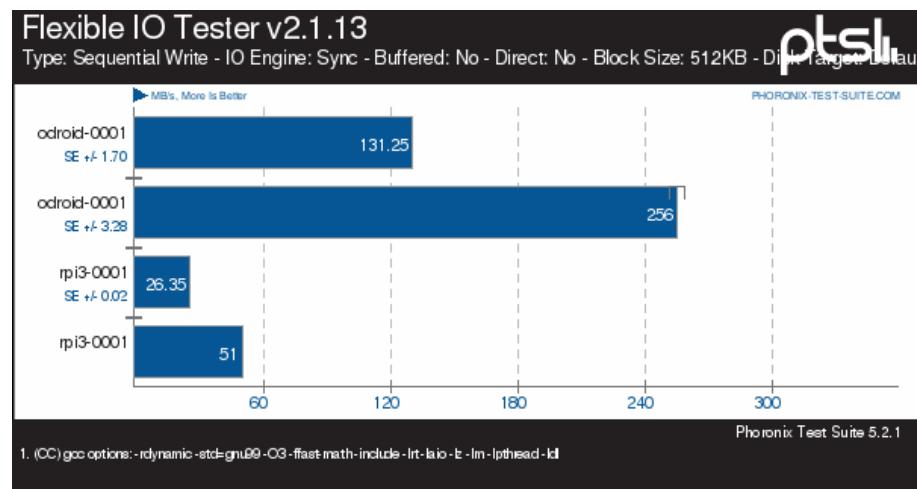
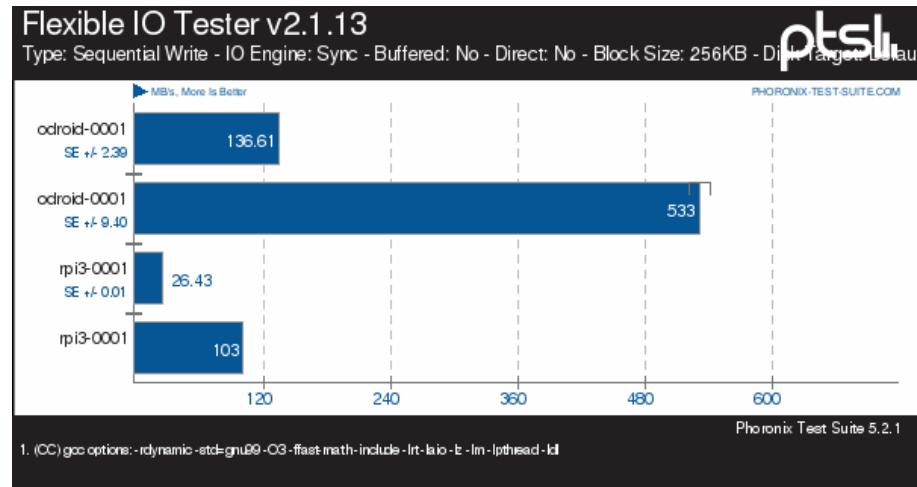


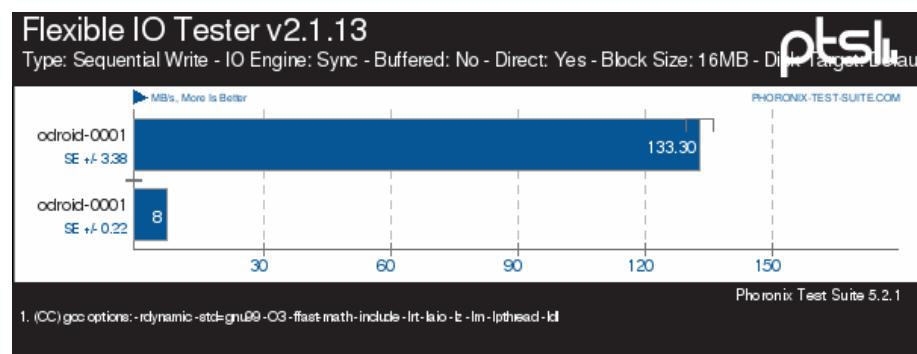
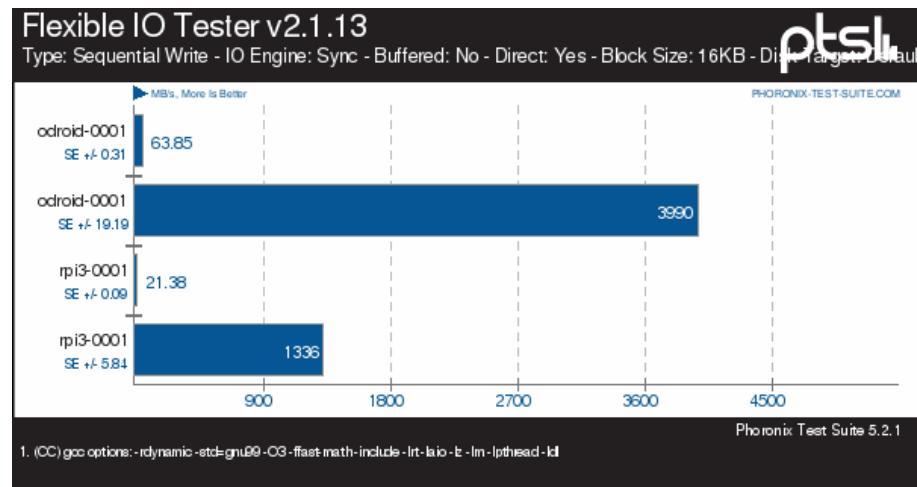


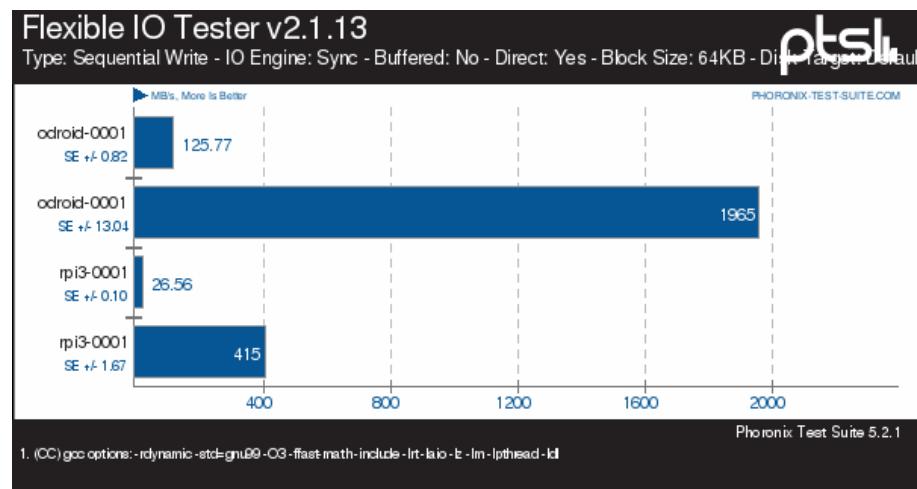
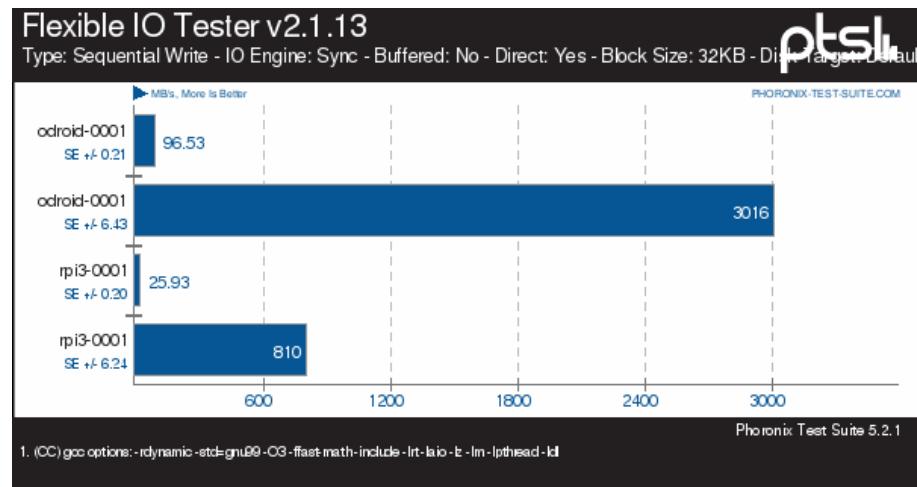


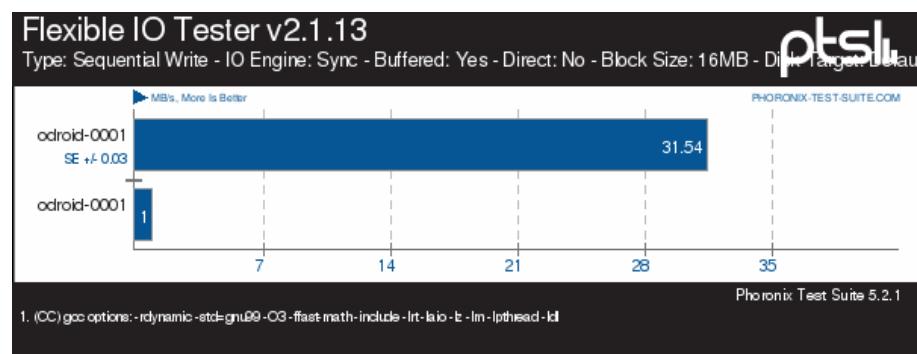
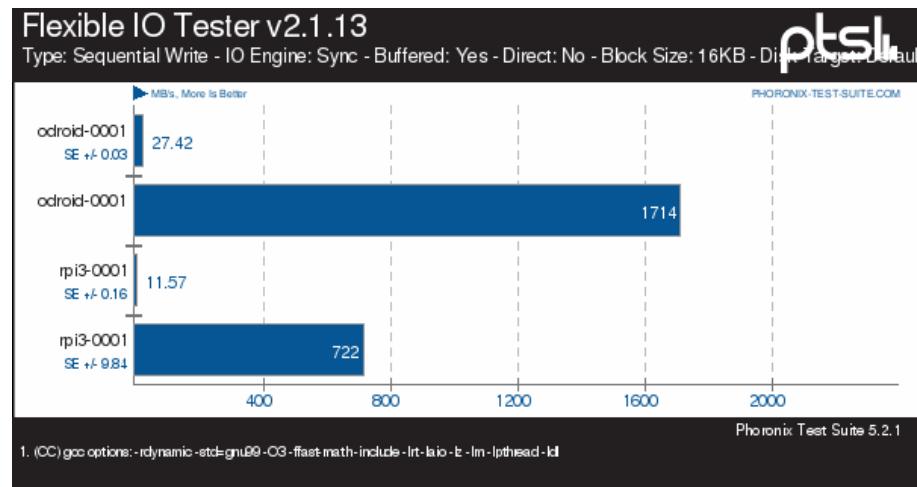


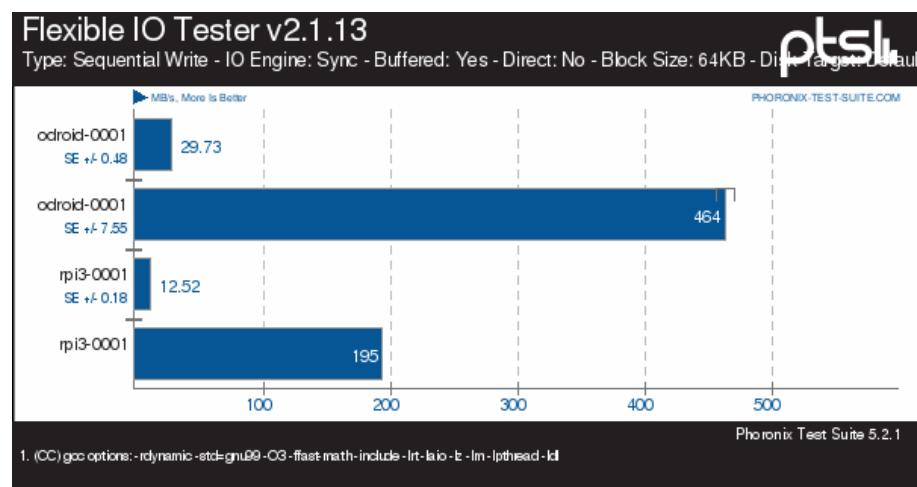
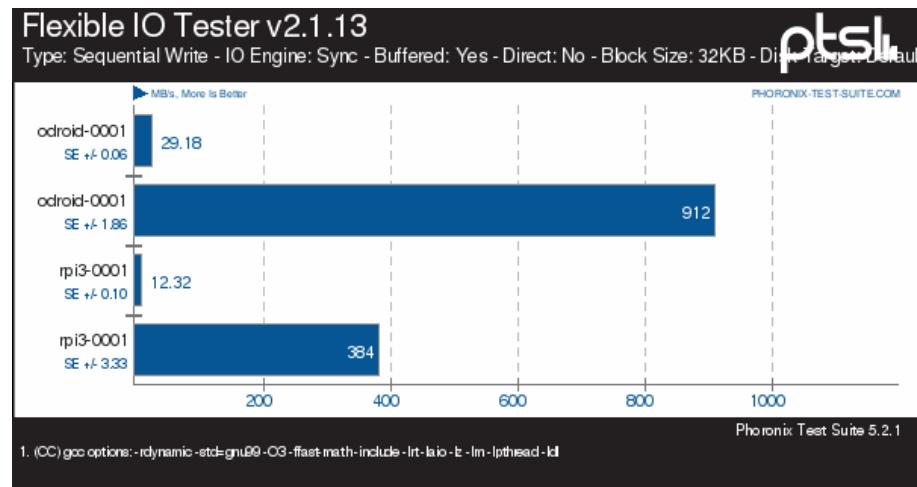


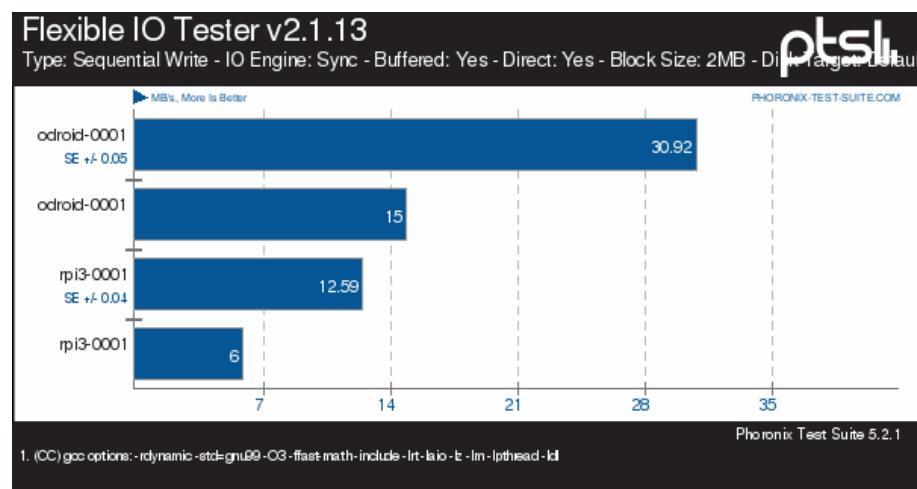
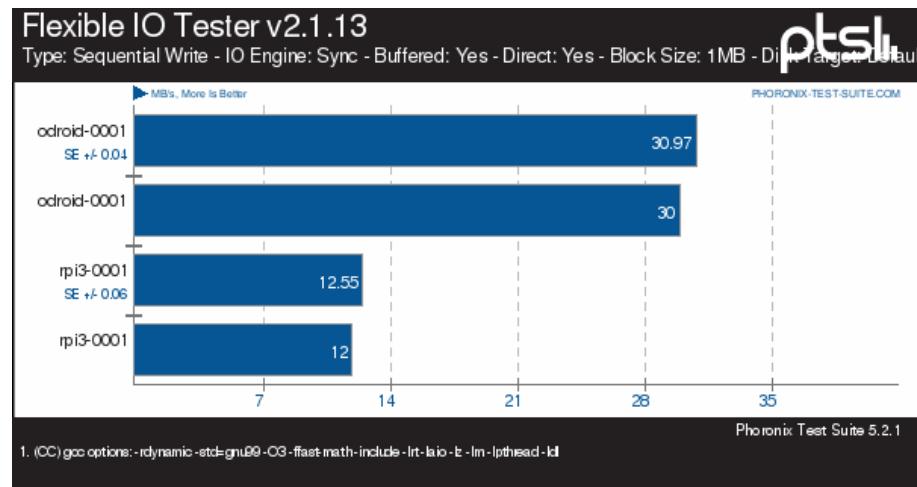


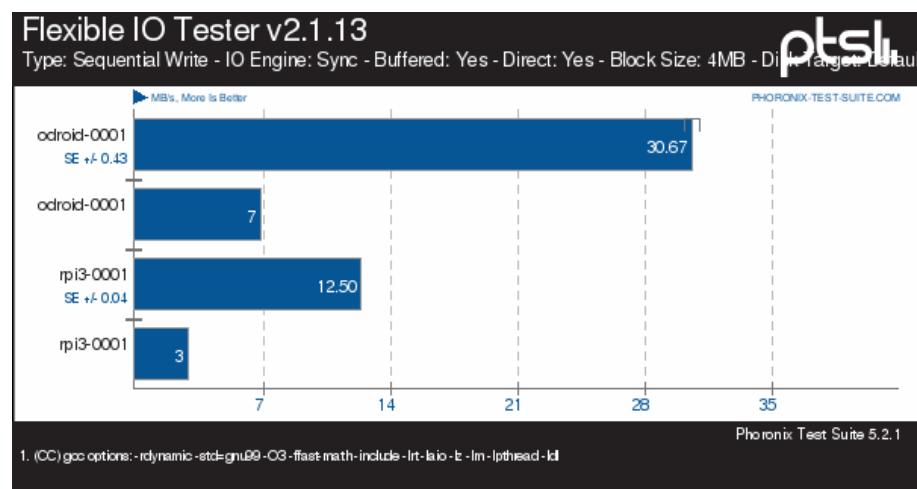
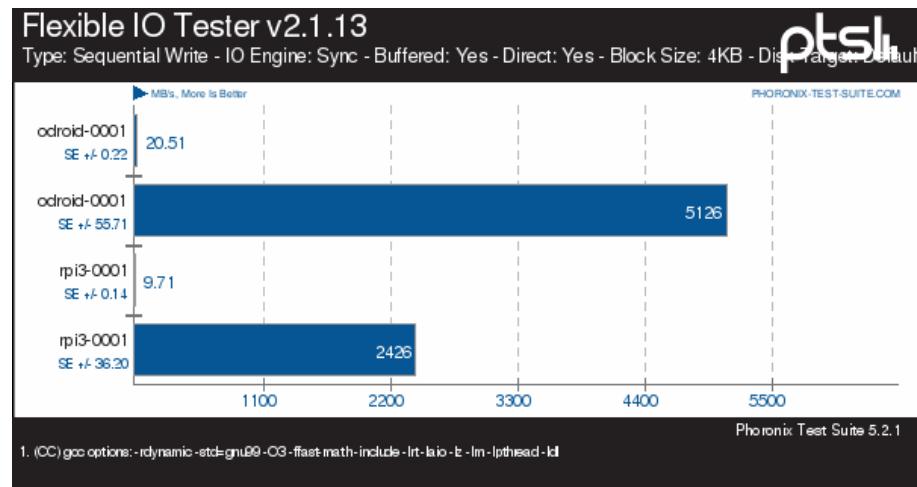


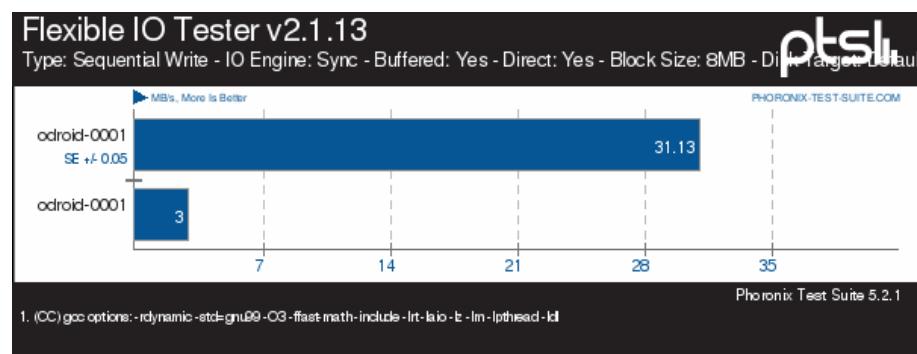
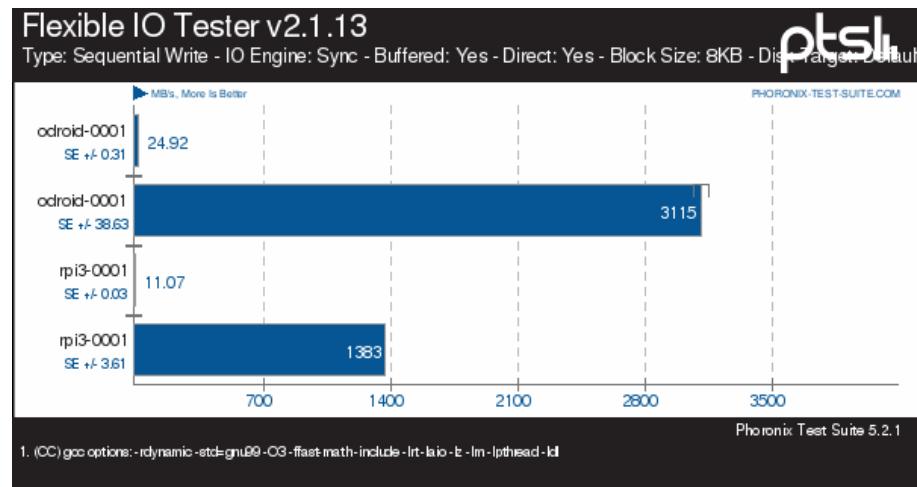


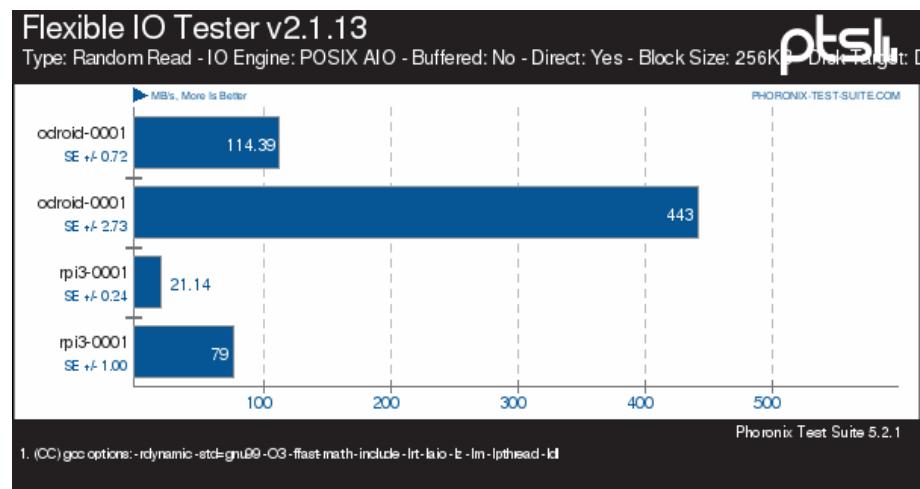
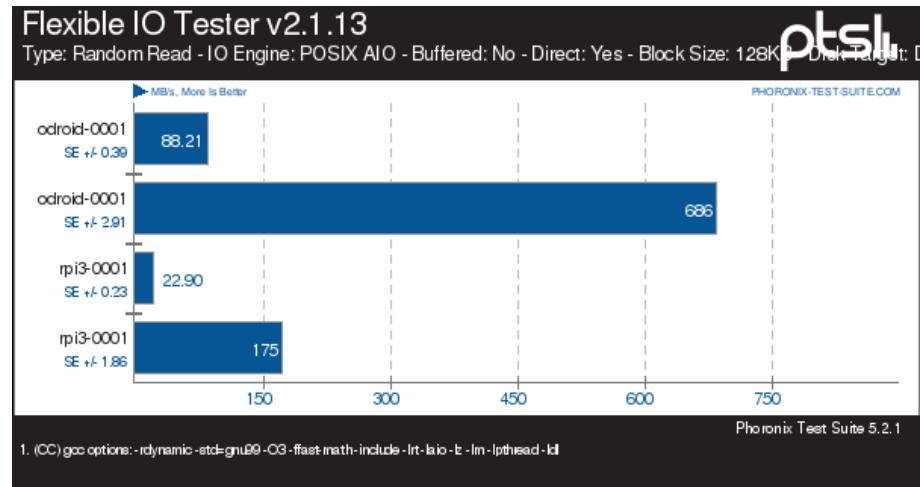


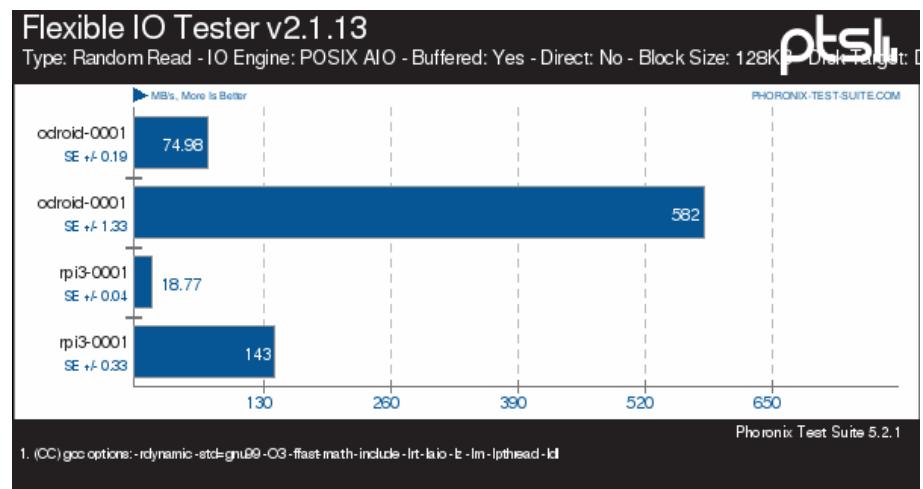
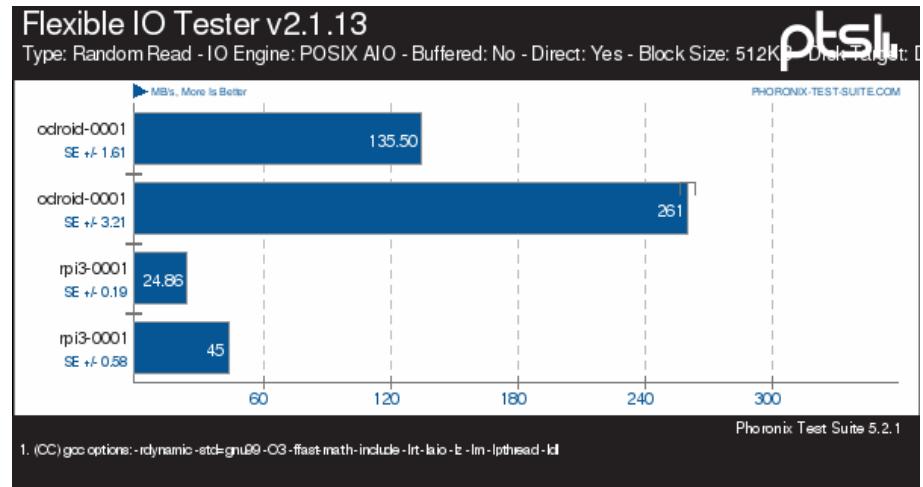


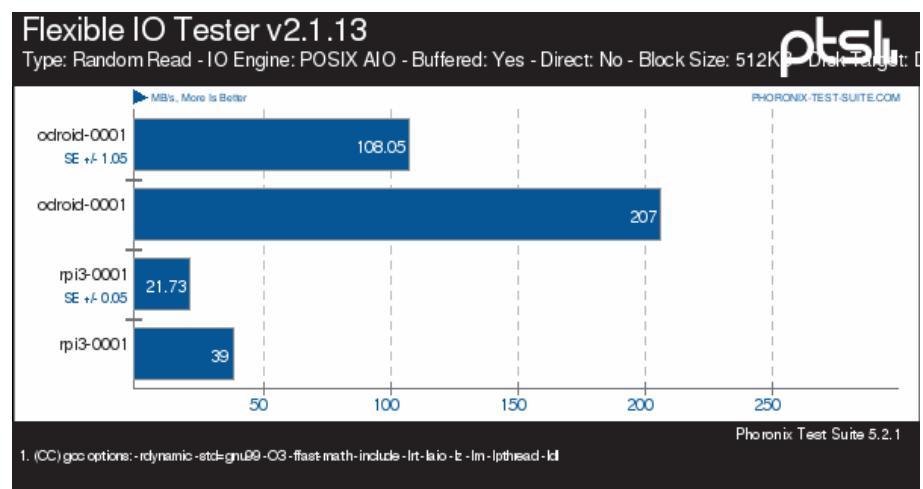
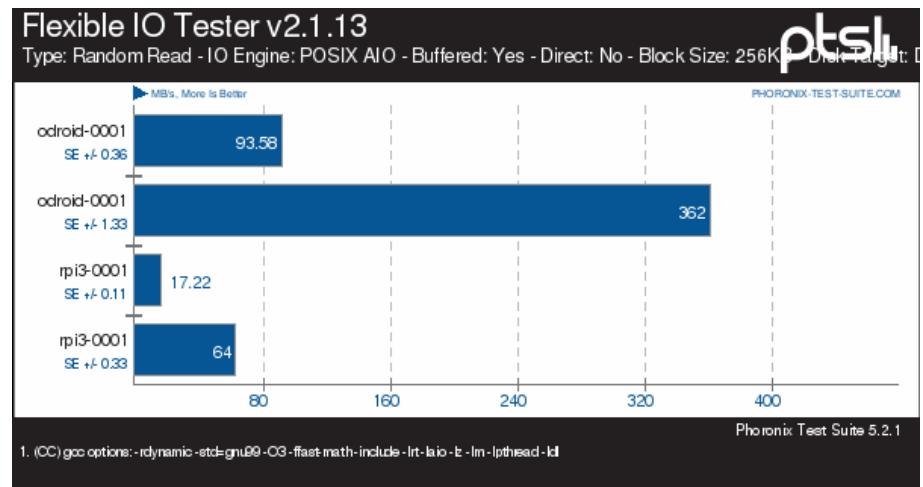


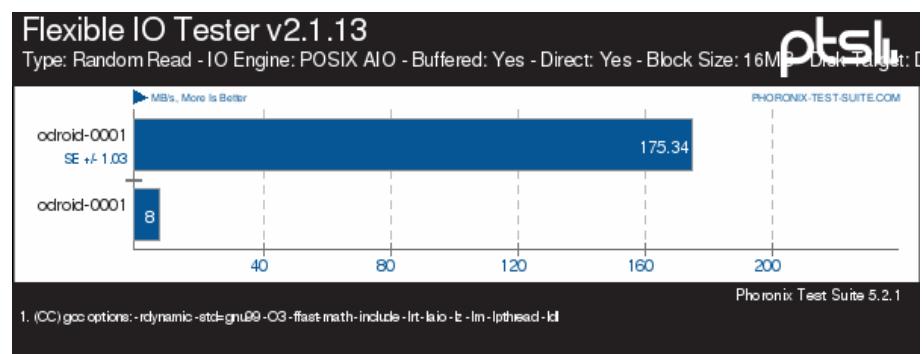
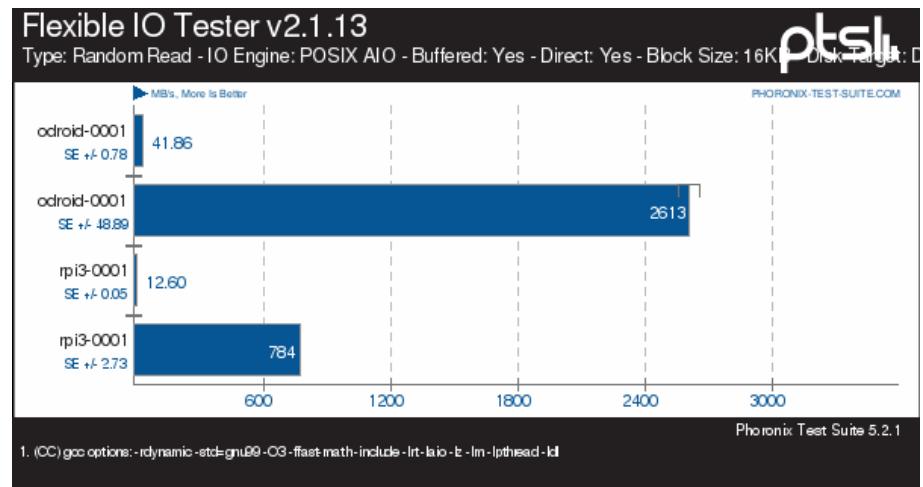


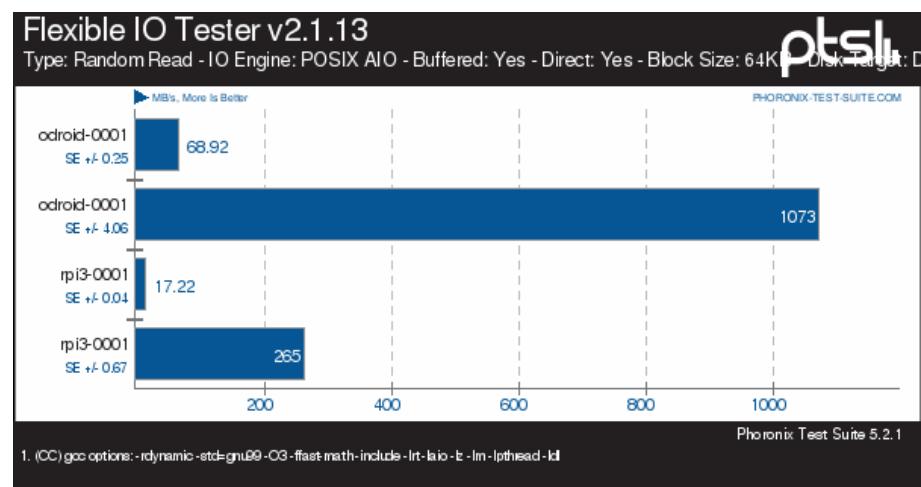
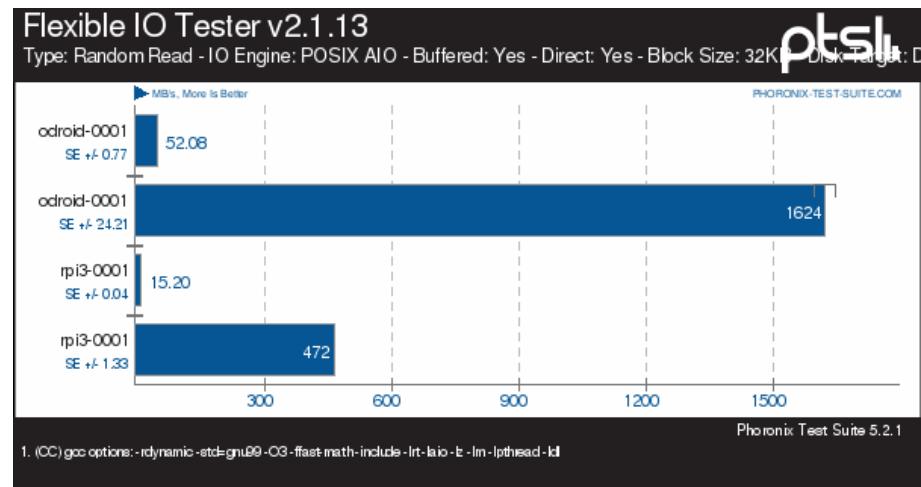


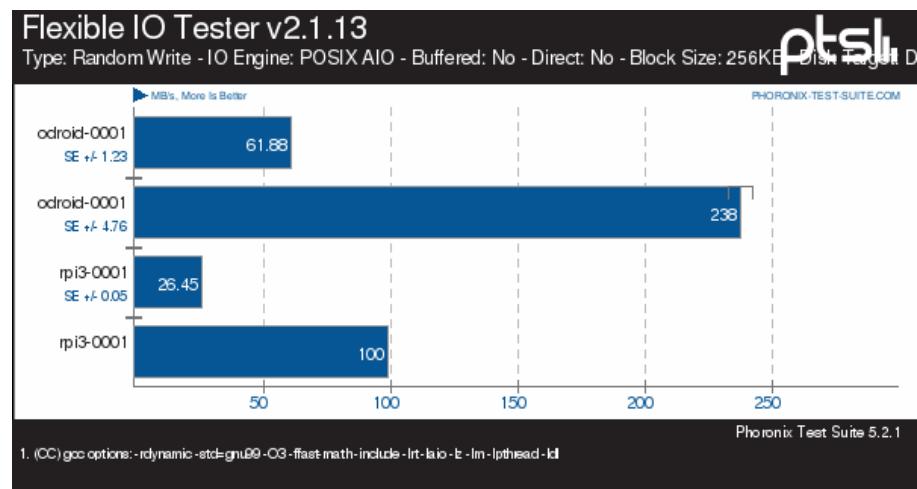
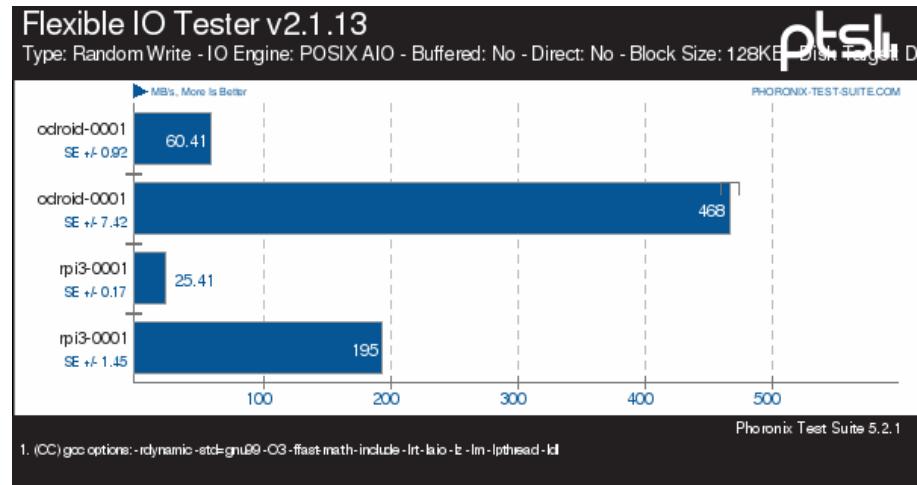


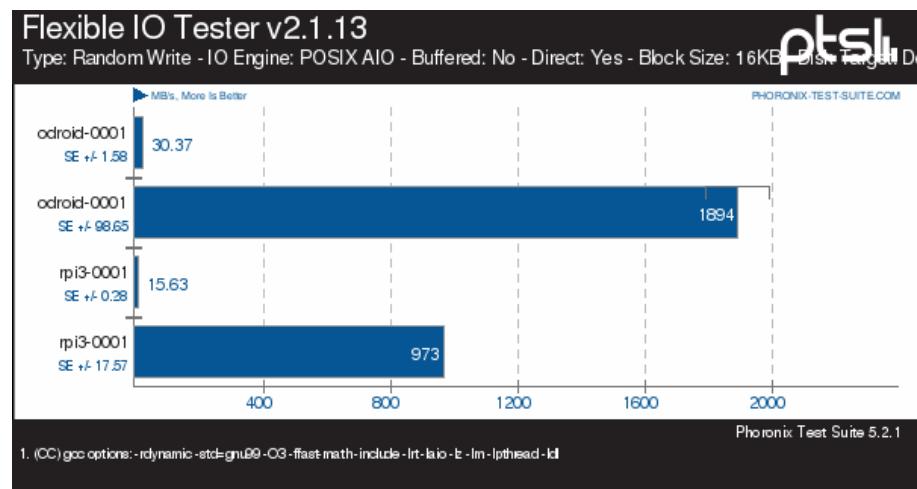
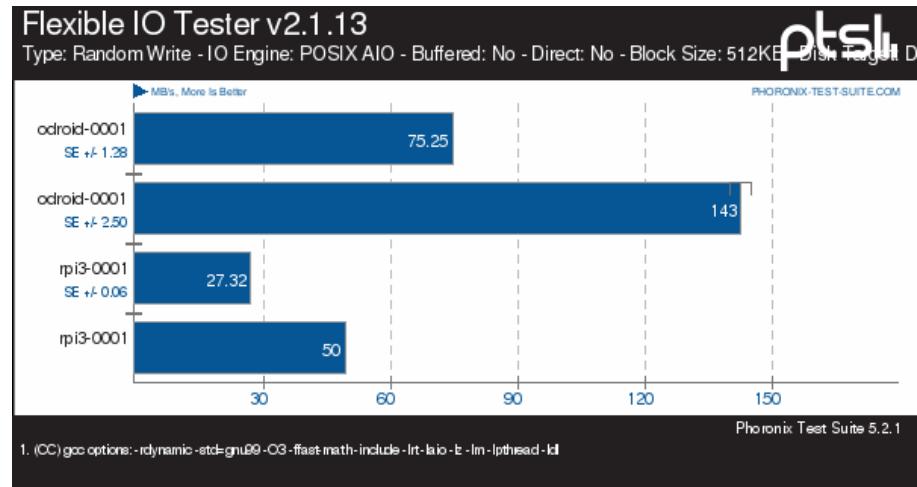


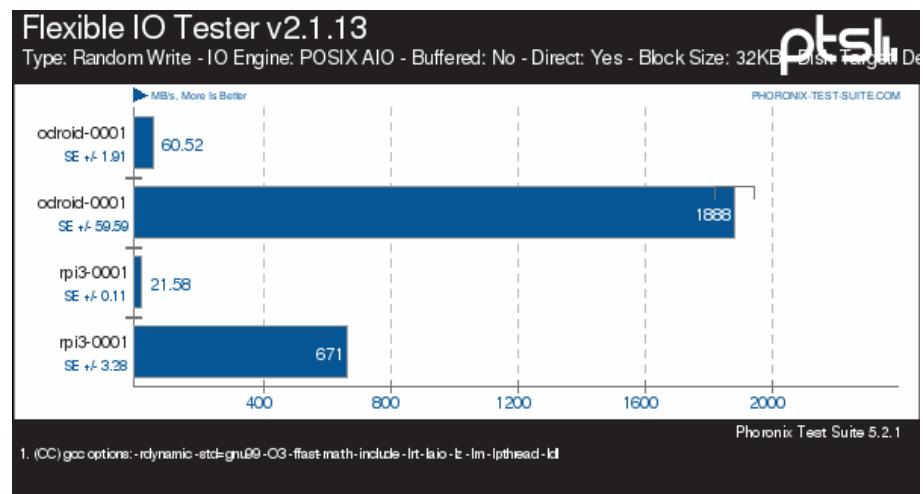
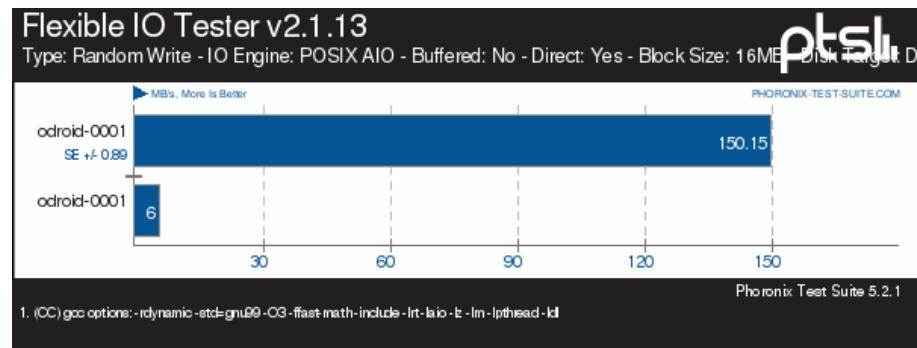


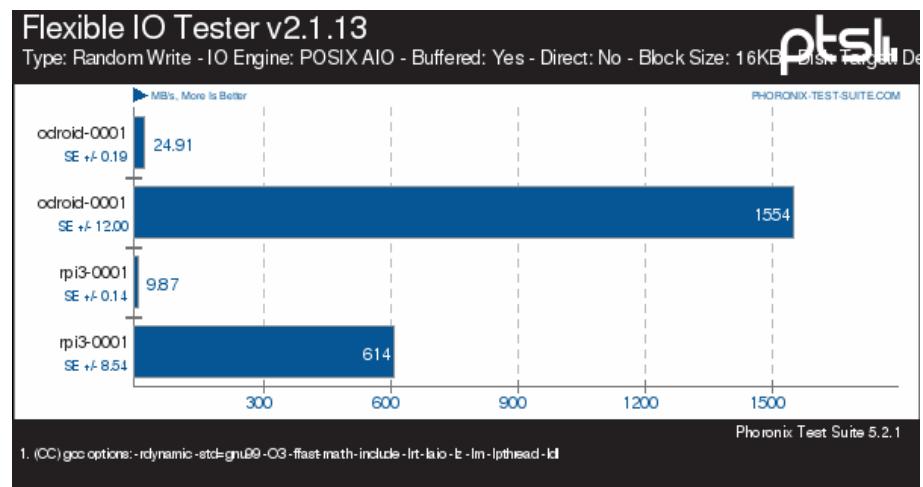
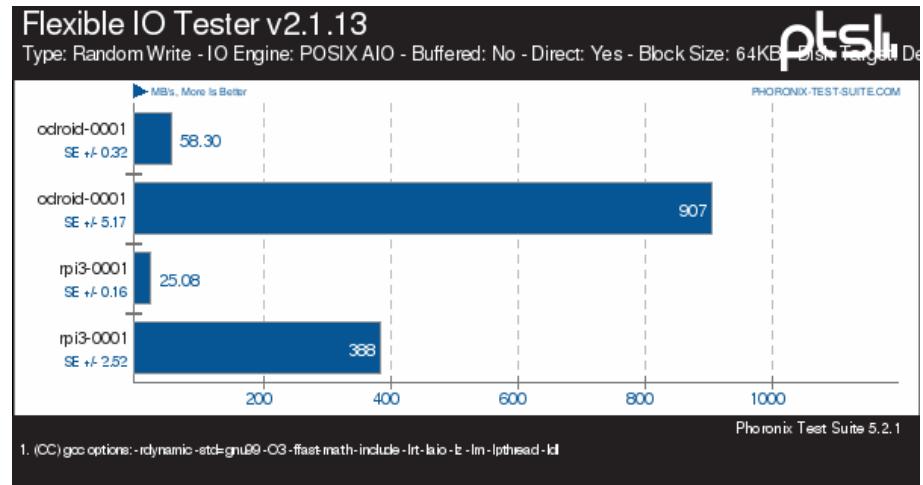


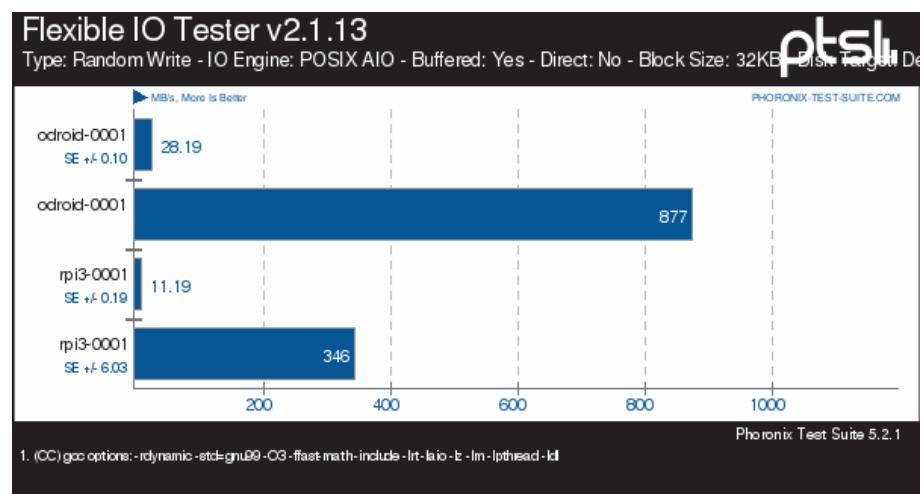
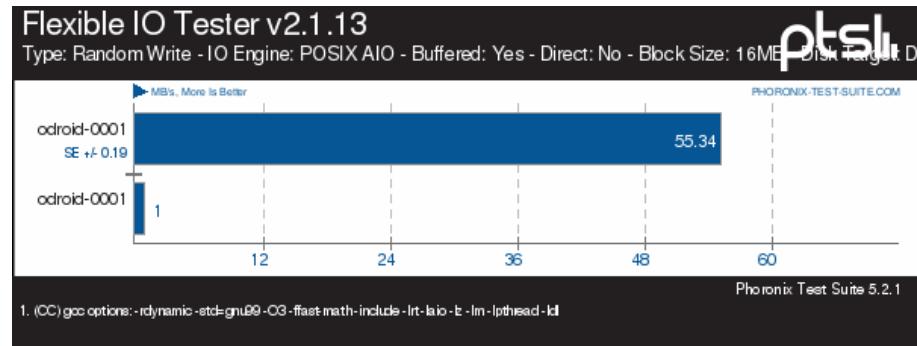


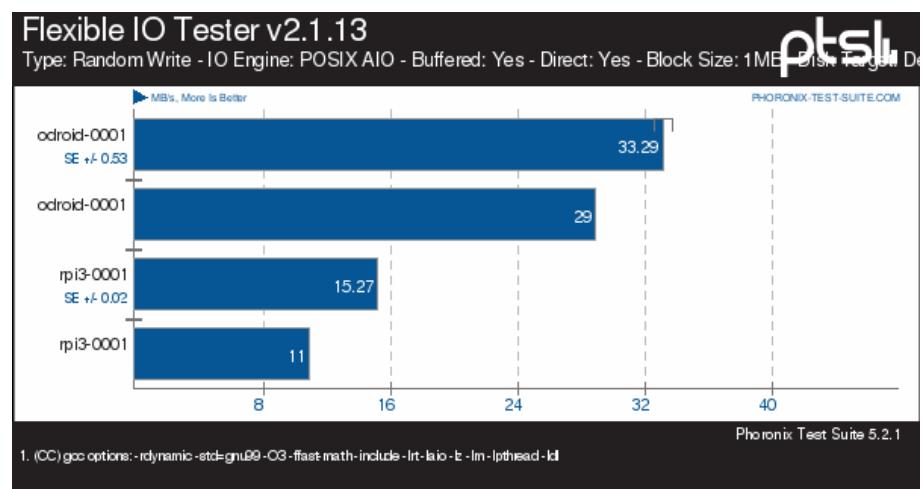
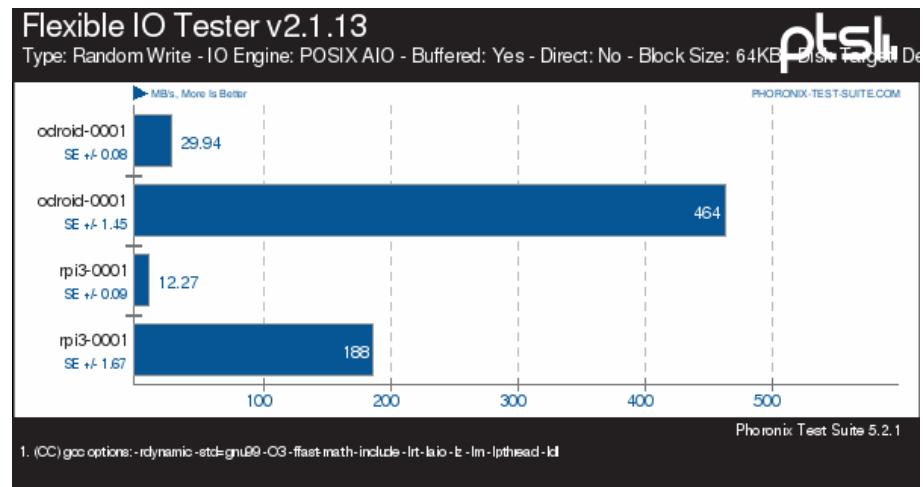


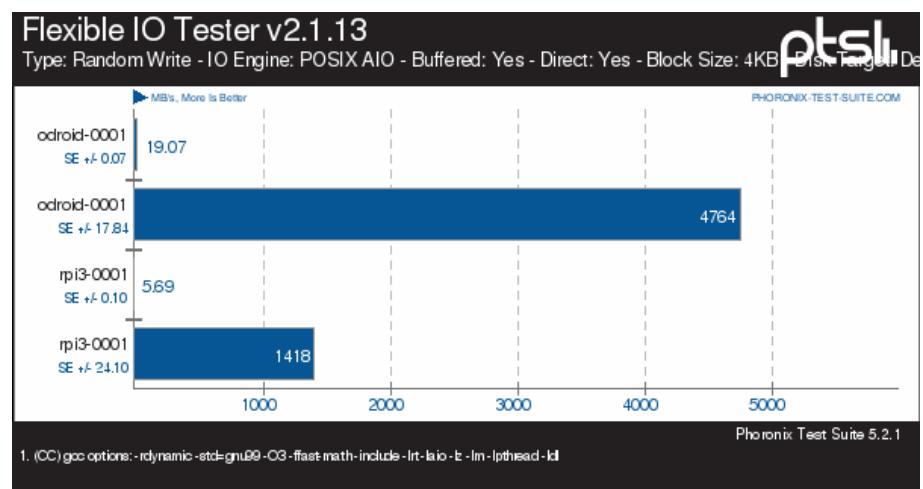
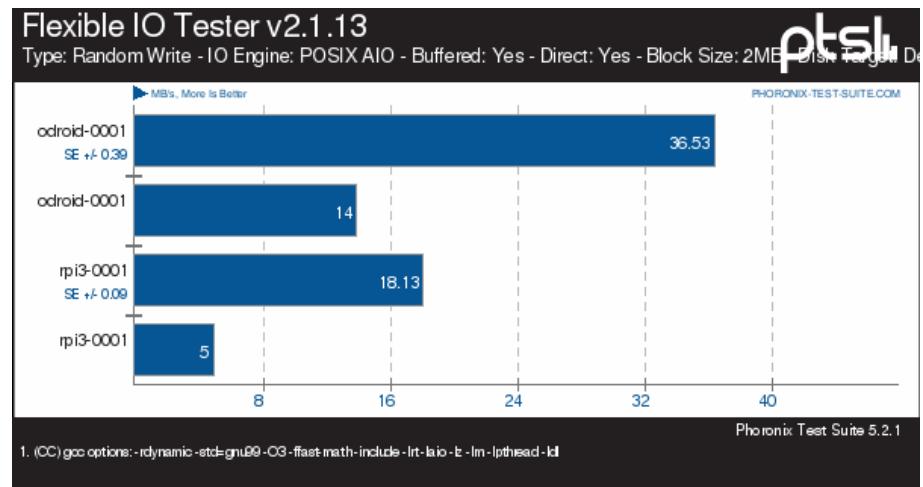


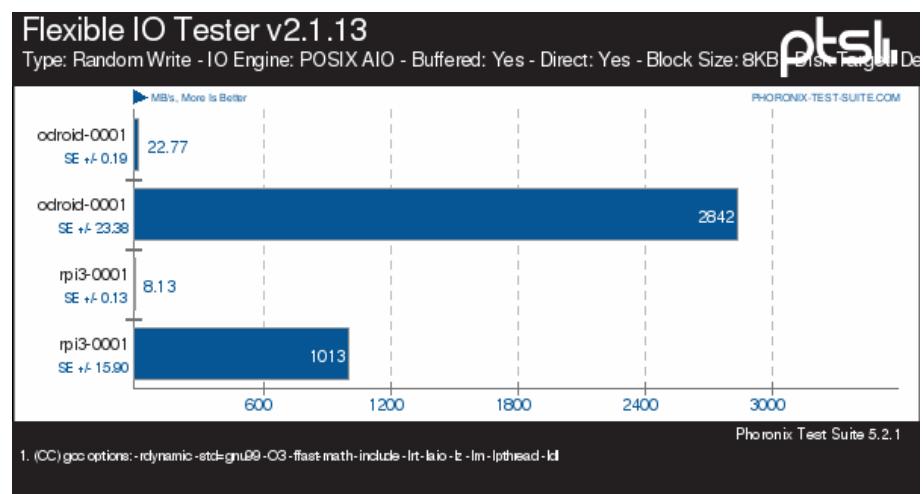
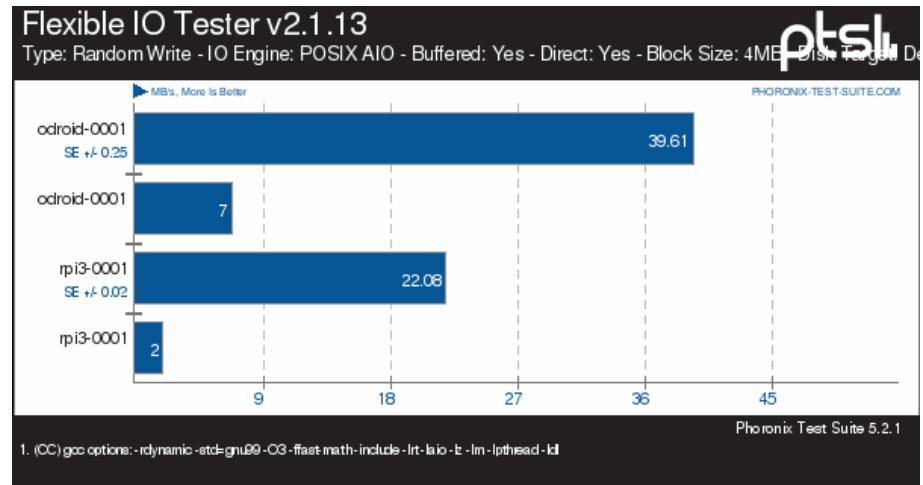


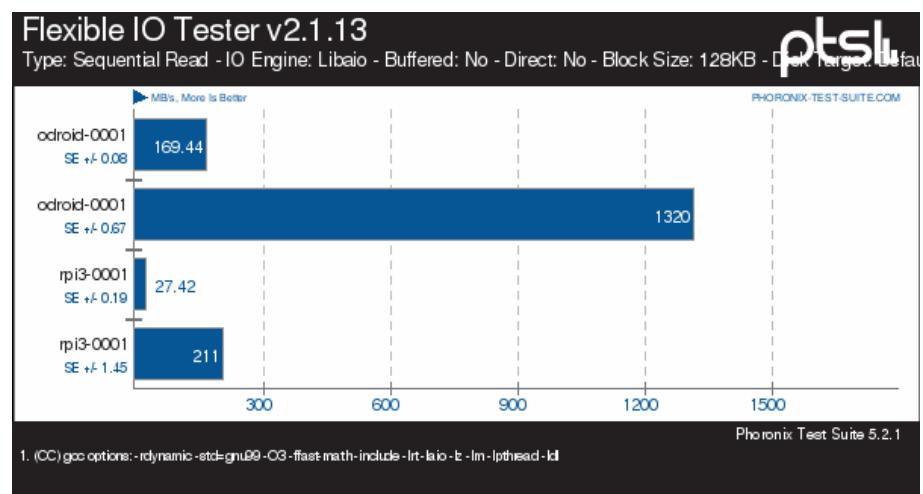
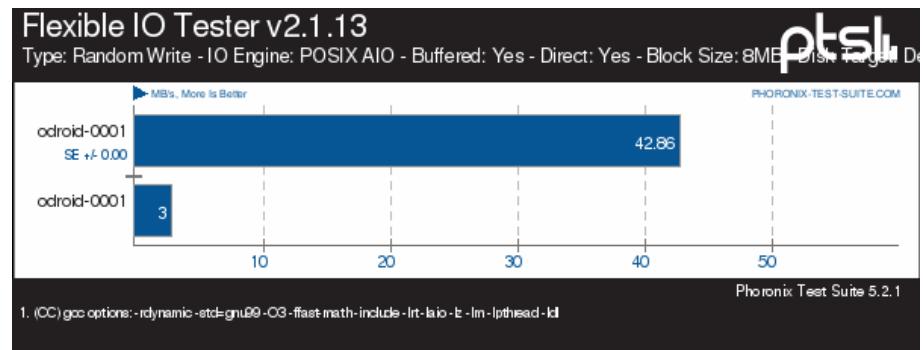


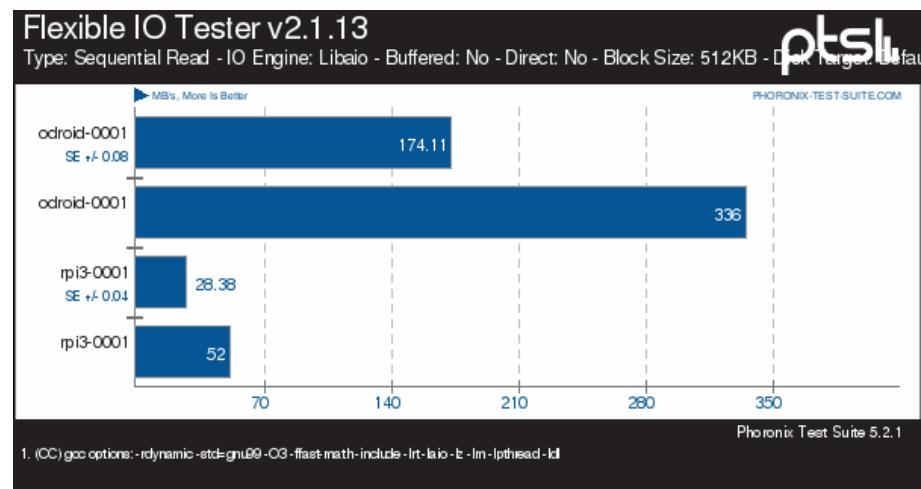
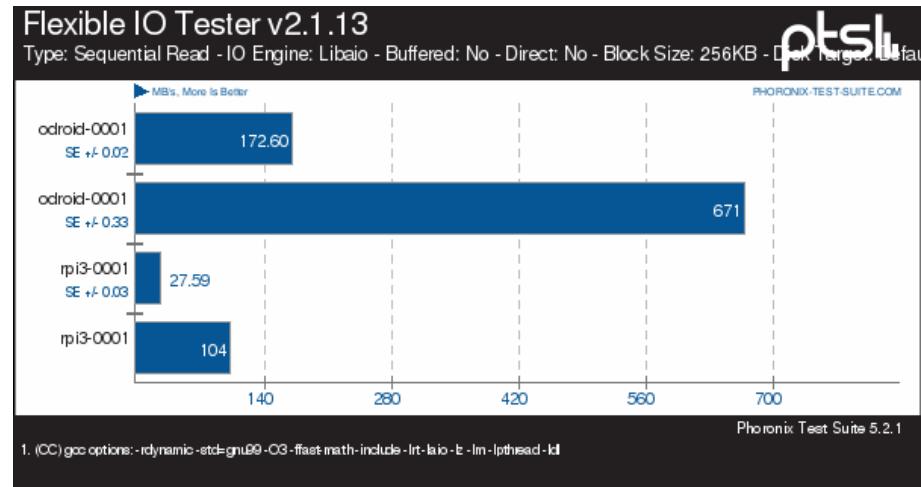


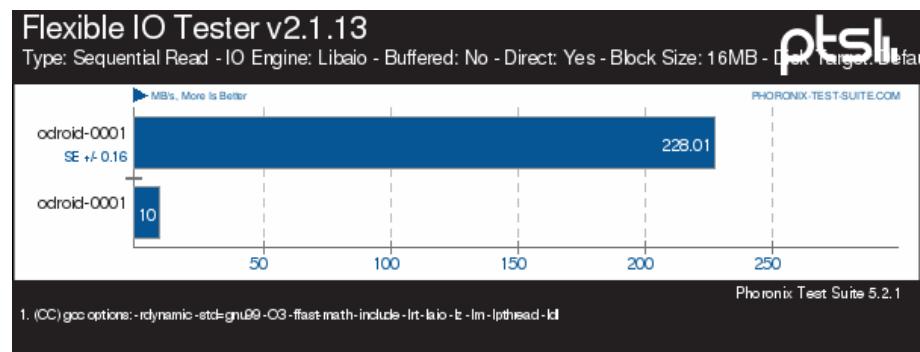
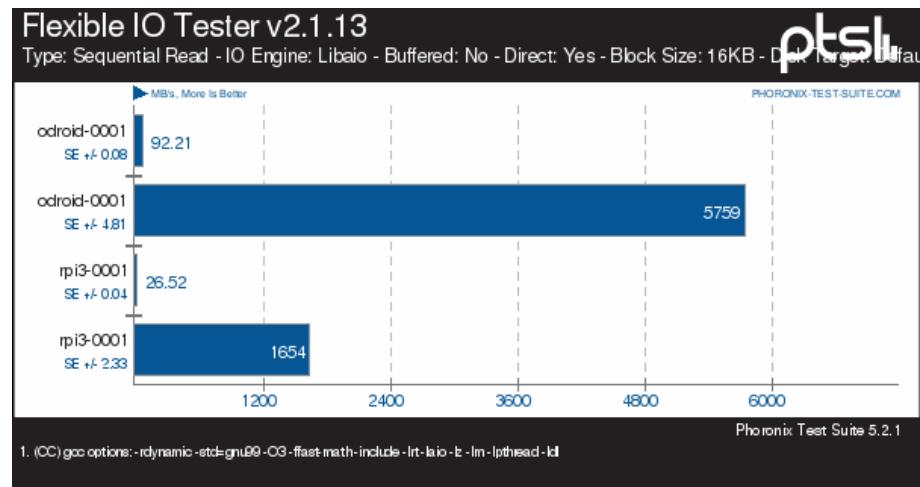


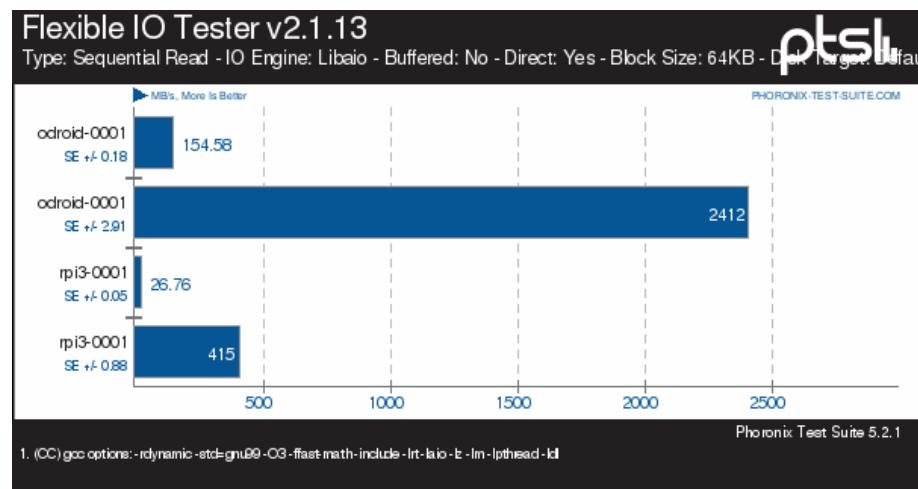
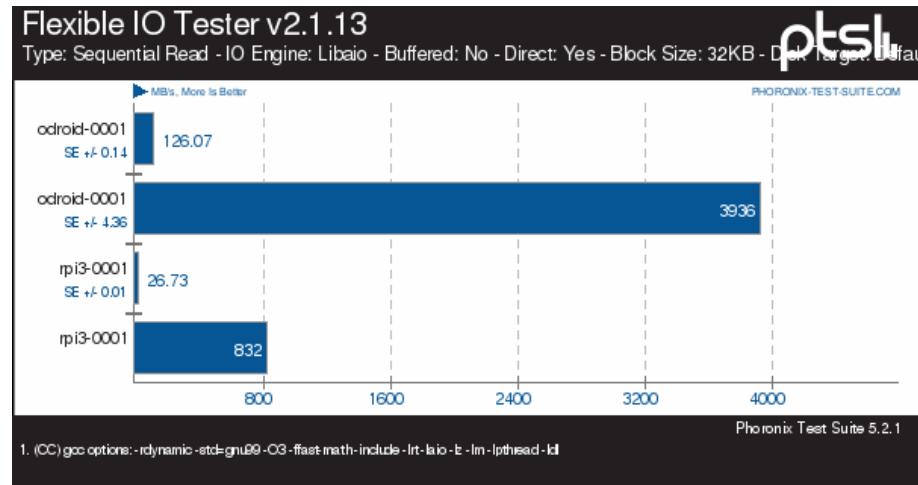


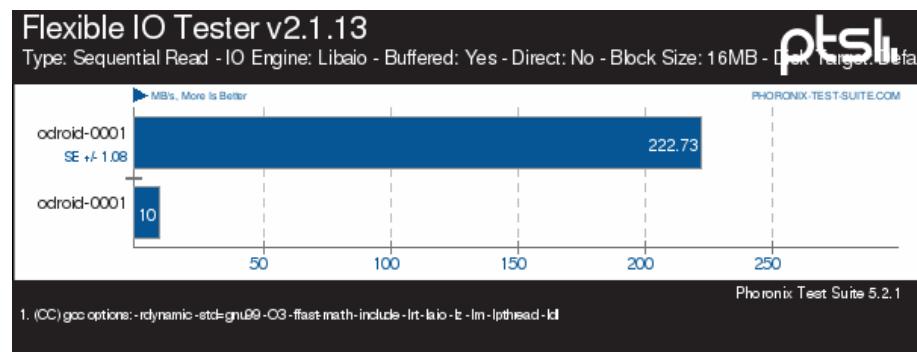
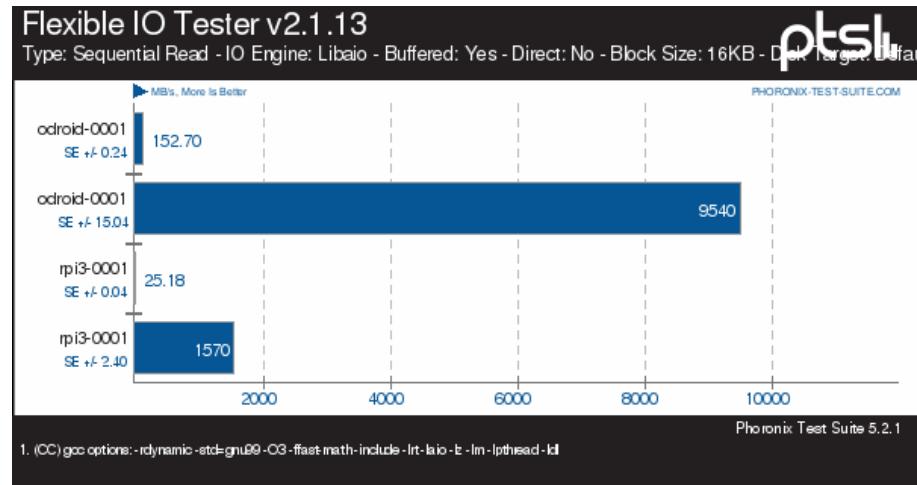


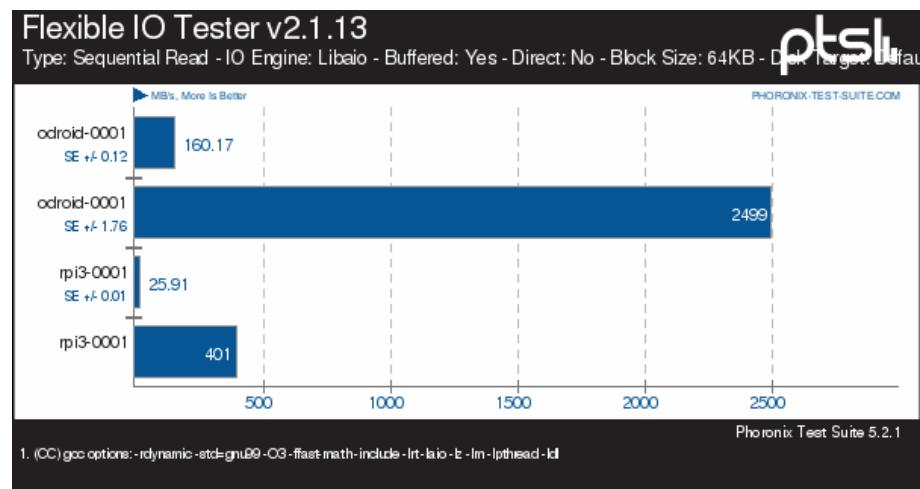
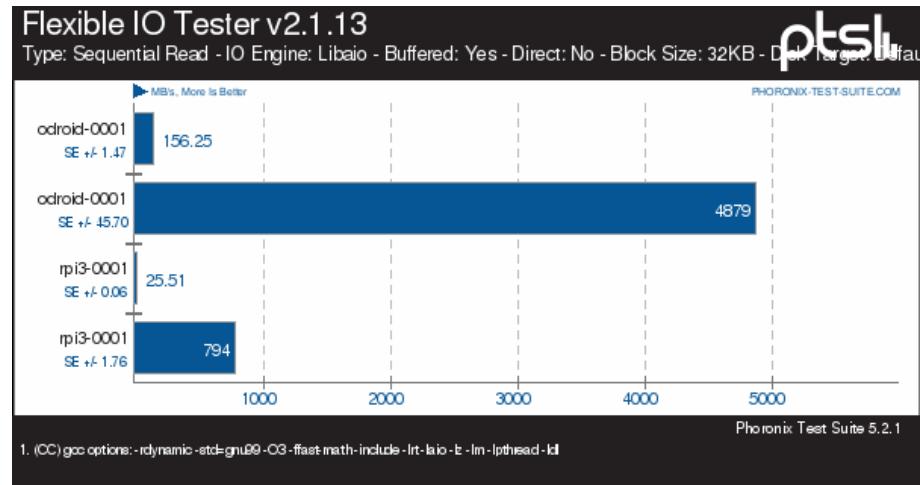


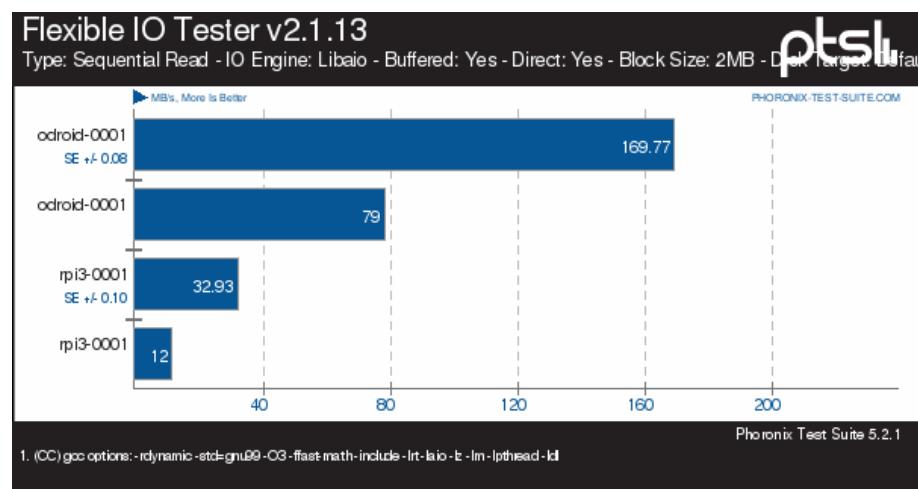
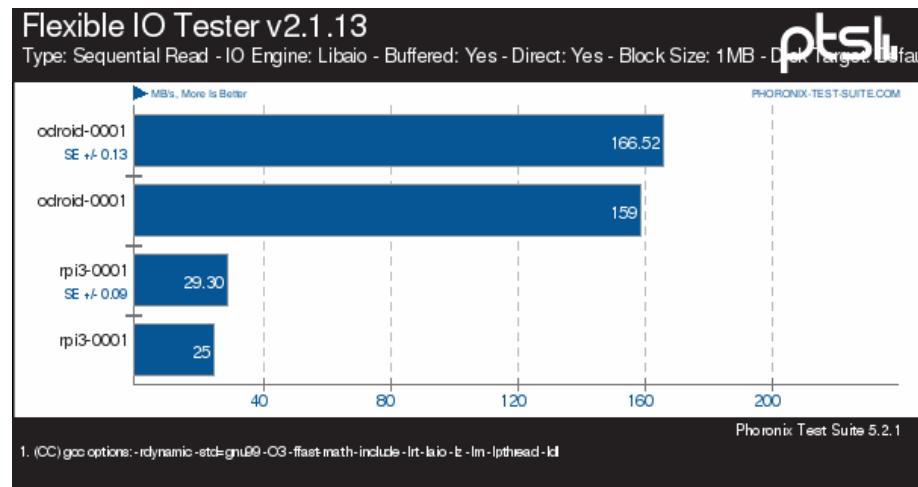


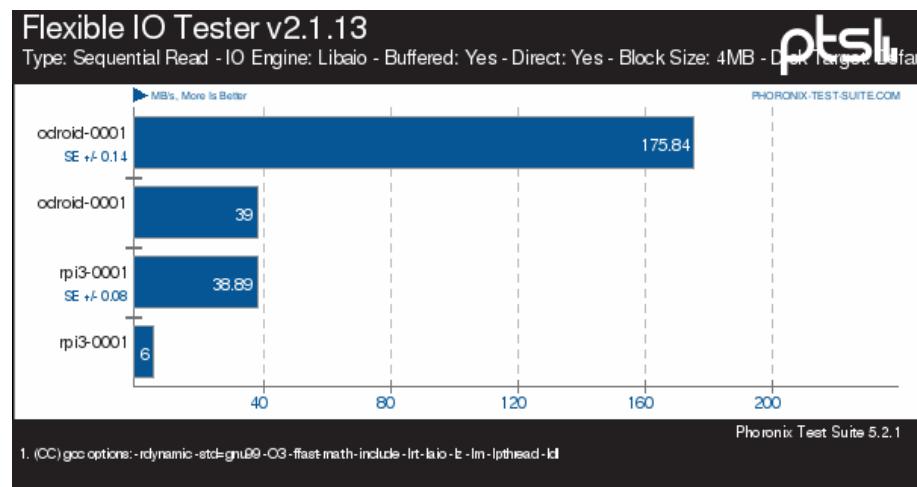
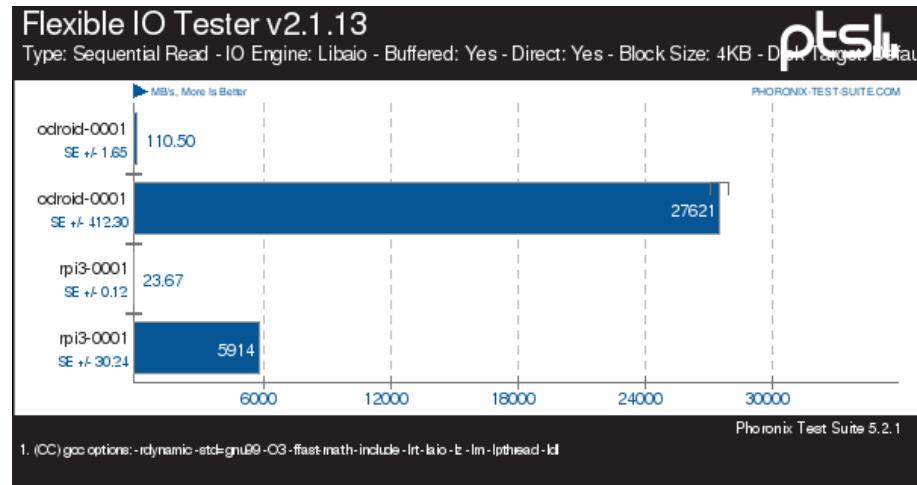


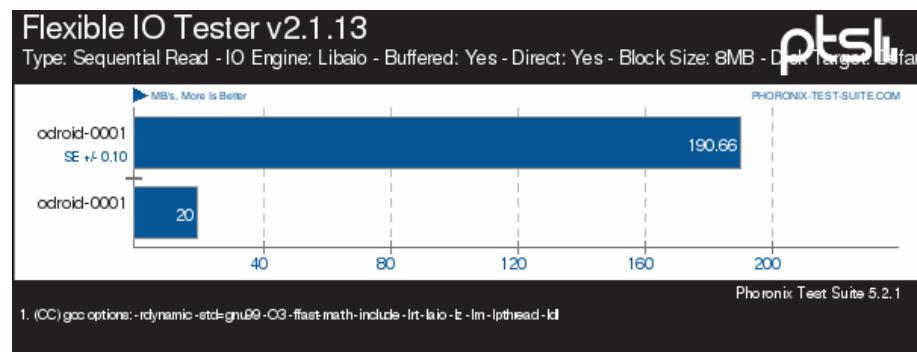
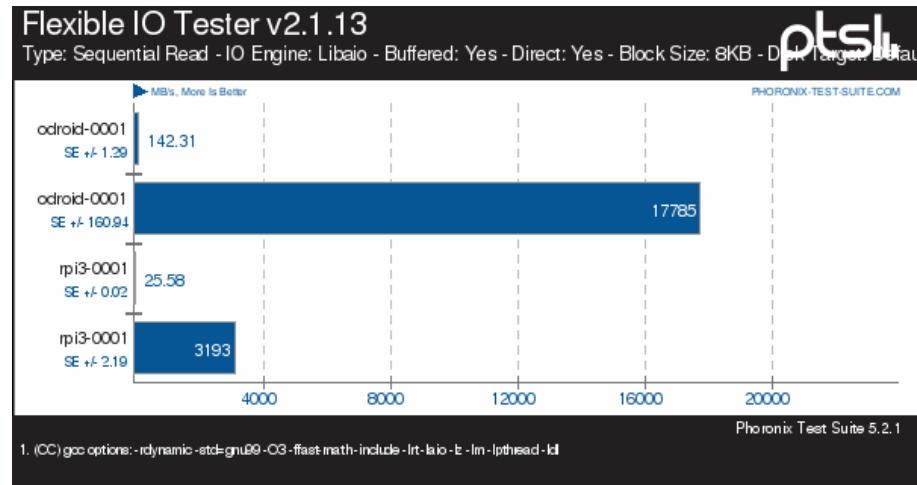


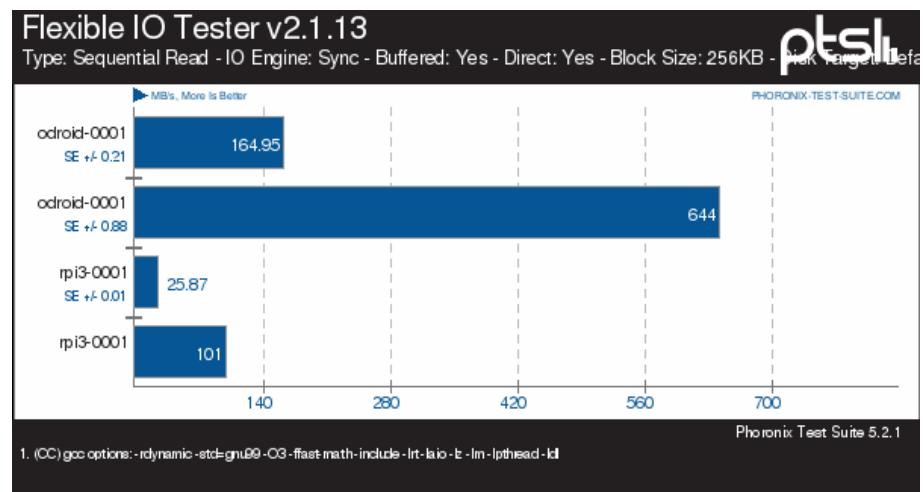
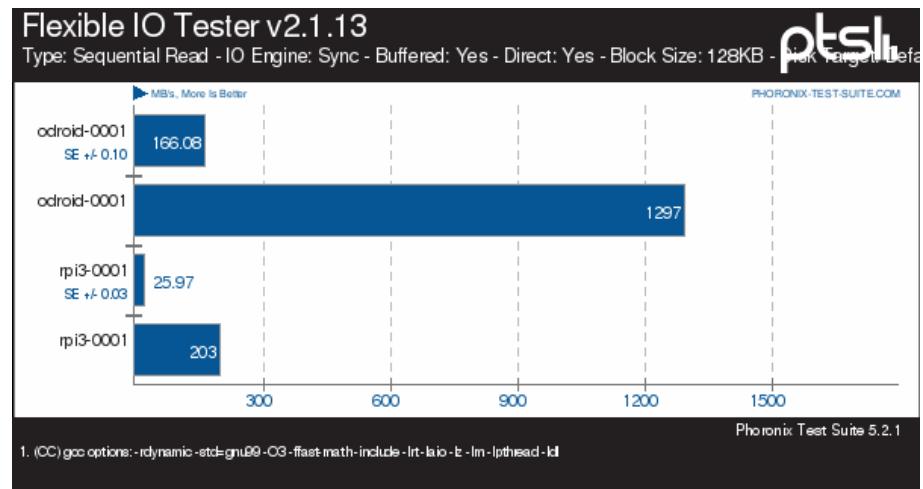


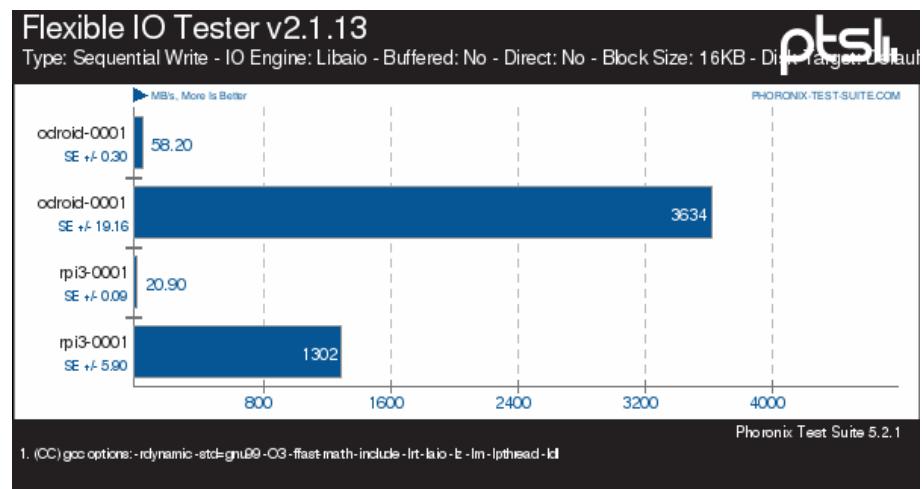
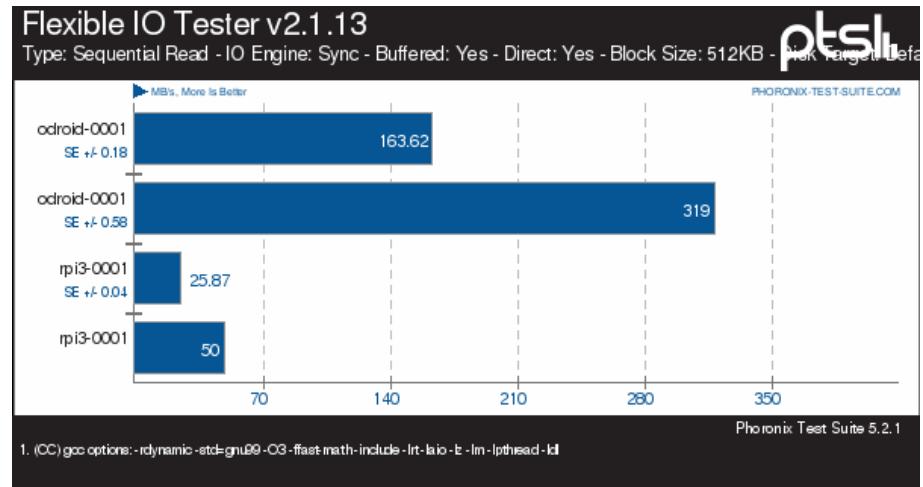


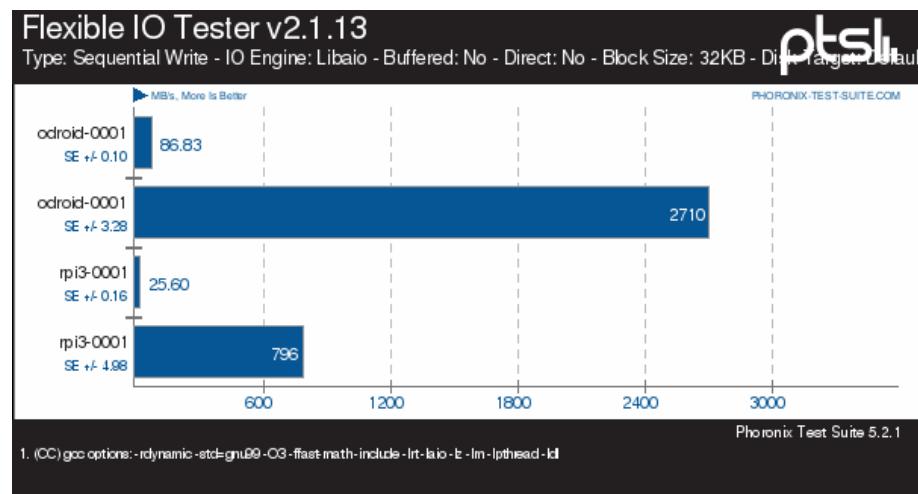
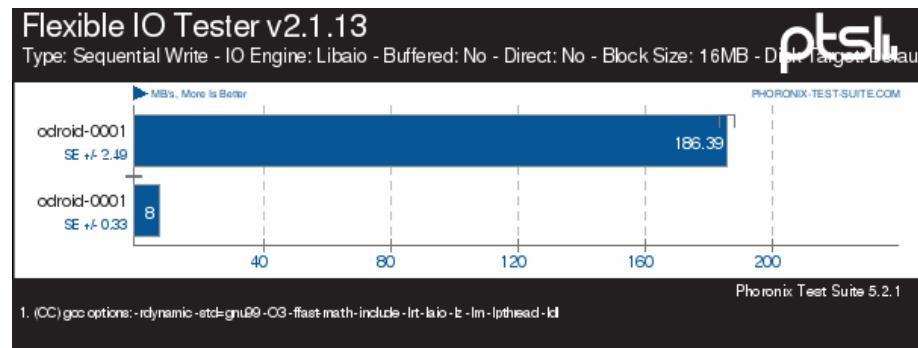


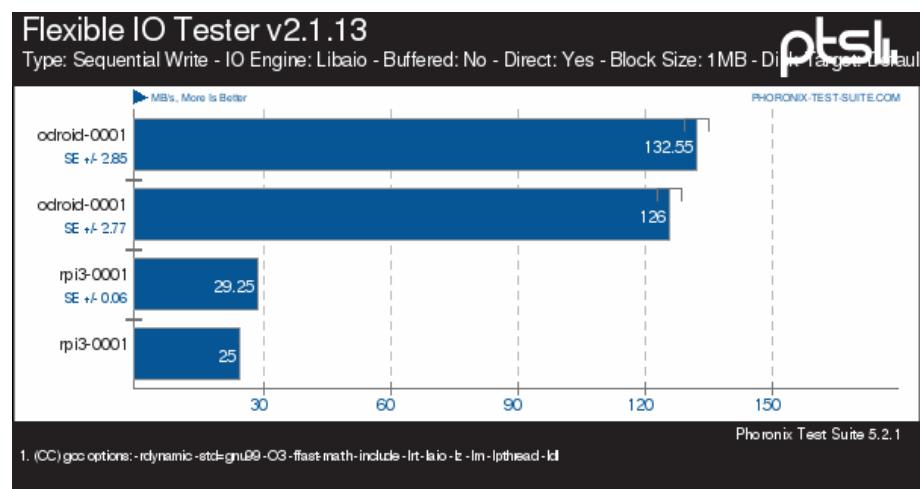
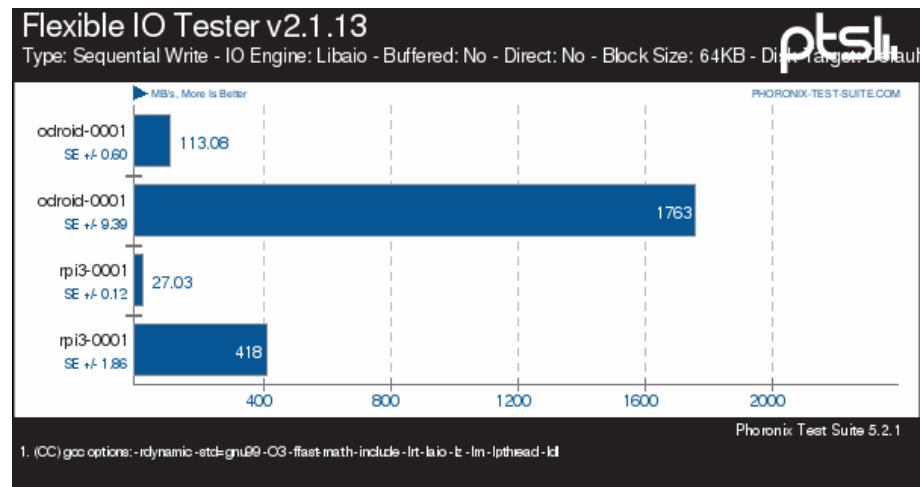


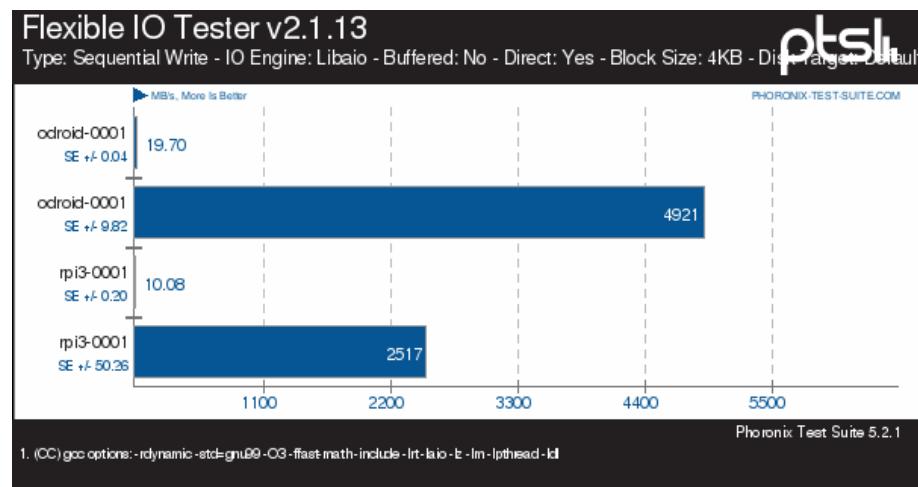
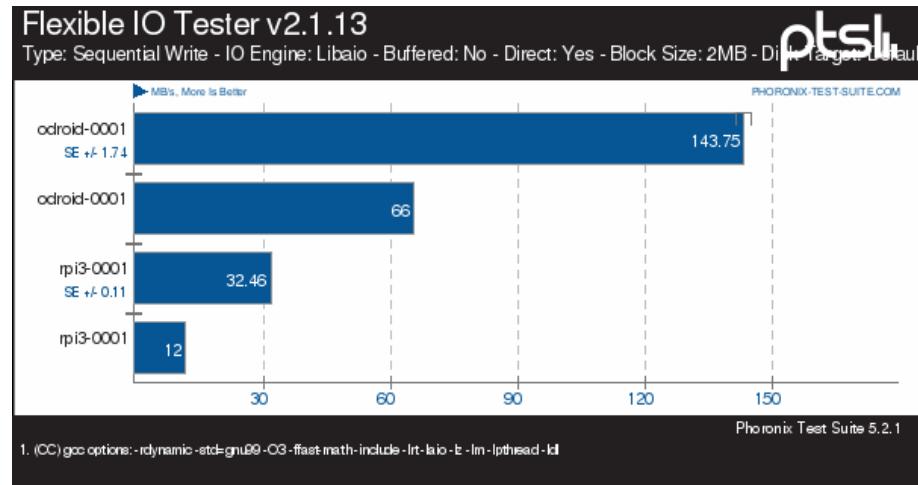


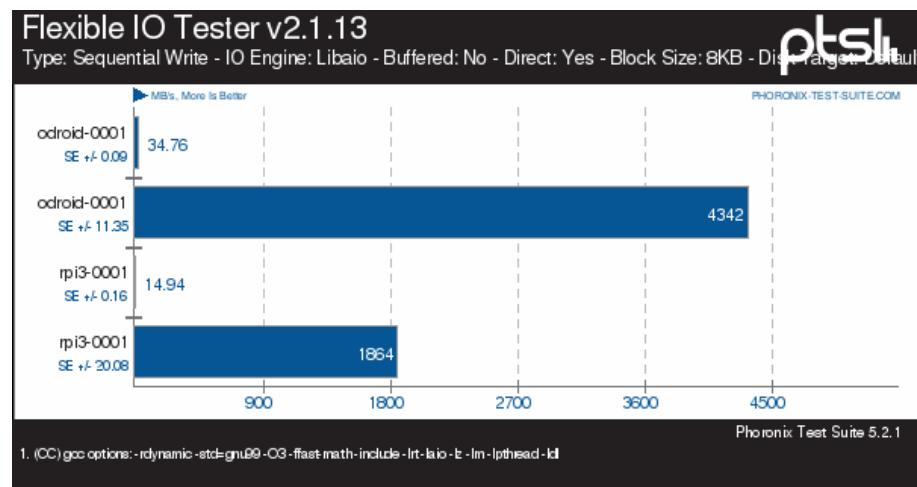
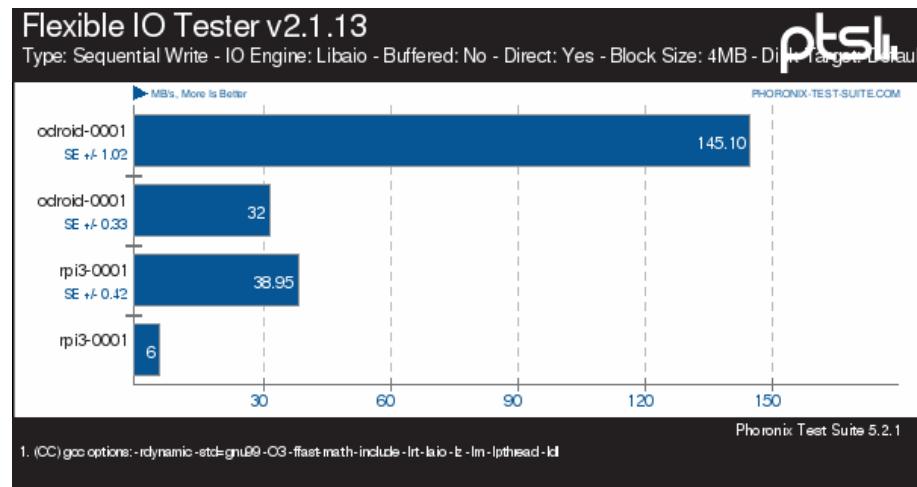


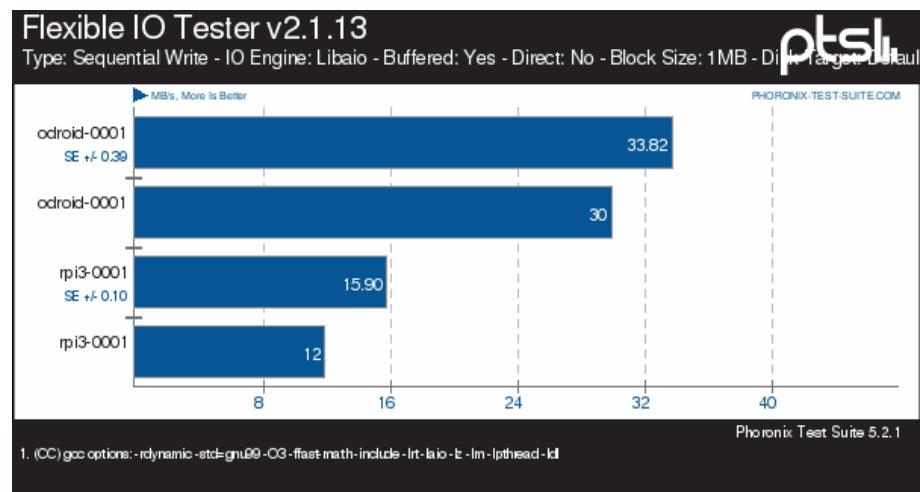
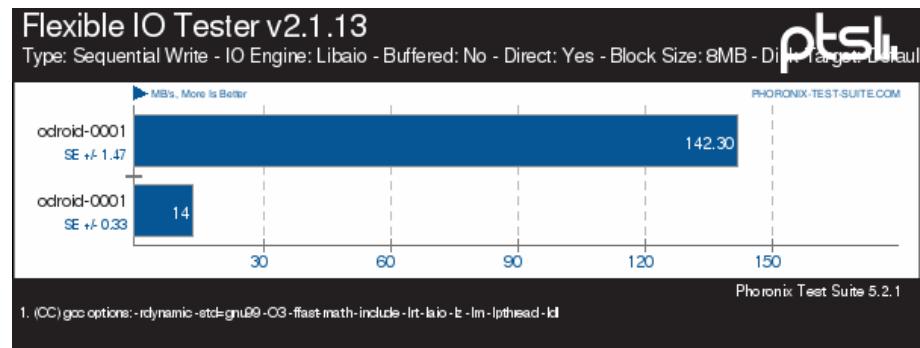


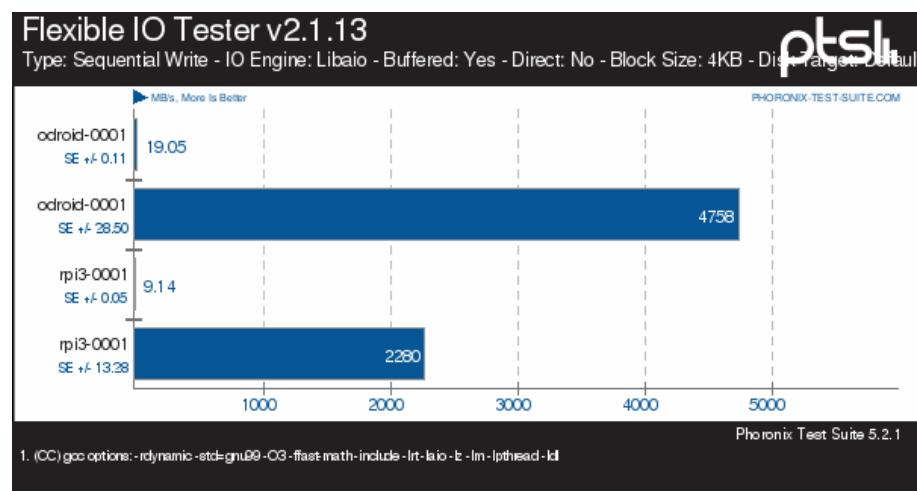
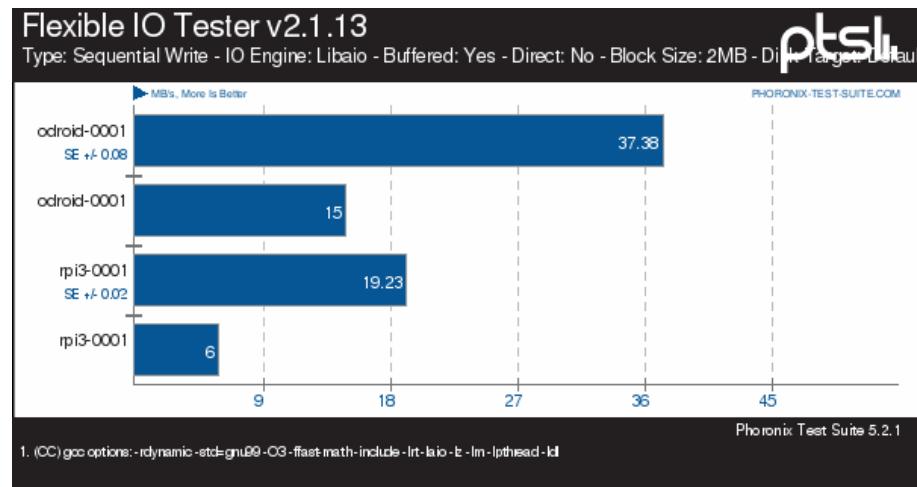


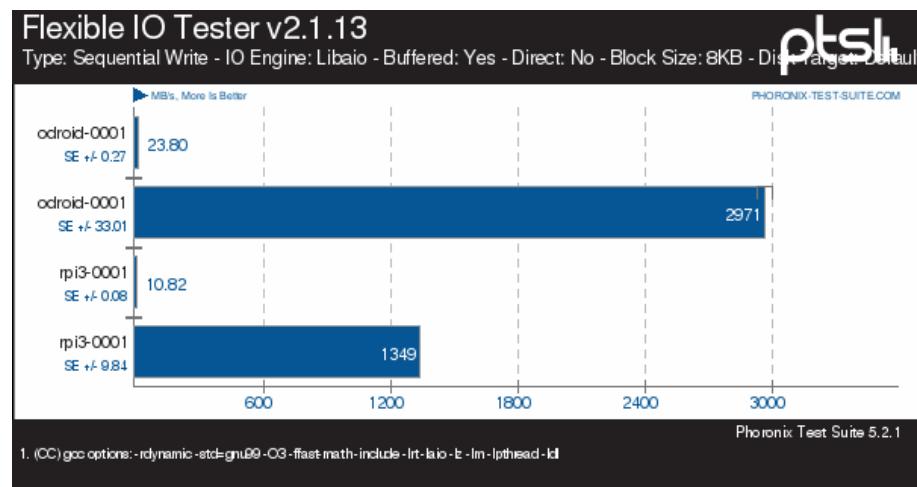
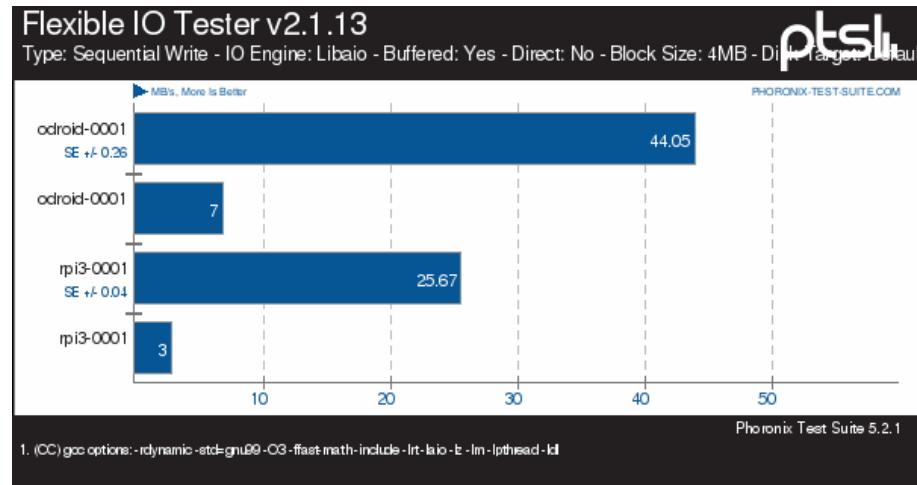


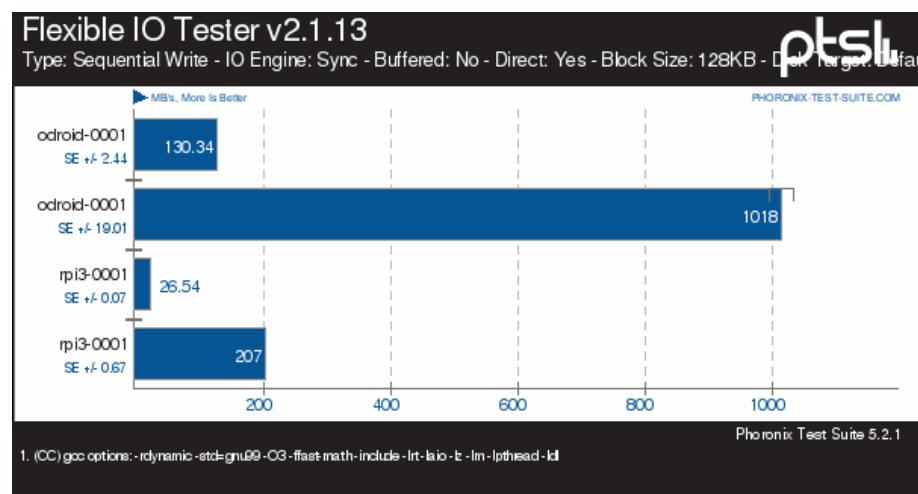
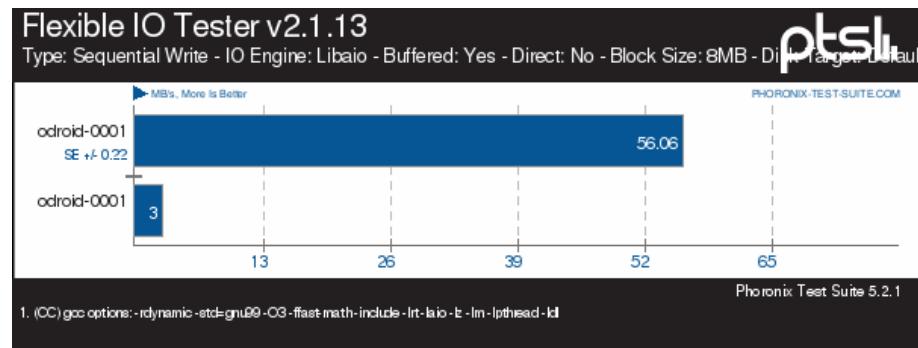


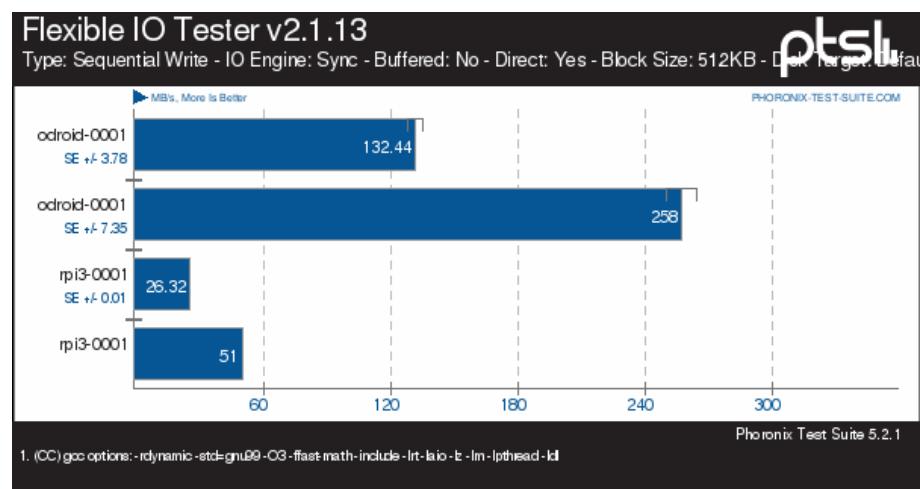
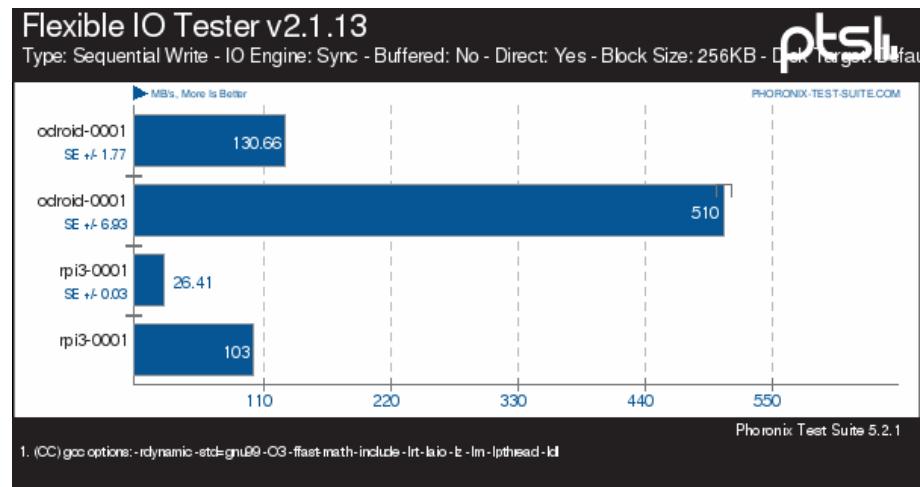


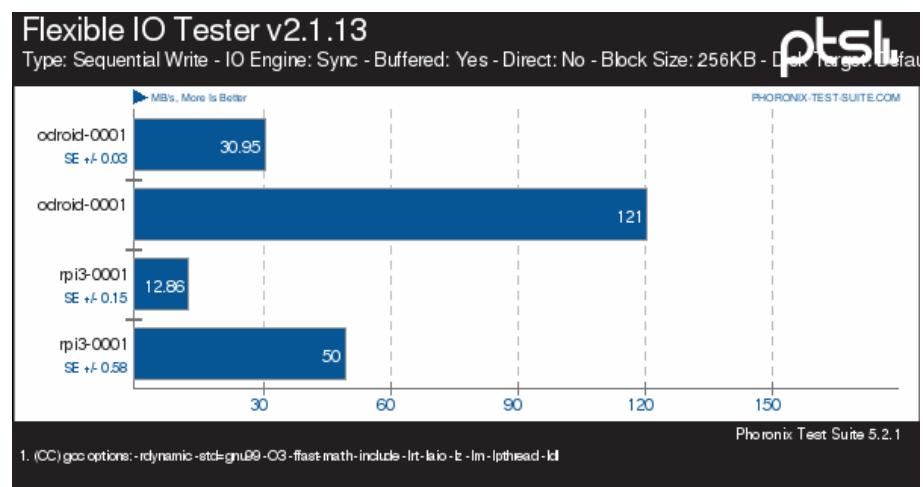
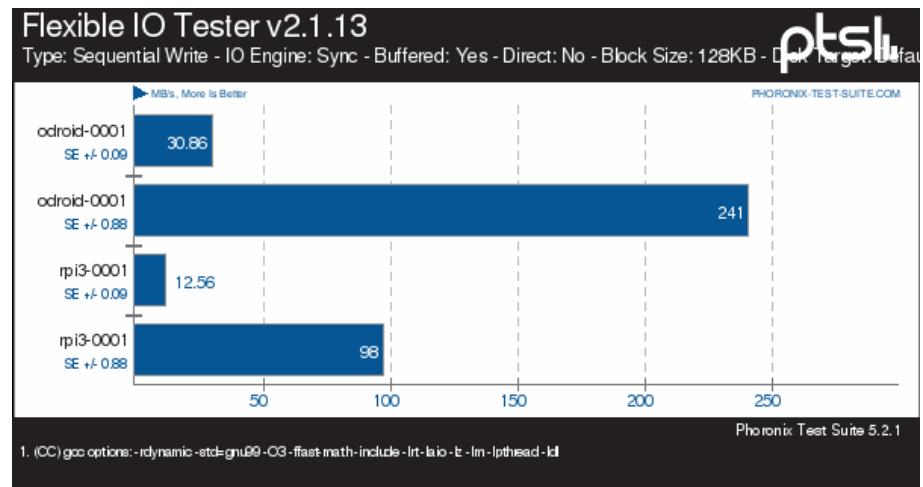


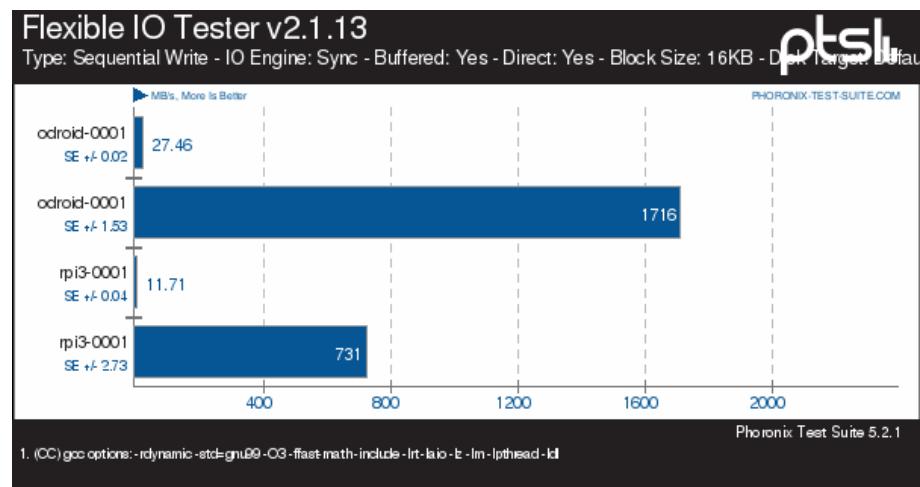
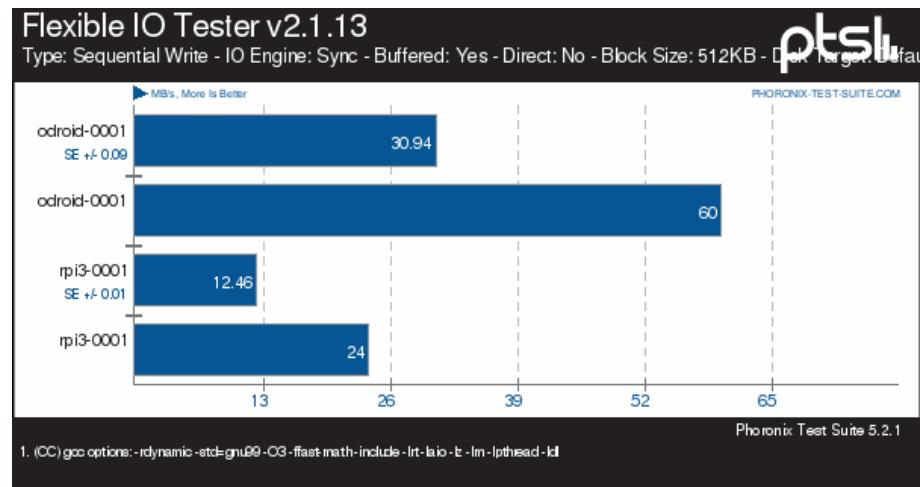


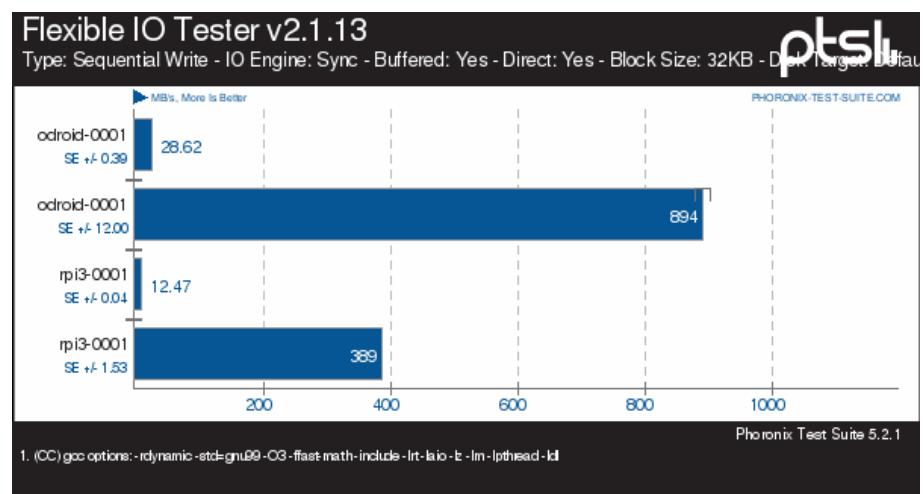
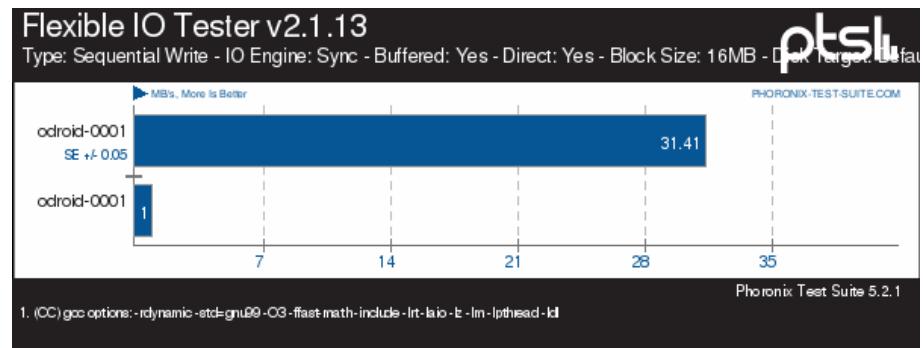


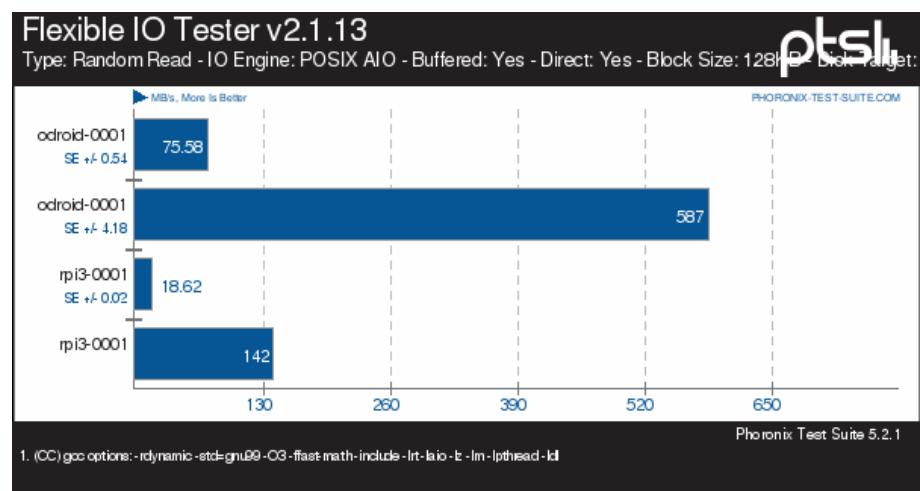
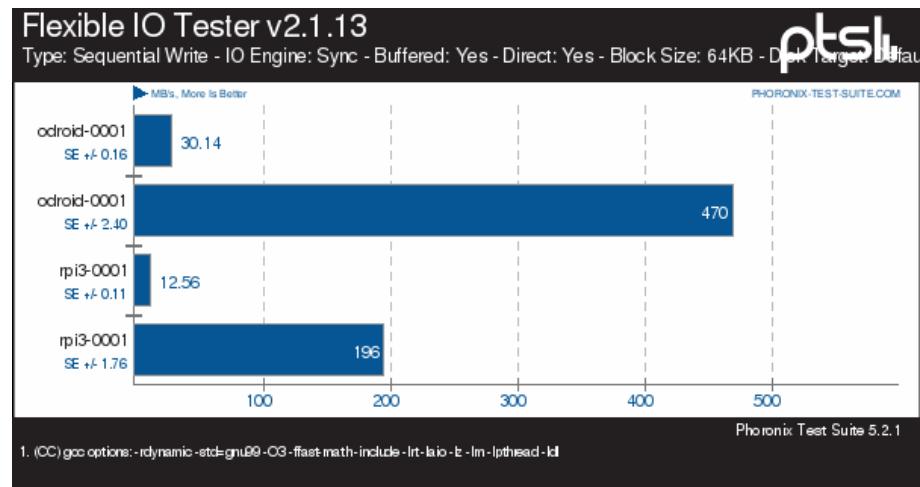


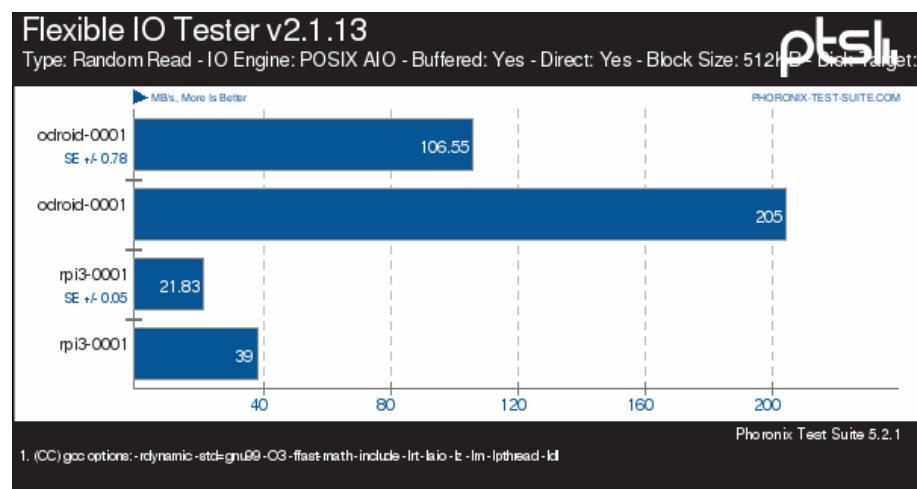
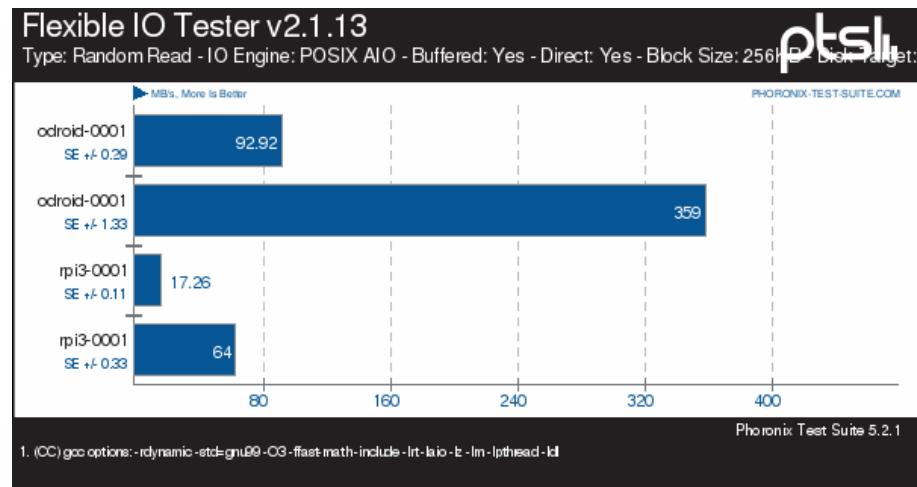


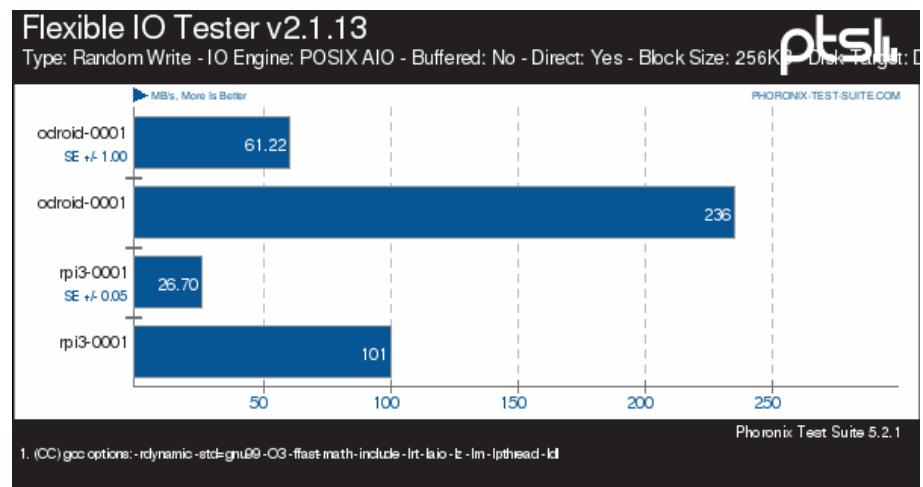
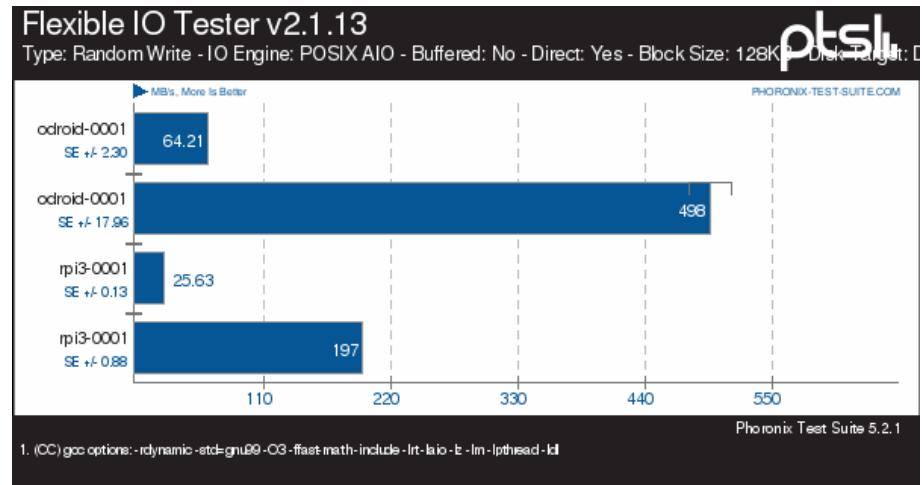


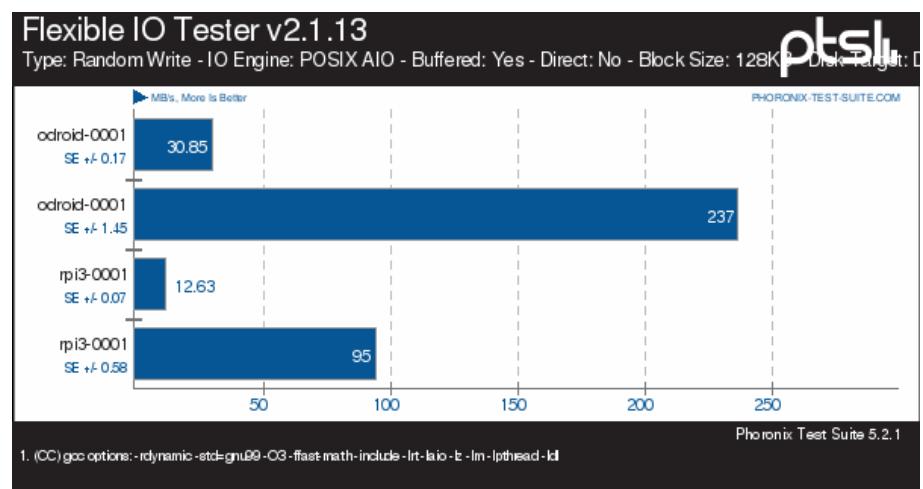
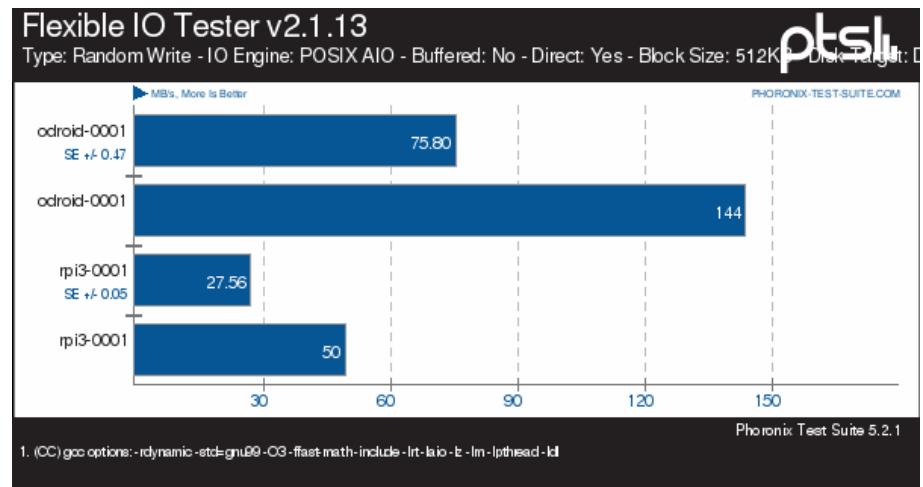


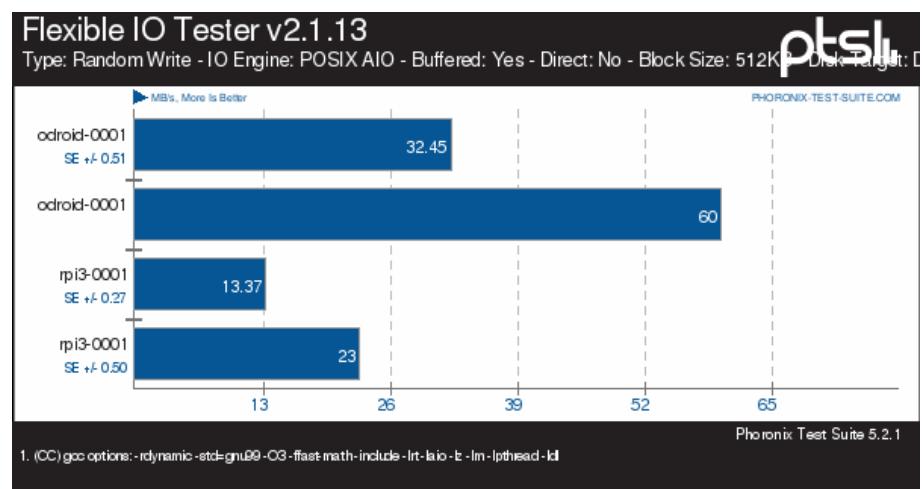
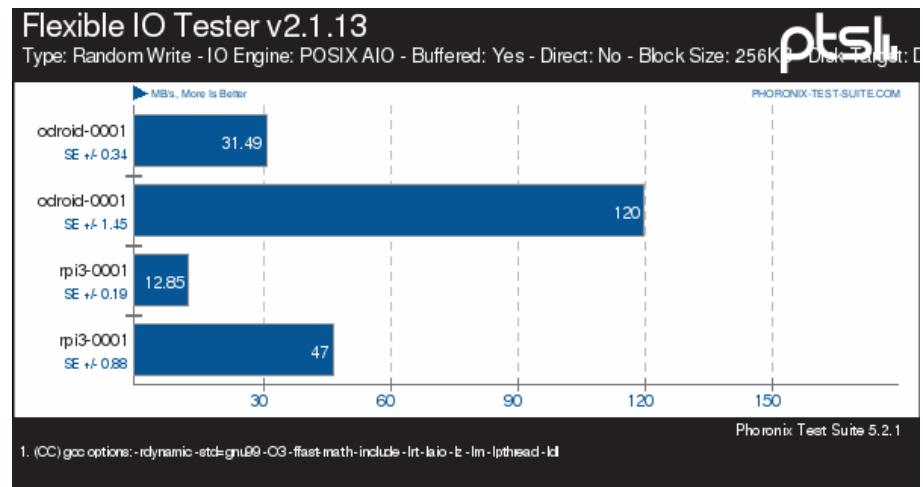


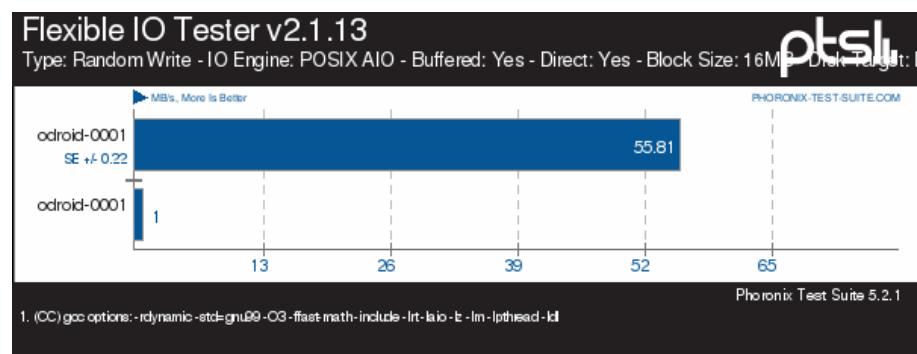
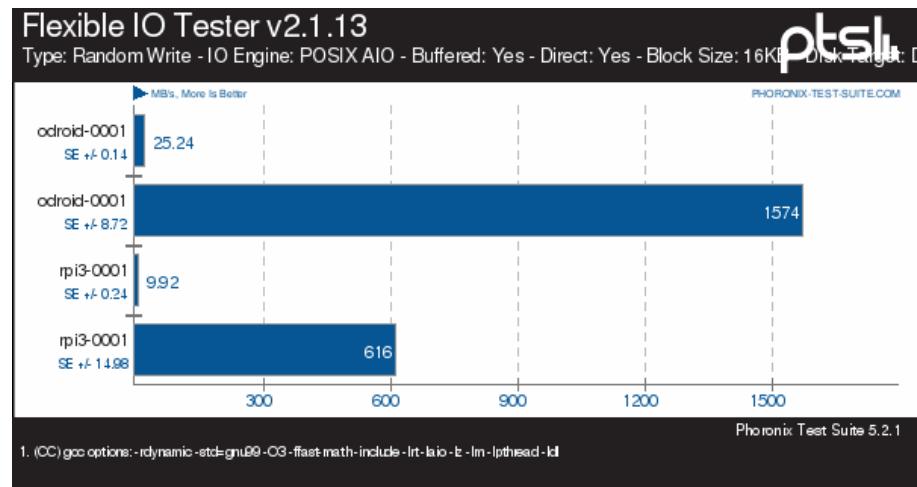


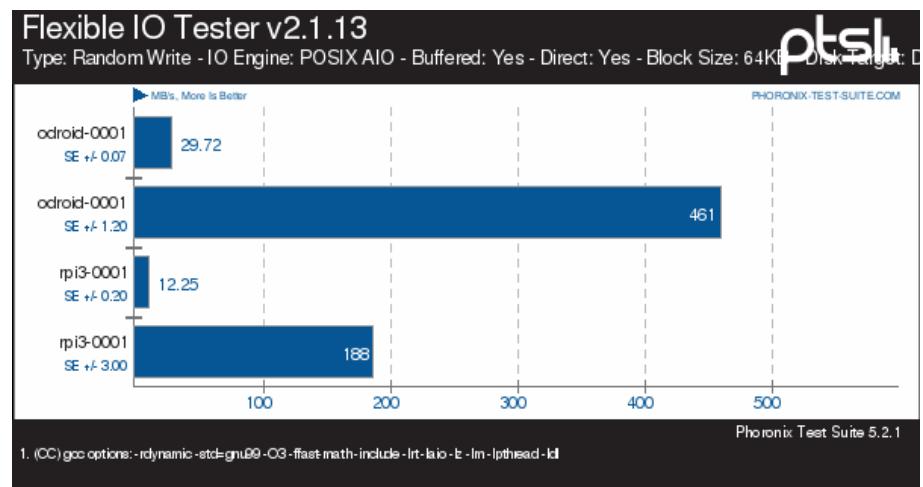
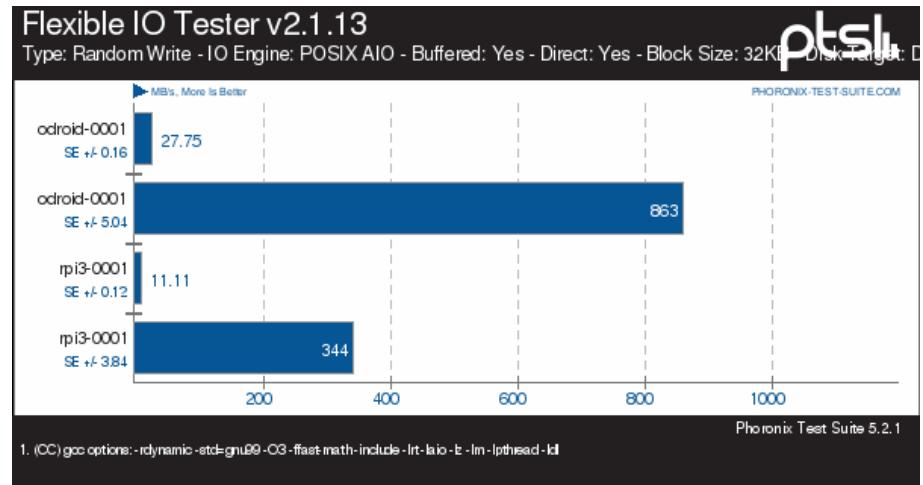


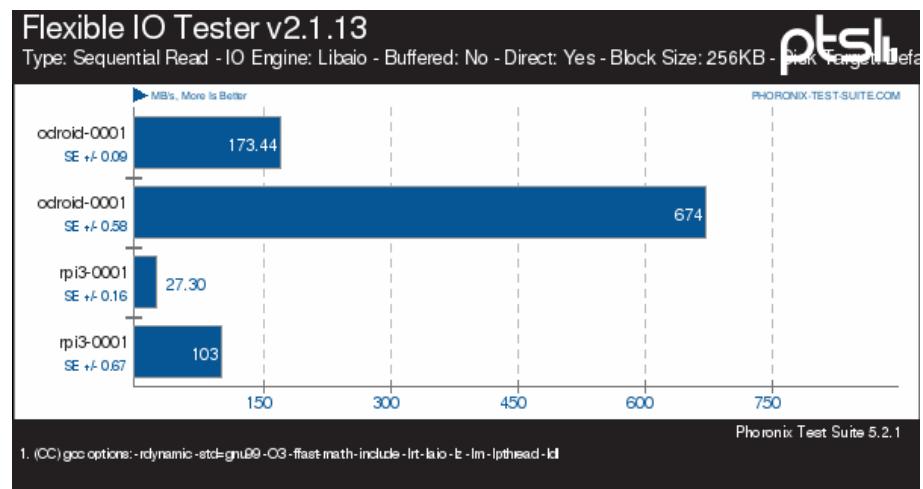
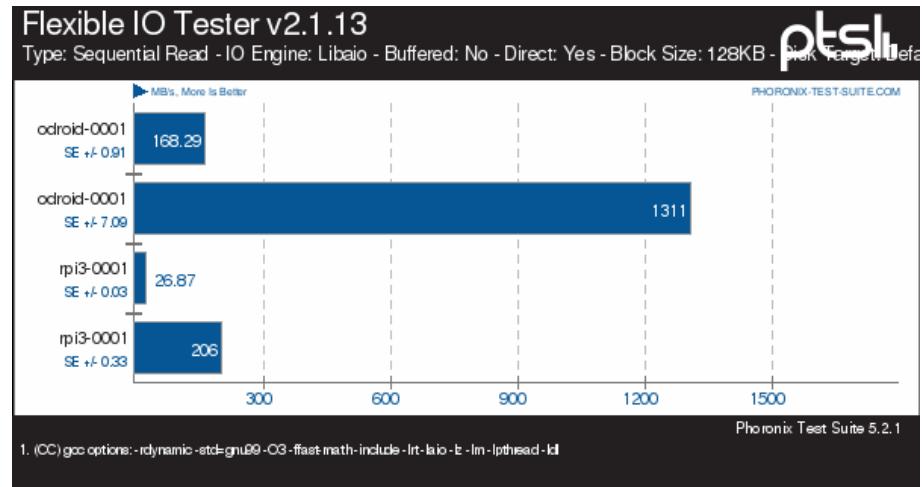


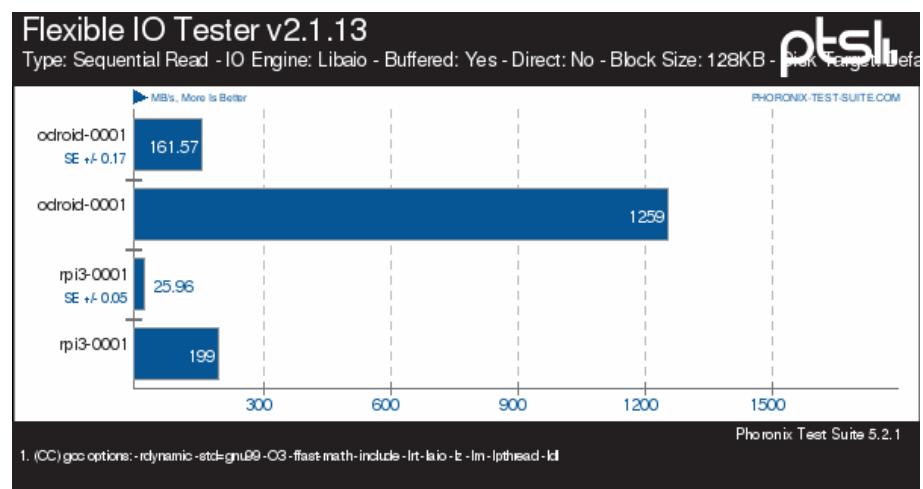
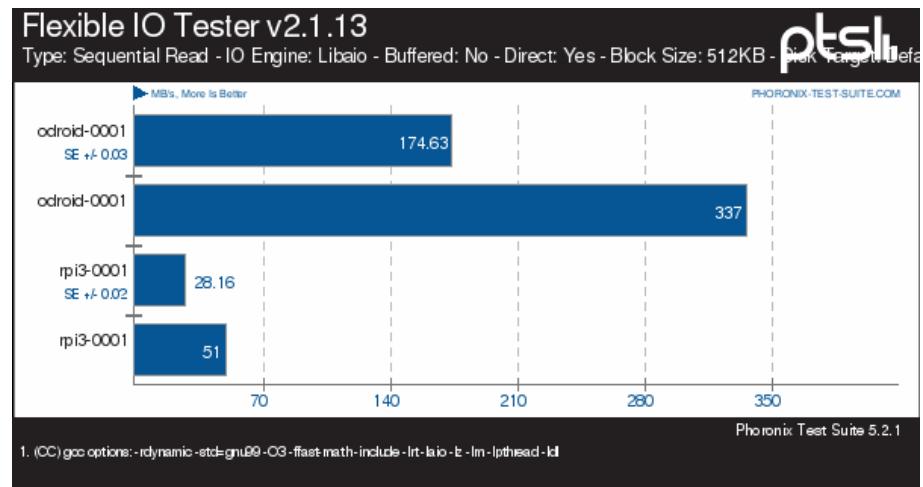


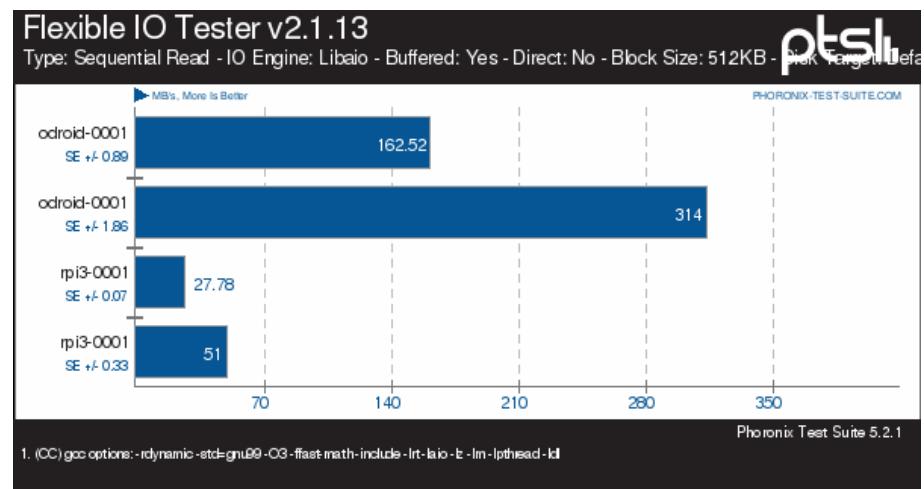
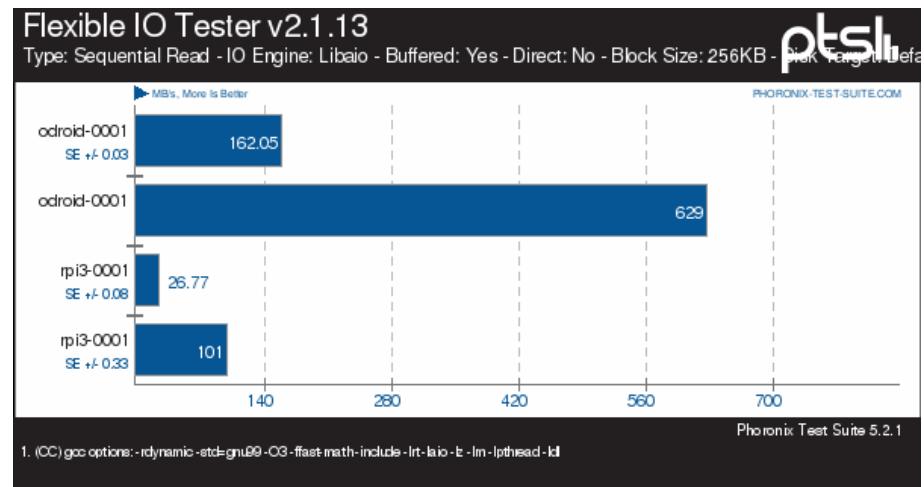


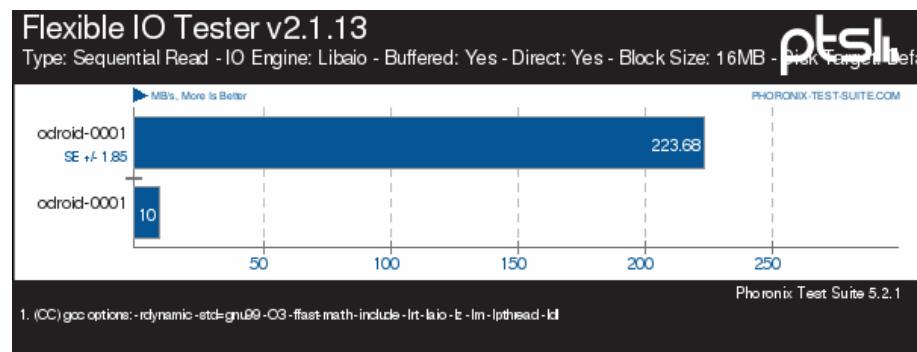
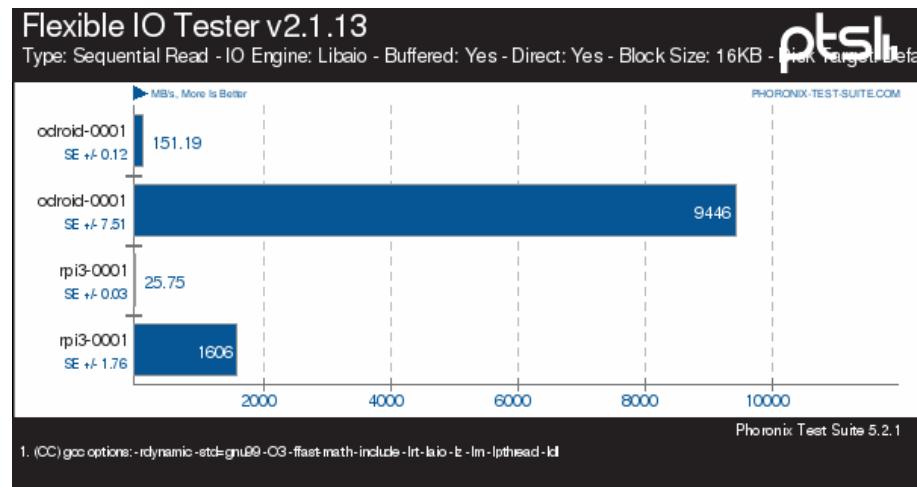


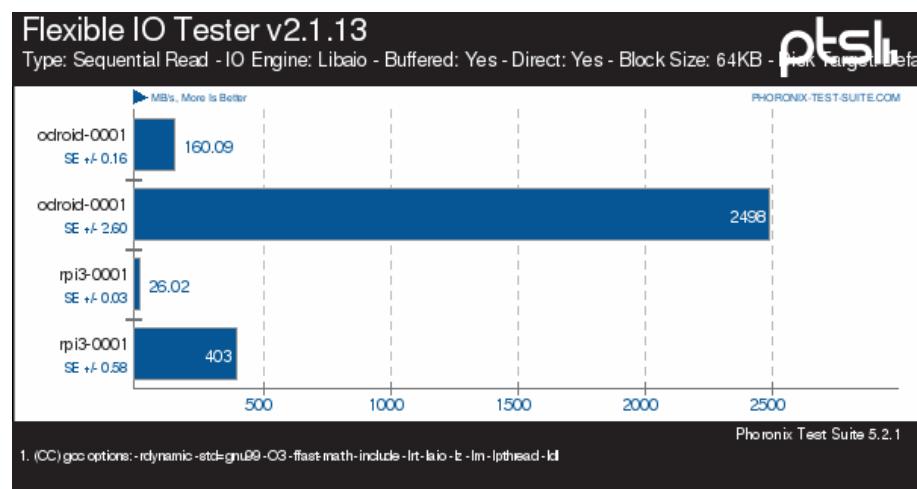
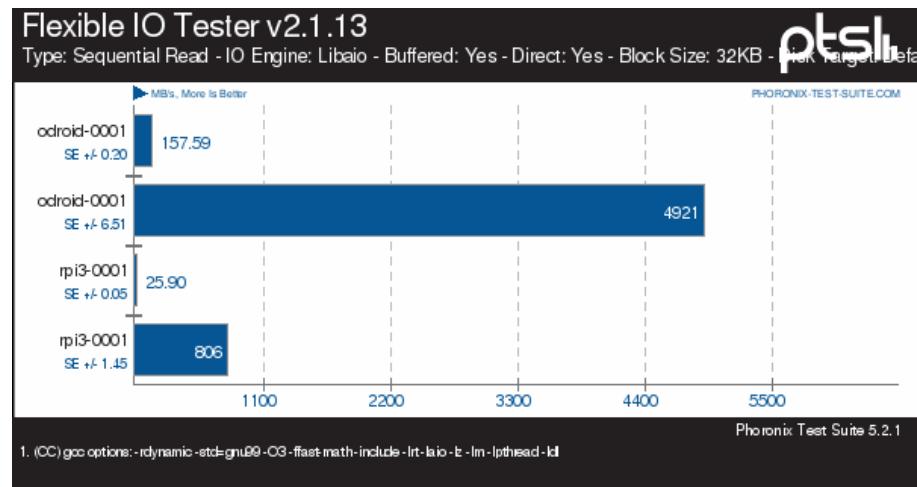


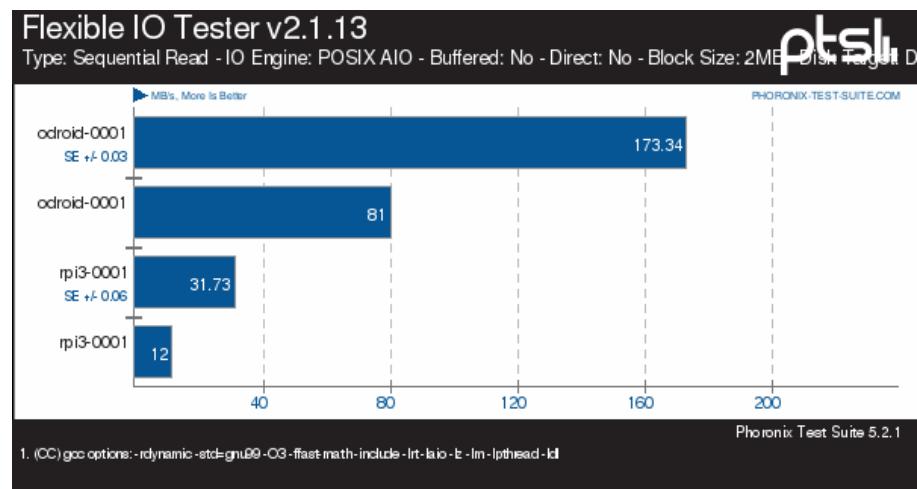
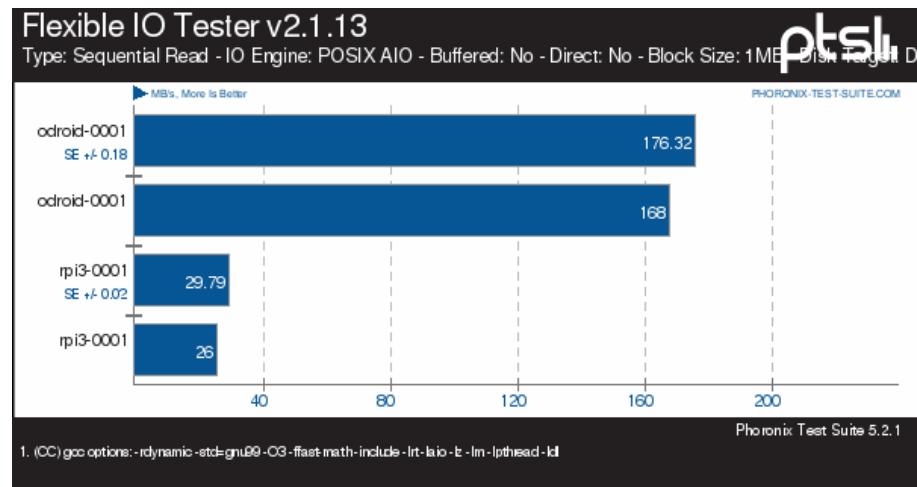


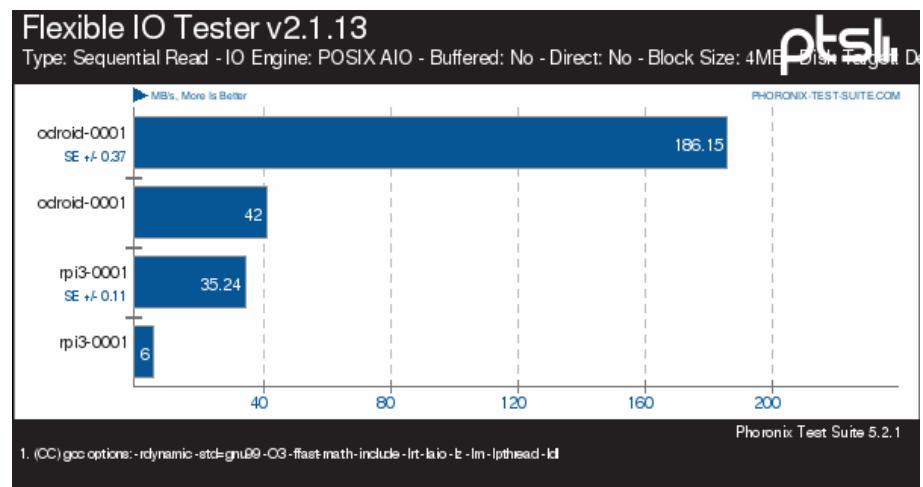
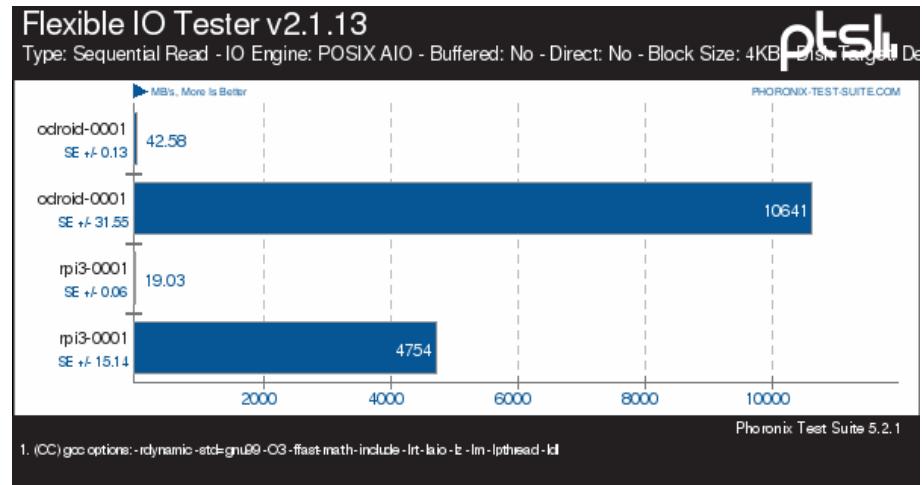


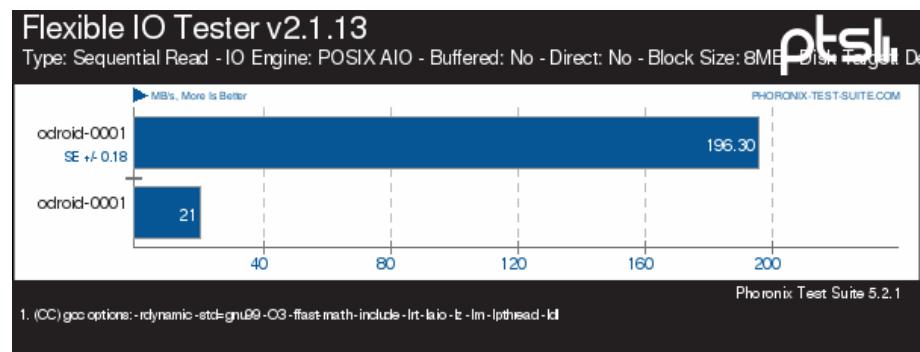
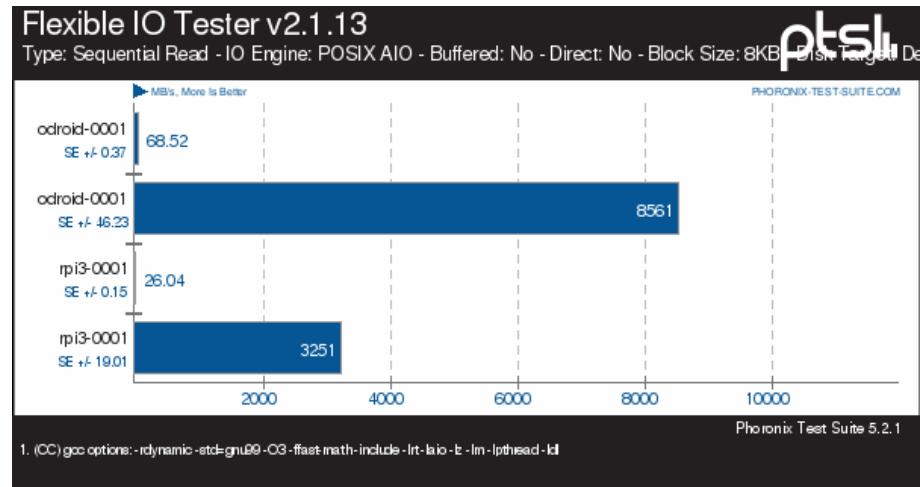


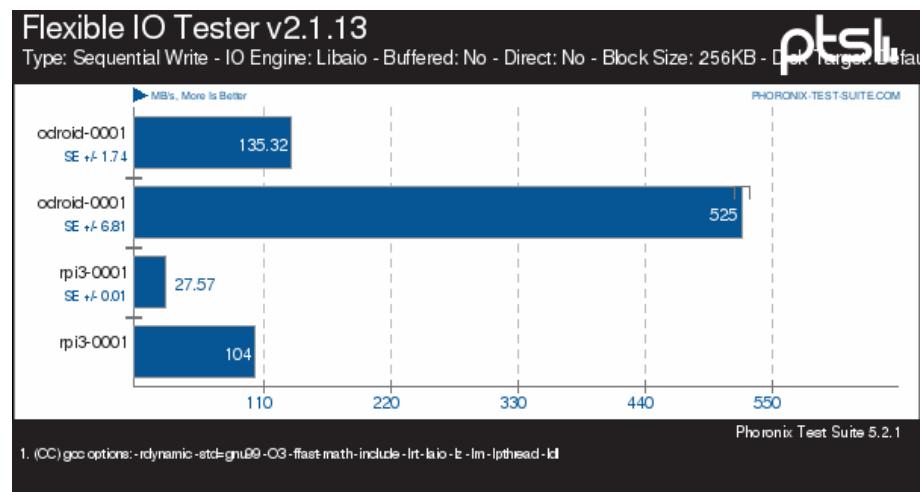
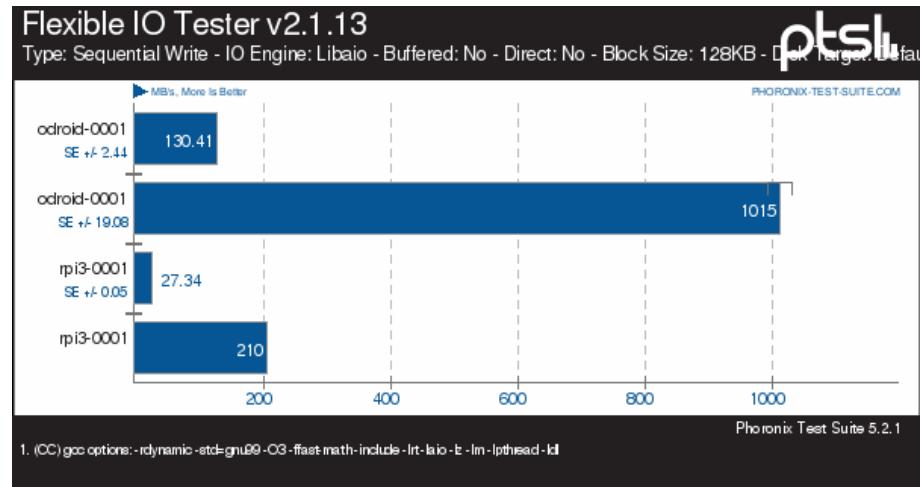


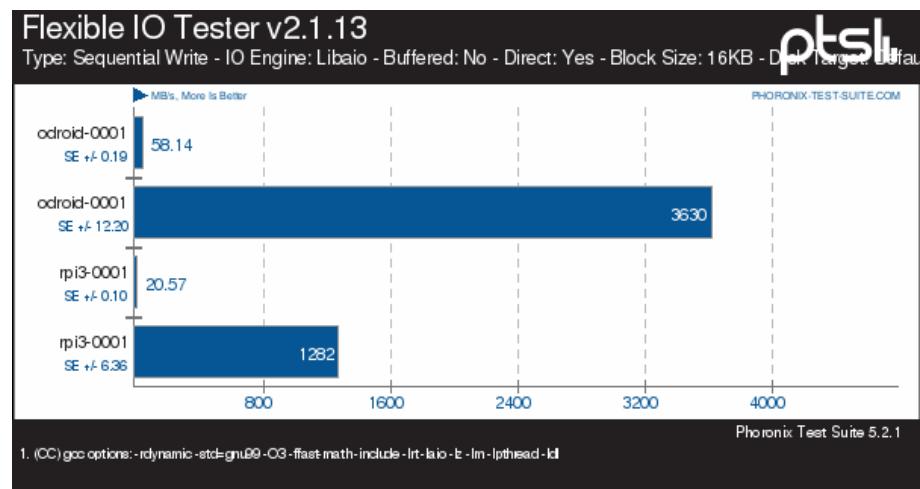
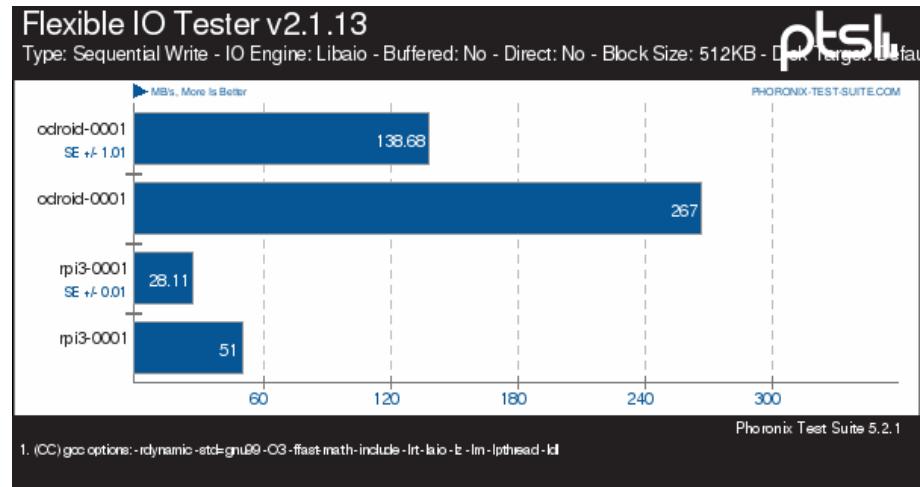


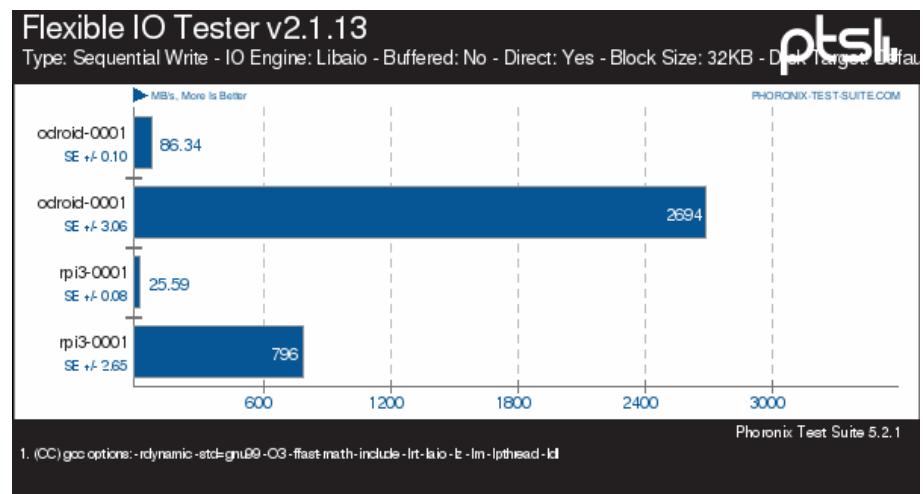
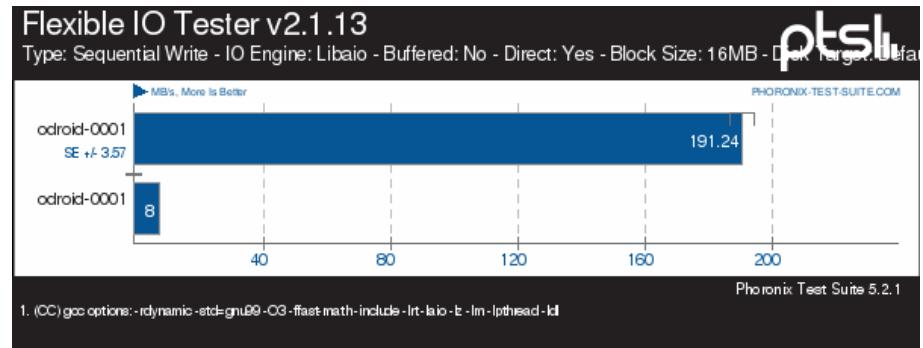


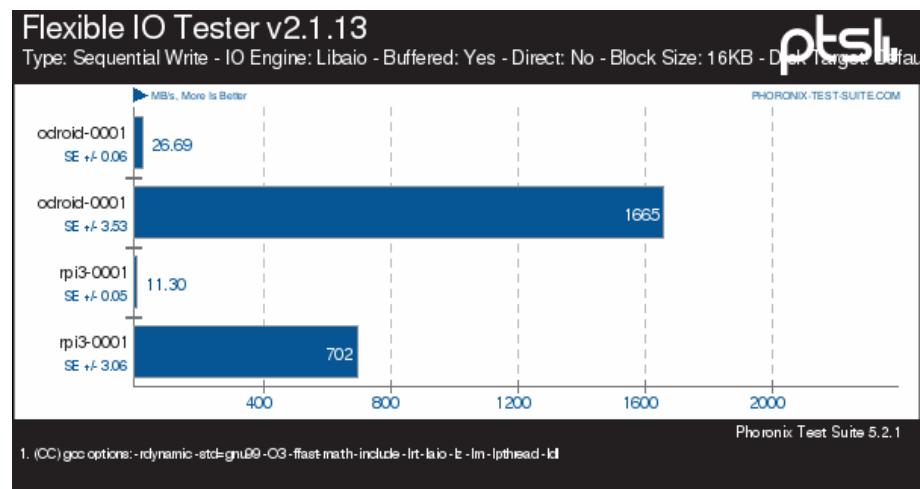
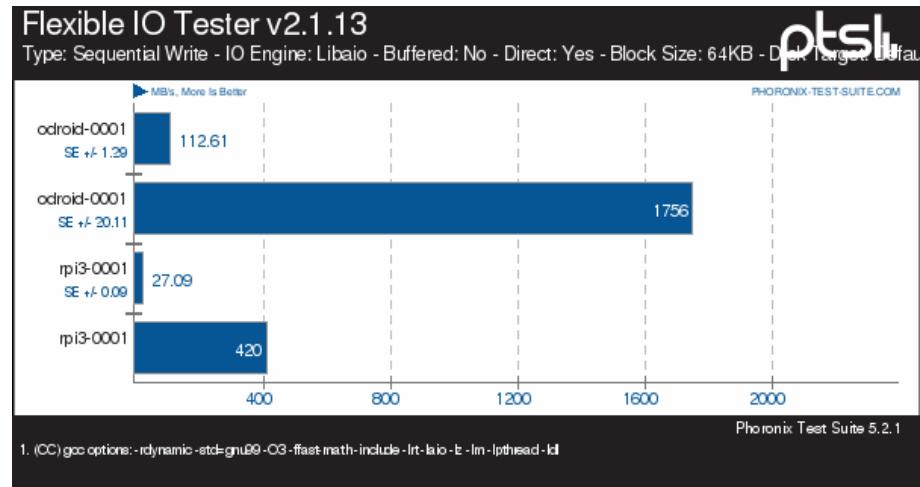


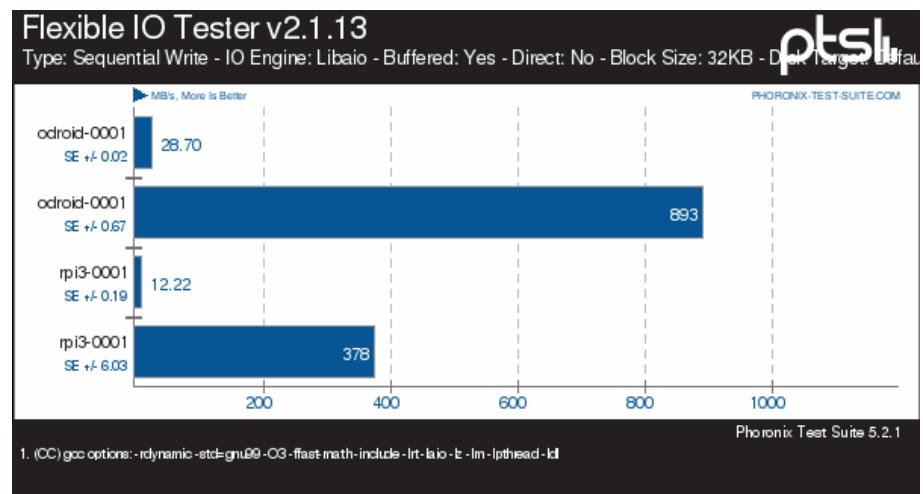
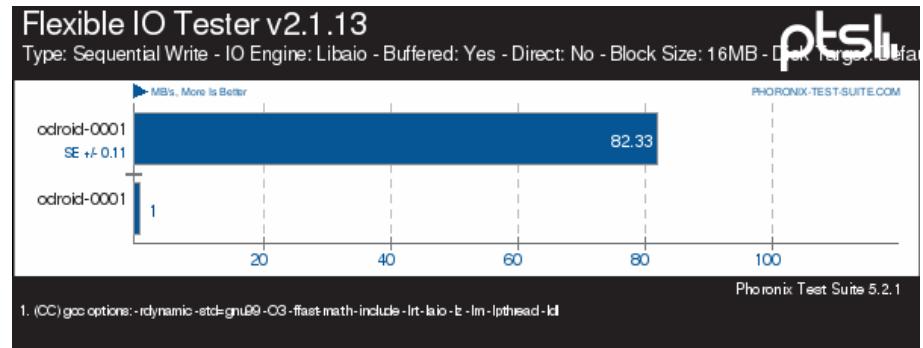


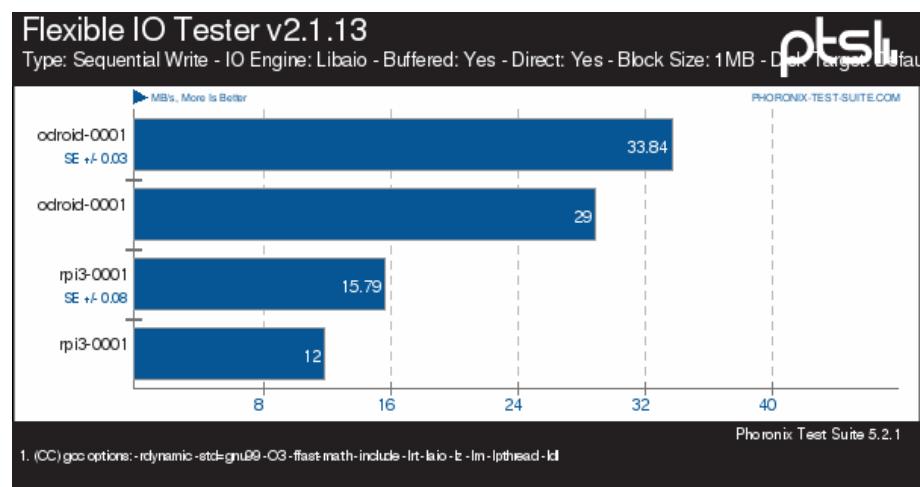
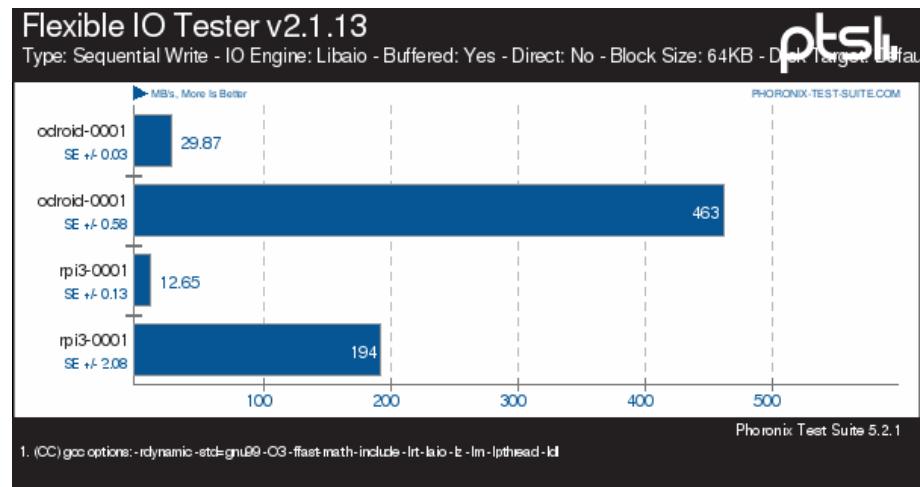


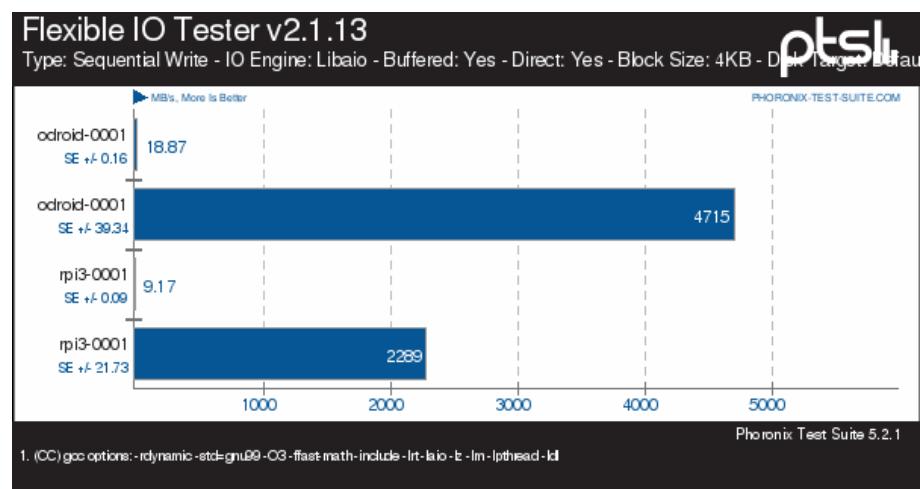
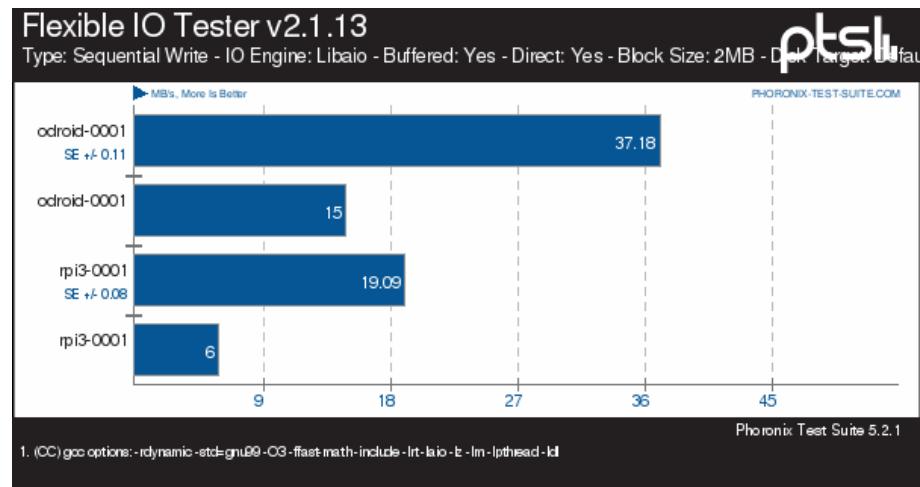


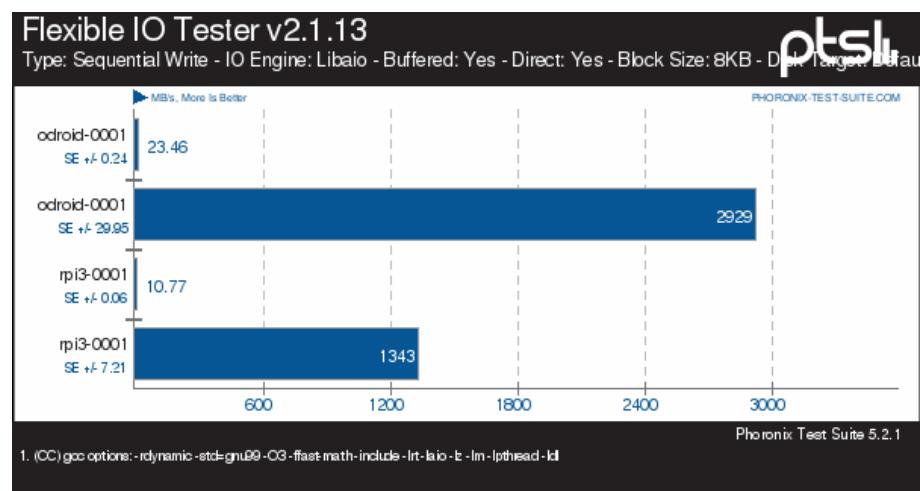
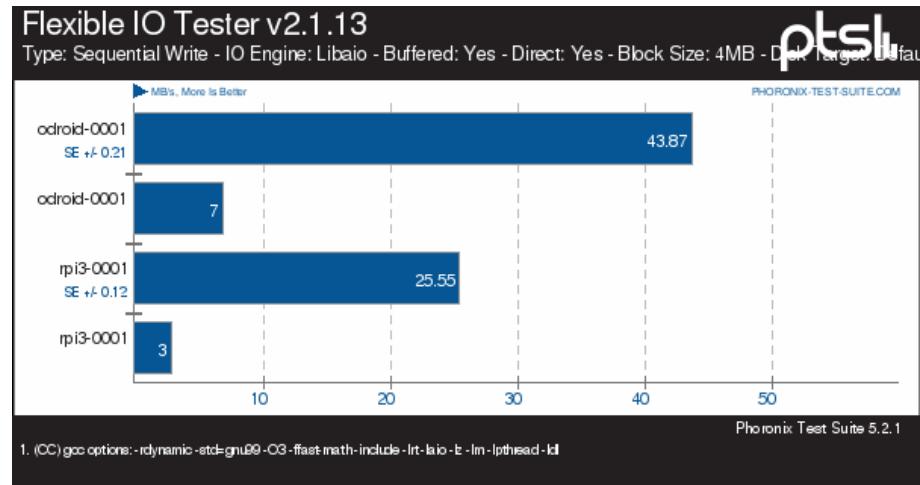


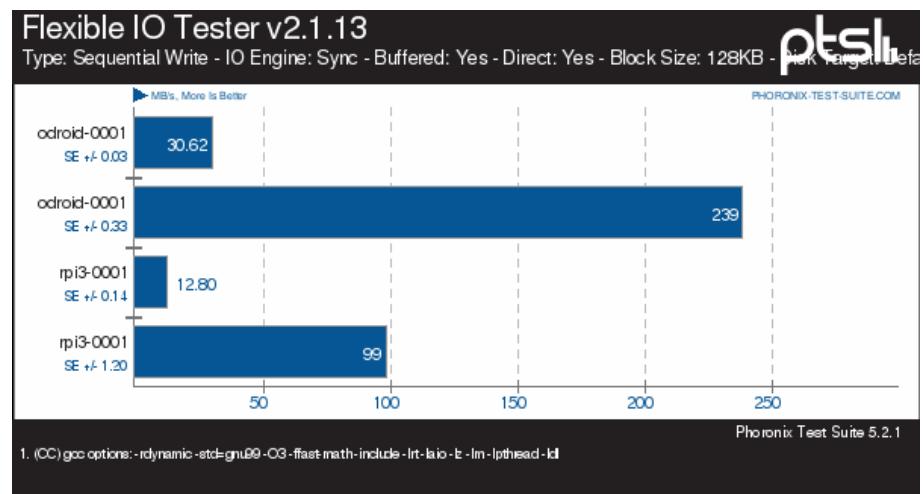
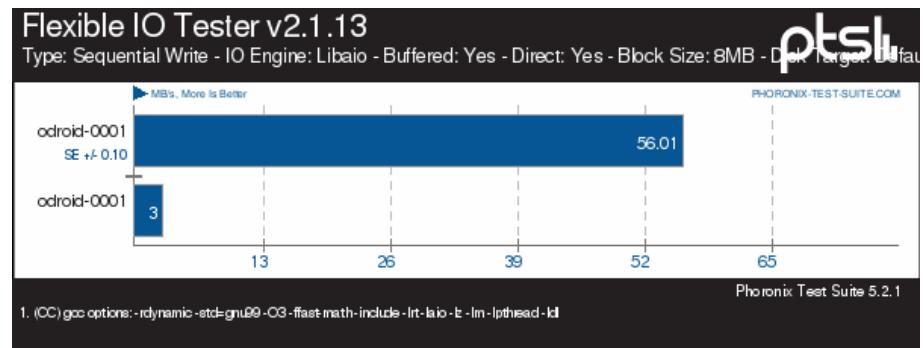


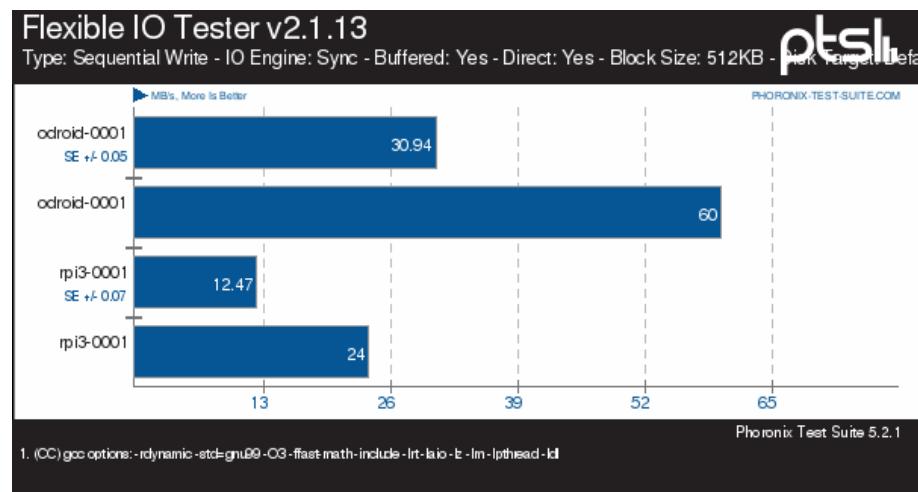
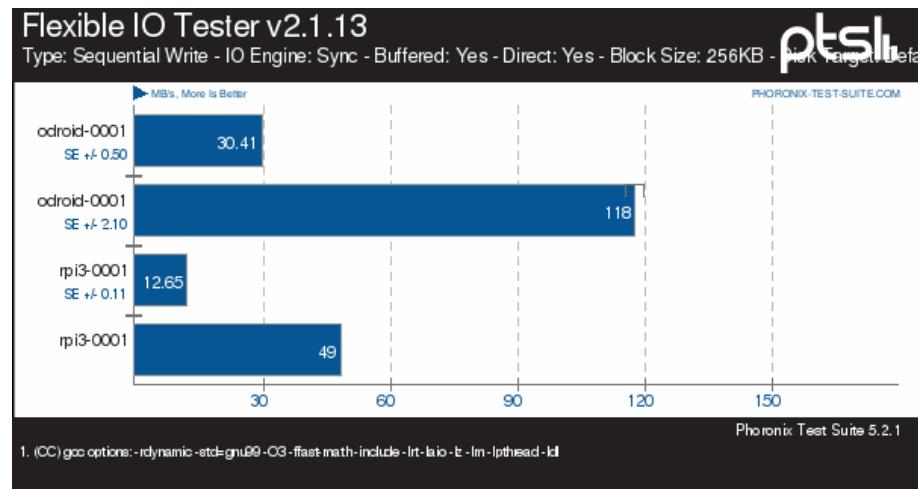


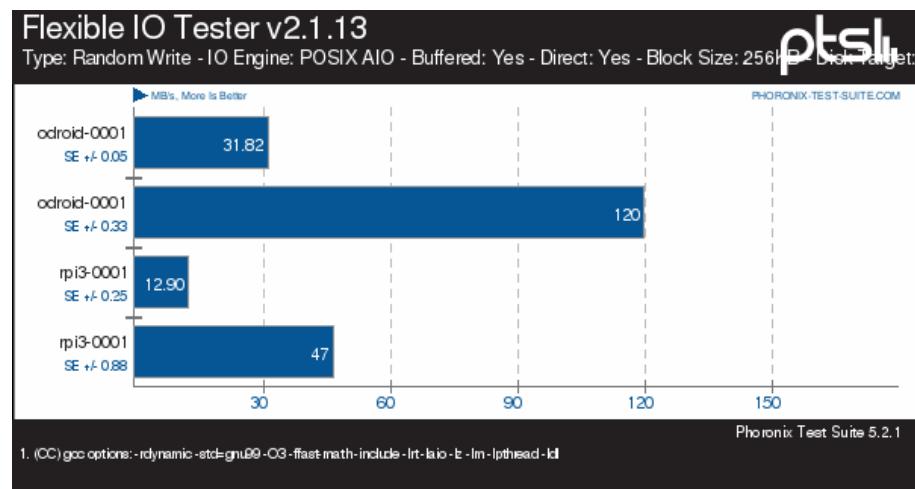
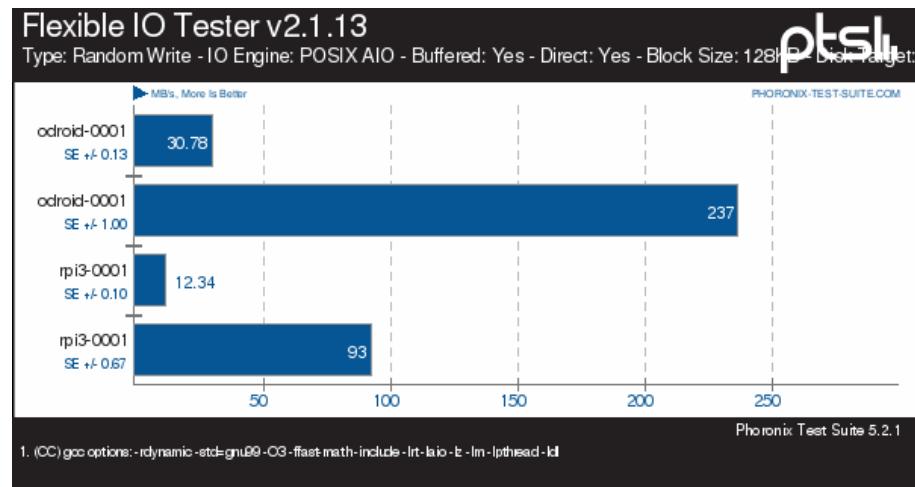


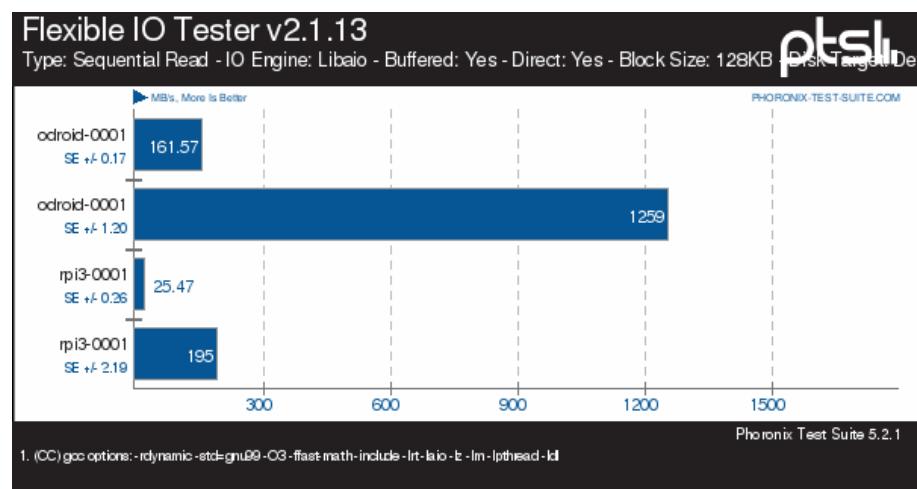
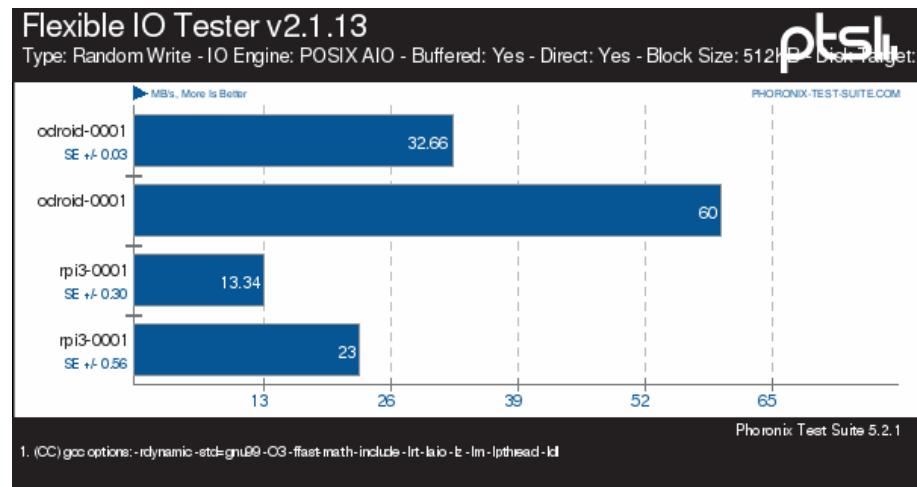


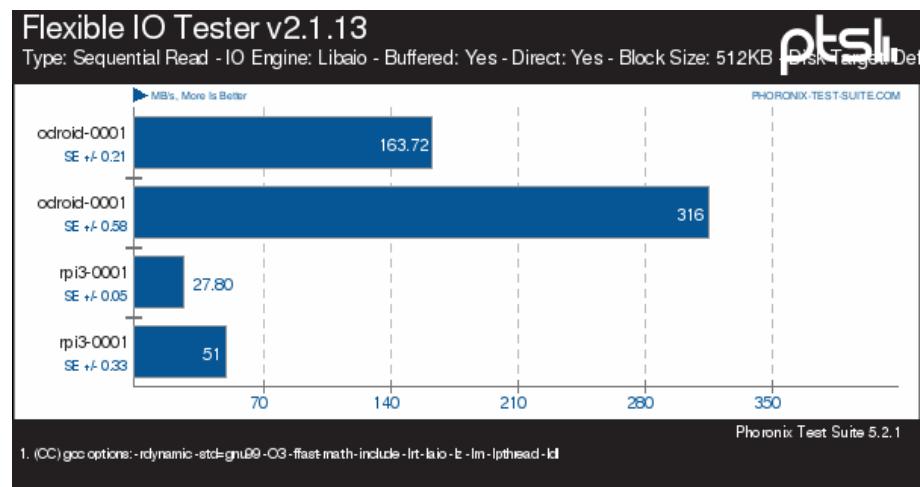
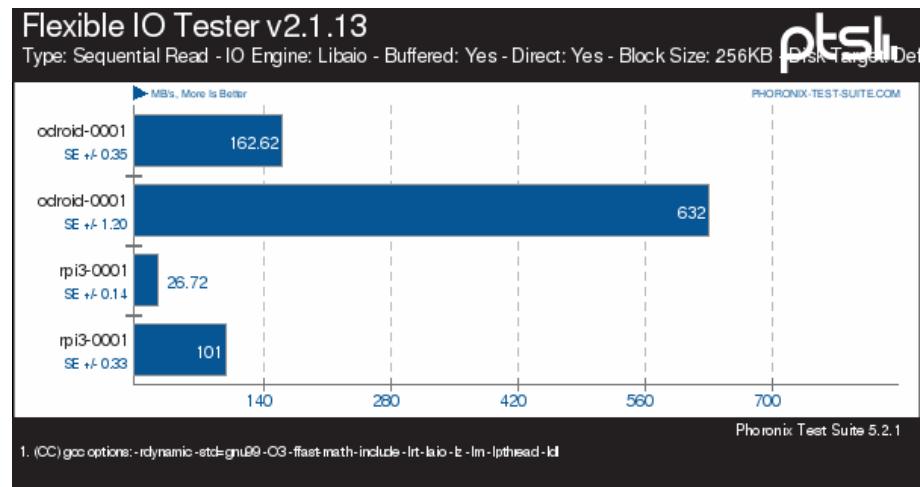


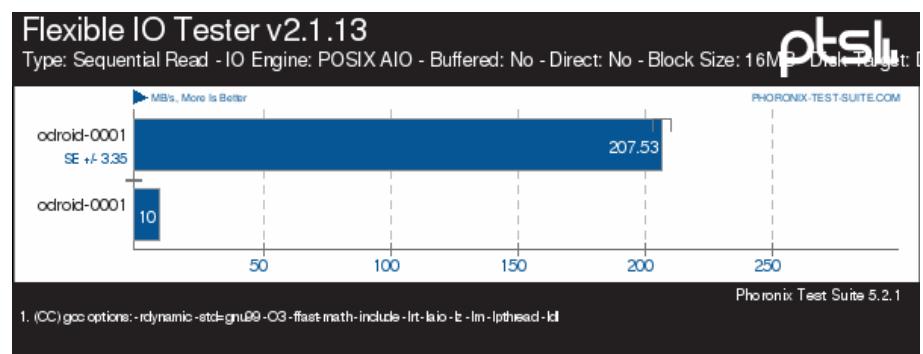
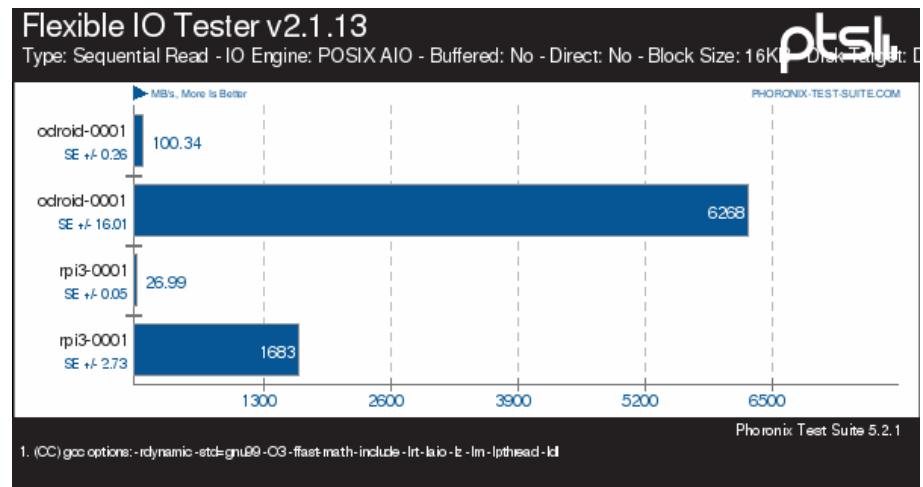


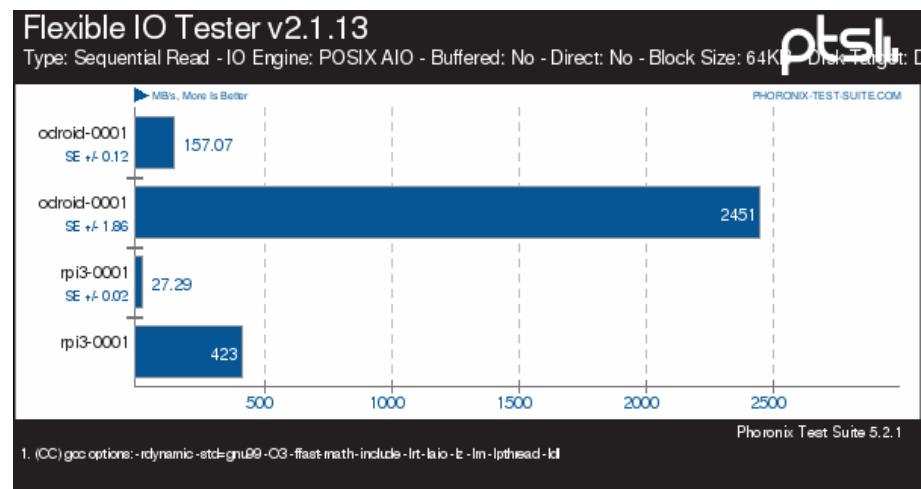
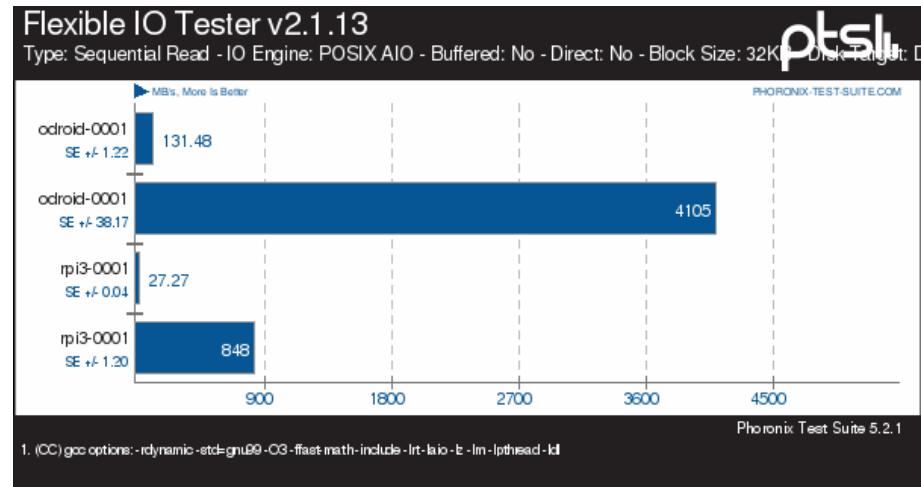


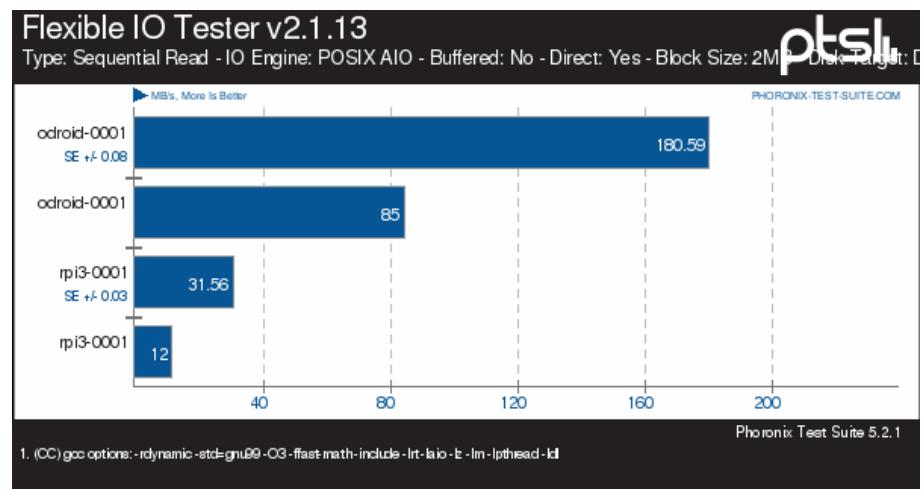
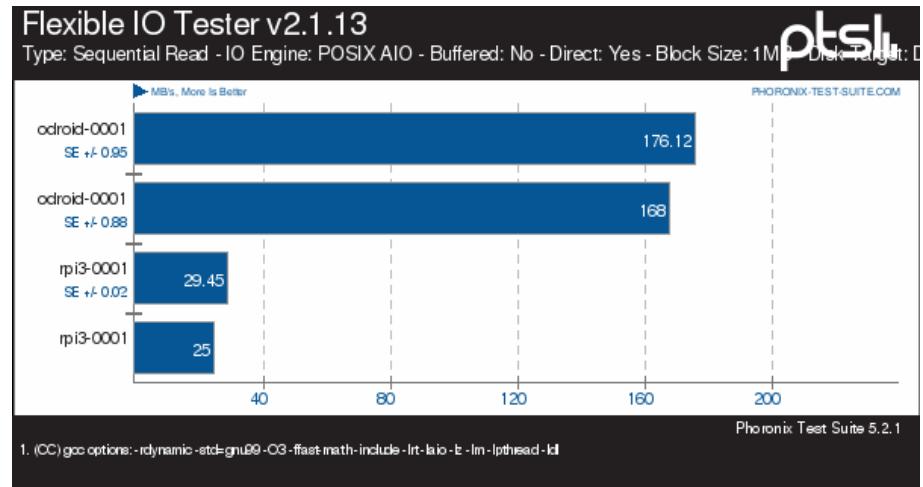


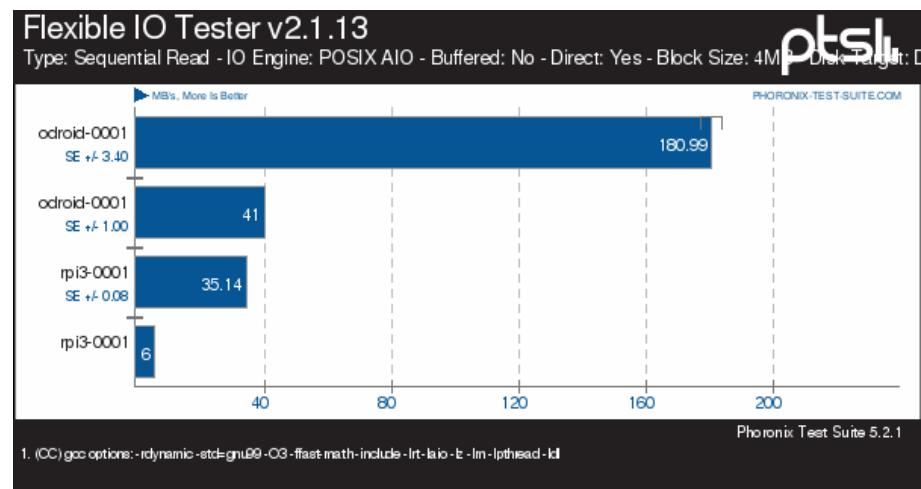
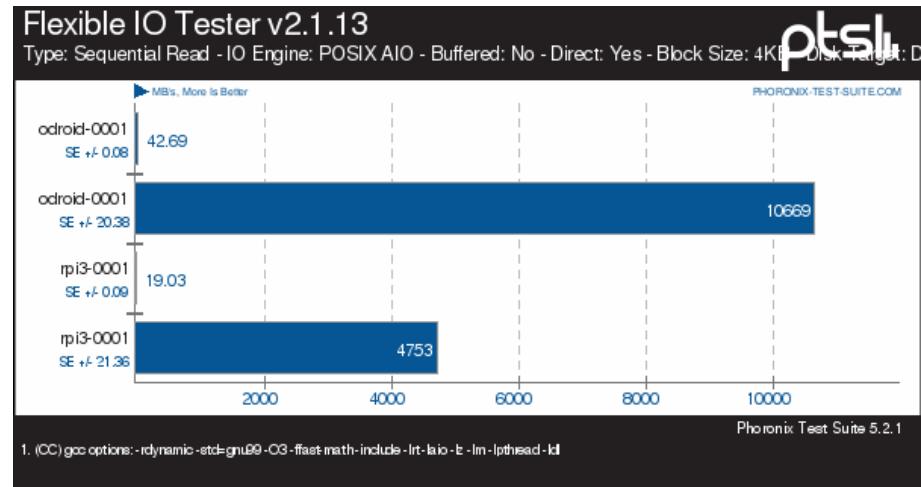


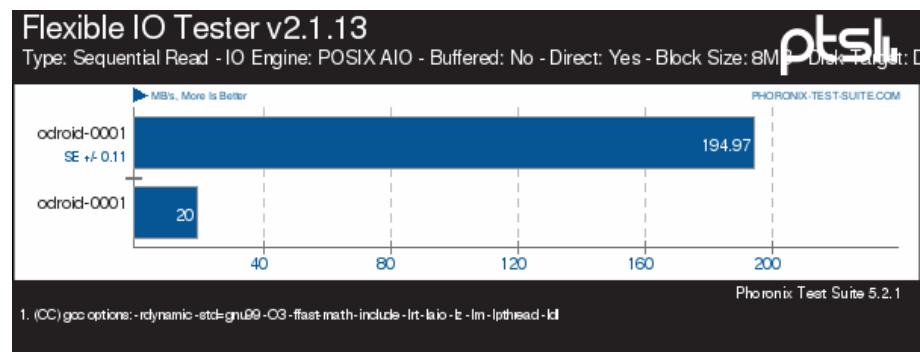
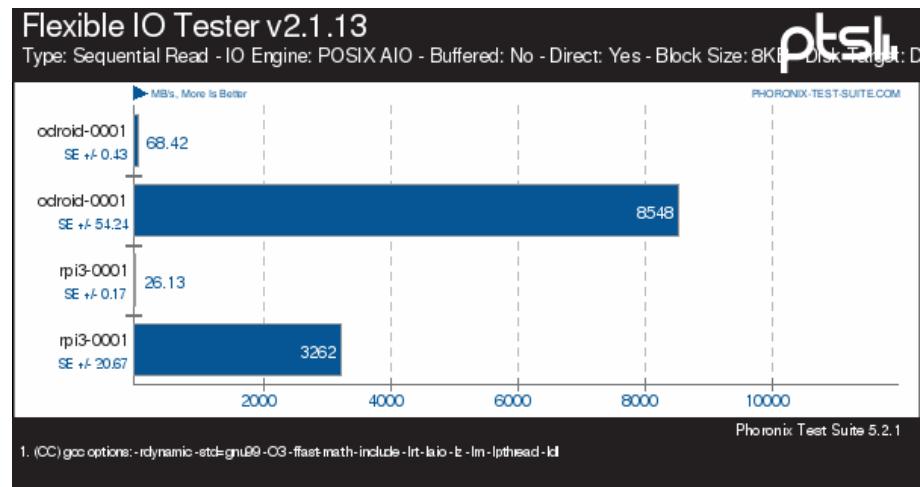


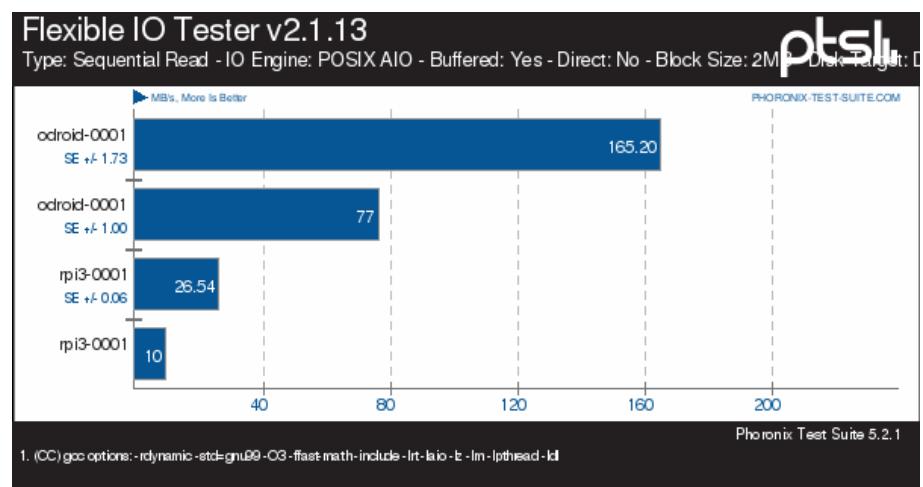
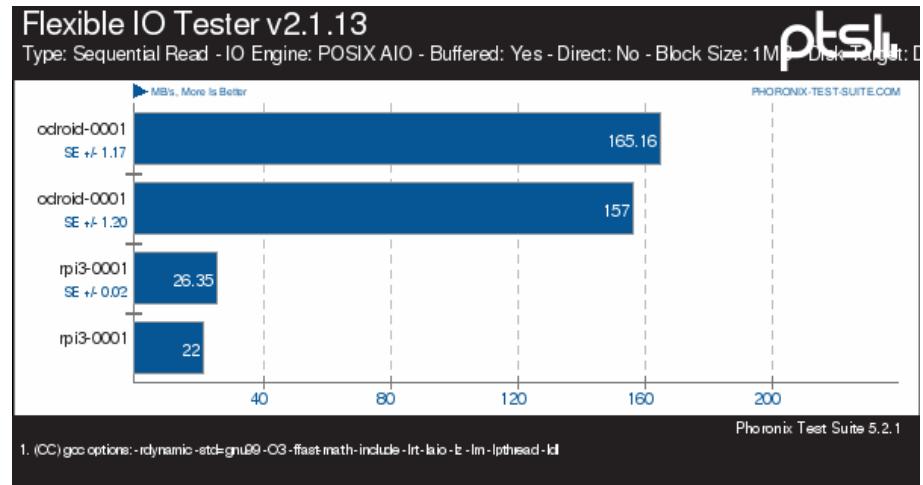


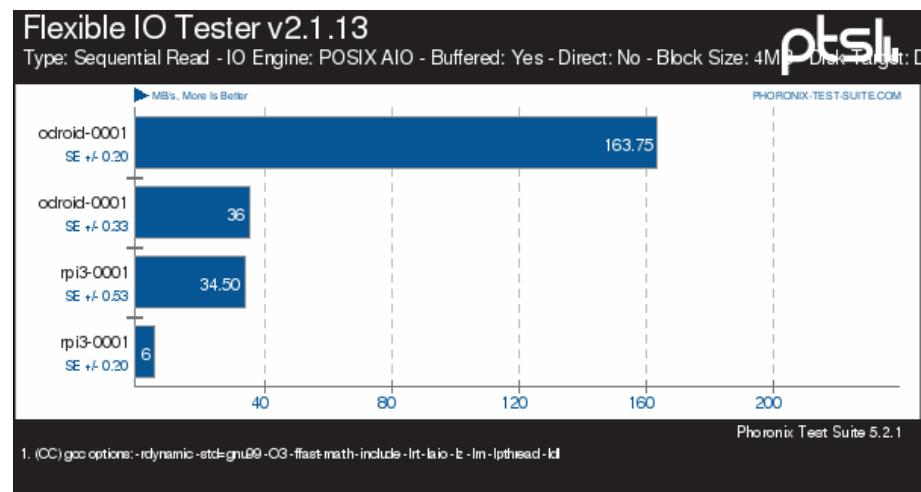
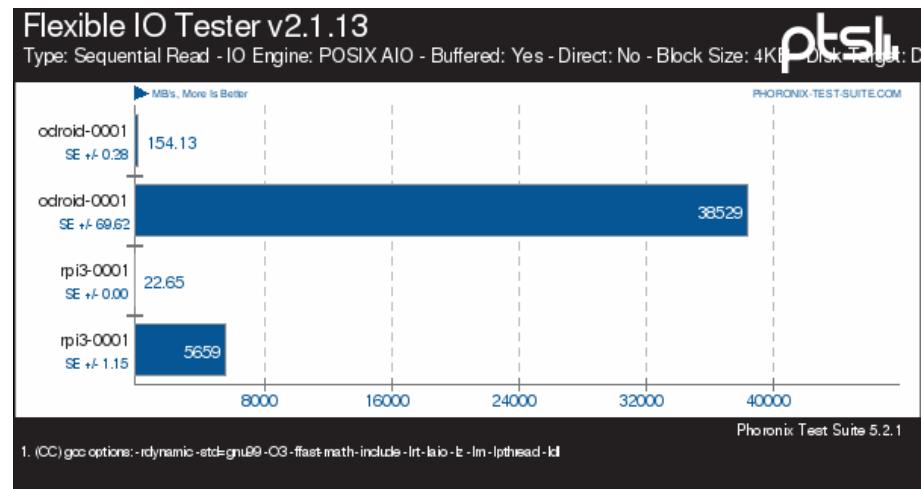


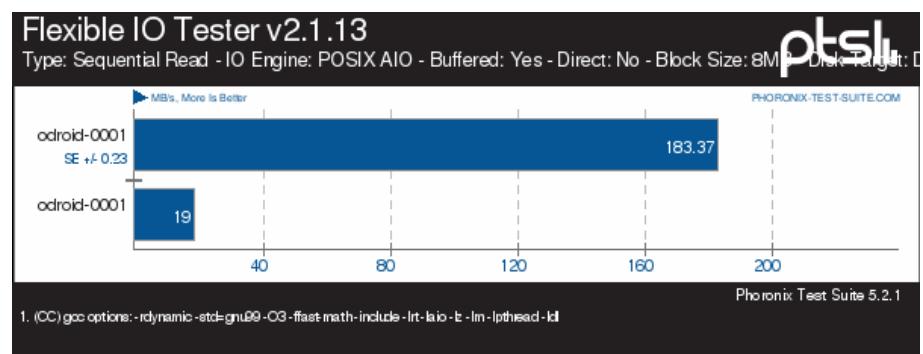
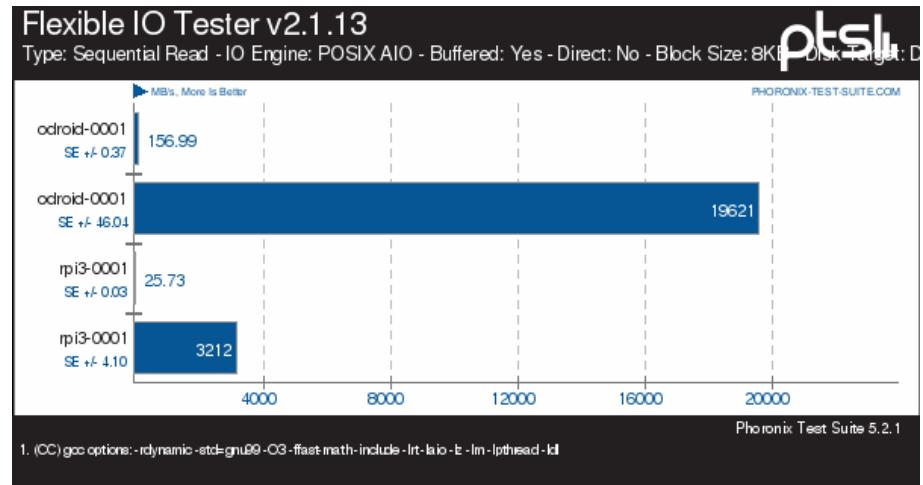


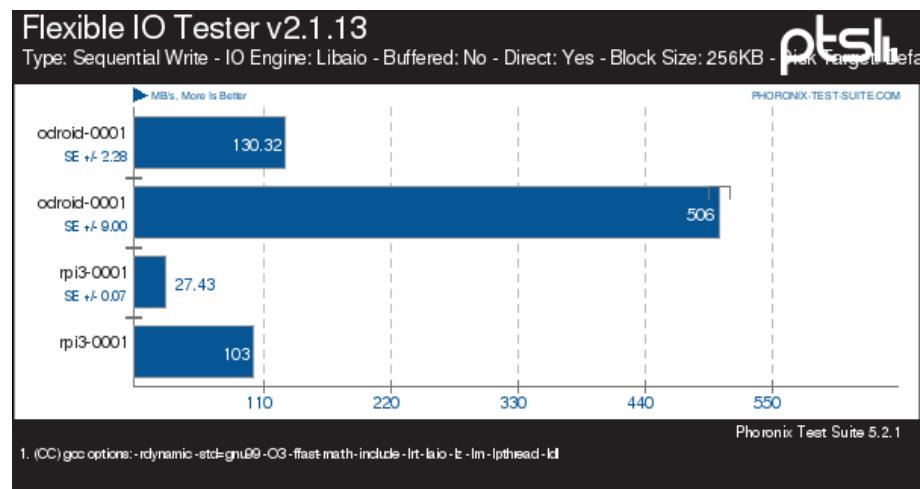
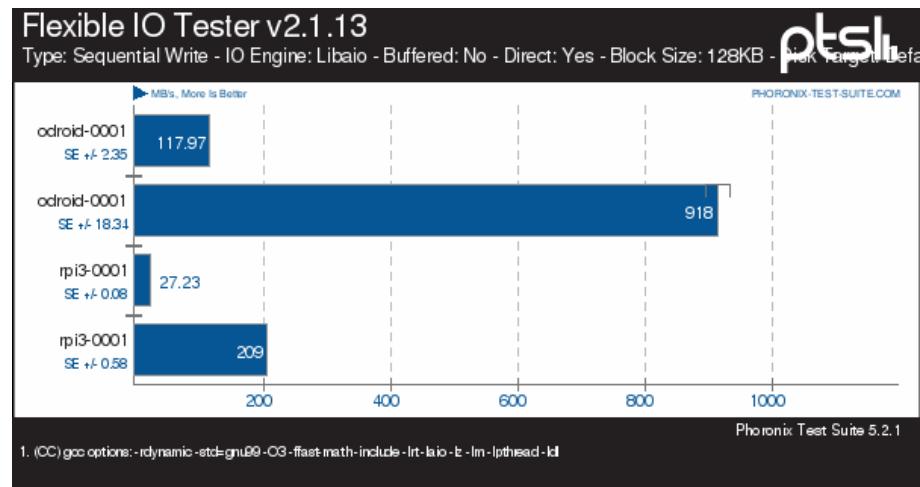


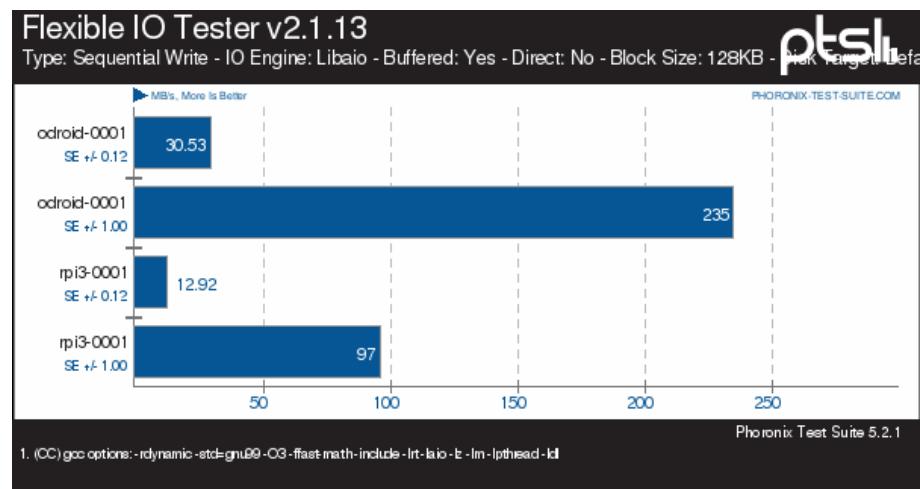
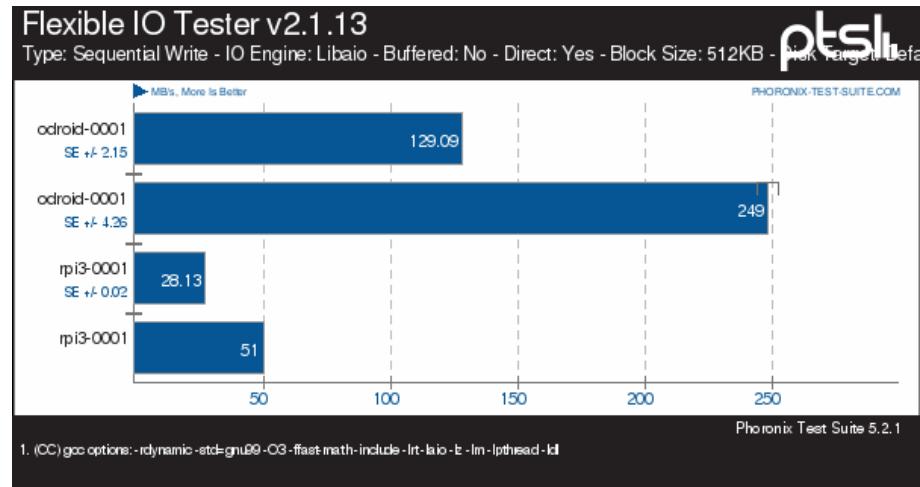


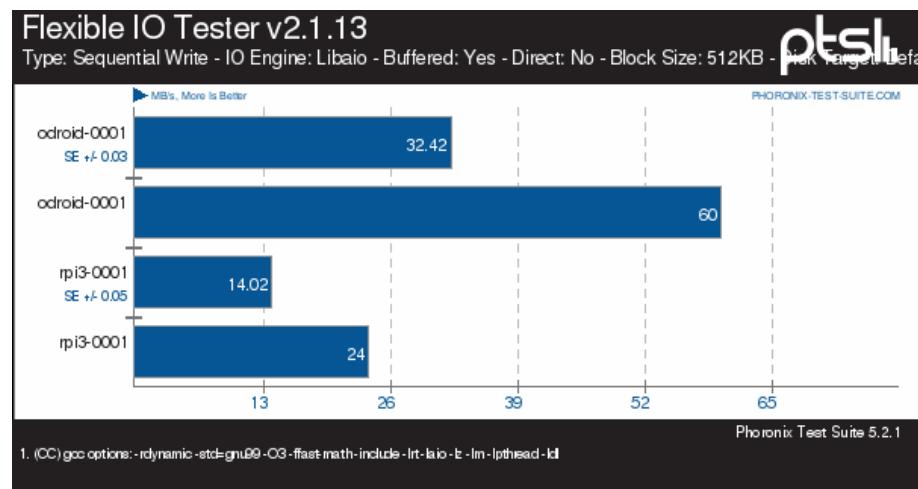
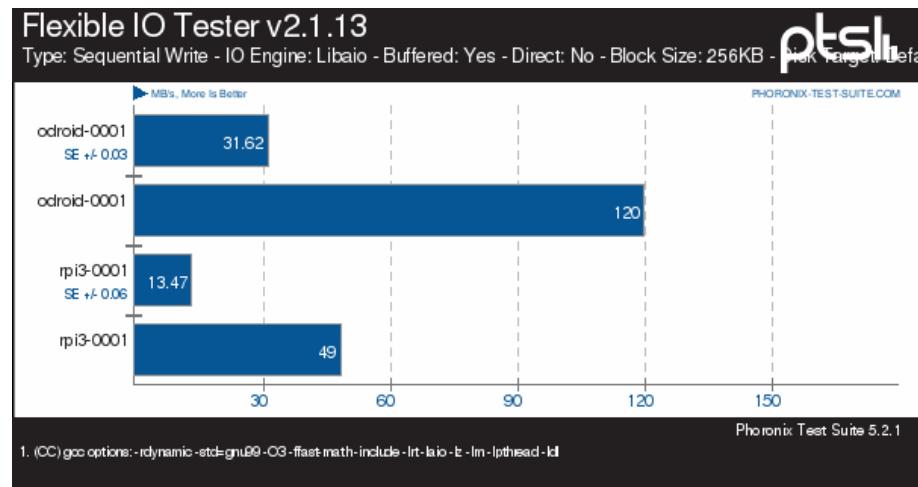


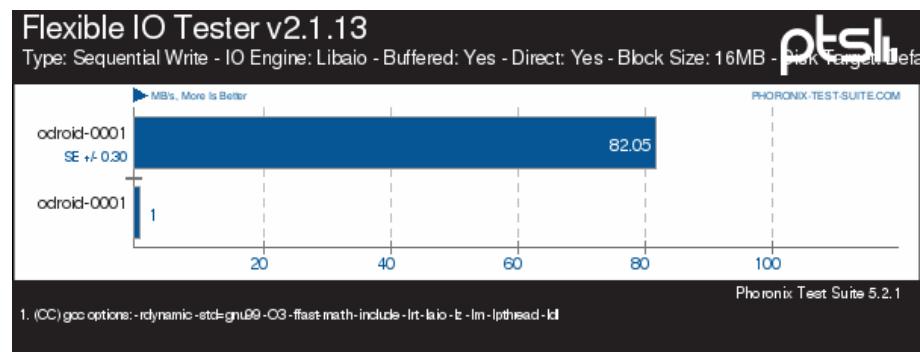
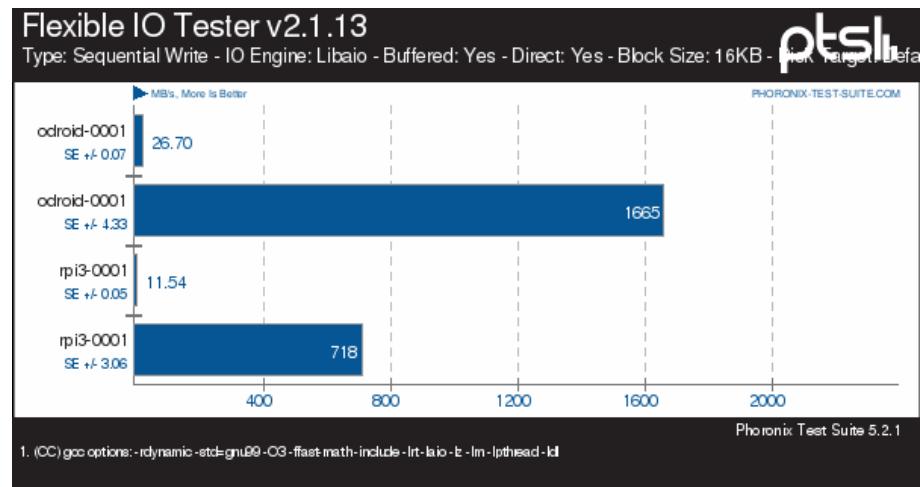


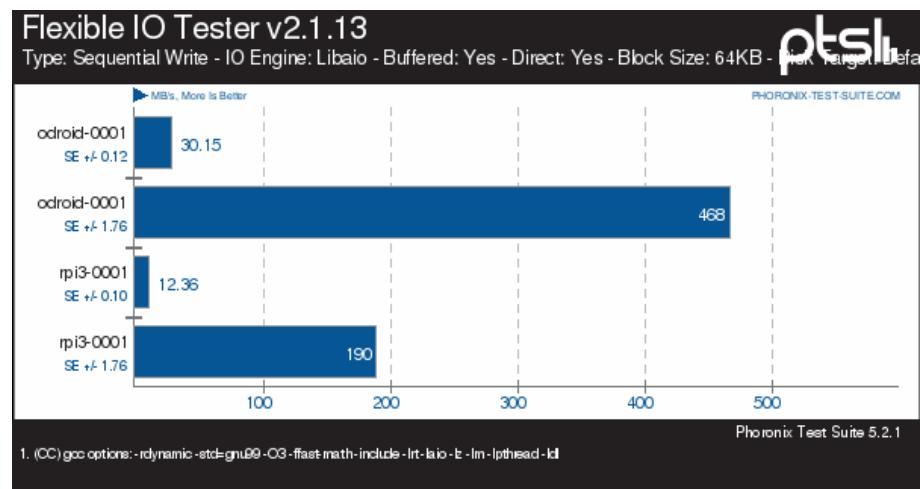
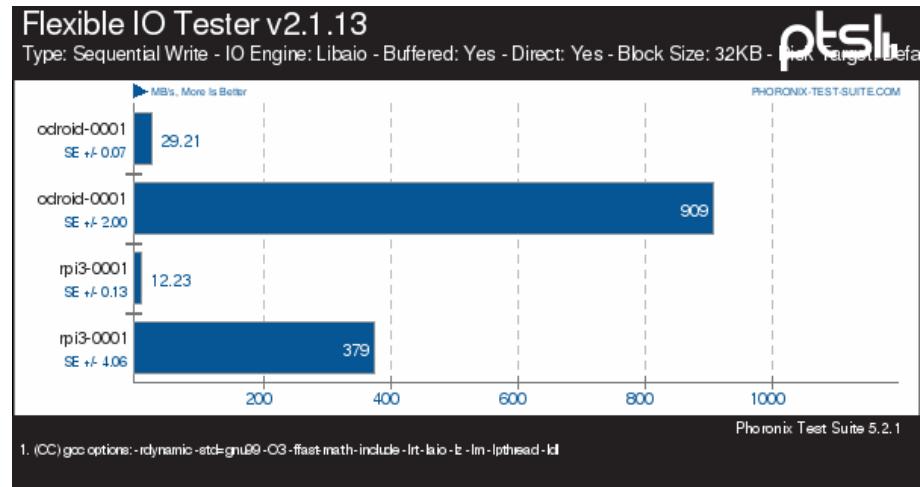


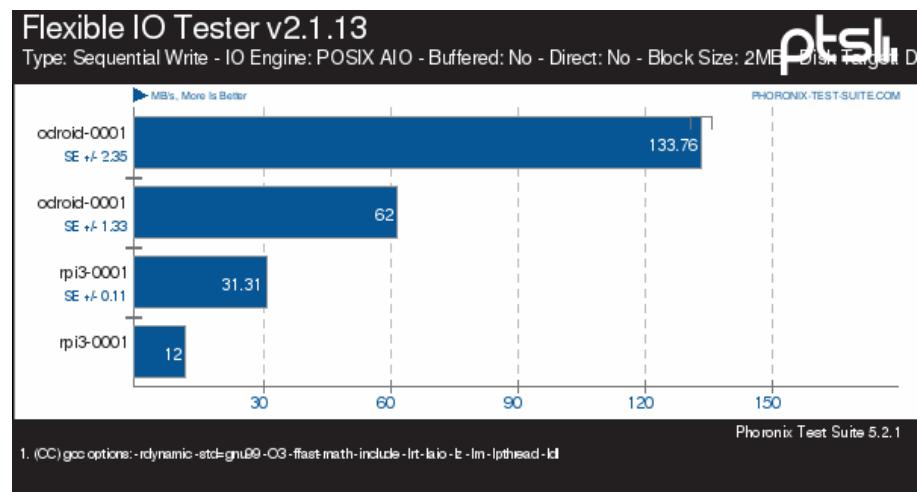
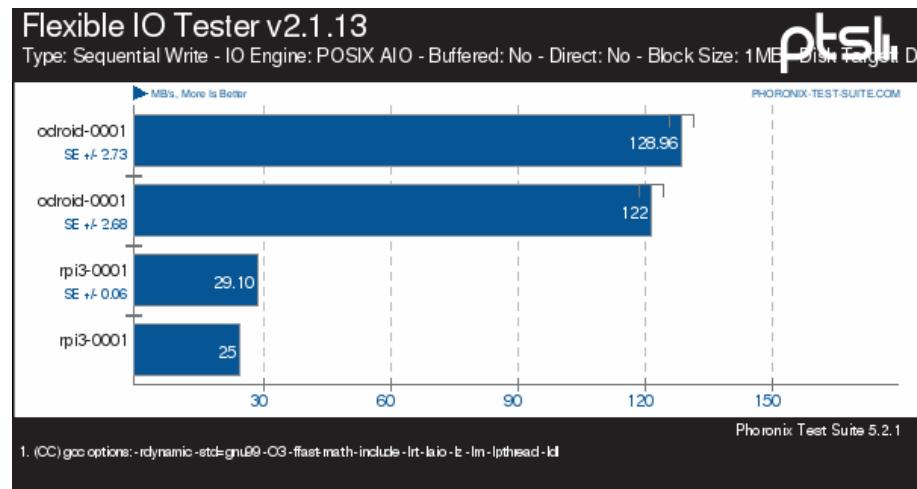


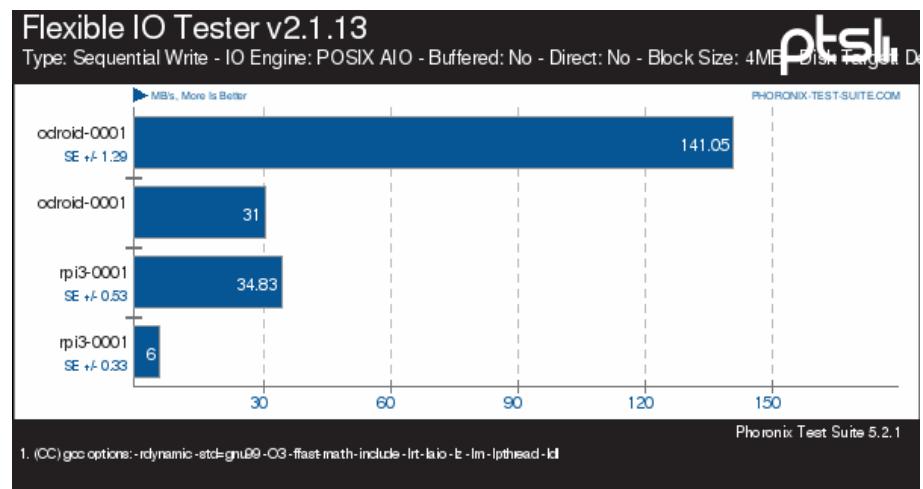
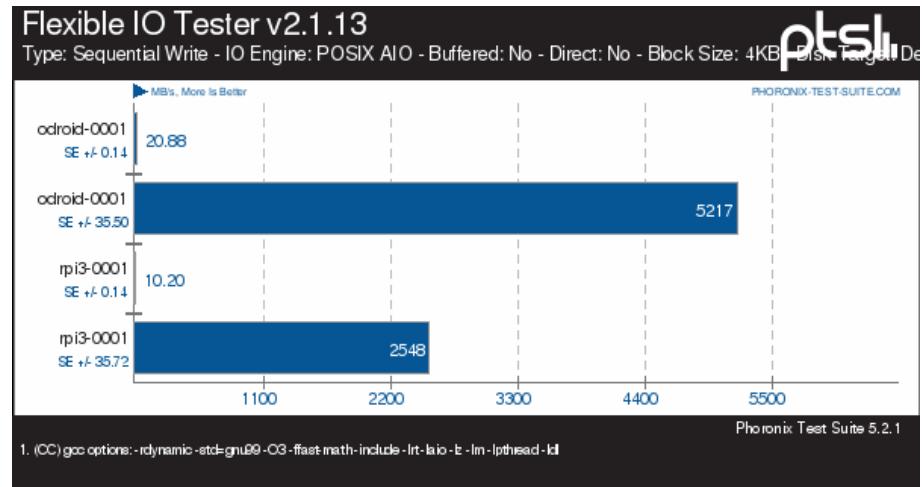


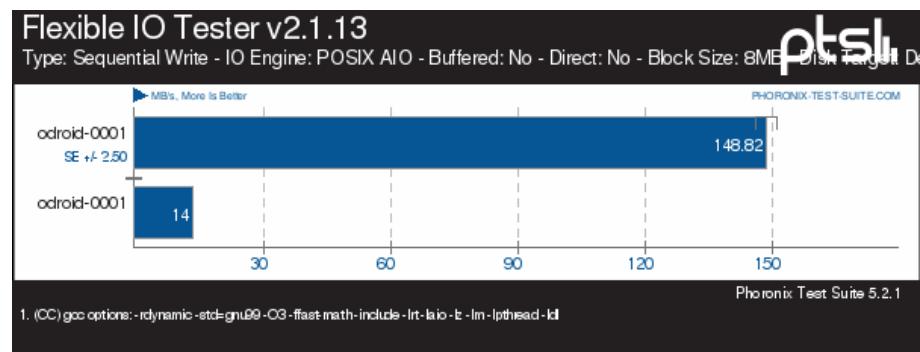
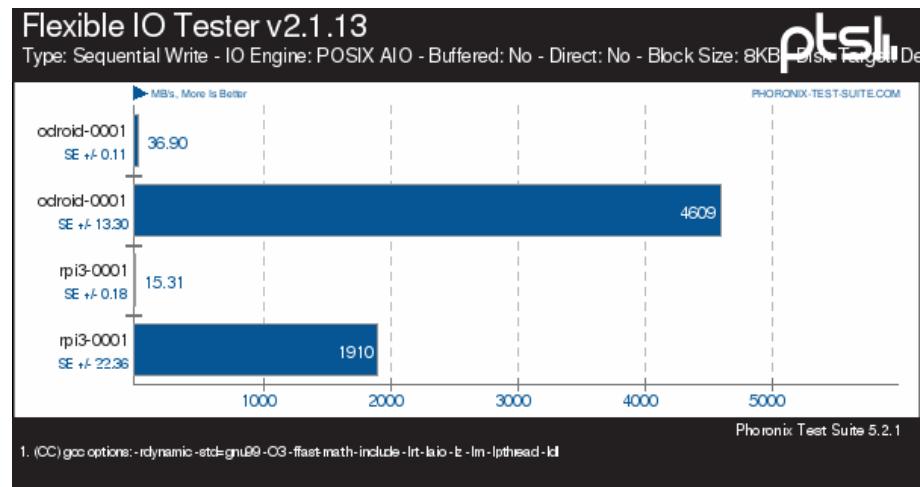


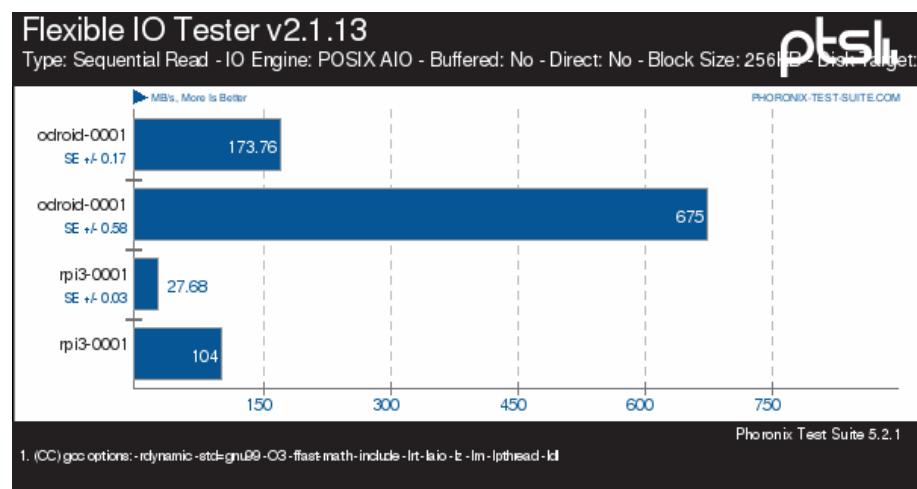
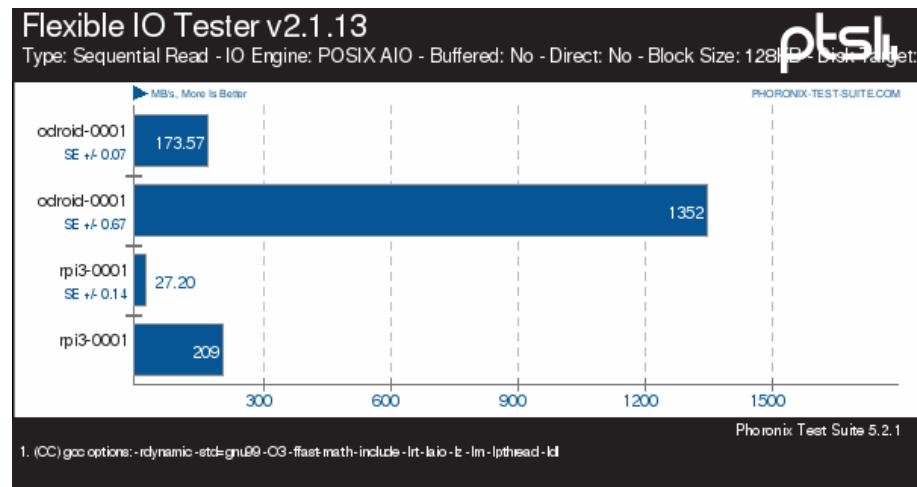


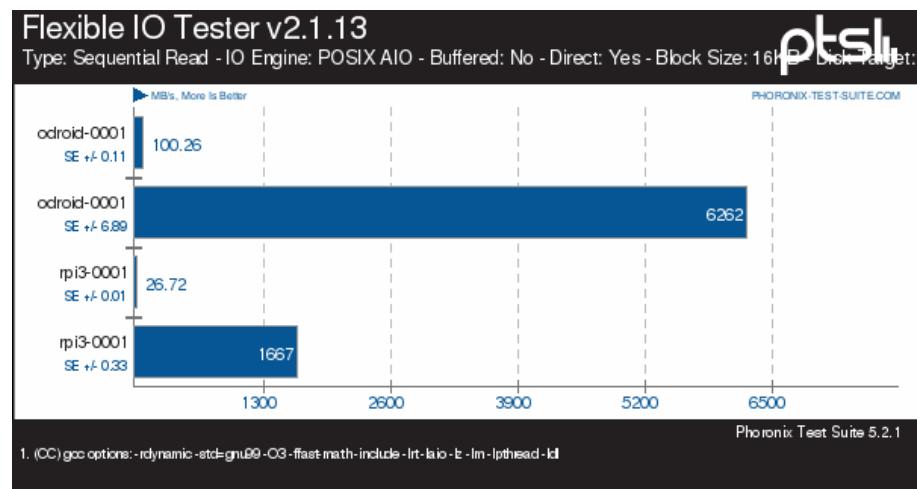
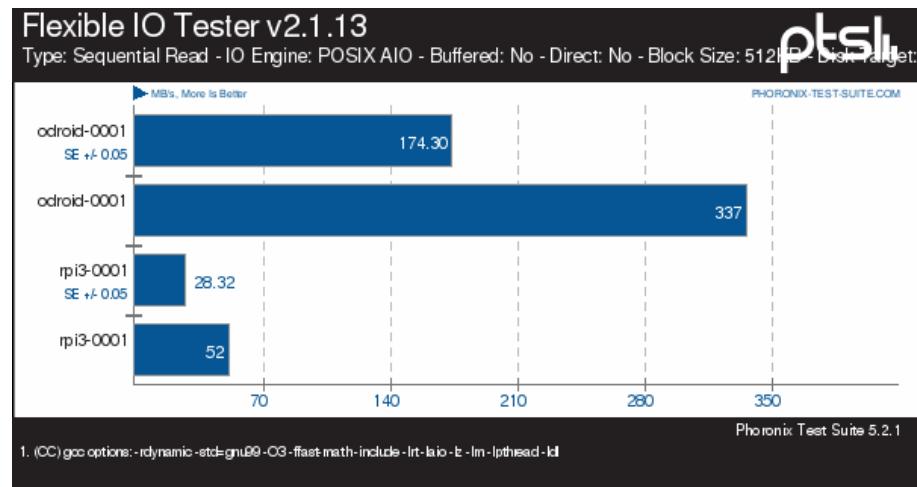


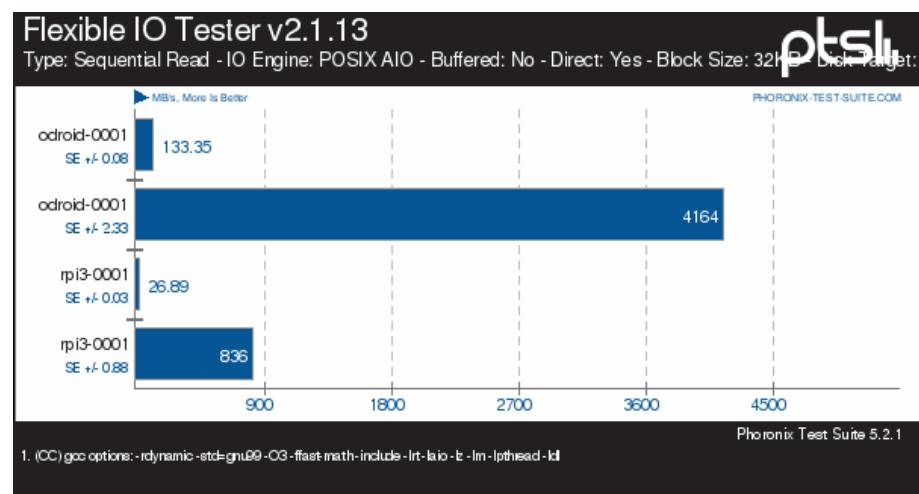
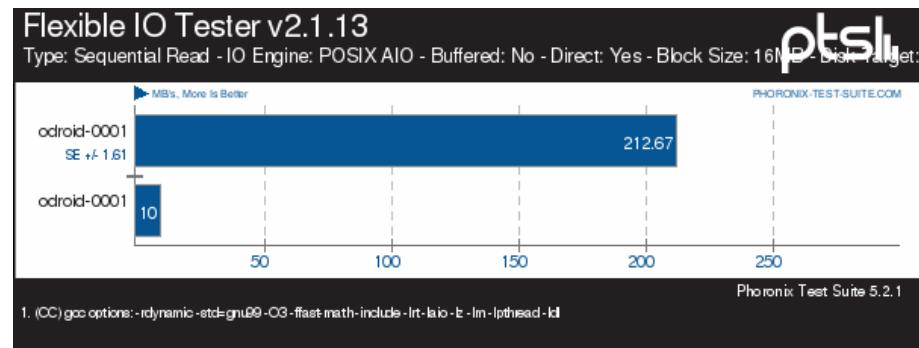


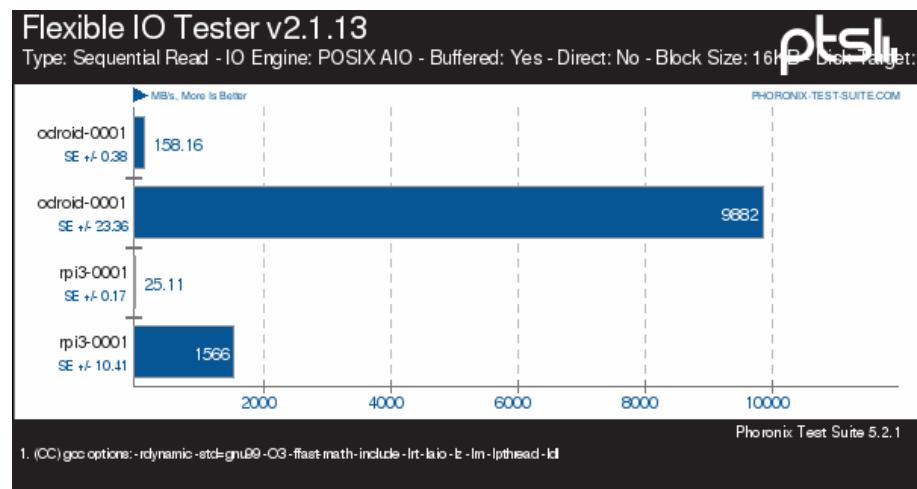
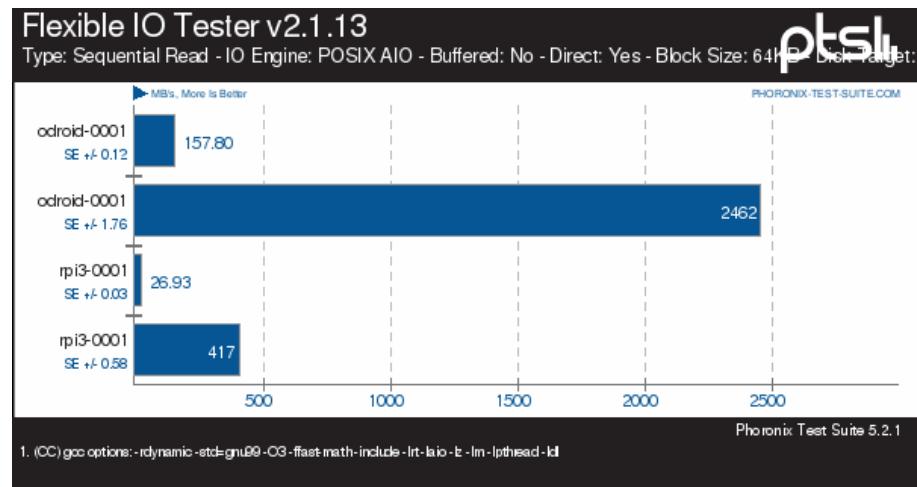


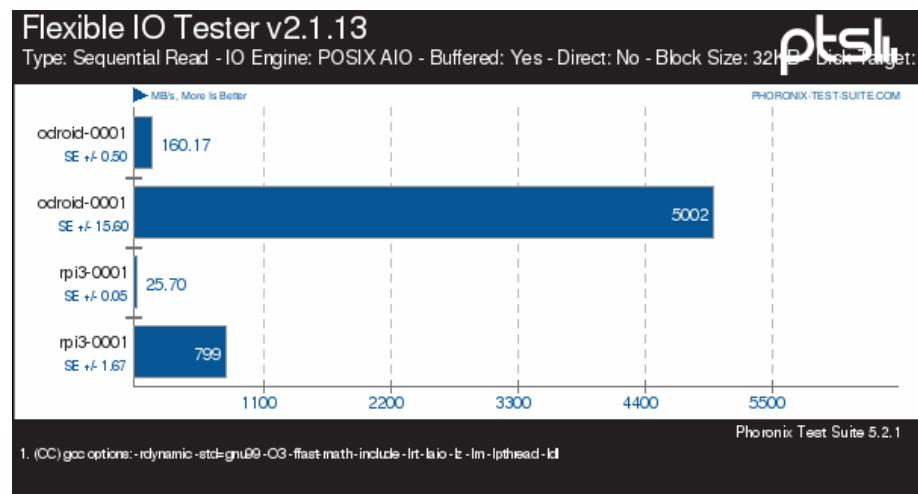
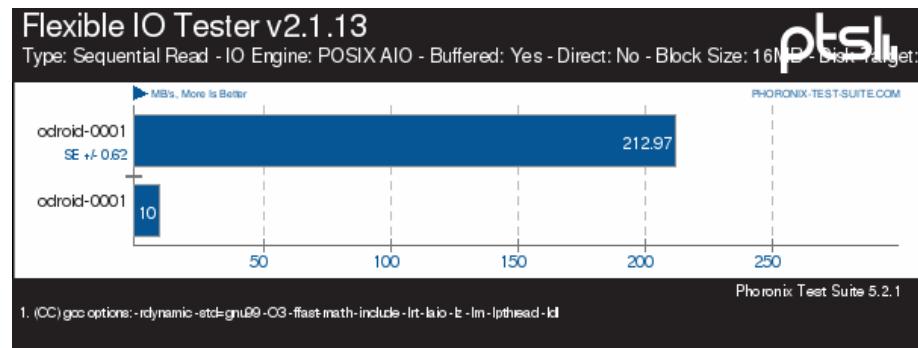


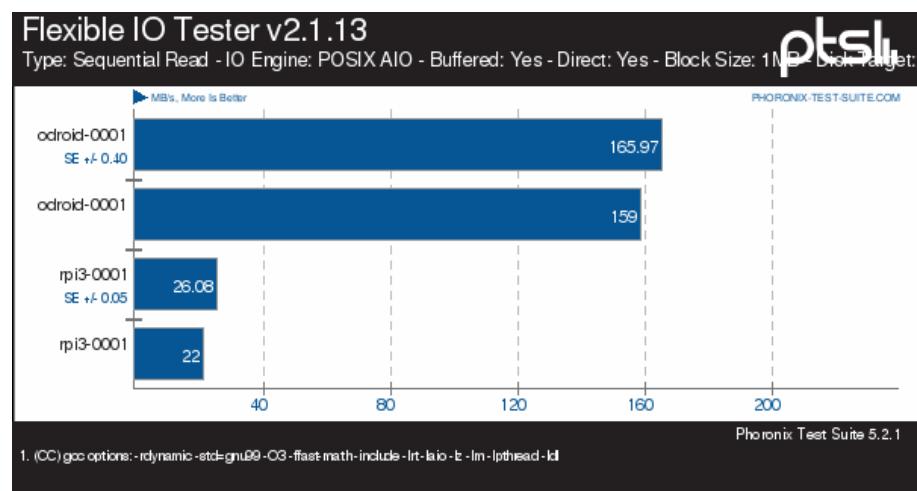
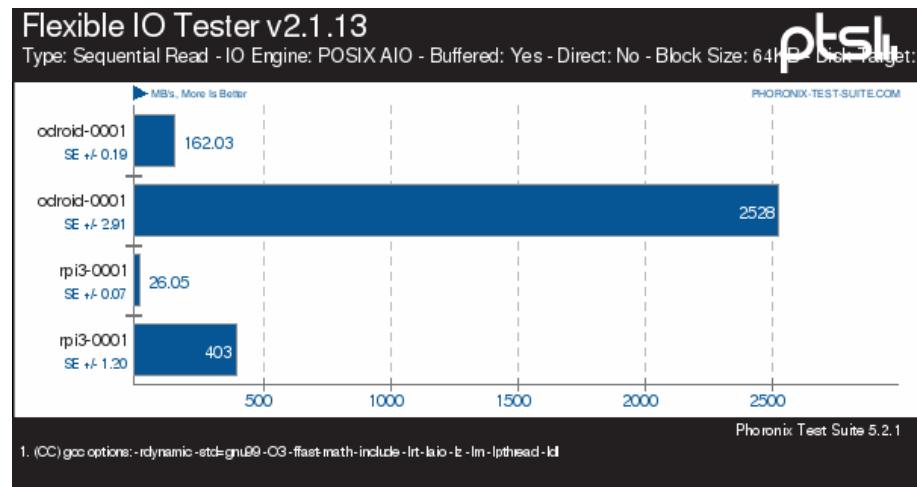


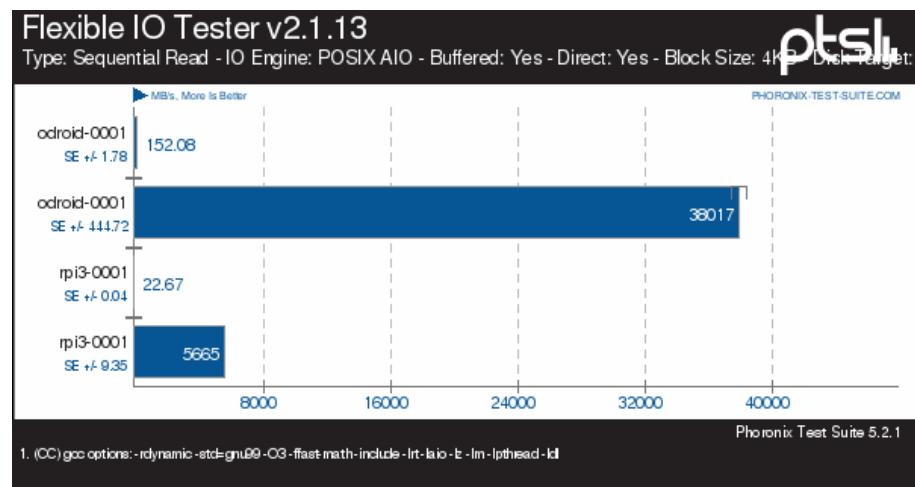
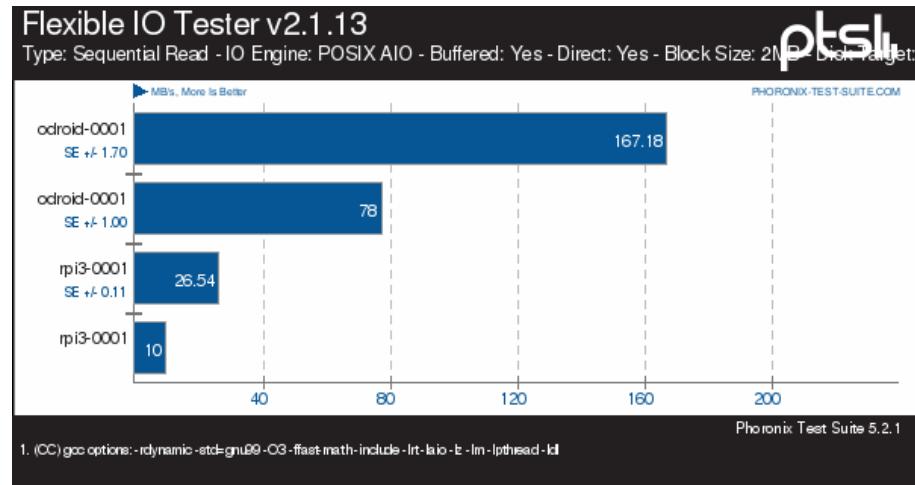


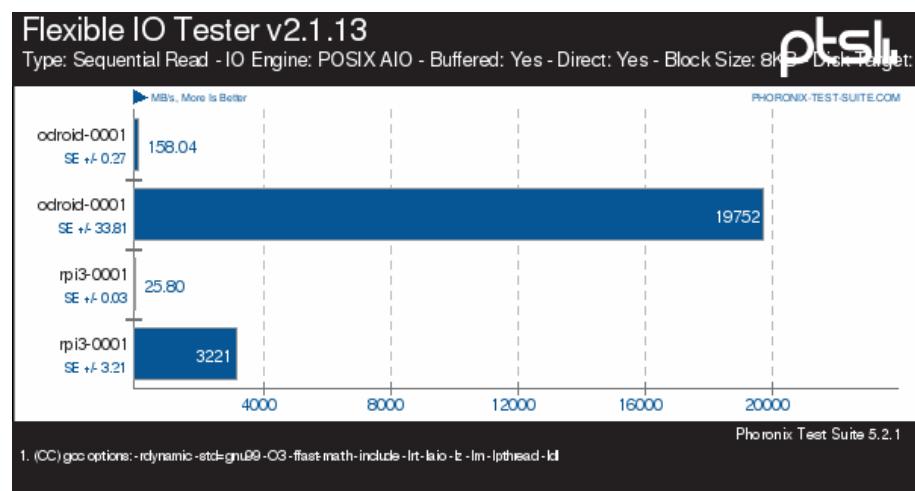
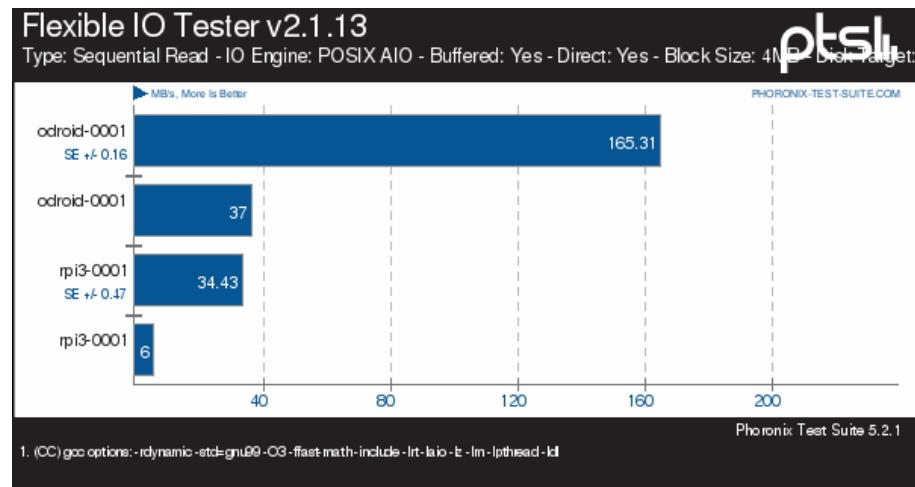


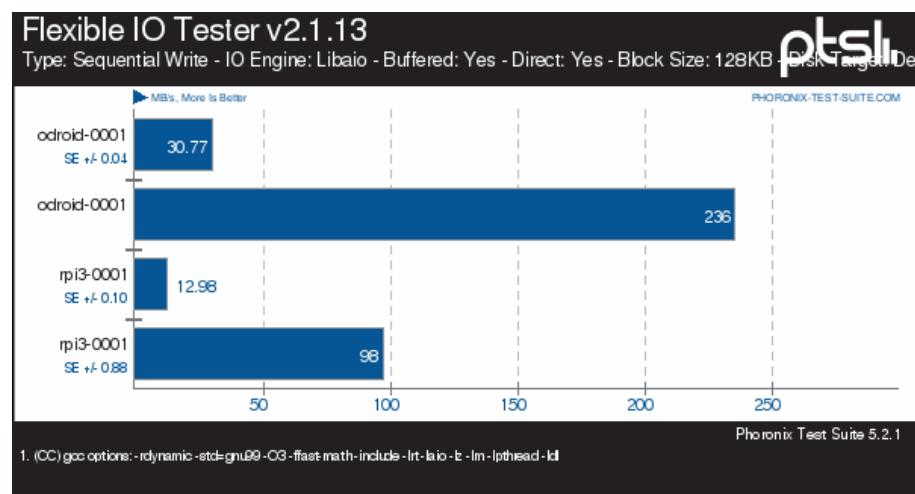
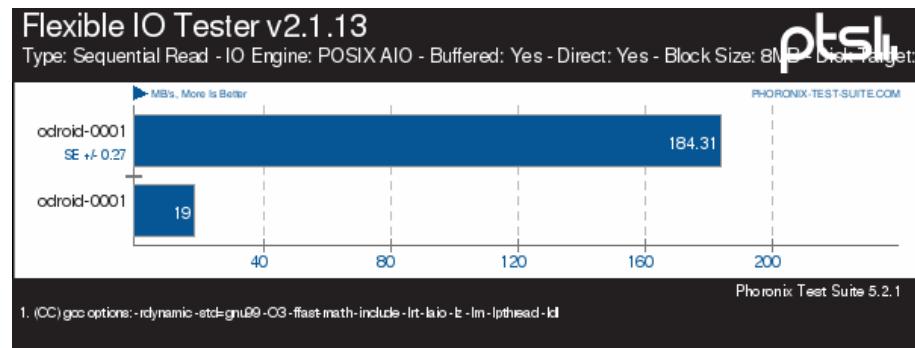


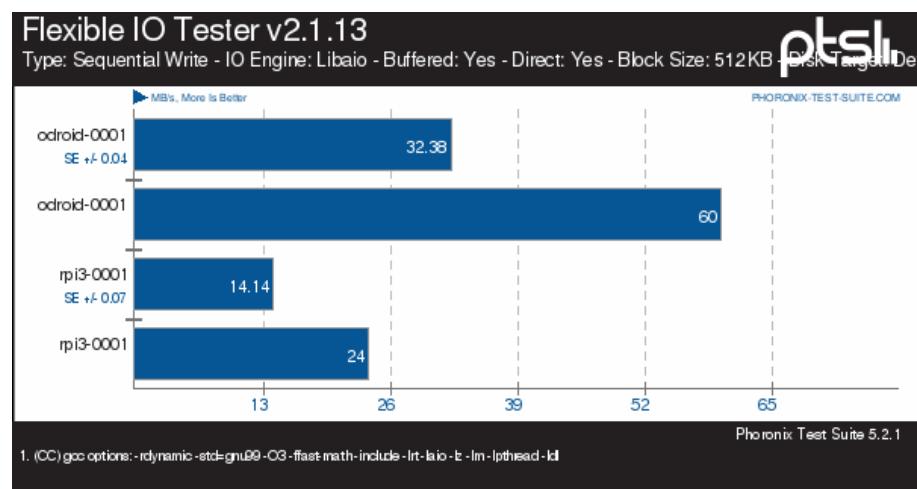
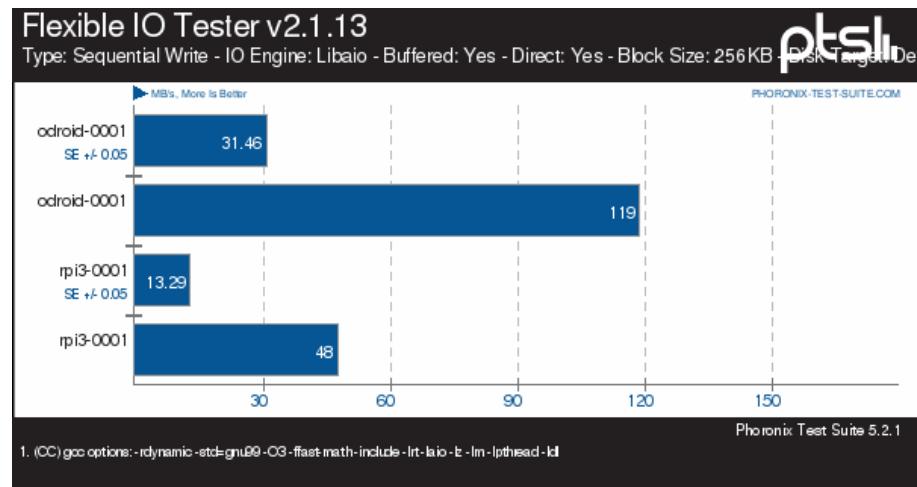


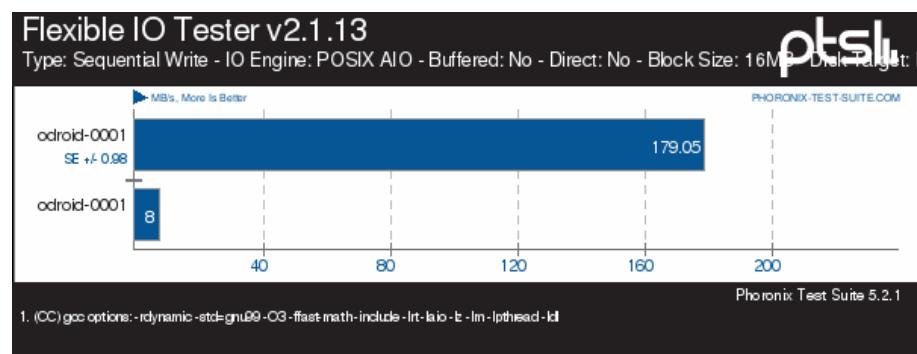
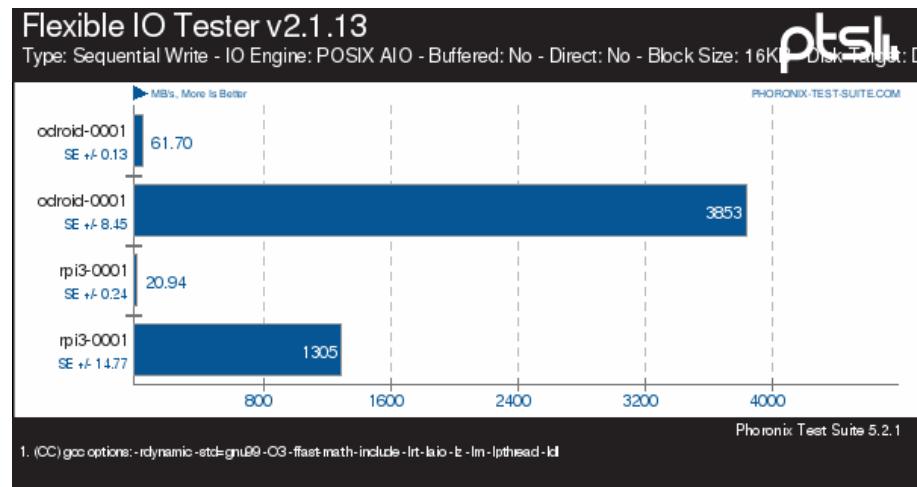


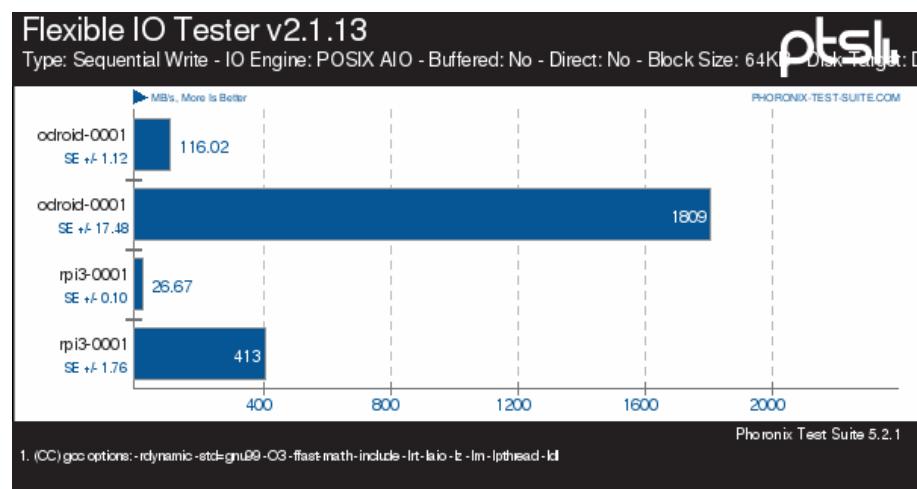
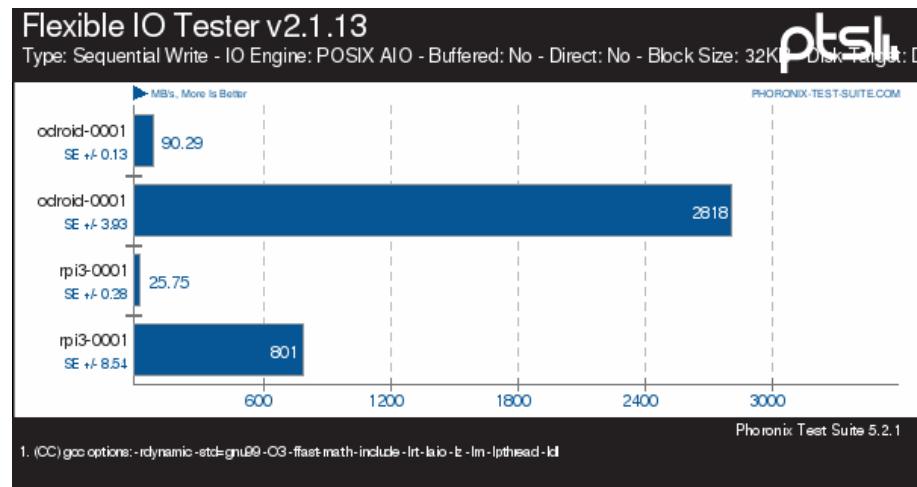


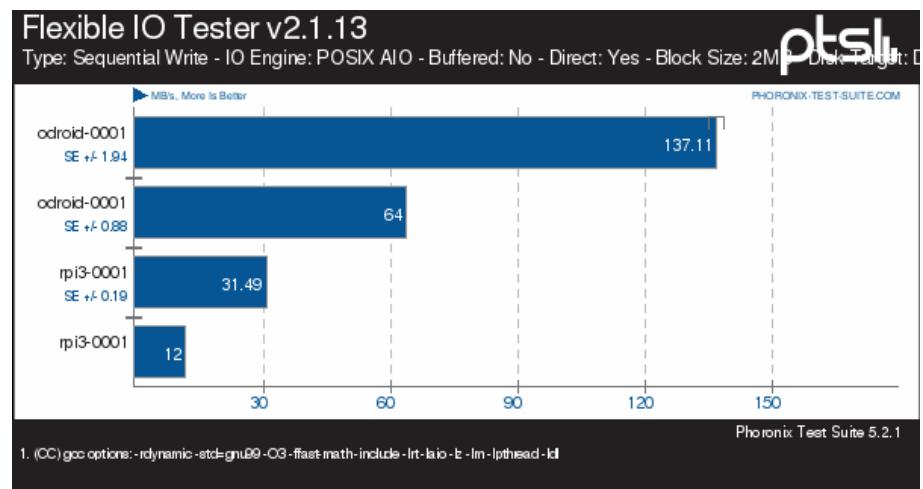
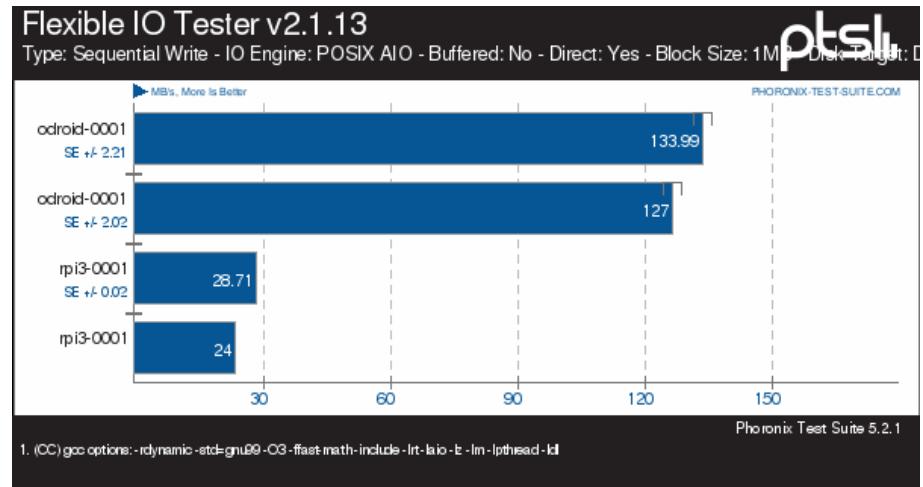


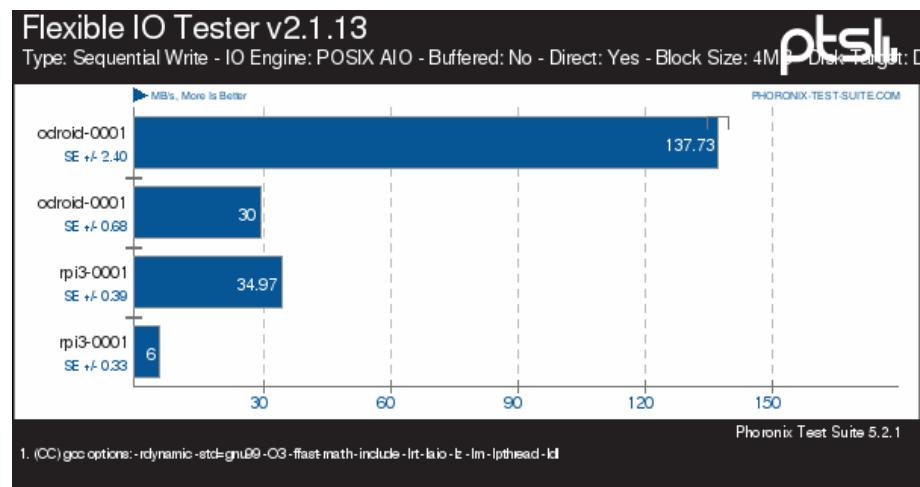
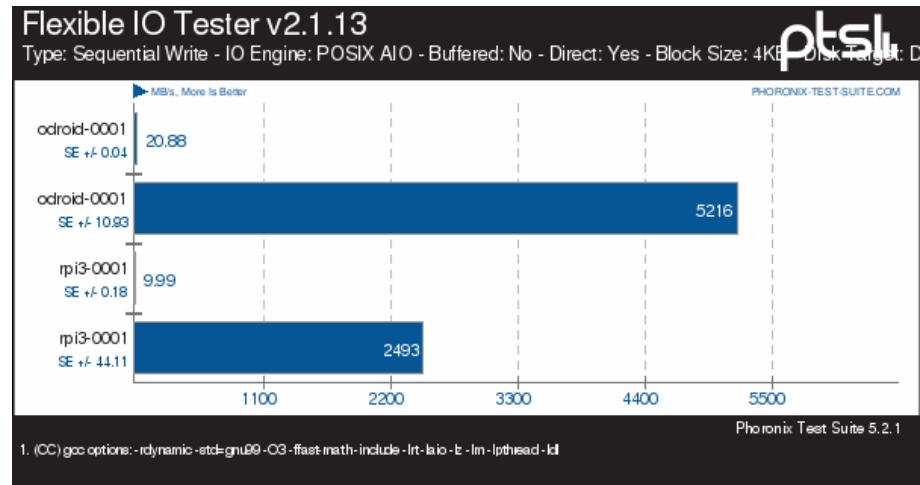


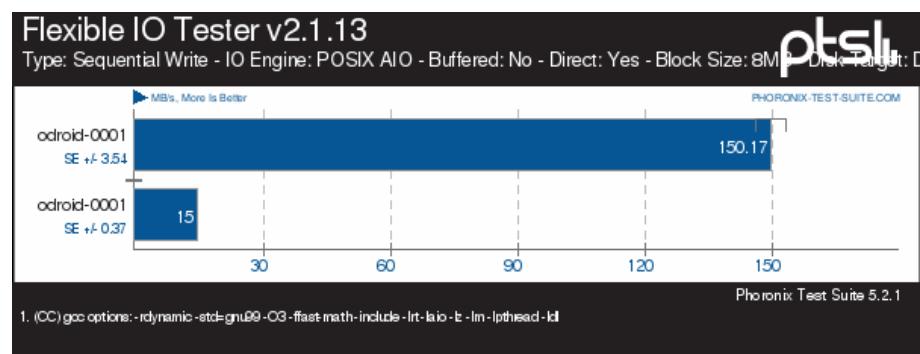
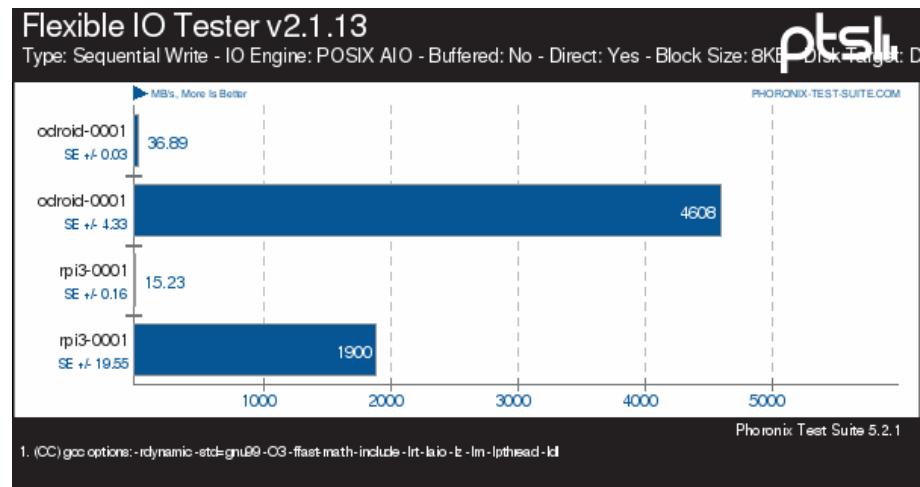


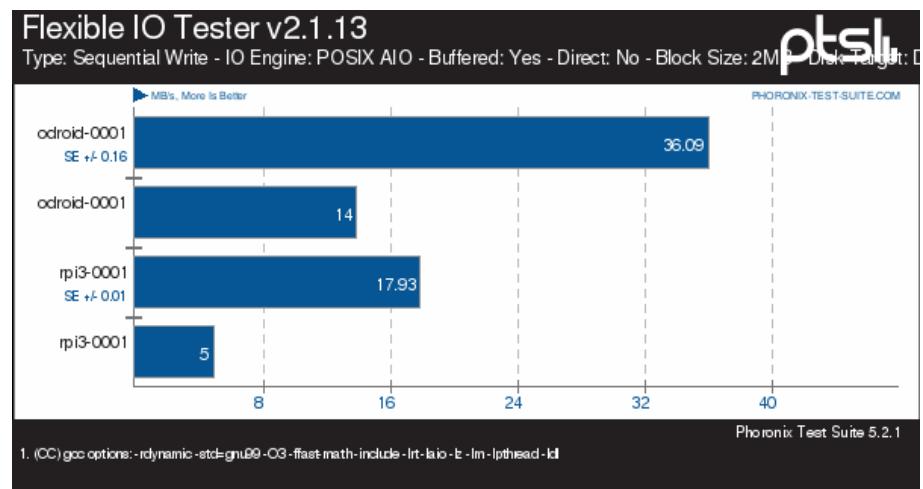
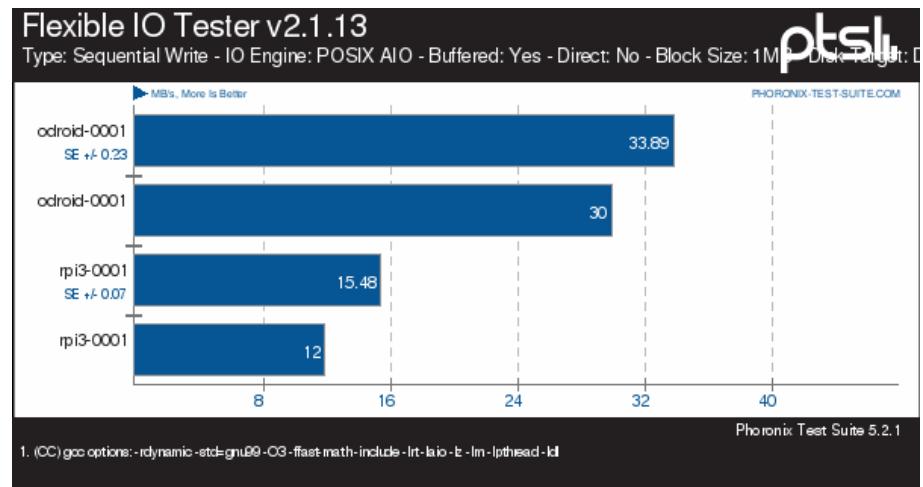


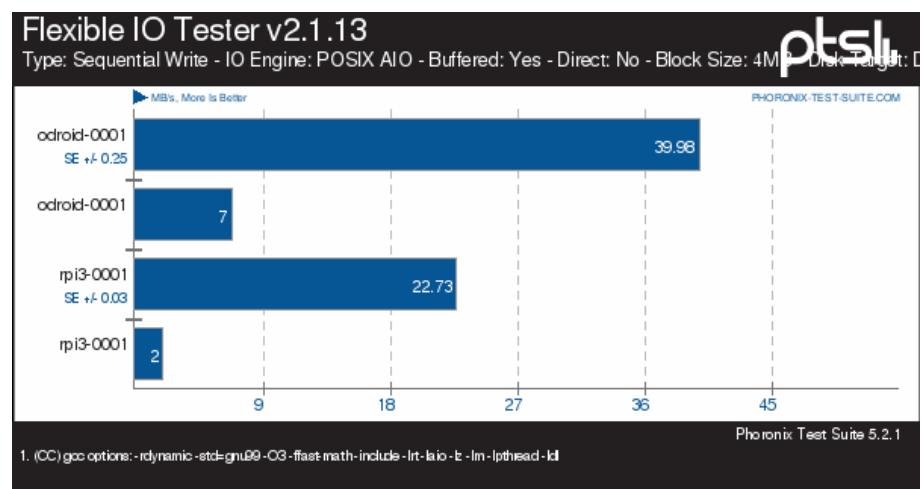
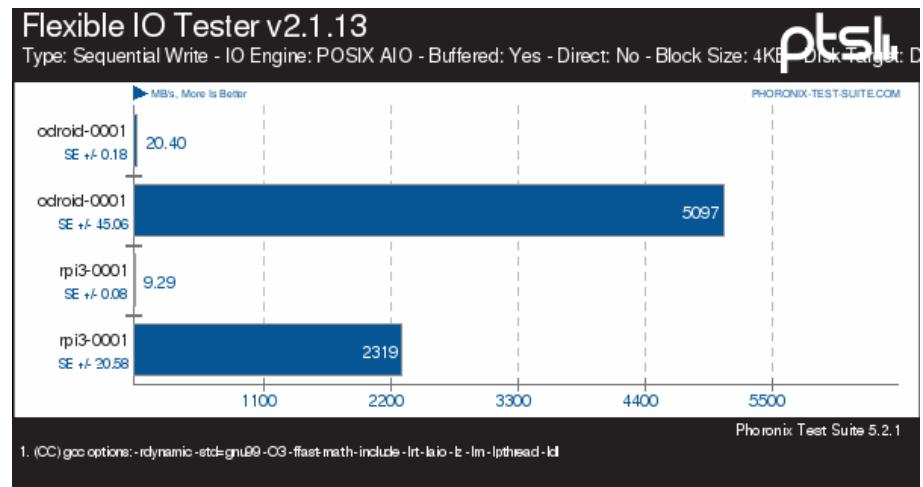


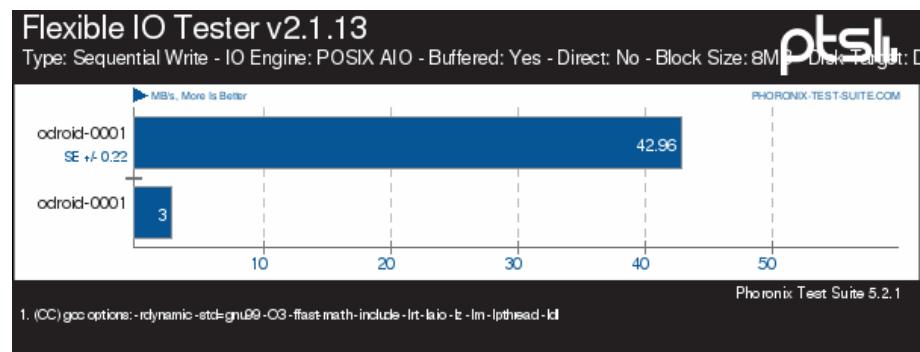
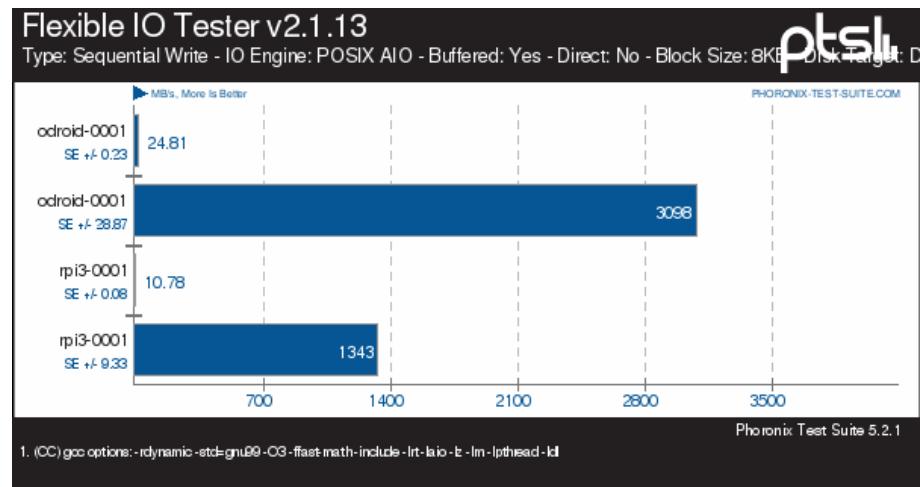


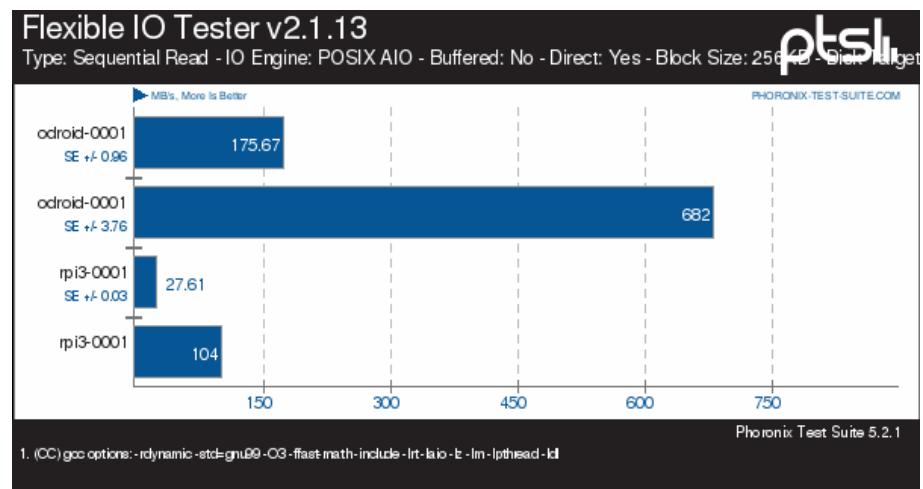
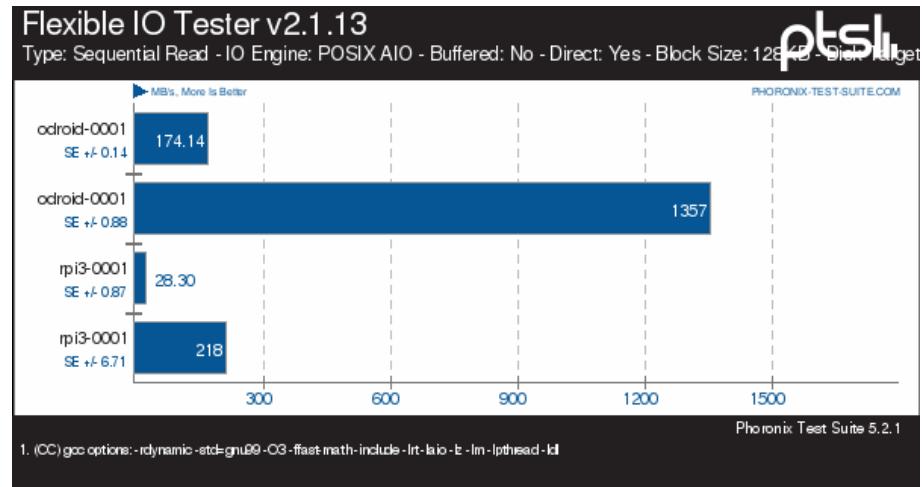


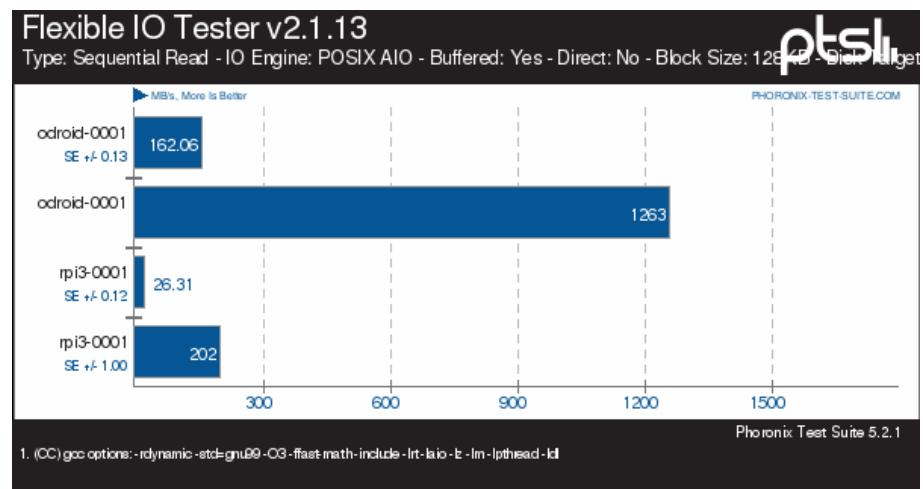
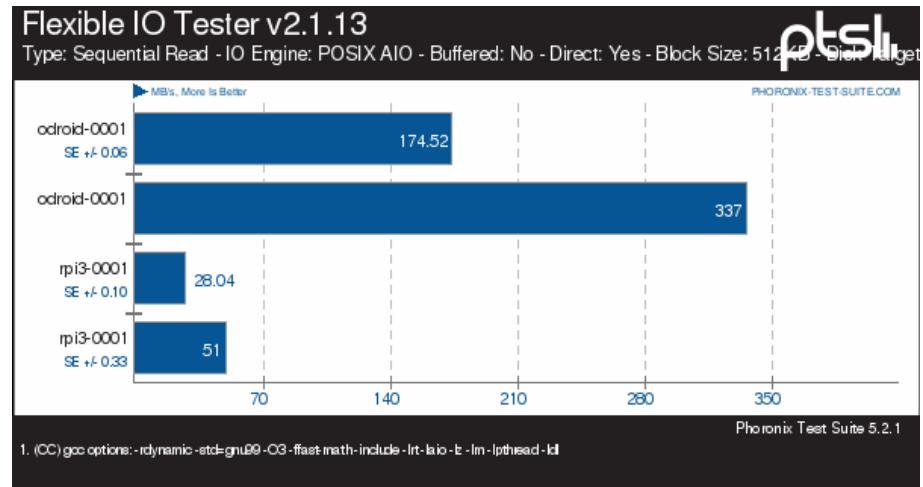


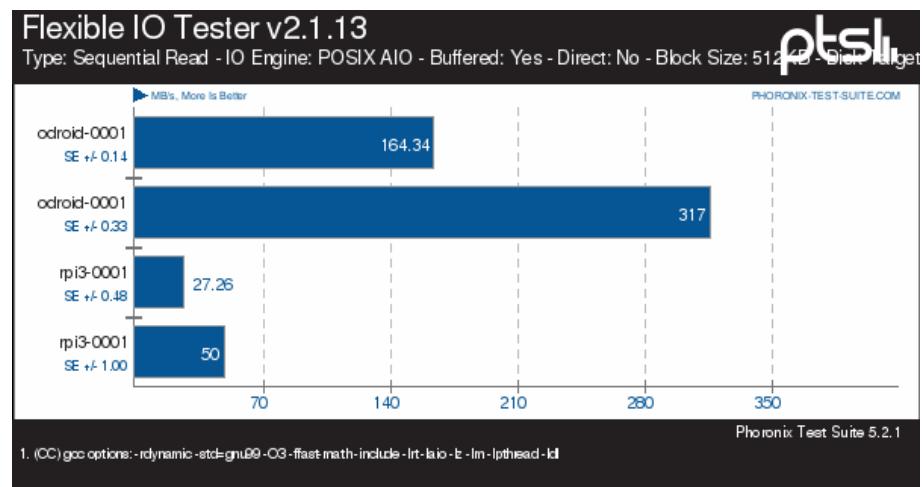
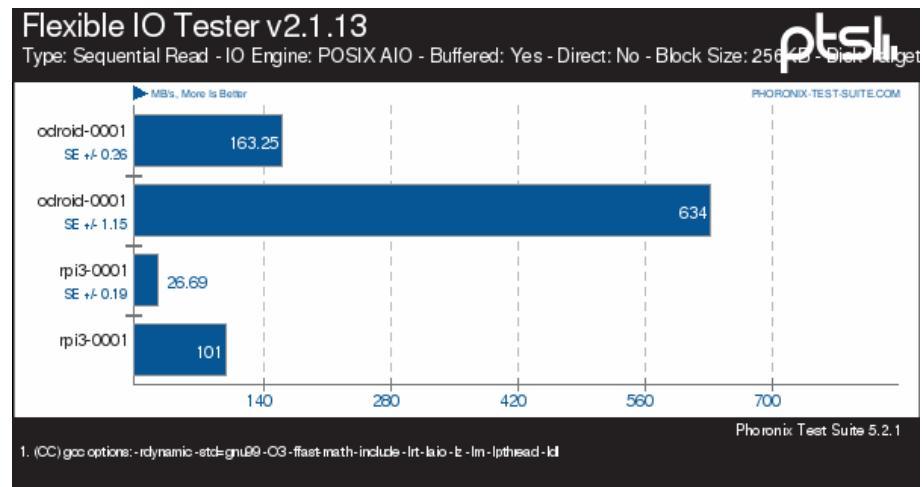


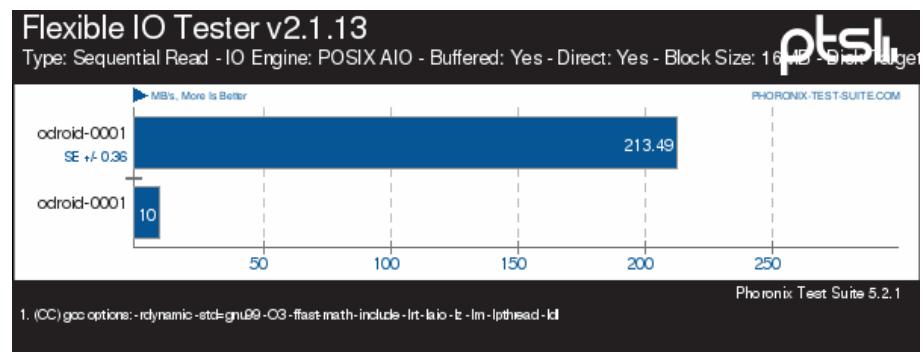
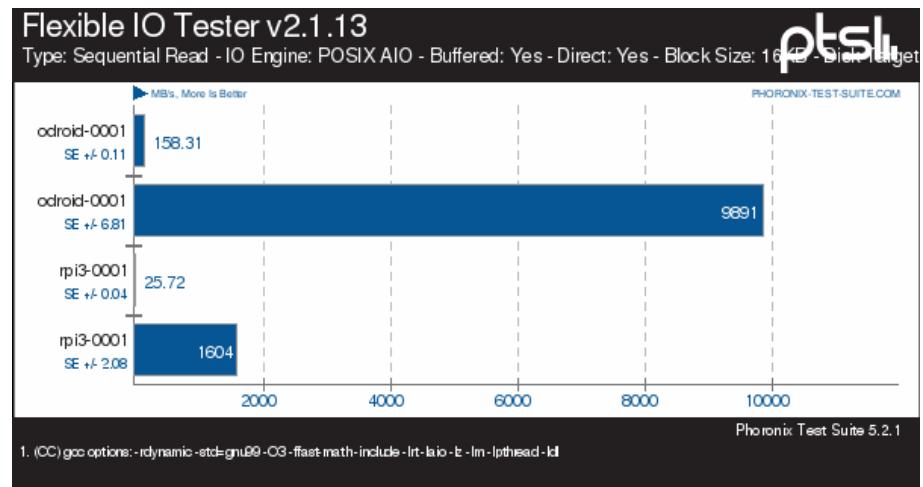


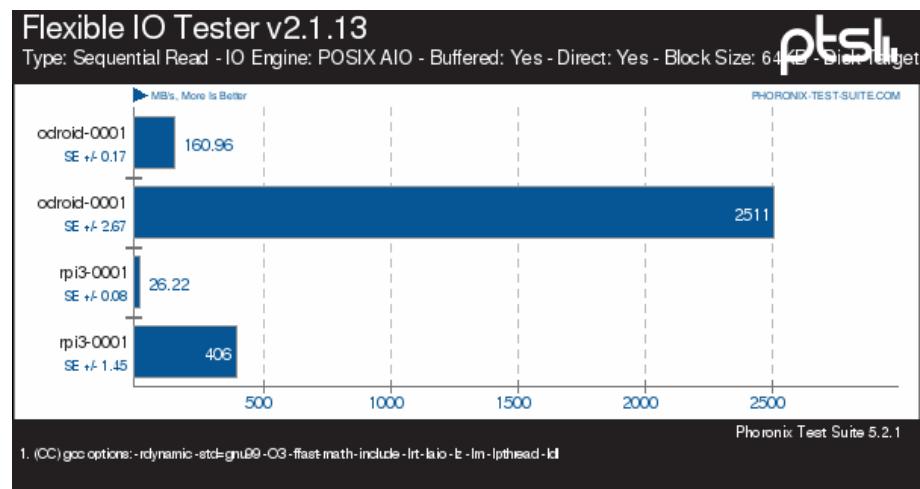
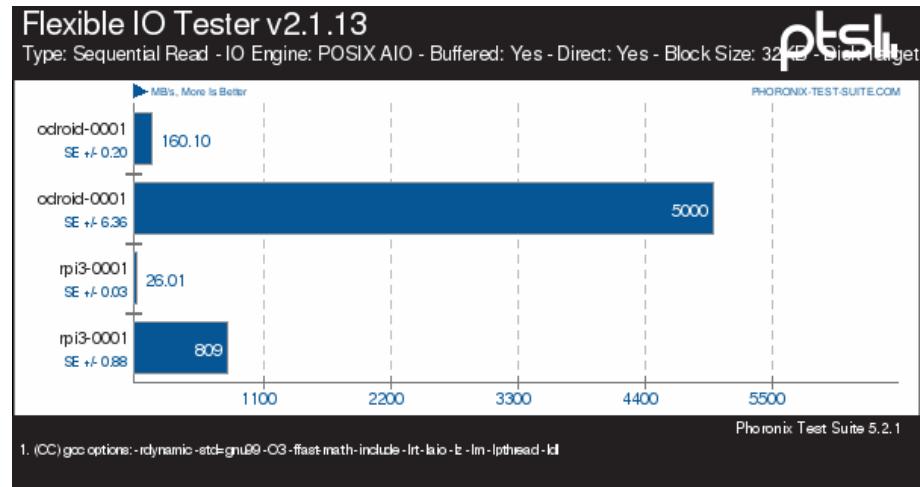


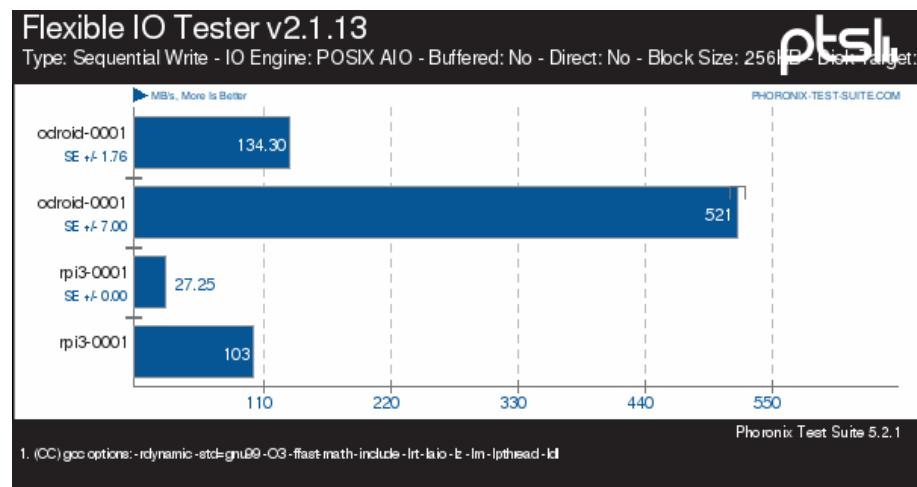
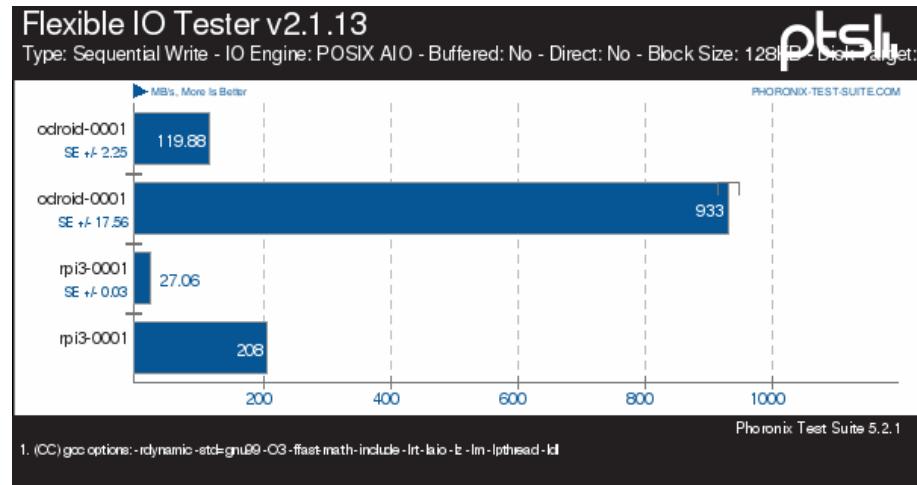


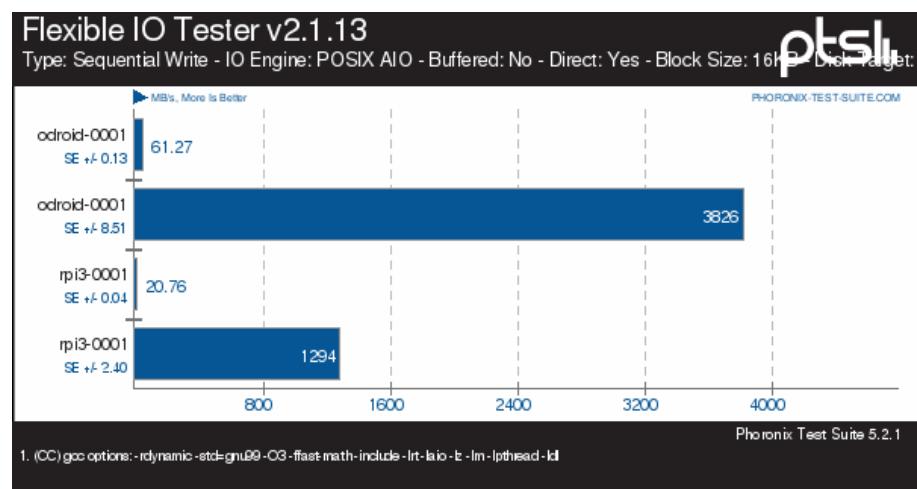
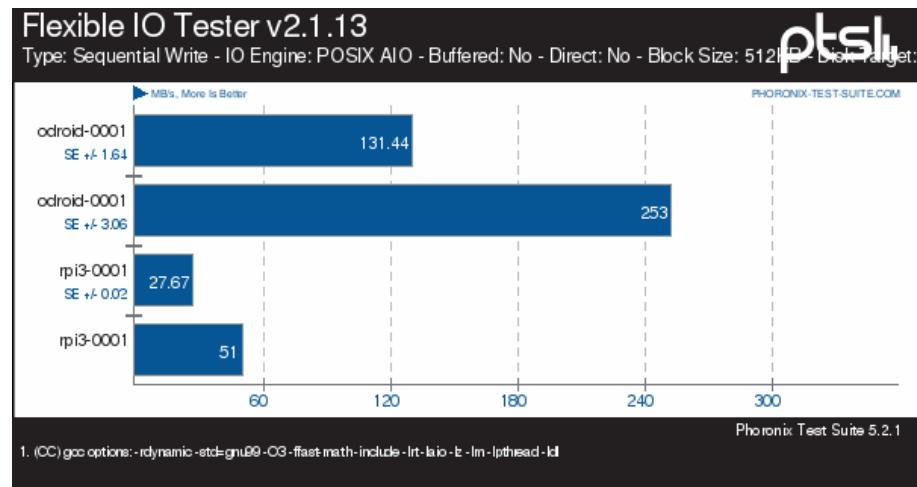


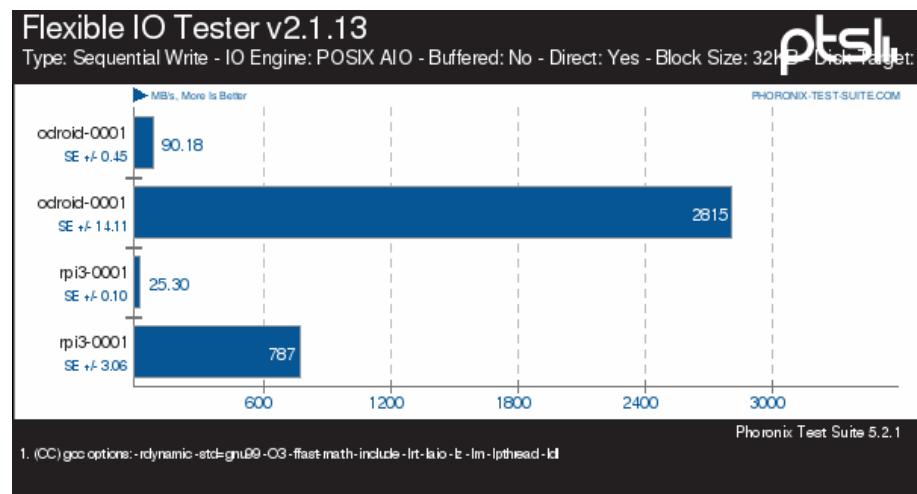
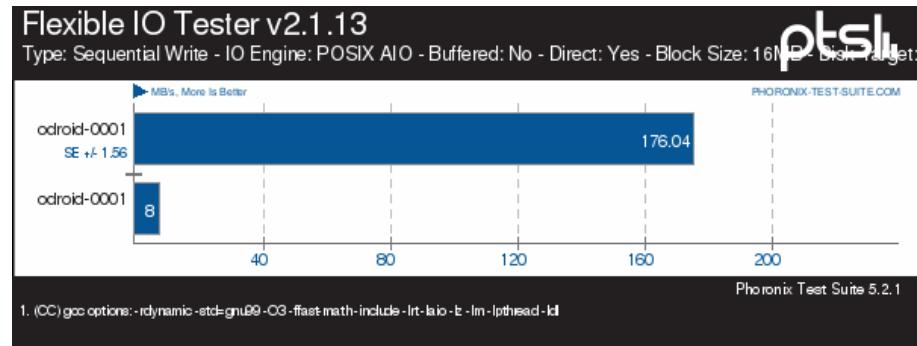


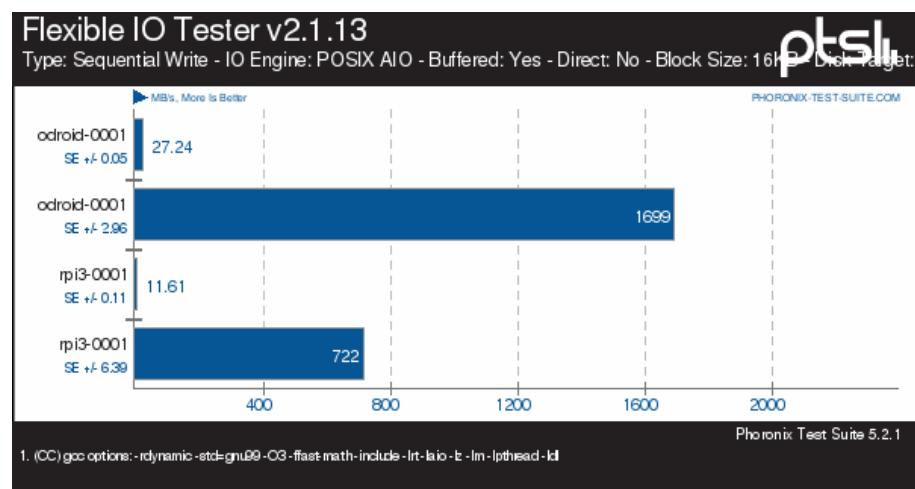
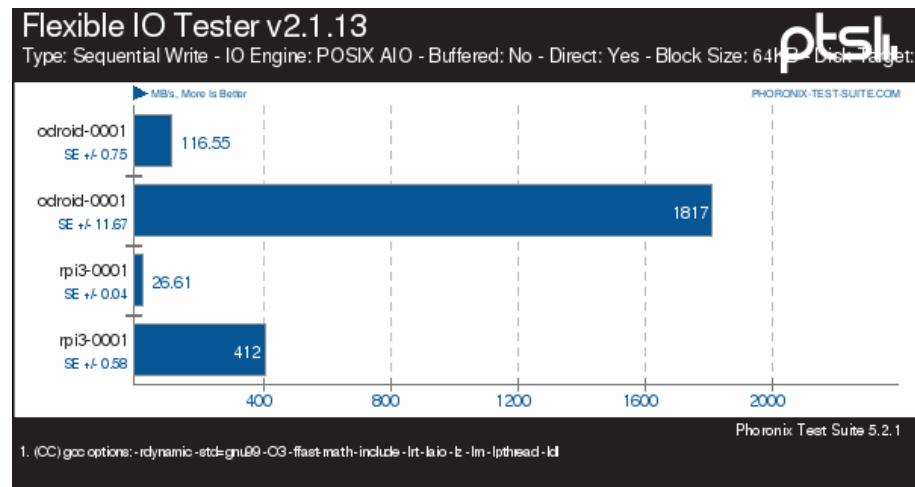


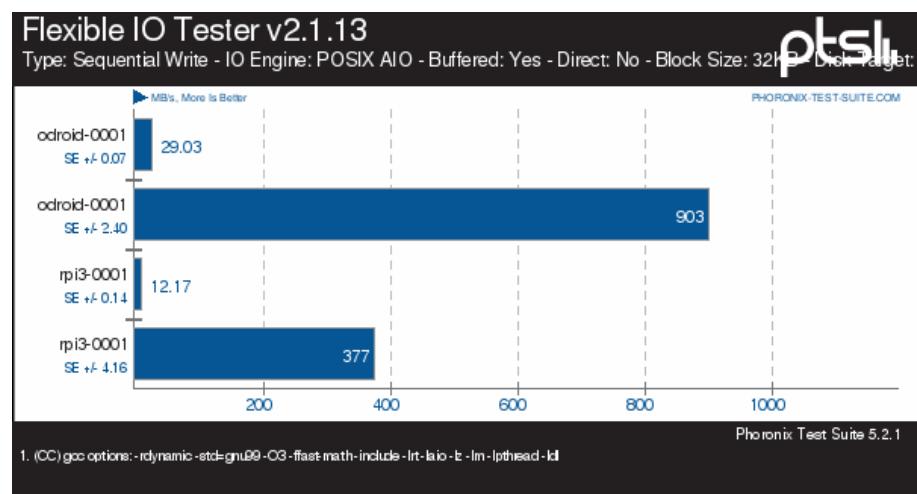
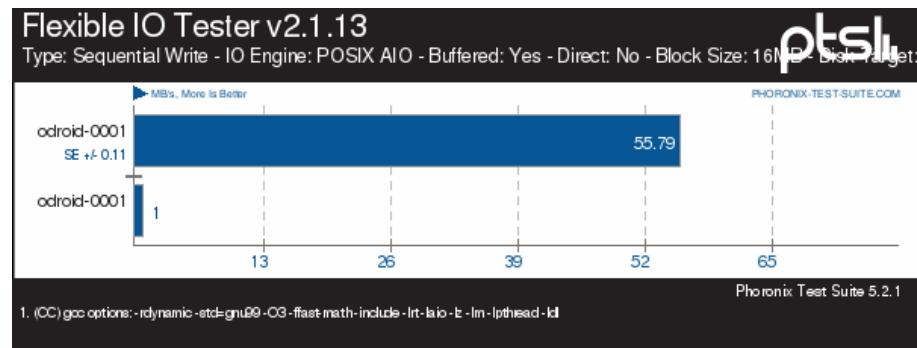


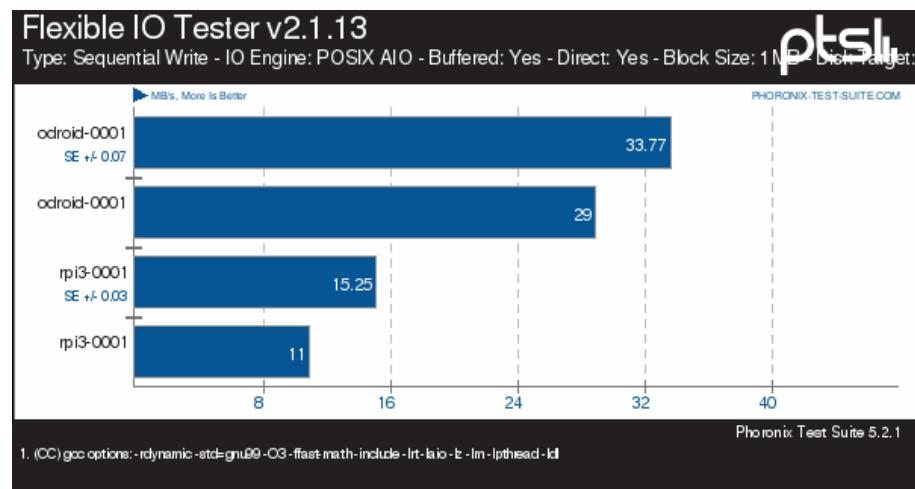
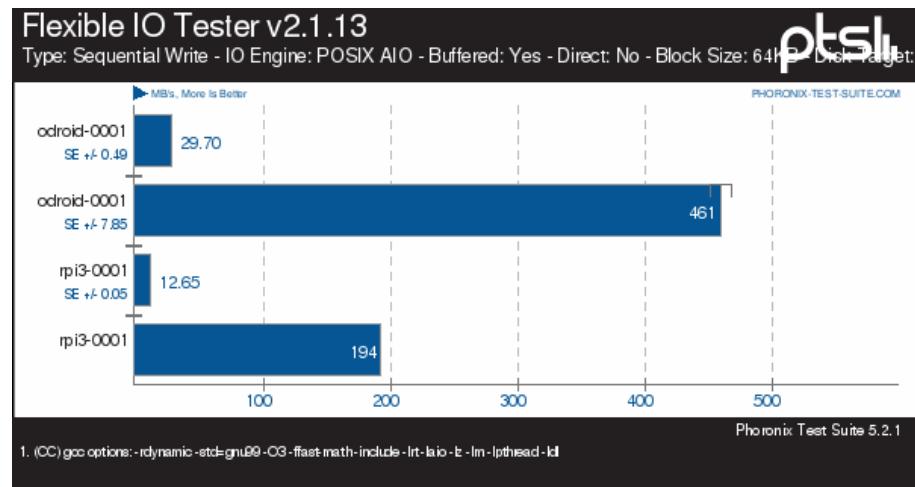


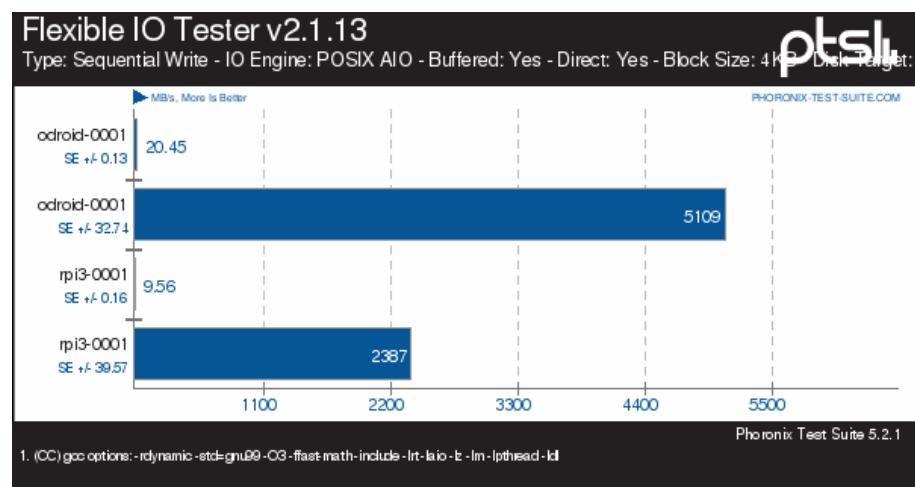
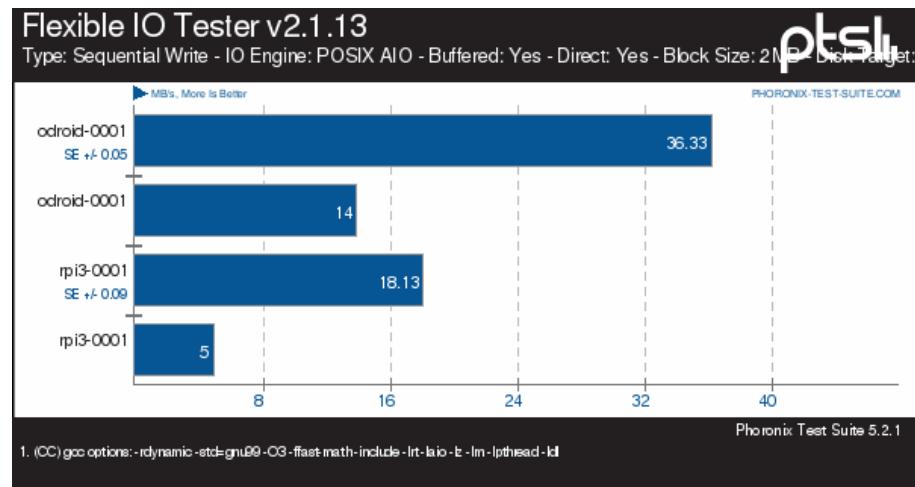


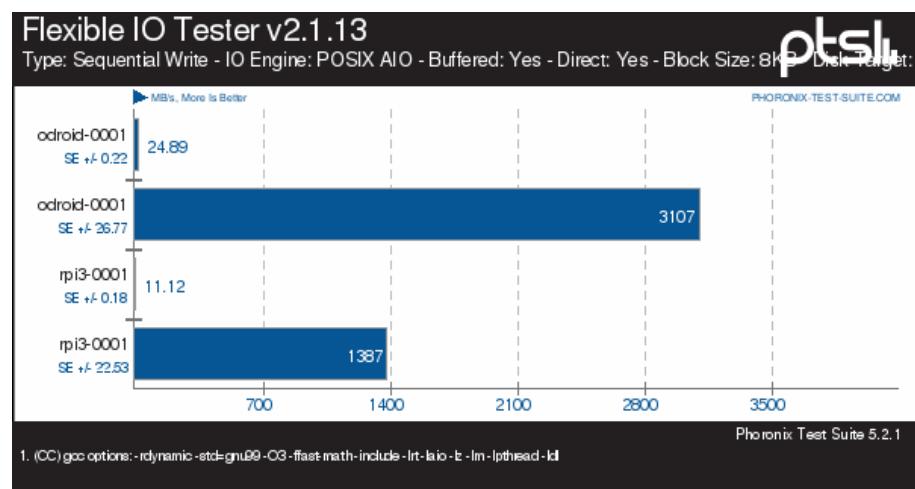
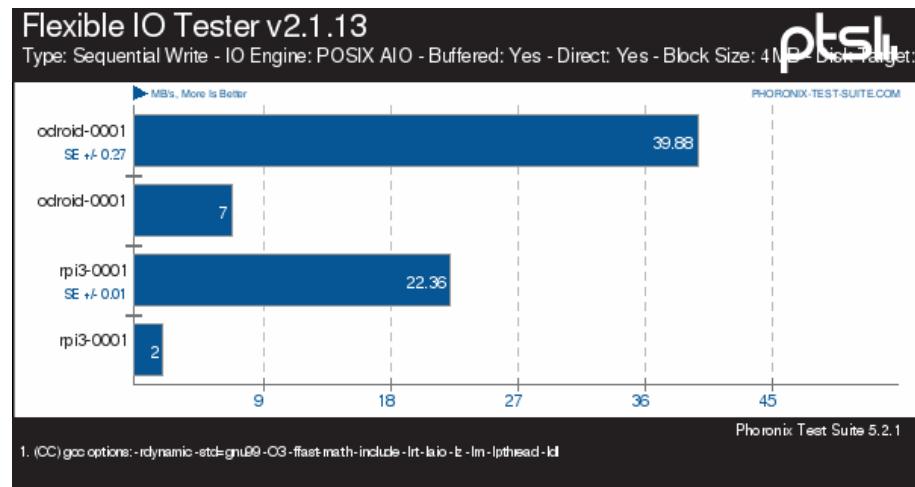


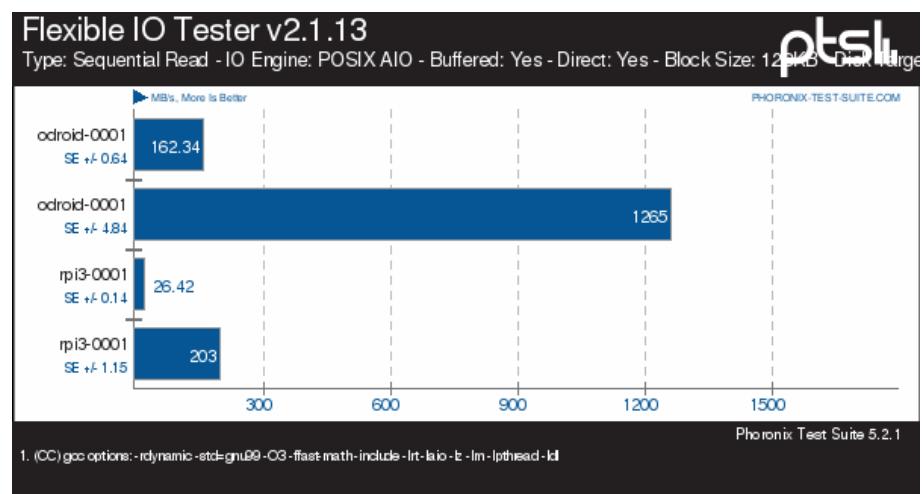
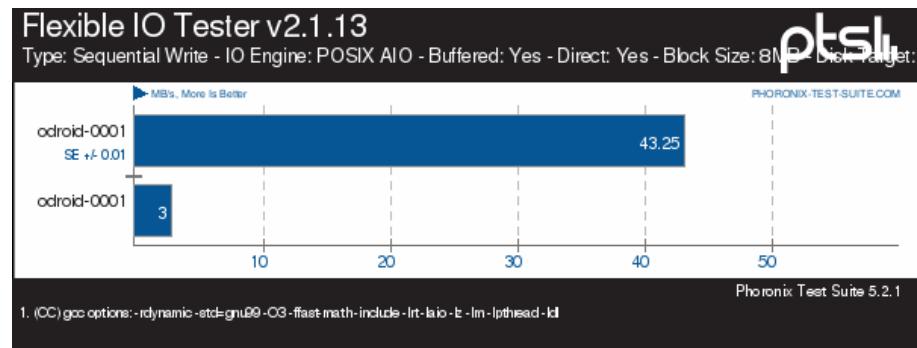


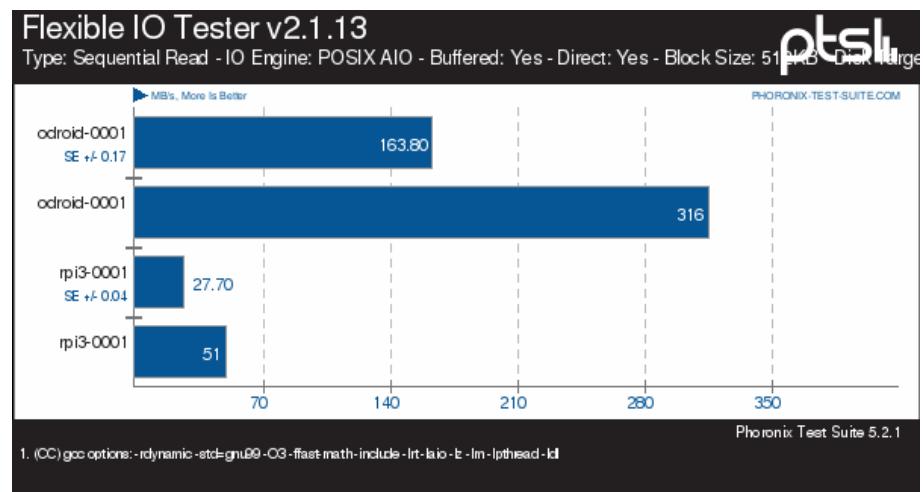
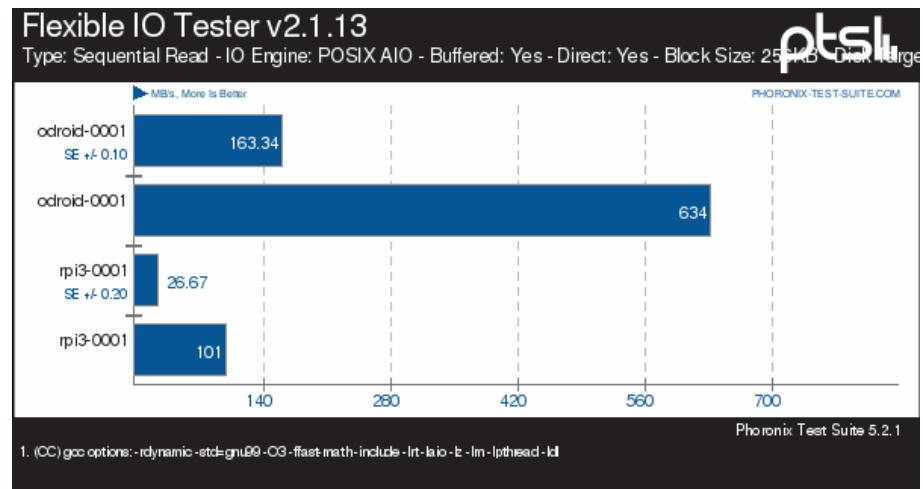


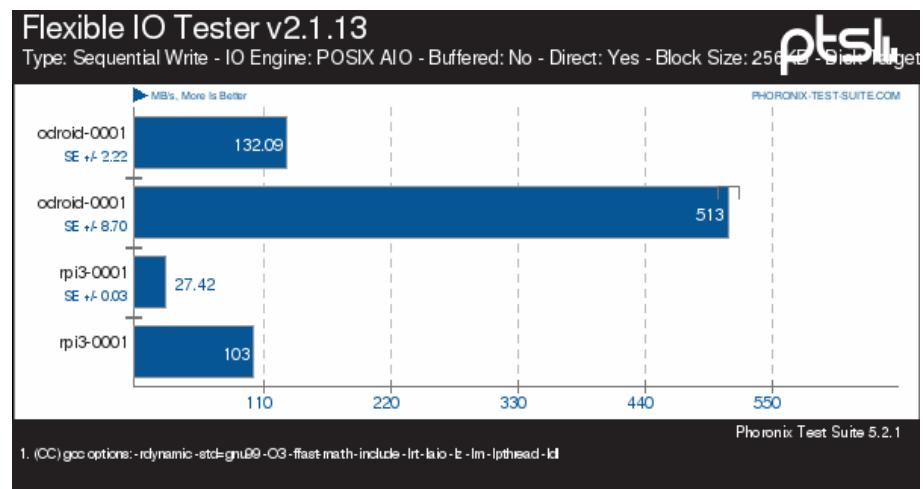
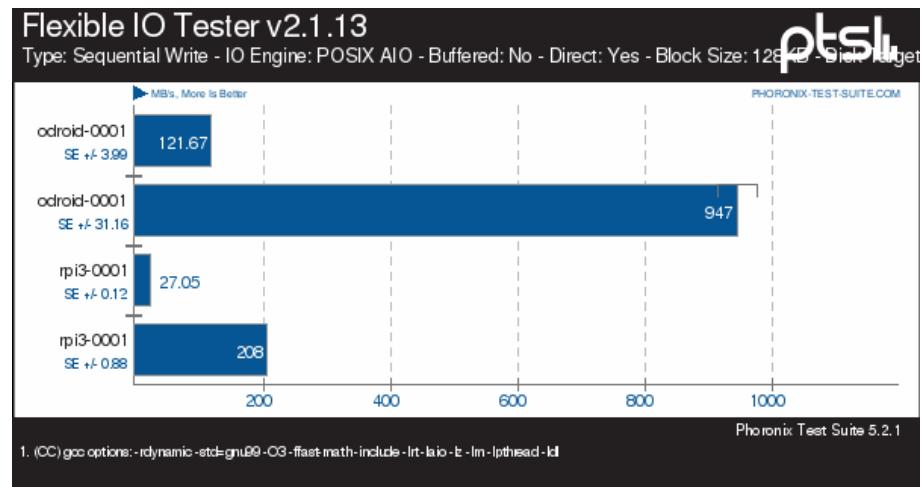


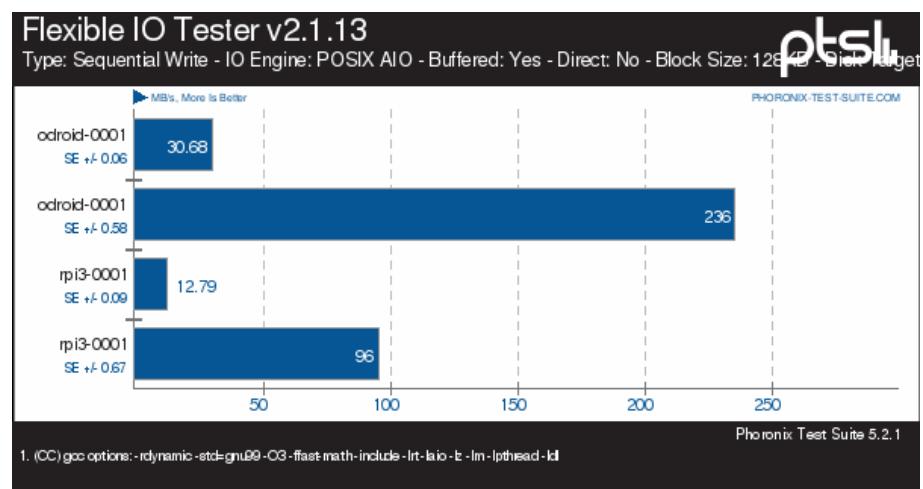
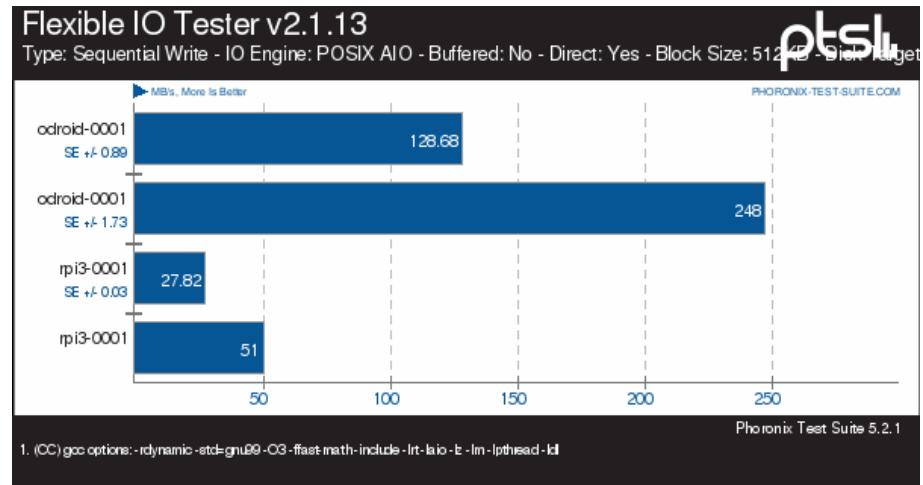


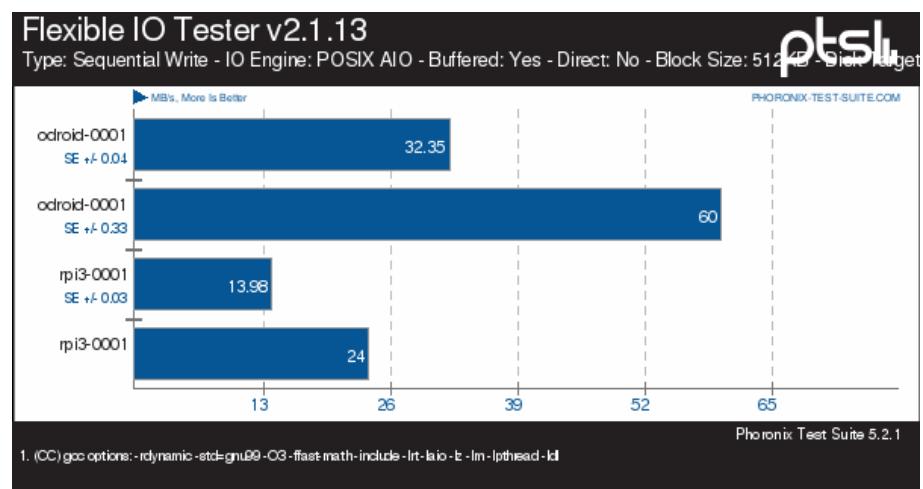
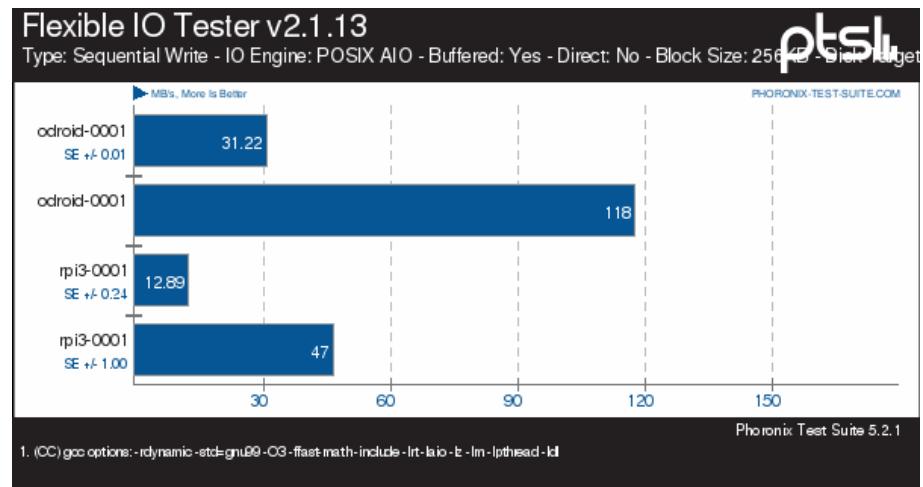


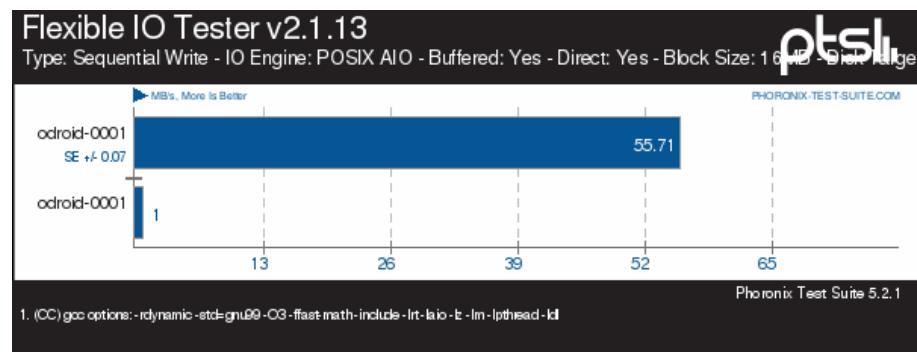
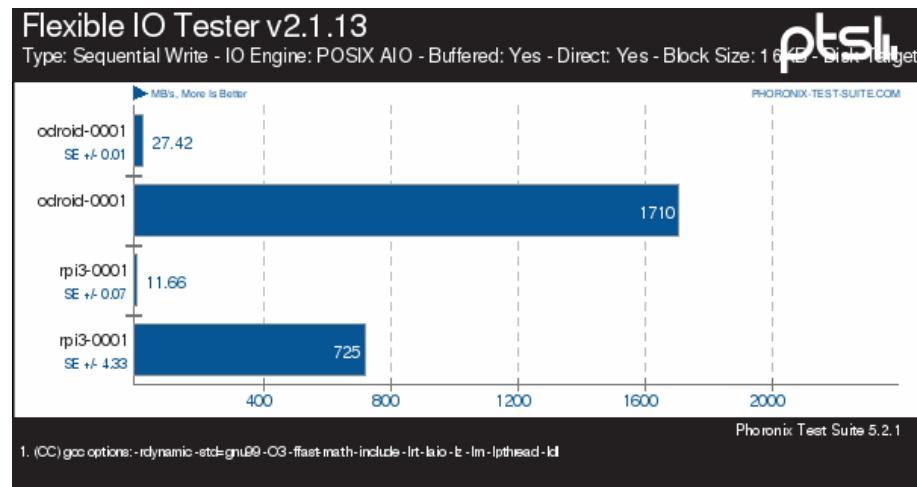


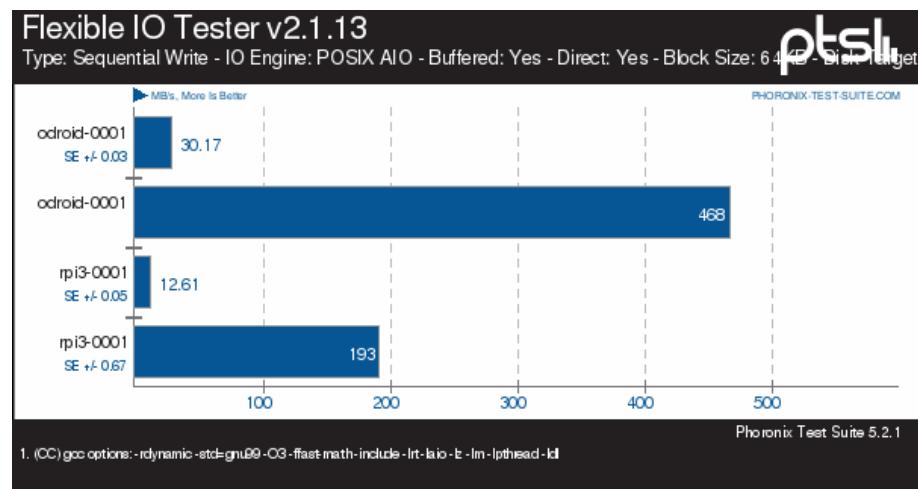
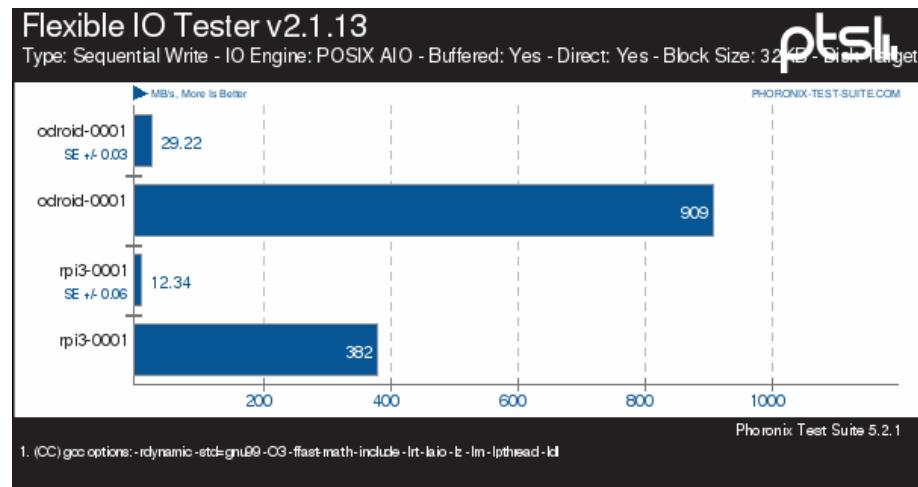


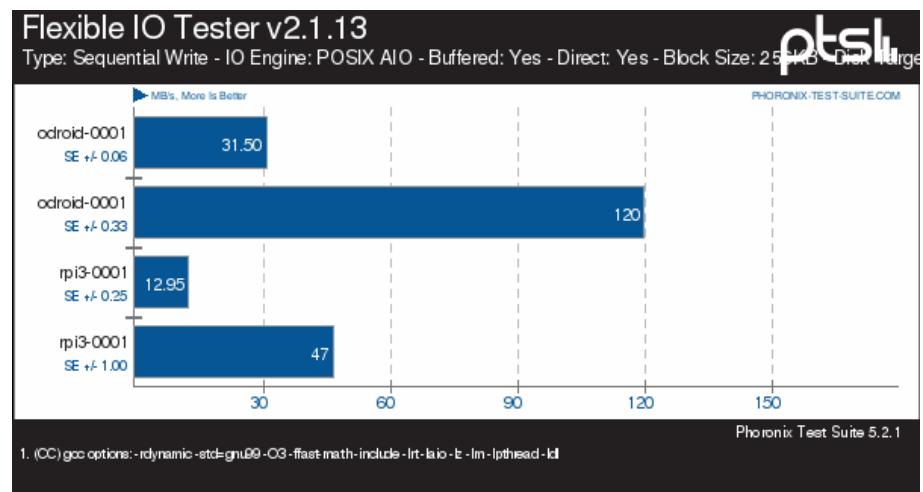
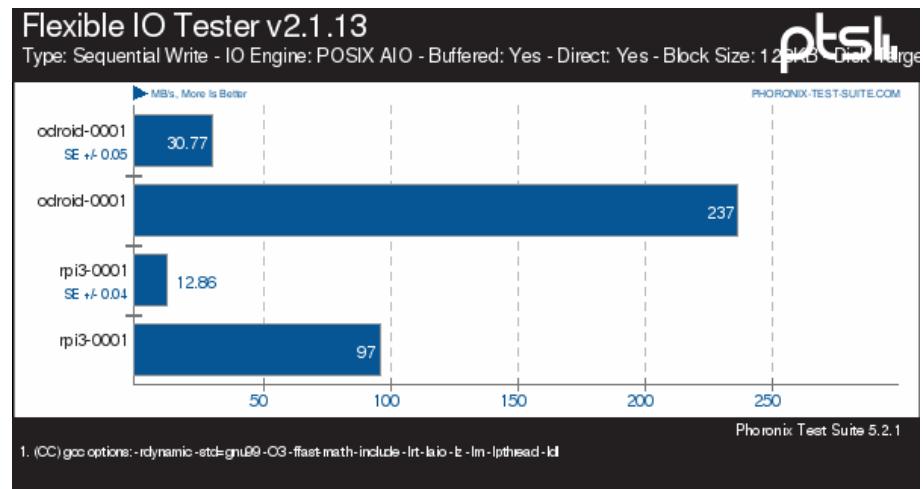


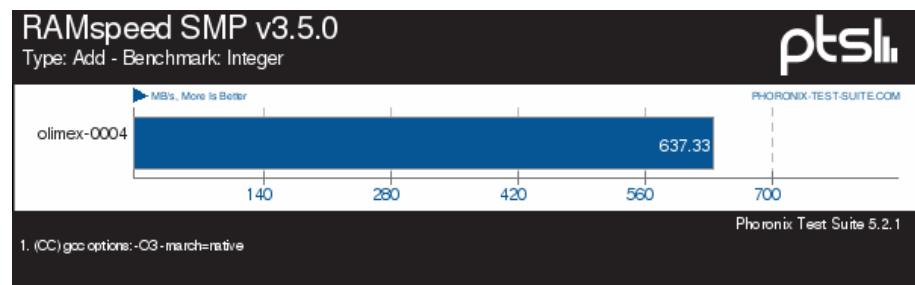
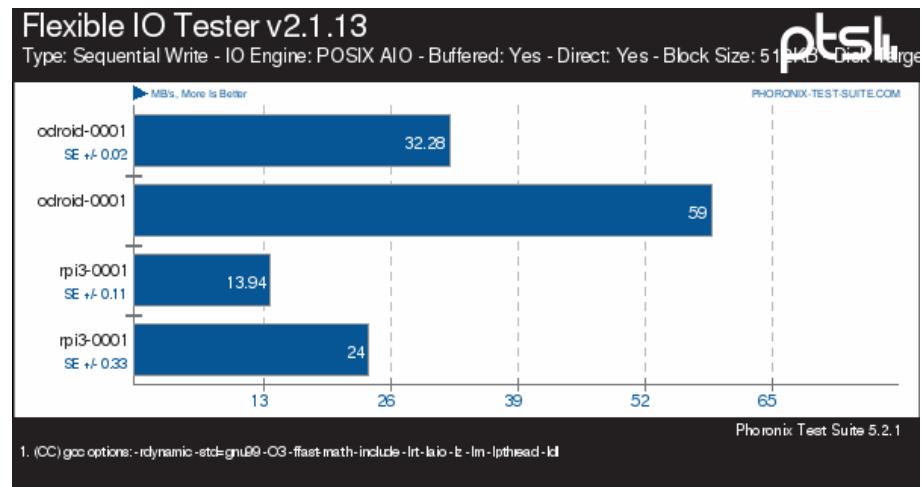


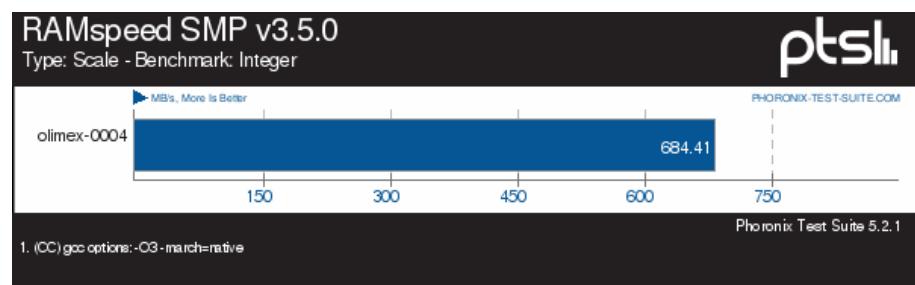
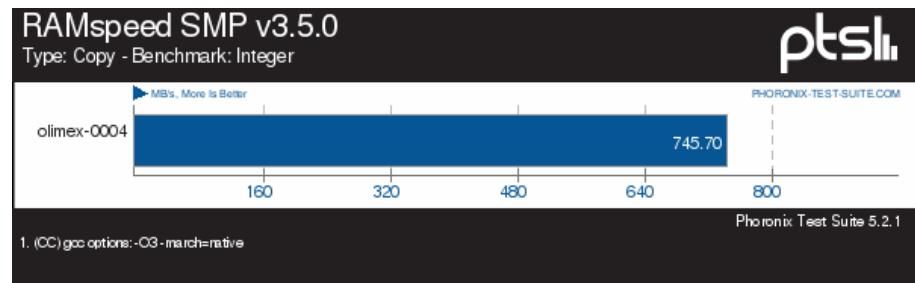


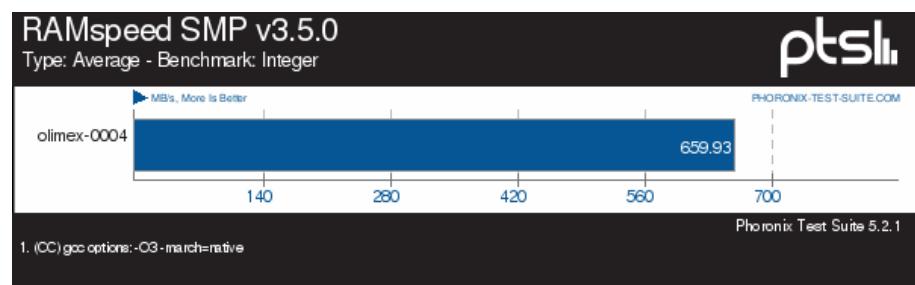
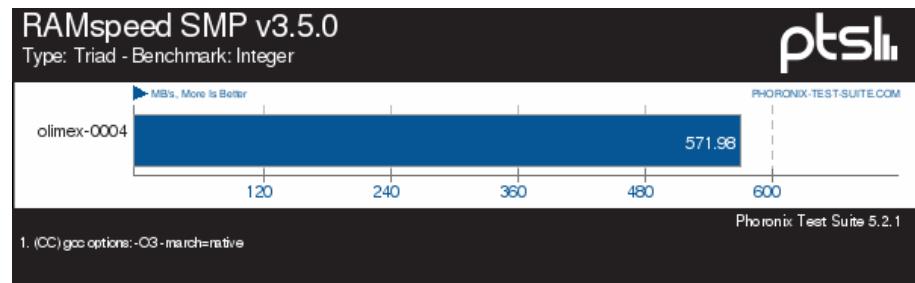


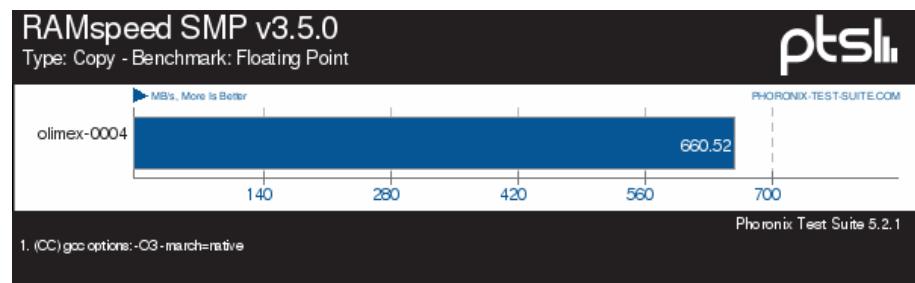
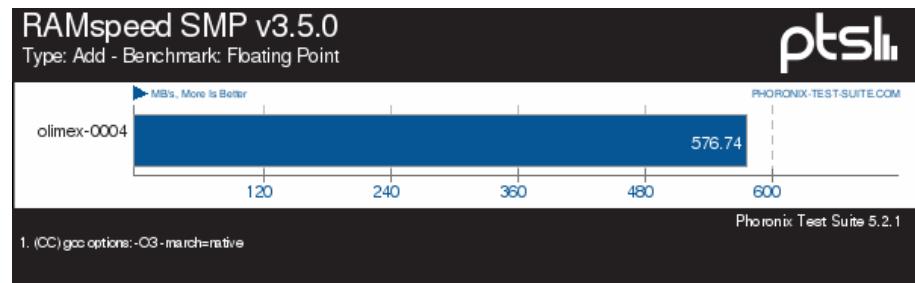


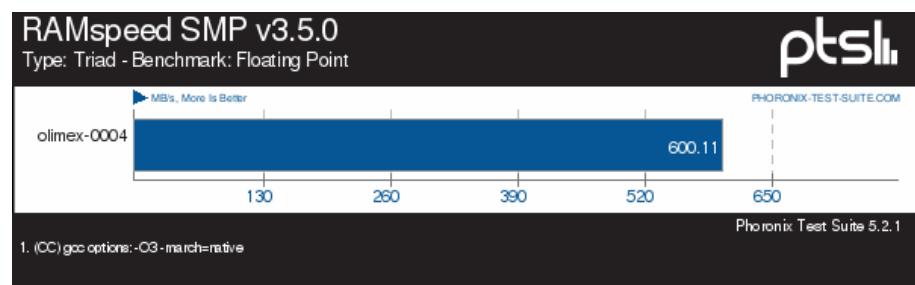
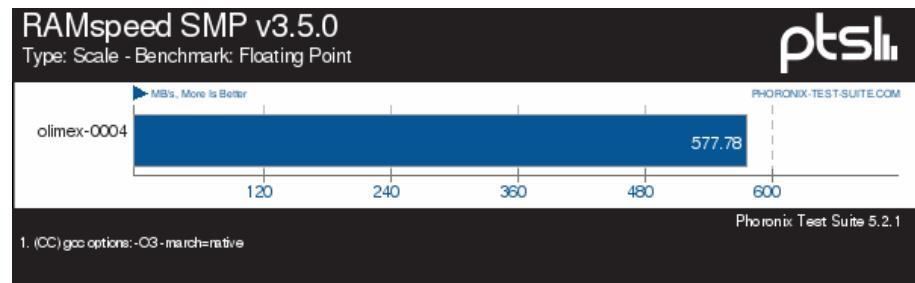


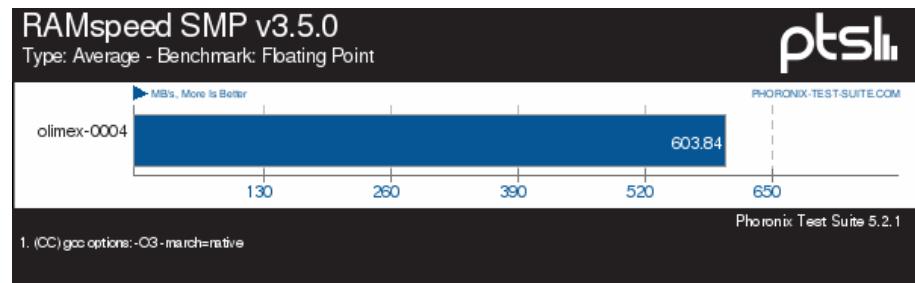












Appendix B: full BOM expense analysis of the new boards

B.1 Khadas Vim2

Component	Value	Package	Shop	Code	Qty	Unit Price	Total Amount	Where to find it
Capacitor	10uF - 16V	C0805	Farnell	1458906	14	0,183	2,562	http://se.farnell.com/yageo-phycmp/c0805zy5v7bb106/cap-27pF-NPO
Capacitor	10uF - 16V	C0603	Farnell	2469397	15	0,356	5,340	http://se.farnell.com/murata/zrb18ar61c106me01/kond-mlcc-12pF-5%-NPO
Capacitor	0.1uF - 16V	C0402	Farnell	1758896	84	0,008	0,680	http://se.farnell.com/multicomp/mc0402b104k160ct/cap-mlcc-100pF-5%-NPO
Capacitor	22uF	C0805	Farnell	1759415	22	0,153	3,366	http://se.farnell.com/multicomp/mc0805x226m63ct/cap-mlcc-100pF-5%-NPO
Capacitor	1uF	C0402	Farnell	2672108	52	0,085	4,436	http://se.farnell.com/murata/grt15560j105ke01d/kond-mlcc-100pF-5%-NPO
Capacitor	0.22uF	C0402	Farnell	2812260	2	0,026	0,053	http://se.farnell.com/wurth-elektronik/885012105002/kond-mlcc-100pF-5%-NPO
Capacitor	220pF	C0402	Farnell	1758981	1	0,010	0,010	http://se.farnell.com/multicomp/mc0402b221k500ct/cap-mlcc-100pF-5%-NPO
Capacitor	0.01uF	C0402	Farnell	1759001	1	0,014	0,014	http://se.farnell.com/multicomp/mc0402f103z500ct/cap-mlcc-100pF-5%-NPO
Capacitor	1nF	C0402	Farnell	1758991	14	0,008	0,112	http://se.farnell.com/multicomp/mc0402b102k500ct/cap-mlcc-100pF-5%-NPO
Capacitor	4.7uF - 16V	C0603	Farnell	2112741	18	0,238	4,284	http://se.farnell.com/taiyo-yuden/ekmk107abj475ka-t/cap-mlcc-100pF-5%-NPO
Capacitor	27pF-NPO	C0402	Farnell	1758953	5	0,010	0,050	http://se.farnell.com/multicomp/mc0402n270l500ct/cap-mlcc-100pF-5%-NPO
Capacitor	12pF- 5% - NPO	C0402	Farnell	1758943	4	0,010	0,040	http://se.farnell.com/multicomp/mc0402n120l500ct/cap-mlcc-100pF-5%-NPO
Capacitor	12pF-NPO	C0402	Farnell	2611891	5	0,031	0,155	http://se.farnell.com/murata/grm1655c1h120ga01d/kondensat-100pF-5%-NPO
Capacitor	2pF	C0402	Farnell	1758932	1	0,021	0,021	http://se.farnell.com/multicomp/mc0402n20c500ct/cap-mlcc-100pF-5%-NPO
Capacitor	10pF	C0402	Farnell	2627383	1	0,009	0,009	http://se.farnell.com/multicomp/mc0402n100j160ct/kondensat-100pF-5%-NPO
Capacitor	10pF - NPO	C0402	Farnell	2627383	1	0,009	0,009	http://se.farnell.com/multicomp/mc0402n100j160ct/kondensat-100pF -NPO
Capacitor	100pF - 5% - NPO	C0402	Farnell	2627387	4	0,010	0,040	http://se.farnell.com/multicomp/mc0402n101j160ct/kondensat-100pF -5% -NPO
Capacitor	330pF - 5% - NPO	C0402	Farnell	2627403	2	0,016	0,033	http://se.farnell.com/multicomp/mc0402n331j160ct/kondensat-330pF -5% -NPO
Capacitor	8pF - NPO	C0402	Farnell	2524800	2	0,013	0,026	http://se.farnell.com/walsin/0402n8rd500ct/kond-mlcc-c0g-8pF -NPO
Capacitor	6.8pF - NPO	C0402	Farnell	2627414	1	0,016	0,016	http://se.farnell.com/multicomp/mc0402n6rd8d500ct/kondensat-6.8pF -NPO
Resistor	100K	R0402	Farnell	2059250RL	5	0,020	0,100	http://se.farnell.com/panasonic-electronic-100K
Resistor	10K	R0402	Farnell	2059239	22	0,020	0,440	http://se.farnell.com/panasonic-electronic-10K
Resistor	1K	R0402	Farnell	2302638	5	0,025	0,127	http://se.farnell.com/panasonic-electronic-1K
Resistor	NC - 0R	R1206	Farnell	2057791	1	0,044	0,044	http://se.farnell.com/panasonic-electronic-NC - 0R
Resistor	NC - 0R	R0402	Farnell	9232516	10	0,006	0,059	http://se.farnell.com/yageo-phycmp/r0402ir-070rl/molst-NC - 0R
Resistor	NC - 0R	R0603	Farnell	2616740	2	0,076	0,152	http://se.farnell.com/vishay/crv060300002eahp/molst-NC - 0R
Resistor	NC - 0R	R0805	Farnell	2057661	1	0,036	0,036	http://se.farnell.com/panasonic-electronic-NC - 0R
Resistor	3K6	R0402	Farnell	2694603	2	0,003	0,006	http://se.farnell.com/multicomp/mcw04x3601ft/molst-tjockfilm-3k6-1-0-0625w/dp/2694603?ost=2694603&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	3.3R	R0402	Farnell	2447173	1	0,004	0,004	http://se.farnell.com/multicomp/mcw04w3r30ftl/res-thick-film-3.3ohm-1-0-0625w/dp/2447173?ost=2447173&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	47K	R0402	Farnell	2447179	16	0,003	0,048	http://se.farnell.com/multicomp/mcw04x4702ftl/res-thick-film-47kohm-1-0-0625w/dp/2447179?ost=2447179&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	499K	R0402	Farnell	2447181	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x499ftl/res-thick-film-499kohm-1-0-0625w/dp/2447181?ost=2447181&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	499R	R0402	Farnell	2059126	2	0,028	0,056	http://se.farnell.com/panasonic-electronic-components/en2rk4990x/molst-tjockfilm-499r-1-0-1w-0402/dp/2059126?ost=2059126&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	124K -1%	R0402	Farnell	2615027	1	0,459	0,459	http://se.farnell.com/te-connectivity/cpf0402b124ke1/molst-tunnfilm-124k-0-1-0-063w/dp/2615027?ost=2615027
Resistor	120K -1%	R0402	Farnell	9239480	3	0,009	0,028	http://se.farnell.com/yageo-phycmp/r0402r-07120k/molst-tjockfilm-120k-1-0-063w/dp/9239480?ost=9239480&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	1M -1%	R0402	Farnell	2447127	4	0,003	0,012	http://se.farnell.com/multicomp/mcw04x1004ftl/molst-tjockfilm-124k-1-0-0625w-0402/dp/2447127?ost=2447127&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	100K -1%	R0402	Farnell	2072519	9	0,008	0,068	http://se.farnell.com/multicomp/mcmr04x1003ftl/molst-nd-ker-100k-1-0-063w-0402/dp/2072519?ost=2072519&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	22.1K -1%	R0402	Farnell	2694569	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x2212ftl/molst-tjockfilm-22.1k-1-0-0625w/dp/2694569?ost=2694569&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	9,31R	R1206	DigiKey	RCL06129R31I	1	0,040	0,040	https://www.digkey.se/products/en?keywords=RCL06129R31I-FKEA-ND
Resistor	4.7K	R0402	Farnell	2447187	20	0,003	0,064	http://se.farnell.com/multicomp/mcw04x4701ftl/molst-tjockfilm-4.7k-1-0-0625w/dp/2447187?ost=2447187&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	240R	R0402	Farnell	2447140	2	0,003	0,006	http://se.farnell.com/multicomp/mcw04x2400ftl/res-thick-film-240-ohm-1-0-0625w/dp/2447140?ost=2447140&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	240R-1%	R0402	Farnell	2447140	5	0,003	0,015	http://se.farnell.com/multicomp/mcw04x2400ftl/res-thick-film-240-ohm-1-0-0625w/dp/2447140?ost=2447140&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	22R	R0402	Farnell	2447138	15	0,003	0,045	http://se.farnell.com/multicomp/mcw04x220ftl/molst-tjockfilm-22R-1-0-0625w/dp/2447138?ost=2447138&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	2K	R0402	Farnell	2447147	2	0,003	0,006	http://se.farnell.com/multicomp/mcw04x2001ftl/res-thick-film-2kohm-1-0-0625w/dp/2447147?ost=2447147&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	2K - 1%	R0402	Farnell	2447147	10	0,003	0,030	http://se.farnell.com/multicomp/mcw04x2001ftl/res-thick-film-2kohm-1-0-0625w/dp/2447147?ost=2447147&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	6.49K - 1%	R0402	Farnell	2447210	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x6491ftl/res-thick-film-6.49kohm-1-0-0625w/dp/2447210?ost=2447210&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	75R - 1%	R0402	Farnell	2447216	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x750ftl/res-thick-film-75ohm-1-0-0625w/dp/2447216?ost=2447216&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	75R - 1%	R0603	Farnell	2059282	4	0,042	0,166	http://se.farnell.com/panasonic-electronic-components/en3ekf750v/molst-tjockfilm-75-1-0-1w-0603/dp/2059282?ost=2059282&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	2.49K - 1%	R0402	Farnell	2447150	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x2491ftl/res-thick-film-2.49kohm-1-0-0625w/dp/2447150?ost=2447150&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch
Resistor	1.5K	R0402	Farnell	2447125	1	0,003	0,003	http://se.farnell.com/multicomp/mcw04x1501ftl/res-thick-film-1.5kohm-1-0-0625w/dp/2447125?ost=2447125&ddkey=http%3A-SE%2FElement14-Sweden%2Fsearch

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Resistor	200R - 1%	R0402	Farnell	2072751	3	0,008	0,023	http://se.farnell.com/multicomp/mcmr04x2000ftl/motst-nd-ker-200r-1-0-0625w-0402/dp/2072751?ost=2072751&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Resistor	5.1R - 1%	R0402	Farnell	2072507	6	0,008	0,046	http://se.farnell.com/multicomp/mcmr04w5r10ftl/motst-nd-ker-5r1-1-0-0625w-0402/dp/2072507?ost=2072507&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Resistor	2,7k - 1%	R0402	Farnell	2074044	1	0,005	0,005	http://se.farnell.com/multicomp/mcmr04x2701ftl/motst-nd-ker-2k7-1-0-0625w-0402/dp/2074044?ost=2074044&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Resistor	100R	R0402	Farnell	2447095	3	0,003	0,009	http://se.farnell.com/multicomp/mcwr04x1000ftl/res-thick-film-100-ohm-1-0-0625w/dp/2447095?ost=2447095&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Resistor	27k - 1%	R0402	Farnell	2072856	1	0,005	0,005	http://se.farnell.com/multicomp/mcmr04x2702ftl/motst-nd-ker-27k-1-0-0625w-0402/dp/2072856?ost=2072856&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Resistor	562R - 1%	R0402	Farnell	2302609	1	0,025	0,025	http://se.farnell.com/panasonic-electronic-components/en2rkf5620x/motst-tjockfilm-562r-1-0-1w-0402/dp/2302609?ost=2302609&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Inductor	1uH -5A	L5050	DigiKey	732-3342-6-ND	1	1,890	1,890	https://www.digikey.se/products/en?keywords=732-3342-6-ND
Inductor	2.2uH -2A	L5050	DigiKey	587-2552-1-ND	2	0,330	0,660	https://www.digikey.se/products/en?keywords=%09587-2552-1-ND
Inductor	4.7uH -2A	L5050	DigiKey	587-5937-2-ND	2	0,096	0,192	https://www.digikey.se/products/en?keywords=587-5937-2-ND
Inductor	4.7uH -1A_DCR80mohm	L3030	DigiKey	SRR4818A-4R	1	0,274	0,274	https://www.digikey.se/products/en?keywords=%09SRR4818A-4R7YTR-ND
Choke	ACM2012_2p	ACM2012_2p	DigiKey	445-2207-1-ND	3	0,420	1,260	https://www.digikey.se/products/en?keywords=445-2207-2-ND
Transistor	WPM2015(M1)	SOT-23	DigiKey	DMP2305UDIC	1	0,410	0,410	https://www.digikey.se/products/en?keywords=%09DMP2305UDIC-ND
Transistor	PMBT3904M(Q4)	SOT883	DigiKey	1727-6287-1-N	5	0,252	1,262	http://se.farnell.com/nexperia/pmbt3904mb/transistor-npn-40v-200ma-sot883b/dp/2191797?ost=2191797&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Transistor	WNM2020	SOT-23	DigiKey	FDV305NCT-N	1	0,410	0,410	https://www.digikey.se/products/en?keywords=FDV305NCT-ND
Transistor	WNM2015	SOT-23	DigiKey	NTR4501NT1G	1	0,470	0,470	https://www.digikey.se/products/en?keywords=NTR4501NT1GOSCT-ND
Diode	BAT54C	SOT-23	Farnell	2677690	3	0,666	1,998	http://se.farnell.com/taiwan-semiconductor/bat54c/diod-schottky-30v-0-2a-sot-23/dp/2677690?ost=2677690&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
LED	Blue	L0603	Farnell	2762564	1	0,264	0,264	http://se.farnell.com/rohm/sml13bc8t86/led-blue-40mcd-470nm-1608/dp/2762564?ost=2762564&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Diode	1N4148	SOD-123	Farnell	1776392	2	0,379	0,758	http://se.farnell.com/diodes-inc/1n4148w-7-f-diode-switch-300ma-100v-sod123/dp/1776392?ost=1776392&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Diode	AZ5725-01F	ESD0402	DigiKey	F2862CT-ND	12	0,507	6,084	https://www.digikey.se/products/en?keywords=F2862CT-ND
Diode	AZ5413	ESD0402-P	DigiKey	UCLAMP3301F	6	0,630	3,780	https://www.digikey.se/product-detail/en/semtech-corporation/UCLAMP3301P.TCT/UCLAMP3301P.TCT-ND/5052050
Switch	(SW1, SW2, SW3)	IT-1188	AVNET	Minimum batch	3	0,244	0,732	https://www.avnet.com/shop/emea/products/diptronics/1188ep-1w3-v-t-r-3074457345629188525/
Fuse	Fuse-500mA	Fuse-0805	Farnell	1337416	1	0,744	0,744	http://se.farnell.com/multicomp/mcf0805b050fstr/fuse-smd-0805-0-5a/dp/1337416?ost=1337416
Fuse	Fuse-900mA	Fuse-0805	Farnell	1337418	1	0,744	0,744	http://se.farnell.com/multicomp/mcf0805b1r00fstr/fuse-smd-0805-1-8a/dp/1337418?ost=1337418
5V Reg (U2)	SY6874	DFN3x3-10	1stChip	1	1,021	1,021	1,021	https://www.hkinventory.com/p/1/6874.htm
Reg (U3)	MP8756GD	QFN-12	DigiKey	MP8756GD-Z-t	1	0,891	0,891	https://www.digikey.se/product-detail/en/monolithic-power-systems-inc/MP8756GD-Z/MP8756GD-Z-ND/7361535
Reg 3V3(U4)	WL2803E33-5	SOT23-5	Farnell	2781803RL	1	1,640	1,640	http://se.farnell.com/texas-instruments/tps73633dbvt/ido-fixed-3-3v-0-5a-sot-23-5/dp/2781803RL?ost=2781803RL&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
DC-DC (U5,U6)	SY8120B1ABC	SOT23-6	LCSC	SY8120B1ABC	4	0,148	0,592	https://lcsc.com/product-detail/DC-Converters_Silergy_SY8120B1ABC_SY8120B1ABC_C88474.html
Reg 1V8(U7)	WL2803E18-5	SOT23-5	Farnell	2781802	2	2,150	4,300	http://se.farnell.com/texas-instruments/tps73618dbvt/ido-fixed-1-8v-0-5a-sot-23-5/dp/2781802?ost=2781802&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
Reg 2V5(U7)	WL2803E25-5	SOT23-5	Farnell	2728322	1	0,740	0,740	http://se.farnell.com/on-semiconductor/ncp4687dsn251g/ido-fast-2-5v-0-5a-sot-23-5/dp/2728322?ost=2728322&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
W25Q16FWUXIE U 19	CODE UX	DigiKey	W25Q16FWUX	1	0,490	0,490	0,490	https://www.digikey.se/products/en?keywords=W25Q16FWUXIE
RTL8211FD-CG U20	QFN40-PT04-5X5mm	Symmetry Electroics	RTL8211FD-C	1	1,600	1,600	1,600	https://www.semiconductorstore.com/cart/pc/viewPrd.asp?idproduct=50730
MAX809RD/RS8C U23	SOT-23	Mouser	STM809RWX6	1	0,336	0,336	0,336	https://www.mouser.se/ProductDetail/STMicroelectronics/STM809RWX6?qs=%2fbta2pyFadigUR4E45UEoxKkkBTF8tC%252bo4K0aEaBhnL0%3d
NS7538BP K4A8G165WB-B-	IR1	NS7538BP BGA96-0P8MM_DDR4	- Avnet	-	1	0,450	0,450	https://world.taobao.com/item/56896035798.htm
NS7538BP K4A8G165WB-B-	IR1	NS7538BP BGA96-0P8MM_DDR4	- Avnet	-	4	11,000	44,000	https://www.avnet.com/shop/SearchDisplay?searchTerm=K4A8G165WB-B-BCR&countryId=eMEA&defLangId=-1&storeId=10151&catalogId=10001&languageId=-1&type=SimpleSearch&resultCatEntryType=2&searchSource=e&searchType=100&avnSearchType=all
TPS2115ADRBR U24			Farnell	2764817	1	1,710	1,710	http://se.farnell.com/texas-instruments/tps2115adrbr/power-load-switch-5v-vson-8/dp/2764817?ost=2764817&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
24MHz_CL12pF_Clock(Y1)	Y-SMD4P3225	Farnell	2508626	1	0,679	0,679	0,679	http://se.farnell.com/qantek-technology-corporation/c5a24-000012b12m/kristall-24mhz-12pf-5mm-x-3-2mm/dp/2508626?ost=2508626&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
CM315D	Clock(Y2)	CM315D	Farnell	2369324	1	0,522	0,522	http://se.farnell.com/citizen-fine-tech-miyota/cm315d-32-768kdcz-u-crystal-32-768khz-9pf-3-2-x-1dp/2369324?ost=2369324&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch
25MHz_CL12pF_Clock(Y3)			DigiKey	TSX-322525.0C	1	0,219	0,219	https://www.digikey.es/product-detail/es/epson/TSX-3225-25.000MF102-W0/TSX-322525.000MF102-W0-ND/5260881
YM8563	Real Clock (U13)		DigiKey	296-24583-1-N	1	1,330	1,330	https://www.digikey.se/products/en?keywords=296-24583-1-ND
12MHz	Clock(Y4)	Y-SMD4P3225	Farnell	2308719	1	1,580	1,580	http://se.farnell.com/tcx/7m-12-00meep-t/quartz-crystal-12-mhz-10-pf-smd/dp/2308719?ost=2308719&ddkey=http%3A&SE%2FElement14_Sweden%2Fsearch

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37,4Mhz_12pF_1l Clock(Y5)		Farnell	2723247	1	1,530	1,530 http://se.farnell.com/epson/x1e0002510139-fa-118t-37-4mhz-16pf/kristall-37-4mhz-18pf-3-2mm-x/dp/2723247?ost=2723247&ddkey=http%3A%2F%2FElement14.Sweden%2Fsearch
2 HEADER RTC (J1, J4)		DigiKey	455-2956-1-ND	2	0,360	0,720 https://www.digikey.se/products/en?keywords=HFT410CT-ND
FH34SRJ-10S (J16)		DigiKey	HFT410CT-ND	1	1,580	1,580 https://www.digikey.se/products/en?keywords=HFT410CT-ND
GST5009M-LF (J6)	T-24P-PT50mil	Farnell	2427811	1		0,000 http://se.farnell.com/hirose-hrs/fh34srj-10s-0-5sh-50/kontakt-ffc-fpc-utg-10-p-1-rad/dp/2427811?ost=2427811&ddkey=http%3A%2F%2FElement14.Sweden%2Fsearch
MJ88-BX11 (J7)	RJ45	DigiKey	RJLSE4238101	1	1,830	1,830 https://www.digikey.se/products/en?keywords=RJLSE4238101
USB_TypeC (J9)		Farnell	2524076	1		0,000 http://se.farnell.com/molex/105450-0101/usb-connector-3-1-typ-c-hona-smt/dp/2524076?ost=2524076&ddkey=http%3A%2F%2FElement14.Sweden%2Fsearch
sd_503398 (J10)	sd_503398_001	DigiKey	WM11190CT-N	1	2,040	2,040 https://www.digikey.se/product-detail/en/molex-ilc/5033981892/WM11190CT-ND/5230912
USB-2004F-B-T3- (J11,J12)	USB2_0_SMD	DigiKey	609-4946-1-ND	2	0,730	1,460 https://www.digikey.se/products/en?keywords=609-4946-1-ND
HDA31-F1F1-100 (J15)	HDMI-A-19NSMD	DigiKey	609-1010-6-ND	1	1,090	1,090 https://www.digikey.se/product-detail/en/amphenol-fci/10029449-001RLF/609-1010-6-ND/1887807
FB2	100MHz220ohm	FB0603	Estimated value	1	0,3	0,300 Estimated value
Capacitor	0R(ant)	C0402	Estimated value	2	0,014	0,028 Estimated value
LED	White	L0802	Estimated value	1	0,264	0,264 Estimated value
Diode	AZ1345-04F	DFN2510P10E	Estimated value	2	0,600	1,200 Estimated value
GXM_S912	U1A	BGA483_0P65	Estimated value	1	9,000	9,000 Estimated value
EMMC_FLASH	U18B	BGA169-INAND	Estimated value	1	6,260	6,260 Estimated value
AP6359SA	U22	AP62X2_13x15	Estimated value	1	2,500	2,500 Estimated value
FE8.1 (?)	U 21	?	Unspecified component value	1	0,000	Unspecified component value
TOTAL EUR					137,231	

B.2 Dragonboard

Package	Shop	Code	Qty	Unit Price	Total	Description	Where to find it
R1206	Farnell	1469963	2	0,003	0,006	RES 0 200PPM 0.2W 1206 ROHS	http://se.farnell.com/vishay/crcw12060000z0ea/resistor-0r-0r-0-05w
R0201	Farnell	2281444	1	0,041	0,041	RES 0 200PPM 0.2W 1206 ROHS	http://se.farnell.com/panasonic-electronic-components/erj-1gef1003rcs-thick-film-100k-1-0-05w
R0201	Farnell	2281445	2	0,041	0,082	RES 100K 200PPM 1% 0.050W 0201 ROHS	http://se.farnell.com/panasonic-electronic-components/erj-1gef1003rcs-thick-film-100k-1-0-05w
R0201	Farnell	1850869	1	0,000	0,000	RES 115K 200PPM 1% 0.050W 0201 ROHS	http://se.farnell.com/multicomp/mc02016f1153e/motst-tjockfilm-115k-1-0-05w
R0201	Farnell	2281447	1	0,040	0,040	RES 12K 200PPM 1% 0.050W 0201 ROHS	http://se.farnell.com/panasonic-electronic-components/erj-1gef1003rcs-thick-film-100k-1-0-05w
R0201	DigiKey	YAG2434CT-ND	1	0,080	0,080	RES 16.2K 200PPM 1% 0.050W 0201 ROHS	https://www.digikey.se/products/en?keywords=YAG2434CT-ND
R0201	DigiKey	P122765CT-ND	1	0,000	0,000	RES 165K 200PPM 1% 0.050W 0201 ROHS	https://www.digikey.se/products/en?keywords=P122765CT-ND
R0201	DigiKey	P200ABCT-ND	9	0,080	0,720	RES 200 200PPM 1% 0.050W 0201 ROHS	https://www.digikey.se/product-detail/en/panasonic-electronic-components/erj-1gef1003rcs-thick-film-100k-1-0-05w
R0201	Farnell	2140233	2	0,001	0,003	RES 22.1K 200PPM 1% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw020122k1ned/motst-tjockfilm-22k1-1-0-05w
R0201	DigiKey	P122856CT-ND	2	0,080	0,160	RES 240 200PPM 1% 0.050W 0201 ROHS	https://www.digikey.se/product-detail/en/panasonic-electronic-components/erj-1gef1003rcs-thick-film-100k-1-0-05w
R0201	DigiKey	P3.92KABC7-ND	1	0,080	0,080	RES 3.92K 200PPM 1% 0.05W 0201 ROHS	https://www.digikey.se/products/en?keywords=P3.92KABC7-ND
R0201	Farnell	2282164	3	0,040	0,120	RES 47K 200PPM 1% 0.050W 0201 ROHS	http://se.farnell.com/panasonic-electronic-components/erj-1gef14702rcs-thick-film-47k-1-0-05w
R0201	DigiKey	P90.9KABC7-ND	1	0,080	0,080	RES 90.9K 200PPM 1% 0.050W 0201 ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02010000z0ed/motst-tjockfilm-100k-1-0-05w
R0201	Farnell	2302823	1	0,003	0,003	RES 68.1K 100PPM 1% 0.063W 0402 ROHS	http://se.farnell.com/panasonic-electronic-components/erj2rkf6812x/res-thick-film-68k1-100mw-1-0-05w
R0402	Farnell	2139811	34	0,003	0,117	RES 0 200PPM 5% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-2k-5-0-05w
R0402	Farnell	1458865RL	8	0,002	0,015	RES 10K 200PPM 5% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw02011r07100k/motst-tjockfilm-10k-5-0-05w
R0201	Farnell	1458866	4	0,002	0,008	RES 100K 200PPM 5% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw02011r07100k/motst-tjockfilm-100k-5-0-05w
R0201	Farnell	2281468	2	0,021	0,042	RES 1M 200PPM 5% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-2k-5-0-05w
R0201	Farnell	2147741	14	0,180	2,520	RES 2K 200PPM 5% 0.050W 0201 ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-2k-5-0-05w
R0201	DigiKey	P27KAGCT-ND	3	0,080	0,240	RES 27K 200PPM 5% 0.050W 0201 ROHS	https://www.digikey.se/products/en?keywords=%09P27KAGCT-ND
R0201	DigiKey	YA2G364CT-ND	1	0,080	0,080	RES 68 200PPM 5% 0.050W 0201 ROHS	https://www.digikey.se/products/en?keywords=YA2G364CT-ND
R0201	Farnell	9232516	5	0,001	0,003	RES 0 200PPM 5% 0.063W 0402 ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-Or-5-0-0625w
R0603	Farnell	2752987	1	0,002	0,002	RES 0 200PPM 5% 0.1W 0603 ROHS	http://se.farnell.com/bourns/cr0603-000eas/motst-tjockfilm-Or-5-0-1w-0603dp/2752987ost+dkey+http%3Ase
R1206	Farnell	1865244	1	0,027	0,027	RES 0.100 100PPM 1% 0.5W 1206 CURRENT SENSE ROHS	http://se.farnell.com/bourns/crm1206-1x-100ef/motst-tjockfilm-0-1r-0-5w
C0201	DigiKey	1276-1392-1-ND	1	0,100	0,100	CAP,CHIP CERAMIC 1.2PF +/-0.1PF COG/NPO 25V ROHS	https://www.digikey.se/products/en?keywords=1276-1392-1-ND
C0201	Farnell	1740563	3	0,021	0,063	CAP,CHIP CERAMIC 18PF 5% COG/NPO 25V ROHS	http://se.farnell.com/vishay/crcw02010000z0ed/motst-tjockfilm-100k-5-0-05w
C0201	Farnell	2434636	1	0,002	0,002	CAP,CHIP CERAMIC 22PF 5% COG/NPO 25V ROHS	http://se.farnell.com/vishay/crcw02010000z0ed/motst-tjockfilm-100k-5-0-05w
C0201	Farnell	1844482	1	0,040	0,040	CAP,CHIP CERAMIC 47PF 5% COG/NPO 25V ROHS	http://se.farnell.com/vishay/crcw02010000z0ed/motst-tjockfilm-100k-5-0-05w
C0201	Farnell	2688493	1	0,006	0,006	CAP,CHIP CERAMIC 33PF 5% COG/NPO 50V ROHS	http://se.farnell.com/murata/grm0335c1h330ja01d/kondensator-cap-mlcc-47pf-25v
C0402	Farnell	1535558	2	0,008	0,017	CAP,CHIP CERAMIC 1000PF 5% COG/NPO 50V ROHS	http://se.farnell.com/murata/grm1555c1h820ja01d/kondensator-cap-mlcc-47pf-50v
C0402	Farnell	2470460	1	0,002	0,002	CAP,CHIP CERAMIC 82PF 5% COG/NPO 50V ROHS	http://se.farnell.com/murata/grm1555c1h820ja01d/kondensator-cap-mlcc-47pf-50v
C0201	Farnell	1758849	3	0,003	0,008	CAP,CHIP CERAMIC 2200PF 10% X7R 10V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	Farnell	490-3192-1-ND	3	0,036	0,107	CAP,CHIP CERAMIC 4700PF 10% X7R 10V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0402	Farnell	2776913RL	2	0,188	0,375	CAP,CHIP CERAMIC 10UF 10% X7R 25V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0402	DigiKey	490-1308-1-ND	1	0,080	0,080	CAP,CHIP CERAMIC 4700PF 10% X7R 50V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0603	DigiKey	478-5052-1-ND	2	0,120	0,240	CAP,CHIP CERAMIC 0.1UF 10% X7R 50V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	DigiKey	490-5403-1-ND	1	0,080	0,080	CAP,CHIP CERAMIC 0.01UF 10% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	DigiKey	1276-1013-1-ND	50	0,017	0,850	CAP,CHIP CERAMIC 0.1UF 10% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	Farnell	2524946	8	0,034	0,272	CAP,CHIP CERAMIC 0.022UF 10% X5R 6.3V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	DigiKey	478-10774-1-ND	8	0,100	0,800	CAP,CHIP CERAMIC 0.047UF 10% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0402	DigiKey	709-1060-1-ND	5	0,200	1,000	CAP,CHIP CERAMIC 1UF 10% X5R 6.3V ROHS	https://www.digikey.se/products/en?keywords=709-1060-1-ND
C0201	DigiKey	1276-1115-1-ND	10	0,080	0,800	CAP,CHIP CERAMIC 0.1UF 10% X5R 10V ROHS	https://www.digikey.se/products/en?keywords=1276-1115-1-ND
C0402	Farnell	1828862	2	0,015	0,031	CAP,CHIP CERAMIC 0.1UF 10% X5R 10V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-100pf-10%X5R10V
C0402	Farnell	2525061RL	5	0,242	1,210	CAP,CHIP CERAMIC 1.0UF 10% X5R 10V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-100pf-10%X5R10V
C0402	Farnell	2346879	10	0,321	3,210	CAP,CHIP CERAMIC 2.2UF 10% X5R 10V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-100pf-10%X5R10V
C0402	DigiKey	445-13820-1-ND	22	0,347	7,634	CAP,CHIP CERAMIC 4.7UF 10% X5R 10V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0603	DigiKey	587-1180-1-ND	4	0,080	0,320	CAP,CHIP CERAMIC 0.01UF 10% X5R 16V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0603	DigiKey	311-1444-1-ND	5	0,080	0,400	CAP,CHIP CERAMIC 1.0UF 20% X5R 16V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0603	DigiKey	445-7478-1-ND	1	0,310	0,310	CAP,CHIP CERAMIC 4.7UF 10% X5R 16V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0201	Farnell	9543686	3	0,089	0,266	CAP,CHIP CERAMIC 100PF 10% X5R 25V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-100pf-10%X5R25V
C0603	Farnell	2112832	2	0,338	0,676	CAP,CHIP CERAMIC 0.47UF 20% X5R 4V ROHS	http://se.farnell.com/vishay/crcw02012k00ned/motst-tjockfilm-100pf-10%X5R4V
C0201	DigiKey	1276-6441-1-ND	33	0,220	7,260	CAP,CHIP CERAMIC 1.0UF 20% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0402	DigiKey	1276-1451-1-ND	1	0,500	0,500	CAP,CHIP CERAMIC 10UF 20% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0603	DigiKey	1276-1193-1-ND	9	0,250	0,2250	CAP,CHIP CERAMIC 22UF 20% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0805	DigiKey	1276-2412-1-ND	2	0,200	0,400	CAP,CHIP CERAMIC 22UF 20% X5R 6.3V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
C0805	DigiKey	490-9961-1-ND	3	0,740	2,220	CAP,CHIP CERAMIC 47UF 20% X5R 10V ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
-	DigiKey	283-4776-1-ND	2	6,010	12,020	INDUCTOR,POWER 4.7UF 20% DCR=5.5A SHIELDED ROHS	https://www.digikey.se/product-detail/en/eaton/hcm1a1707-200mhz/47mpf-cl12pf-rohs
L0603	DigiKey	490-4023-1-ND	1	0,120	0,120	INDUCTOR,CHOKE 2.2UH 20% 120MA SRF=80 ROHS	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
L0201	DigiKey	490-6725-1-ND	2	0,080	0,160	INDUCTOR,CHIP FILM 2.7NH +/-0.1NH Q=14@500MHZ	https://www.digikey.se/product-detail/en/vishay/crcw02012k00ned/res-thick-film-x7r-2-2nf-10v
L0201	DigiKey	490-6711-1-ND	2	0,080	0,160	INDUCTOR,CHIP FILM 1	

49-UFBGA, WLC	DigiKey	4-UFBGA, WLCSP	1	3,868	3,868	IC,VIDEO INTERFACE RECEIVER MIPI/DSI W/HDMI	https://www.digikey.se/product-detail/en/analog-devices-ic-video-interface-receiver-mipi-dsi-w-hdmi/0408-0000-0000-0000
4-UFBGA,WLCS	Digkey	FPF1203LUCXCT-ND	1	0,350	0,350	IC,LOAD SWITCH 55MOHM@3.3V SLEW RATE CONTROLLED	https://www.digikey.se/product-detail/en/on-semiconductor/fpf1203lucxct-nd/0408-0000-0000-0000
SOT-23-5	Farnell	1287689	1	0,587	0,587	IC,VOLTAGE REGULATOR 200MA 3.3V LDO ULTRALOW	http://se.farnell.com/texas-instruments/tps79333dbvrg4/ic-v-reg-200ma-3-3v-ldo-ultralow-1287689
12-UFBGA, DSB	Digikey	296-39348-1-ND	2	1,140	2,280	IC,USB OTG W/BUS OVERVOLT/CURRENT PROTECT 4CHAN	https://www.digikey.se/product-detail/en/texas-instruments/296-39348-1-nd/0408-0000-0000-0000
10-UFQFN	DigiKey	296-21888-1-ND	1	0,460	0,460	IC,ESD PROTECT 6-CH 15@AIR GAP/8@CONT ACT	https://www.digikey.se/products/en?keywords=296-21888-1-nd
SPST	Farnell	2320112	1	1,590	1,590	SWITCH,DIP SPST 4-POS 0.050" PITCH ROHS	http://es.farnell.com/c-k-components/ida04h0sb1/interruptor-embutida-spst-4
SMD	Farnell	2468741	3	0,020	0,060	SWITCH,TACT PUSH-BUTTON 12VDC 50MA HEIGHT=2MM	http://se.farnell.com/c-k-components/ida04h0sb1/switch-flush-spst-4-way-smd/dp/2320112?st=2320112&dky=http%3Ase-farnell.com%2Fc-k-components%2Fida04h0sb1%2Fswitch-flush-spst-4-way-smd
L0603	DigiKey	754-1434-1-ND	1	0,390	0,390	LED,CHIP 0603 BLUE 100MCD@20MA 470NM ROHS	https://www.digikey.se/product-detail/en/led-chip/754-1434-1-nd/0408-0000-0000-0000
L0603	DigiKey	754-1121-1-ND	4	0,310	1,240	LED,CHIP 0603 GREEN 15MCD@20MA 565NM ROHS	https://www.digikey.se/product-detail/en/led-chip/754-1121-1-nd/0408-0000-0000-0000
L0603	DigiKey	754-1434-1-ND	1	0,310	0,310	LED,CHIP 0603 YELLOW 8MCD@20MA 590NM ROHS	https://www.digikey.se/product-detail/en/led-chip/754-1434-1-nd/0408-0000-0000-0000
6-UFDNF	DigiKey	296-24244-1-ND	1	0,600	0,600	PROTECTOR,USB-HS/USB OTG/USB A CHANNEL ESD ROHS	https://www.digikey.se/product-detail/en/texas-instruments/296-24244-1-nd/0408-0000-0000-0000
16-WFQFN	DigiKey	296-40694-1-ND	1	0,730	0,730	SUPPRESOR,TVS DIODE HDMI ESD PROT 13CH CURRENT	https://www.digikey.se/product-detail/en/texas-instruments/296-40694-1-nd/0408-0000-0000-0000
-	DigiKey	490-5907-1-ND	2	0,160	0,320	CONN,COAX SWITCH SMT 2X2	https://www.digikey.se/product-detail/en/murata-electronics/490-5907-1-nd/0408-0000-0000-0000
sd_503398_001	DigiKey	WM11190CT-ND	1	2,040	2,040	CONN,MICRO SD/TRANSFLASH CARD SLOT	https://www.digikey.se/product-detail/en/molex/wm11190ct-nd/0408-0000-0000-0000
-	DigiKey	CP-041H-ND	1	0,560	0,560	CONN,DC POWER PCB JACK 16VDC 5A 1.65MM DIA ROHS	https://www.digikey.se/products/en?keywords=PJ-041H
-	DigiKey	609-1045-ND	2	0,590	1,180	CONNECTOR,USB R/A RCPT SERIES A PIN LENGTH=2.8MM	https://www.digikey.se/products/en?keywords=87520-0010BLF
-	DigiKey	609-4614-1-ND	1	0,620	0,620	CONN,HDMI 19-POS RECEPTACLE R/A W/O FLANGE 3U" AU	https://www.digikey.se/product-detail/en/amphenol/609-4614-1-nd/0408-0000-0000-0000
-	DigiKey	609-4618-1-ND	1	0,340	0,340	CONN,RECEPTACLE R/A USB MICRO-B ROHS	https://www.digikey.se/product-detail/en/amphenol/609-4618-1-nd/0408-0000-0000-0000
-	DigiKey	0873814063-ND	1	0,848	0,848	CONN,RECEPTACLE 40-POS H=4.50MM W/ COVER ROHS	https://www.digikey.se/products/en?keywords=873814063
-	DigiKey	609-1619-1-ND	1	4,870	4,870	CONN,RECEPTACLE 0.8MM CTR 60-POS W/ METAL CAP	https://www.digikey.se/product-detail/en/amphenol-fci/61082-1619-1-nd/0408-0000-0000-0000
-	Arrow	APQ-8016E-1-760NSP-TF	1	9,916	9,916	APQ8016 (100-0760NSP.1.2GHZ,533MHZ,FDH,1080.8MP/13MP,BAGHEER	https://www.arrow.com/en/products/apq-8016e-1-760nsp-tr
-	DigiKey	P4.7KAGCT-ND	1	0,080	0,080	ERJ-1GEJ472C (APQ8016 (100-0760NSP.1.2GHZ,533MHZ,FDH,1080.8MP/13MP,BAGHEER	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERJ-1GEJ472C/P4.7KAGCT-ND/285202
SANDISK SD9DS28K-8G			1	0,3	0,300	FILTER,SAW GPS/GNSS 1565-1606MHZ IL=1.9DB 50/100	Estimated value
			1	0,3	0,300	FILTER,SAW GPS/GNSS 1565-1606MHZ IL=1.9DB 50/100	Estimated value
			1	0,3	0,300	FILTER,BAND PASS 2400-2500MHZ 1411 IL=1.0DB ROHS	Estimated value
			1	4,000	4,000	WGR7640 (032-0), 17WLNSP, RF/ANALOG, RHEA	Estimated value
			1	4,000	4,000	WCN3620 (005-0), 61WLNSP, RF/ANALOG, PB-FREE,, RHEA	Estimated value
			1	4,000	4,000	PM8916 (002-YC), 176NSP, RF/ANALOG, AKELA (2.0), SMIC	Estimated value
			1	6,260	6,260	IC,MEMORY EMCP (8GB EMMC 5.0 + 8GBIT LPDDR3) HF-	Estimated value
			2	1,540	3,080	IC,REGULATOR STEP-DOWN DC/DC CONV SYNC 18V 4.0A	Estimated value

TOTAL EUR 115,379

B.3 Olimex A20

Component	Value	Package	Shop	Code	Qty	Unit Price	Total	Where to find it
Resistor	0,03R	R1206	DigiKey	PRL1632.030FCT-ND	1	0,560	0,560	https://www.digikey.se/product-detail/en/susumu/PRL1632-R030-F1/PRL1632.030FCT-ND/948873
Resistor	0R	R0402	DigiKey	P0.0JCT-ND	4	0,080	0,320	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERJ-2GE0R00X/P0.0JCT-ND/146726
Resistor	0R	R0603	DigiKey	P0.0GCT-ND	2	0,080	0,160	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERJ-3GEYR00V/P0.0GCT-ND/134711
Resistor	1k1 - 1%	R0603	DigiKey	311-1.10KHRCT-ND	2	0,080	0,160	https://www.digikey.se/product-detail/en/yageo/RC603FR-071K1L/311-1.10KHRCT-ND/729795
Resistor	100R	R0603	DigiKey	P100DBCT-ND	1	0,280	0,280	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERA-3AEB10V/P100DBCT-ND/1466028
Resistor	100k - 1%	R0603	DigiKey	P100KDBCT-ND	3	0,280	0,840	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERA-3AEB10V/P100KDBCT-ND/1466100
Resistor	10M	R0402	DigiKey	311-10.0MLRCT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/yageo/RC0402FR-0710ML/311-10.0MLRCT-ND/2827890
Resistor	10k	R0402	DigiKey	RR05P10.0KDCT-ND	18	0,060	1,080	https://www.digikey.se/product-detail/en/susumu/RR0510P-103-D/RR05P10.0KDCT-ND/432960
Resistor	1M	R0402	DigiKey	MCS0402-1.00M-CFCT-ND	1	0,240	0,240	https://www.digikey.se/product-detail/en/vishay-beyschlag/MCS0402C1004FE000/MCS0402-1.00M-CFCT-ND/2607931
Resistor	1k	R0402	DigiKey	RR05P1.0KDCT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/susumu/RR0510P-102-D/RR05P1.0KDCT-ND/432937
Resistor	2k2	R0402	DigiKey	P2.2KDCCT-ND	18	0,250	4,500	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERA-2AEB22X/P2.2KDCCT-ND/1706191
Resistor	22R	R0402	DigiKey	311-22.0LRCT-ND	6	0,010	0,060	https://www.digikey.se/product-detail/en/yageo/RC0402FR-0722RL/311-22.0LRCT-ND/729509
Resistor	2k - 1%	R0402	DigiKey	311-2KLRCT-ND	7	0,010	0,070	https://www.digikey.se/product-detail/en/yageo/RC0402FR-072KL/311-2KLRCT-ND/2827883
Resistor	4k7	R0402	DigiKey	P4.7KDCCT-ND	6	0,360	2,160	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERA-2AE847Z/P4.7KDCCT-ND/1706199
Resistor	470k	R0402	DigiKey	311-470KJRCT-ND	3	0,080	0,240	https://www.digikey.se/product-detail/en/yageo/RC0402JR-07470KL/311-470KJRCT-ND/729430
Resistor	47k	R0402	DigiKey	P47.0KLCT-ND	6	0,080	0,480	https://www.digikey.se/product-detail/en/panasonic-electronic-components/ERJ-2RKF4702X/P47.0KLCT-ND/1746693
Resistor	13k - 1%	R0603	DigiKey	311-13.0KHRCT-ND	2	0,080	0,160	https://www.digikey.se/product-detail/en/yageo/RC0603FR-0713KL/311-13.0KHRCT-ND/729876
Resistor	191R - 1%	R0603	DigiKey	311-191HRCT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/yageo/RC0603FR-07191RL/311-191HRCT-ND/729951
Resistor	2k49 - 1%	R0603	DigiKey	311-2.49KHRCT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/yageo/RC0603FR-072K49L/311-2.49KHRCT-ND/729974
Resistor	200k - 1%	R0603	DigiKey	A102235CT-ND	3	0,080	0,240	https://www.digikey.se/product-detail/en/te-connectivity-passive-product/CPF0603F200KC1/A102235CT-ND/730075
Resistor	3k32 - 1%	R0603	DigiKey	311-3.32KHRCT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/yageo/RC0603FR-073K32L/311-3.32KHRCT-ND/730075
Resistor	330R - 1%	R0603	DigiKey	311-330HRCT-ND	3	0,080	0,240	https://www.digikey.se/product-detail/en/yageo/RC0603FR-07330RL/311-330HRCT-ND/730109
Resistor	4k99 - 1%	R0603	Farnell	1502246RL	3	0,099	0,297	http://se.farnell.com/holsworthy-te-connectivity/rp73d2a4k99btg/motst-tuntnfilm-4k99-0-1-0
Resistor	6k8 - 1%	R0603	DigiKey	311-6.80KHRCT-ND	2	0,080	0,160	https://www.digikey.se/product-detail/en/yageo/RC0603FR-076K8J/311-6.80KHRCT-ND/730270
Resistor	8k25 - 1%	R0603	DigiKey	RMCF0603FT8K25CT-ND	1	0,080	0,080	https://www.digikey.se/product-detail/en/stackpole-electronics-inc/RMCF0603FT8K25/RMCF0603FT8K25CT-ND/730270
Capacitor	100nF	C0402	DigiKey	1276-1002-1-ND	27	0,017	0,459	https://www.digikey.se/product-detail/en/samsung-electro-mechanics/C105B104KP5NNNC/1276-1002-1-ND/3889088
Capacitor	10nF	C0402	DigiKey	445-5199-1-ND	4	0,080	0,320	https://www.digikey.se/product-detail/en/tdk-corporation/C1005X7S2A103K050BB/445-5199-1-ND/2116334
Capacitor	10pF	C0402	DigiKey	712-1252-1-ND	2	0,290	0,580	https://www.digikey.se/product-detail/en/johanson-technology-inc/500R07S100GV4T/712-1252-1-ND/2116334
Capacitor	10uF	C0603	DigiKey	490-3896-1-ND	21	0,113	2,373	https://www.digikey.se/product-detail/en/murata-electronics-north-america/GRM188R60J106ME47D/490-3896-1-ND/2116334
Capacitor	1nF	C0402	DigiKey	490-3244-1-ND	8	0,080	0,640	https://www.digikey.se/product-detail/en/murata-electronics-north-america/GRM155SC1H102JA01D/490-3244-1-ND/2116334
Capacitor	220nF	C0402	DigiKey	478-6020-1-ND	98	0,032	3,175	https://www.digikey.se/product-detail/en/avx-corporation/0402ZD224KAT2A/478-6020-1-ND/2116334
Capacitor	1nF	C1206	DigiKey	478-4600-1-ND	1	0,730	0,730	https://www.digikey.se/product-detail/en/avx-corporation/1206GC102KAZ1A/478-4600-1-ND/2116334
Capacitor	1uF	C0603	DigiKey	1276-1019-1-ND	6	0,080	0,480	https://www.digikey.se/product-detail/en/samsung-electro-mechanics/CL10B105KO8NNNC/1276-1019-1-ND/2116334
Capacitor	22pF	C0603	DigiKey	490-3575-1-ND	2	0,660	1,320	https://www.digikey.se/product-detail/en/murata-electronics-north-america/GQM1885C1H220JB01D/490-3575-1-ND/2116334
Capacitor	22uF	C0603	DigiKey	1276-1193-1-ND	46	0,174	8,004	https://www.digikey.se/product-detail/en/samsung-electro-mechanics/CL10A226M08NRC/1276-1193-1-ND/2116334
Capacitor	27pF	C0603	DigiKey	490-1413-1-ND	2	0,090	0,180	https://www.digikey.se/product-detail/en/murata-electronics-north-america/GRM1885C1H270JA01D/490-1413-1-ND/2116334
Capacitor	33pF	C0603	DigiKey	490-1415-1-ND	2	0,090	0,180	https://www.digikey.se/product-detail/en/murata-electronics-north-america/GRM1885C1H330JA01D/490-1415-1-ND/2116334

SATA Connector	-	-	DigiKey	WM4279CT-ND	1	0,690	0,690	https://www.digikey.se/products/en?keywords=WM4279CT-ND
Button	-	SMD	Farnell	2468741	3	0,020	0,060	http://se.farnell.com/alcoswitch-te-connectivity/1437566-3/tryckknappsbrytare-spst-0-05a/dp/2468741?ost=2468741&ddkey=http%3A%2F%2FElement14.Sweden%2Fsearch
Processor	A20			TFBGA441	1	9,000	9,000	Estimated value
Memory	AXP209	QFN48			1	2,690	2,690	Estimated value
Memory	-	-		MTFC4GACAANA-4M IT	1	2,370	2,370	Estimated value
Inductor	-	L0805	-	-	-	-	-	Unspecified component value
Inductor	-	L0805	-	-	-	-	-	Unspecified component value
Fuse	-	1206	-	-	-	-	-	Unspecified component value
Capacitor	-	C0402	-	-	-	-	-	Unspecified component value
Resistor	-	R0402	-	-	-	-	-	Unspecified component value
Resistor	-	R0603	-	-	-	-	-	Unspecified component value

TOTAL EUR 124,750