UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
SAN ANTONIO DIVISION

POLARIS INNOVATIONS LIMITED, an Irish limited company Plaintiff, v. DELL INC, a Delaware corporation NVIDIA CORPORATION, a Delaware corporation Defendants.	CASE NO.: **COMPLAINT FOR PATENT INFRINGEMENT** DEMAND FOR JURY TRIAL

Plaintiff Polaris Innovations Limited ("Polaris") hereby alleges for its Complaint for patent infringement against Defendants Dell Inc. ("Dell") and NVIDIA Corporation ("NVIDIA") (collectively "Defendants") on personal knowledge as to its own actions and on information and belief as to the actions of others, as follows:

THE PARTIES

1. Polaris Innovations Limited is a corporation organized and existing under the laws of Ireland, with its principal place of business at Polaris Innovations Limited, 29 Earlsfort Terrace, Dublin 2, Republic of Ireland.

2. On information and belief, Defendant Dell is a corporation organized and existing under the laws of Delaware, with its principal place of business at 1 Dell Way, Round Rock, TX 78682. Dell is registered with the State of Texas and may be served with process through its registered agent, Corporation Service Company, 211 E. 7th St., Suite 620, Austin, TX 78701.

3. On information and belief, Dell designs, develops, manufactures, sells, offers to

sell, and imports a wide range of products including personal computers, servers, and tablet computers incorporating and using graphics processors ("GPUs"), accelerated processing units ("APUs"), or graphics cards.

4. On information and belief, Dell develops, designs, and manufactures in Texas and in this District personal computers, servers, and tablet computers incorporating and using graphics processors ("GPUs"), accelerated processing units ("APUs"), or graphics cards.

5. On information and belief, Dell conducts a significant amount of business in Texas and in this District through online sales and advertisements directly to consumers and through product sales by Dell's distributors and resellers.

6. On information and belief, Defendant NVIDIA is a corporation organized and existing under the laws of Delaware, with its principal place of business at 2701 San Tomas Expressway, Santa Clara, CA 95050. NVIDIA is registered with the State of Texas and may be served with process through its registered agent, Corporation Service Company d/b/a CSC-Lawyers Incorporating Service Company, 211 E. 7th St., Suite 620, Austin, TX 78701. Additionally and on information and belief, NVIDIA has a regional office at 11001 Lakeline Blvd., Building 2, Suite 100, Austin, TX 78717, where it employs engineers to design and develop GPUs and graphics cards.

7. On information and belief, NVIDIA designs, develops, manufactures, sells, offers to sell, and imports GPUs, systems-on-chips ("SoCs"), and graphics cards for a wide range of products including mobile devices and desktop systems. NVIDIA additionally creates and provides reference graphics card designs for third parties to use when incorporating NVIDIA GPUs into third-party graphics cards. On information and belief, NVIDIA designs and develops GPUs and graphics cards in this District.

8. On information and belief, NVIDIA additionally manufactures, or contracts third parties to manufacture, mobile processors for smartphones, tablets, and other devices. NVIDIA also sells tablet computers and other devices under the "SHIELD" brand name.

9. On information and belief, NVIDIA provides SoCs and graphics cards to third parties that, in this District, develop, manufacture, sell, and offer to sell tablets and mobile and desktop devices.

10. On information and belief, NVIDIA sells and offers to sell products and services throughout the United States, including in this District, through its website, through major electronics retailers in North America, and in concert and partnership with third parties who sell graphics cards, personal computers, servers, and notebook computers.

11. On information and belief, NVIDIA conducts a significant amount of business in Texas and this District through online sales and advertisements directly to consumers, through product sales by NVIDIA's distributors and resellers, and in concert and partnership with third parties who sell graphics cards, personal computers, servers, and laptop computers.

NATURE OF THE ACTION

12. This is a patent infringement action by Polaris to end Defendants' unauthorized, willful, and infringing manufacture, use, sale, offering to sell, and/or importing in the United States of systems and components that incorporate Polaris's patented inventions or that are instrumentalities for practicing methods that incorporate Polaris's patented inventions.

13. Polaris is the assignee and owner of the patents at issue in this action: U.S. Patents Nos. 6,532,505; 7,124,325; 7,405,993; 7,886,122; 8,161,344; and 8,207,976 (collectively, the "Asserted Patents").

14. Polaris holds all substantial rights and interest in the Asserted Patents, as

described below, including the exclusive right to sue Defendants for infringement and recover damages.

15. Defendants make, use, sell, offer to sell, and/or import in the United States systems and components that infringe one or more claims of the Asserted Patents and/or that are instrumentalities for their infringement or the infringement by others of one or more method claims of the Asserted Patents. Polaris seeks monetary damages and prejudgment interest for Defendants' past and ongoing direct and indirect infringement of the Asserted Patents.

JURISDICTION

16. This action for patent infringement arises under the patent laws of the United States, Title 35 of the United States Code.

17. This Court has subject matter jurisdiction of this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

18. This Court has personal jurisdiction over Defendant Dell. Dell has systematic and continuous contacts with the forum, including because its headquarters is in Texas and this District at 1 Dell Way, Round Rock, TX 78682.

19. Additionally, on information and belief, Dell has systematic and continuous contacts with Texas and this District because it conducts substantial business in Texas and in this District. Dell makes, uses, sells, offers to sell, and/or imports, within the state of Texas and in this District, systems and components that infringe one or more of the Asserted Patents or that are the instrumentalities for infringing one or more of the method claims of the Asserted Patents. Dell derives substantial revenue from the sale of infringing systems, components, and instrumentalities distributed within the District, and/or expects or should reasonably expect its actions to have consequences within the District. Dell has committed and continues to commit acts of patent

infringement in this District, including making, using, selling, offering to sell, and/or importing infringing systems and components, practicing infringing methods within this District, and inducing and contributing to the infringement by others in this District, including by and through these activities described above that were and are undertaken in concert with NVIDIA.

20. This Court has personal jurisdiction over Defendant NVIDIA. NVIDIA conducts substantial business in Texas and in this District, including establishment of a regional office at 11001 Lakeline Blvd., Building 2, Suite 100, Austin, TX 78717, where software and hardware development and sales are conducted of NVIDIA systems or components that infringe one or more of the Asserted Patents, are components in products that infringe one or more of the Asserted Patents, and/or are instrumentalities for infringing one or more of the method claims of the Asserted Patents. NVIDIA makes, uses, sells, offers to sell, and/or imports its systems and components, including systems and components that infringe the Asserted Patents, within the state of Texas and in this District. Such business conducted in this District includes, for example, selling and offering to sell NVIDIA systems and components to Dell in this District, systems and components that comprise a critical and material component in Dell products that are made, sold, used, offered for sale, and/or imported in this District and that infringe one or more Asserted Patents or that are instrumentalities for infringing one or more of the method claims of the Asserted Patents. NVIDIA derives substantial revenue from the sale of such systems and components that are distributed within the District, including by Dell, and/or expects or should reasonably expect its actions to have consequences within the District and derives substantial revenue from interstate and international commerce. NVIDIA has committed and continues to commit acts of patent infringement, including making, using, selling, offering to sell, and/or importing within this District systems and/or components that infringe one or more of the Asserted

Patents or that are instrumentalities for infringing one or more method claims of the Asserted Patents. NVIDIA and Dell also act in partnership and/or in concert to make, sell and offer to sell NVIDIA and Dell co-branded products that are made in this District and that infringe one or more Asserted Patents or are instrumentalities for infringing one or more method claims of the Asserted Patents.

VENUE

21. Polaris incorporates and realleges paragraphs 1-20 above as if fully set forth herein.

22. Venue is proper in this Court pursuant to 28 U.S.C. §§ 1391 and 1400(b) because Dell and NVIDIA are subject to personal jurisdiction in this District and because a substantial part of the events giving rise to Polaris's claims against Dell and NVIDIA occurred and continue to occur in this District.

23. On information and belief, Dell makes, uses, sells, offers to sell, and/or imports, within the state of Texas and in this District, systems and components that infringe one or more of the Asserted Patents or that are the instrumentalities for infringing one or more of the method claims of the Asserted Patents. Dell is headquartered in this District at 1 Dell Way, Round Rock, TX 78682. Dell has established a significant presence in this forum by manufacturing, using, selling, offering to sell, and importing in Texas and in this District its desktop and laptop computers and tablets that infringe one or more Asserted Patents in this action or that are instrumentalities for infringing one or more method claims of the Asserted Patents. For example, according to publicly available documentation, Dell manufactures the accused products and instrumentalities at its 300,000-square-foot Mort Topfer Manufacturing Center in Round Rock, Texas. The operation of this facility and the sale and offer for sale of Dell's products and

instrumentalities in Texas and in this District constitute infringement by Dell of one or more Asserted Patents in this District.

24. On information and belief, NVIDIA makes, uses, sells, offers to sell, and/or imports, within the state of Texas and in this District, systems and components that infringe one or more of the Asserted Patents or that are the instrumentalities for infringing one or more of the method claims of the Asserted Patents. On information and belief, NVIDIA has an established place of business within this District, including a regional office at 11001 Lakeline Blvd., Building 2, Suite 100, Austin, TX 78717, where software and hardware development activities are conducted of NVIDIA systems, components, and instrumentalities that are material to the infringement by NVIDIA and its customers of one or more of the Asserted Patents.

25. On information and belief, Dell, NVIDIA's direct customer and/or partner in marketing, designing, and selling of Dell's products containing NVIDIA GPUs and graphics cards, is headquartered in this District. And, on information and belief, Dell and NVIDIA transact and coordinate at Dell's headquarters in this District and/or at NVIDIA's regional office in this District to cooperatively and jointly design, develop, and integrate NVIDIA GPUs and graphics cards with Dell components to make the infringing systems, components, and instrumentalities. In addition, NVIDIA and Dell act cooperatively and in concert in this District to co-brand and co-market systems, components, and instrumentalities that are material to the infringement of one or more of the Asserted Patents. Further, on May 6, 2016—with actual notice from Polaris of the patents and of NVIDIA's actions constituting infringement of the patents—NVIDIA selected a forum in this judicial district to announce and offer for sale the NVIDIA GeForce GTX 1080 graphics card, which upon information and belief infringes at least one claim of each of U.S. Patents 7,886,122; 8,161,344; and 8,207,976. Specifically, NVIDIA's co-founder and CEO Jen-Hsun Huang

promoted NVIDIA products, including the NVIDIA GeForce GTX 1080 graphics card, for more than an hour at the Austin Convention Center located at 500 East Cesar Chavez Street, Austin, TX, 78701, in this judicial district. Mr. Huang demonstrated and touted the capabilities of the GeForce GTX 1080 products. NVIDIA also demonstrated for the first time another infringing product (GeForce GTX 1070).

JOINDER

26. Polaris incorporates and realleges paragraphs 1-25 above as if fully set forth herein.

27. Joinder is proper under 35 U.S.C. § 299, including because at least some of each Defendant's infringement arises out of the same transactions and occurrences that likewise give rise to the other Defendant's infringement.

28. For example and as described above and below, Dell (alone and cooperatively with NVIDIA) has designed and developed Dell hardware to combine and integrate with NVIDIA graphics processors and cards to make, use, sell, and offer to sell products that infringe one or more of the Asserted Patents and/or are instrumentalities for infringing one or more claimed method of the Asserted Patents. Likewise, the NVIDIA design and functionality of the graphics processors and cards themselves comprise a critical and material portion of the claimed inventions. On information and belief, Dell and NVIDIA have acted and continue to cooperate and act in concert to design, develop, and make their respective material components of infringing systems, components, and instrumentalities. For example, Dell's Precision 15 5000 Series laptops and Dell's systems that integrate NVIDIA Quadro K2200 graphics cards and GeForce 980 graphics cards infringe or are instrumentalities for infringing one or more of the Asserted Patents.

29. Additionally, joinder is proper because questions of fact common to all

Defendants will arise in this action.

30. Polaris alleges patent infringement by Defendants in connection with their making, using, selling, offering to sell, and/or importing patented systems or components in the United States, their practice of the patented methods and their inducement of others to infringe in the United States, based at least in part on systems and components developed by NVIDIA that are designed to be used in conjunction with components developed and/or supplied by Dell, where the combination and integration of those components comprise infringing products or instrumentalities for practicing infringing methods. The design, development, integration, and operation of NVIDIA and Dell's respectively contributed systems and components involve questions of fact that are common to each of NVIDIA and Dell.

31. Also, there will be common factual issues regarding the knowledge that each Defendant has regarding the infringement of the Asserted Patents and each Defendant's acts to induce or contribute to the infringement by others. On information and belief, Dell and NVIDIA have together entered into partnerships or agreements to make, use, sell, offer to sell, and/or import in the United States the accused products and instrumentalities, including for example systems and products using NVIDIA Quadro, Tesla, and GeForce GPUs and graphics cards. Both Dell and NVIDIA have repeatedly and publicly advertised and marketed their partnership, including for example on Dell's website at "Dell and NVIDIA", https://www.dell.com/learn/us/en/555/solutions/ws-partner-nvidia, and on NVIDIA's website at "NVIDIA PROFESSIONAL GRAPHICS SOLUTIONS," https://www.nvidia.com/content/quadro/pdf/NV-ProGraphics-DELL-LineCard-JUL-10-FNL-HR.pdf, and "Dell and NVIDIA Workstation Solutions," http://www.nvidia.com/object/IO_16084.html. NVIDIA's website also directs customers interested

in buying systems and products that incorporate the NVIDIA accused systems, products, and components to Dell. *See* "Where to Buy," http://www.nvidia.com/object/grid-partners.html#.

32. On information and belief, Dell and NVIDIA have also together entered into partnerships and agreements to advertise infringing products through Dell's own and third-party websites (for example, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC and http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD) and to provide their customers and third parties with hardware, software, and other infrastructure to enable, support, and make use of infringing products, including: documentation, instructions, technical specifications (for example, Tech Specs of Dell's 4 GB NVIDIA Quadro K2200 Graphic Card, http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD&mfgpid=238969), service manuals (for example, Alienware 13 Service Manual, http://www.dell.com/support/manuals/us/en/ukdhs1/alienware-13/Alienware13_SM-v1/Before-working-inside-your-computer?guid=GUID-5D3B1051-9384-409A-8D5B-9B53BD496DE8&lang=en-us), software driver downloads, diagnostic tools (for example, Alienware 13 R2 Product Support, http://www.dell.com/support/home/us/en/19/product-support/product/alienware-13-r2/diagnose), and replacement parts.

33. Additionally, for the reasons described in paragraphs 27-32, joinder is proper because Polaris's allegations against NVIDIA and against Dell are not based solely on allegations that Defendants have individually and/or independently infringed the Asserted Patents.

34. Joinder of NVIDIA and Dell in this action is also proper because, as described above and on an element-by-element basis below, the actions of both Dell and NVIDIA comprise aspects of the other Defendant's infringing acts for one or more of the Asserted Patents. For example, for some claims against Dell and NVIDIA, the NVIDIA GPUs comprise a material part

of the claimed inventions while Dell's combination and integration of those NVIDIA GPUs with Dell hardware (e.g., memory devices) meet other aspects of the claimed inventions, making adjudication against NVIDIA alone not feasible or practicable without a finding of infringement against Dell. Also, in some instances, a finding that NVIDIA has induced and/or contributed to the infringement by others of the asserted claims of the 122 and 976 Patents through NVIDIA's sale of NVIDIA GPUs to Dell would first require a finding that Dell made the infringing instrumentalities by and through its integration of those components with its own hardware (e.g., memory devices). As such, an adjudication against NVIDIA for inducing or contributing to the infringement by others for at least some method claims and some accused instrumentalities cannot be had without a determination that Dell made the accused instrumentalities and contributed and combined claimed components.

THE ASSERTED PATENTS

35. On March 11, 2003, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 6,532,505 ("the 505 Patent"), entitled "Universal Resource Access Controller." A copy of the 505 Patent is attached hereto as Exhibit 1.

36. Polaris owns all substantial right, title, and interest in the 505 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

37. On October 17, 2006, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,124,325 ("the 325 Patent"), entitled "Method and Apparatus for Internally Trimming Output Drivers and Terminations in Semiconductor Devices." A copy of the 325 Patent is attached hereto as Exhibit 2.

38. Polaris owns all substantial right, title, and interest in the 325 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

39. On July 29, 2008, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,405,993 ("the 993 Patent"), entitled "Control Component for Controlling a Semiconductor Memory Component in a Semiconductor Memory Module." A copy of the 993 Patent is attached hereto as Exhibit 3.

40. Polaris owns all substantial right, title, and interest in the 993 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

41. On February 8, 2011, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,886,122 ("the 122 Patent"), entitled "Method and Circuit for Transmitting a Memory Clock Signal." A copy of the 122 Patent is attached hereto as Exhibit 4.

42. Polaris owns all substantial right, title, and interest in the 122 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

43. On April 17, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,161,344 ("the 344 Patent"), entitled "Circuits and Methods for Error Coding Data Blocks." A copy of the 344 Patent is attached hereto as Exhibit 5.

44. Polaris owns all substantial right, title, and interest in the 344 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

45. On June 26, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,207,976 ("the 976 Patent"), entitled "Circuit." A copy of the 976 Patent is attached hereto as Exhibit 6.

46. Polaris owns all substantial right, title, and interest in the 976 Patent, and holds the right to sue and recover damages for infringement thereof, including past infringement.

47. At least as of November 5, 2015, representatives of NVIDIA including Mr. Richard Domingo, the Senior Director of Intellectual Property, and Mr. David Shannon, the Chief

Administrative Officer, met with representatives of Polaris to discuss Polaris's portfolio of patents, including at least U.S. Patents Nos. 6,532,505; 7,886,122; and 8,207,976.

48. At least as of March 22, 2016, NVIDIA was placed on actual notice of each of the Asserted Patents and actual notice that its actions constituted and continue to constitute infringement of one or more claims of the Asserted Patents. On April 25, 2016, Polaris provided NVIDIA with an analysis of NVIDIA's infringement of one or more claims of each of the Asserted Patents.

49. On May 12, 2016, Polaris again met with NVIDIA to discuss a potential license to the Asserted Patents. At that meeting, Polaris presented infringement analysis related to the Asserted Patents to NVIDIA. Polaris and NVIDIA also discussed a licensing proposal from Polaris. NVIDIA stated no disagreements and asked no questions regarding Polaris's analysis.

50. At least as of March 22, 2016, Dell was placed on on actual notice of each of U.S. Patents Nos. 7,886,122; 8,161,344; and 8,207,976 and actual notice that its actions constituted and continue to constitute infringement of one or more claims of those patents. On April 5, 2016, Michele Connors, Dell's Senior Counsel for Intellectual Property, Patents, responded by email to Polaris's March 22, 2016, notice, informing Polaris that it believes NVIDIA to be responsible for Polaris's intellectual property claim agains Dell, and stating that Dell had communicated with NVIDIA about Polaris's allegations. Ms. Connors did not dispute the substance of Polaris's infringement allegations against the accused products. Polaris responded to Dell's email on April 20, 2016, reiterating that Polaris's allegations against Dell are against Dell's system-level products, not only NVIDIA components. Dell did not respond further.

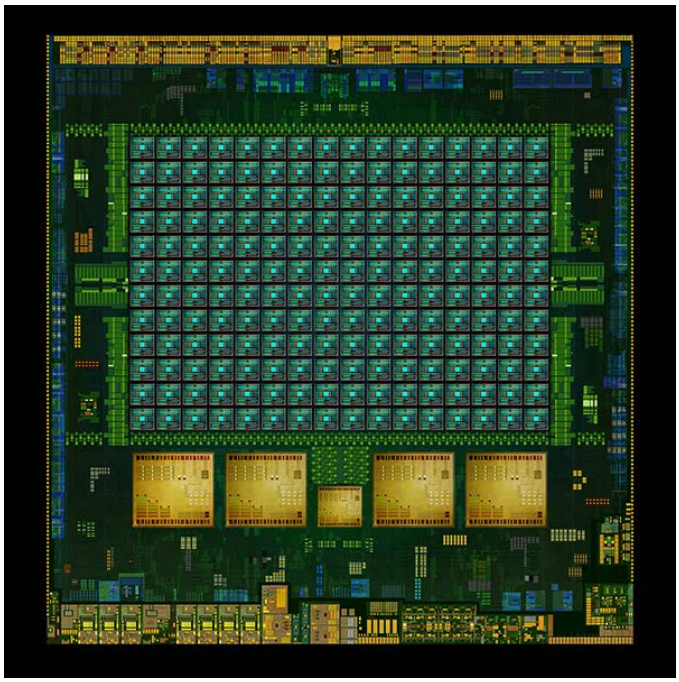
COUNT I:

NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 6,532,505

51. Polaris incorporates and realleges paragraphs 1-50 above as if fully set forth herein.

52. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 505 Patent, including but not limited to Claims 1 - 3, 11 - 12, and 14 - 18, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, NVIDIA microprocessor and tablet products, devices, systems, and/or components of systems that include a universal resource access controller as required by the claims of the 505 Patent. These "505 Patent Infringing Products" and instrumentalities include, for example, at least NVIDIA's Tegra K1 Mobile Processors, Tegra X1 Mobile Processors, Tegra 4 Mobile Processors, Tegra 4i Mobile Processors, NVIDIA SHIELD Android TV, and NVIDIA SHIELD tablets, which include a memory controller that is a universal resource access controller according to the claims of the 505 Patent.

53. By way of example, the die of a representative 505 Patent Infringing Product (Tegra K1 Processor) that includes the claimed universal resource access controller is shown in the image below.



See Mile High Milestone: Tegra K1 "Denver" Will Be First 64-bit ARM Processor for Android, http://blogs.nvidia.com/blog/2014/08/11/tegra-k1-denver-64-bit-for-android/; *see also* NVIDIA Tegra K1 Preview & Architecture Analysis, http://www.anandtech.com/show/7622/nvidia-tegra-k1.

54. On information and belief, the 505 Patent Infringing Products comprise a universal resource access controller (the memory controller that sorts requests to the DRAM subsystem); *see* NVIDIA Tegra K1 Mobile Processor Technical Reference Manual DP-06905001_v02p ("Tegra K1 TRM") at 643-44, http://www.slideshare.net/JosefZila/tegra-k1-trmdp06905001v02p) coupled to a requesting system (for example, memory clients; *see* Tegra K1 TRM at 13) and a resource (for example, the DRAM subsystem and accompanying buffers; *see* Tegra K1 TRM at 12, 643). On information and belief, when the requesting system desires access to the resource, the requesting system generates a resource access request (for example, a memory client request; *see* Tegra K1 TRM at 644) which is passed to the universal resource controller which, in turn, uses a specific characteristic operating parameter of the requested resource (for

example, the device geometry or timing parameters of the device; *see* Tegra K1 TRM at 644, 647), a current state of the requested resource (see, for example, the bank queues; *see* Tegra K1 TRM at 644), and a requested state of the requested resource to generate a corresponding sequenced command (for example, the ordered commands generated by the row sorter; *see* Tegra K1 TRM at 644) suitable for accessing the resource as required by the requesting system.

55. On information and belief, the universal resource access controller in the 505 Patent Infringing Products comprises a configurable system interface (for example, the memory controller; *see* Tegra K1 TRM at 643, configurability described at Tegra K1 TRM at 647) coupled to the requesting system suitably arranged to both receive the resource access request and to generate a corresponding universal command, a universal command sequencer coupled to the configurable system interface (for example, the row sorter; *see* Tegra K1 TRM at 644), a resource tag buffer coupled to the command sequencer arranged to store a resource tag arranged to identify the current state of the requested resource and a resource tag arranged to identify the requested state of the requested resource (for example, bank queues; *see* Tegra K1 TRM at 644), and a characteristic operating parameter buffer coupled to the command sequencer arranged to store the characteristic operating parameter associated with the requested resource (for example, the buffer into which the DRAM size and geometry are programmed; *see* Tegra K1 TRM at 647). On information and belief, the universal command sequencer uses the respective resource tags that identify the current state and the requested state of the requested resource and the characteristic operating parameter associated with the requested resource to generate the sequenced universal command (for example, to generate memory requests in a particular order, *see* Tegra K1 TRM at 644, 647).

56. On information and belief, the 505 Patent Infringing Products comprise a

universal resource access controller wherein the requesting system is one processor (for example, an individual core of the quad-core CPU Complex; *see* Tegra K1 TRM at 12) of a plurality of processors (for example, the CPU Complex; *see* Tegra K1 TRM at 12) included in a multiprocessor computing system (for example, the NVIDIA Tegra K1 mobile processor; *see* Tegra K1 TRM at 11). On information and belief, the configurable system interface is configurable to be able to accept and process resource requests (for example, a memory client request; *see* Tegra K1 TRM at 644) from any of the plurality of processors.

57. On information and belief, the 505 Patent Infringing Products comprise a system bus (for example, the internal bus; *see* Tegra K1 TRM at 13), a plurality of processors each capable of issuing a processor command and an associated data burst to the system bus (for example, the four cores in the quad-core CPU Complex; *see* Tegra K1 TRM at 12), and the memory controller described above connected to the plurality of processors by way of the system bus (for example, the memory controller built in to the Tegra K1 processor; *see* Tegra K1 TRM at 12). On information and belief, the memory controller is arranged to receive the processor commands and associated data bursts issued by the processors and to issue corresponding shared memory commands (*see* Tegra K1 TRM at 643). On information and belief, the 505 Patent Infringing Products additionally comprise a shared memory device (for example, DDR3L, LP-DDR3, or LP-DDR2 memory; *see* Tegra K1 TRM at 12), a command bus connecting the shared memory device to the memory controller arranged to carry the issued shared memory commands according to a minimum issue time generated by the memory controller (for example, using deadline-based arbitration; *see* Tegra K1 TRM at 645), and a data bus connecting the shared memory to the memory controller arranged to carry read data from the shared memory to the memory controller based upon the data offset generated by the memory controller (for example,

the external memory interface connecting the memory controller to external memory such as DDR3L, LP-DDR3, or LP-DDR2 memory; *see* Tegra K1 TRM at 12).

58. On information and belief, in the multiprocessor computing system in the 505 Patent Infringing Products, the shared memory is an SDRAM (for example, DDR3L, LP-DDR3, or LP-DDR2 memory, *see* Tegra K1 TRM at 12).

59. On information and belief, when the 505 Patent Infringing Products are operated according to their normal and expected use by NVIDIA, the 505 Patent Infringing Products control access to a resource by a requesting system by (i) generating a resource access request (for example, a memory client request; *see* Tegra K1 TRM at 644) by a requesting system (for example, memory clients; *see* Tegra K1 TRM at 13), (ii) passing the resource access request to a universal resource access controller (for example, the memory controller that sorts requests to the DRAM subsystem; *see* Tegra K1 TRM at 643), and (iii) generating a sequenced resource access command suitable for accessing the resource as required by the requesting system (for example, the ordered commands generated by the row sorter; *see* Tegra K1 TRM at 644) and based upon a specific operating parameter of the requested resource (for example, the device geometry or timing parameters of the device; *see* Tegra K1 TRM at 644, 647), a current state of the requested resource (see, for example, the bank queues; *see* Tegra K1 TRM at 644), and a requested state of the requested resource (*see* Tegra K1 TRM at 644).

60. On information and belief, the 505 Patent Infringing Products comprise a universal resource access controller with a configurable system interface (for example, the memory controller that sorts requests to the DRAM subsystem; *see* Tegra K1 TRM at 643, an example of configurability described at 647) coupled to the requesting system, suitably arranged to both receive the resource access request and to generate a corresponding universal command, a

universal command sequencer coupled to the configurable system interface (for example, the row sorter; *see* Tegra K1 TRM at 644), a resource tag buffer coupled to the command sequencer arranged to store a resource tag arranged to identify the current state of the requested resource and a resource tag arranged to identify the requested state of the requested resource (for example, bank queues; *see* Tegra K1 TRM at 644), and a characteristic operating parameter buffer coupled to the command sequencer arranged to store the characteristic operating parameter associated with the requested resource (*see* Tegra K1 TRM at 647).

61. On information and belief, the 505 Patent Infringing Products comprise a requesting system that is one processor (for example, an individual core of the quad-core CPU Complex; *see* Tegra K1 TRM at 12) of a plurality of processors (for example, the CPU Complex; *see* Tegra K1 TRM at 12) included in a multiprocessor computing system (for example, the NVIDIA Tegra K1 mobile processor; *see* Tegra K1 TRM at 11). On information and belief, there is a system interface in the multiprocessor computing system that is configurable to be able to accept and process resource requests (for example, a memory client request; *see* Tegra K1 TRM at 644) from any of the plurality of processors.

62. On information and belief, in the 505 Patent Infringing Products, when the universal resource access controller generates a sequenced resource access command, the requested resource includes a memory device (for example, DDR3L, LP-DDR3, or LP-DDR2 memory, *see* Tegra K1 TRM at 12).

63. On information and belief, in the 505 Patent Infringing Products, the memory device includes a number of shared memory devices (for example, the two LP-DDR4 memory devices in each NVIDIA SHIELD Android TV), each of which are coupled to the universal resource access controller.

64. On information and belief, NVIDIA has induced and continues to induce infringement of one or more claims of the 505 Patent, including but not limited to Claims 1 - 3, 11 - 12, and 14 - 18, pursuant to 35 U.S.C. § 271(b) by encouraging its customers and other third parties such as users, distributors, wholesalers, and retailers of the 505 Patent Infringing Products to make, use, sell, offer to sell, and/or import in the United States without authorization the 505 Patent Infringing Products as described above and/or by encouraging those same customers and third parties to perform the claimed methods for controlling access to a resource. Controlling access to a resource by a requesting system in a universal resource access controller as claimed constitutes direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 505 Patent by such customers and third parties. NVIDIA's acts of inducement include: providing the 505 Patent Infringing Products to its customers and other third parties and intending them to use the 505 Patent Infringing Products with hardware, software, and other infrastructure that enable and/or make use of these products; advertising these products through its own and third-party websites (for example http://www.nvidia.com/object/tegra-k1-processor.html); encouraging customers and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; and providing instructions on how to use these products. For example, NVIDIA's documentation supplied with the representative 505 Patent Infringing Product, NVIDIA Tegra K1, instructs users to install the processor in a system with memory (for example, DDR3L, LP-DDR3, or LP-DDR2 memory), and thus to perform the claimed methods. *See, e.g.*, Tegra K1 TRM at 12, 643.

65. NVIDIA proceeded in this manner despite its actual knowledge since at least November 5, 2015, of the 505 Patent and its knowledge that the specific actions it actively induced

and continues to actively induce on the part of its customers and other third parties constitute infringement of the 505 Patent. At the very least, because NVIDIA has been and remains on notice of the 505 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

66. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 505 Patent, including but not limited to Claims 1 - 3, 11 - 12, and 14 - 18, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority systems or components of systems that include the claimed universal resource access controller and/or perform the claimed methods for controlling access to a resource by a requesting system in a universal resource access controller, including, without limitation Tegra K1 processors and other Tegra system-on-chip devices. These systems and components supplied by NVIDIA are critical and material components to smartphones, tablets, and laptops that infringe one or more claims of the 505 Patent or that are the instrumentalities for infringing one or more method claims of the 505 Patent. For example, the Tegra K1 processors or other Tegra system-on-chip devices comprise the claimed universal resource access controllers and are also the critical and material component to controlling the memory in a smartphone, tablet, or laptop according to claimed methods. NVIDIA supplied and continues to supply these components, including, without limitation, Tegra K1 processors and other Tegra system-on-chip devices, with the knowledge of the 505 Patent and with the knowledge that these components constitute critical and material parts of the claimed inventions of the 505 Patent. Moreover, NVIDIA knows at least by virtue of its knowledge of its own products and the 505 Patent, that these components are especially made and/or especially adapted for use as claimed in the 505 Patent and there is no substantial non-infringing use of the claimed elements of these components.

67. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 505 Patent.

68. NVIDIA's infringement of the 505 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of November 5, 2015, when Polaris placed NVIDIA on notice of infringement of the 505 Patent and identified the 505 Infringing Products, NVIDIA has had actual knowledge of infringement of the 505 Patent and has proceeded to infringe the 505 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 505 Patent. Despite knowledge of the 505 Patent, NVIDIA has acted, and is acting, in this manner despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT II:

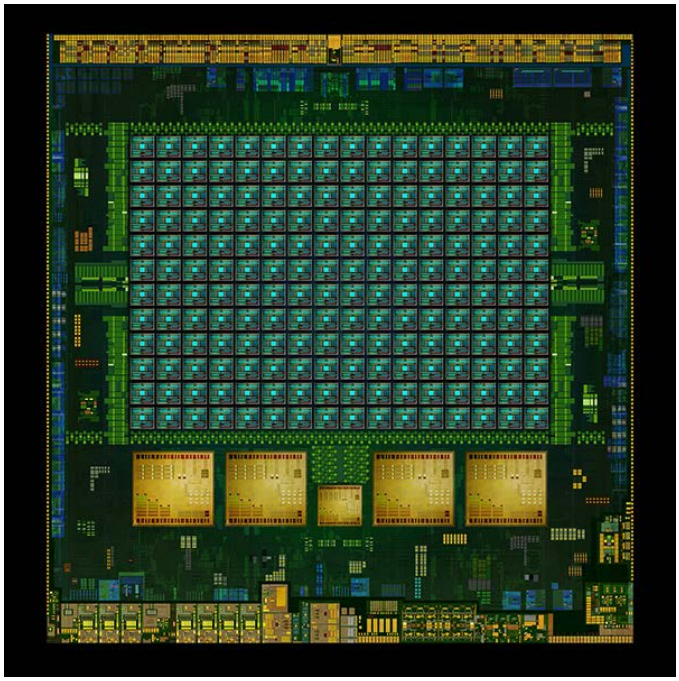
NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 7,124,325

69. Polaris incorporates and realleges paragraphs 1-50 as if fully set forth herein.

70. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 325 Patent, including but not limited to Claim 14, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, NVIDIA microprocessor and tablet products, devices, systems, and/or components of systems that include a semiconductor device as required by the claims of the 325 Patent. These "325 Patent Infringing Products" include, for

example, at least NVIDIA's Tegra K1 Mobile Processors, Tegra X1 Mobile Processors, Tegra 4 Mobile Processors, Tegra 4i Mobile Processors, NVIDIA SHIELD Android TV, and NVIDIA SHIELD tablets, which include a semiconductor device as claimed in the 325 Patent.

71. By way of example, the die of a representative 325 Patent Infringing Product (Tegra K1 Processor) that comprises the claimed semiconductor device is shown in the image below.



See Mile High Milestone: Tegra K1 "Denver" Will Be First 64-bit ARM Processor for Android, http://blogs.nvidia.com/blog/2014/08/11/tegra-k1-denver-64-bit-for-android/; *see also* NVIDIA Tegra K1 Preview & Architecture Analysis, http://www.anandtech.com/show/7622/nvidia-tegra-k1.

72. On information and belief, the 325 Patent Infringing Products comprise at least one interface device having a settable control element (for example, the DQ pins on the DRAM interface or controlled output impedance MPIO pins; *see* Tegra K1 TRM at 12, 264-65); a trimming register connected to said control element (for example, the pad control registers; *see*

Tegra K1 TRM at 264-65, 767-68, 857-58); and a trimming unit for writing to said trimming register based on a measured variable detected on said interface device (for example, the auto-calibration unit; *see* Tegra K1 TRM at 762-63). On information and belief, the trimming unit is connected to the interface device and the trimming register (*see, e.g.*, Tegra K1 TRM at 767-68).

73. On information and belief, NVIDIA has induced and continues to induce infringement of one or more claims of the 325 Patent, including, but not limited to, Claim 14, pursuant to 35 U.S.C. § 271(b) by encouraging its customers and other third parties such as users, distributors, wholesalers, and retailers of the 325 Patent Infringing Products to make, use, sell, offer to sell, and/or import in the United States without authorization the 325 Patent Infringing Products as described above and/or by encouraging those same customers and other third parties to configure the 325 Patent Infringing Products to calibrate the drive strength of DRAM interface outputs. This use, without authorization, of the infringing products comprising the claimed semiconductor device constitutes direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 325 Patent by such customers and third parties. NVIDIA's acts of inducement include: providing the 325 Patent Infringing Products to its customers and other third parties and intending them to use the 325 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products, including DRAM chips; advertising these products through its own and third-party websites (for example http://www.nvidia.com/object/tegra-k1-processor.html); encouraging customers and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; and providing instructions on how to use these products. For example, NVIDIA's technical documentation supplied with the representative 325 Patent Infringing Products, NVIDIA Tegra K1, encourages users to configure

output drive strength. *See* Tegra K1 TRM at 767-68.

74. NVIDIA proceeded in this manner despite its actual knowledge since at least March 22, 2016, of the 325 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 325 Patent. At the very least, because NVIDIA has been and remains on notice of the 325 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

75. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 325 Patent, including but not limited to Claim 14, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority components of the 325 Patent Infringing Products, including, without limitation, Tegra K1 processors and other Tegra system-on-chip devices. These components supplied by NVIDIA are critical and material components to smartphones and tablets that infringe one or more claims of the 325 Patent. For example, the Tegra K1 processors or other Tegra system-on-chip devices comprise the claimed semiconductor device and are also the critical and material components capable of calibrating the drive strength of DRAM interface outputs in a smartphone or tablet according to the claims of the 325 Patent. NVIDIA supplied and continues to supply these components, including, without limitation, Tegra K1 processors and other Tegra system-on-chip devices, with the knowledge of the 325 Patent and with the knowledge that these components constitute critical and material parts of the claimed inventions of the 325 Patent. Moreover, NVIDIA knows, at least by virtue of its knowledge of its own products and the 325 Patent, that these components are especially made and/or especially adapted for use as claimed in the 325 Patent and there is no substantial non-infringing use of the claimed elements of these

components.

76. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 325 Patent.

77. NVIDIA's infringement of the 325 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed NVIDIA on notice of infringement of the 325 Patent and identified NVIDIA infringing products, NVIDIA has had actual knowledge of infringement of the 325 Patent and has proceeded to infringe the 325 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 325 Patent. Despite knowledge of the 325 Patent, NVIDIA has acted, and is acting, in this manner despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT III:

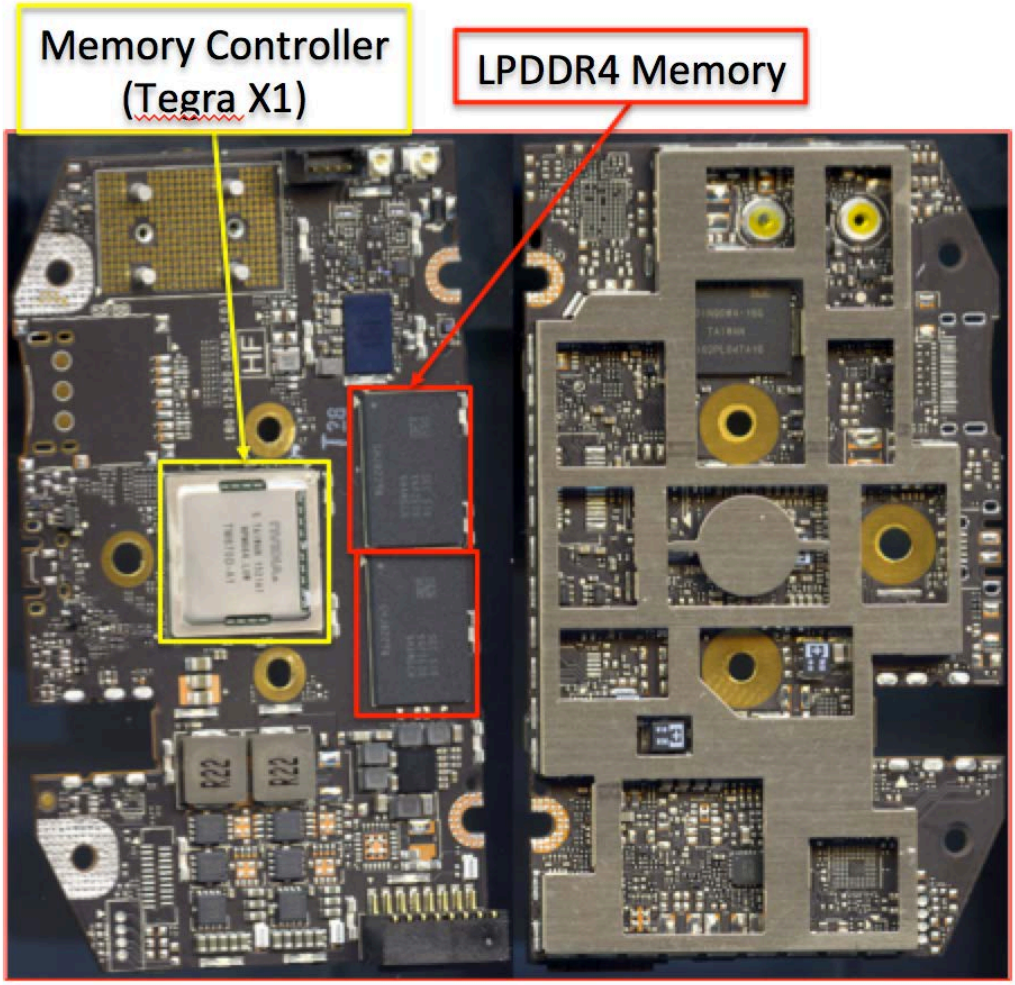
NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 7,405,993

78. Polaris incorporates and realleges paragraphs 1-50 above as if fully set forth herein.

79. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 993 Patent, including but not limited to Claims 1 - 3, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell in the United States, and/or importing in the United States without authority, microprocessor and

claimed memory control products, devices, systems, and/or components of systems (the "993 Patent Infringing Products"), including, for example, at least NVIDIA's Tegra Mobile Processors configured to control Low-Power DDR ("LPDDR") memory such as Tegra X1 Processors and NVIDIA SHIELD Android TV, which include a control component for controlling semiconductor memory (e.g., LPDDR memory) according to the claims of the 993 Patent.

80. By way of example, the top and bottom views of the motherboard of a representative 993 Patent Infringing Product (NVIDIA SHIELD Android TV with an NVIDIA Tegra X1 Mobile Processor) are shown in the image below.



See http://forum.xda-developers.com/shield-tv/general/teardown-reverse-engineering-t3268452 (annotations added).

81. The 993 Patent Infringing Products, such as the NVIDIA SHIELD Android TV, contain control components for controlling a semiconductor memory component in a semiconductor memory module and include a control unit. *See, e.g.*, NVIDIA Tegra X1, NVIDIA'S New Mobile Superchip, Whitepaper V1.0 ("Tegra X1 Whitepaper") at 8, http://international.download.nvidia.com/pdf/tegra/Tegra-X1-whitepaper-v1.0.pdf ("Tegra X1 include[es] . . . memory controllers"). Further, on information and belief, the 993 Patent Infringing Products' control unit generates control signals for controlling read and write access to the semiconductor memory component and address signals for addressing memory cells in the semiconductor memory component for read and write access. Moreover, on information and belief, the 993 Patent Infringing Products comprise a plurality of address terminals for providing the address signals and a selection circuit for supplying one of the address terminals with a selected signal selected between one of the address signals and one of the control signals. *See, e.g.*, Tegra X1 Whitepaper at 6 ("LPDDR4 memory controller").

82. In addition, one or more 993 Patent Infringing Products include a plurality of memory chips. *See, e.g.*, Figure shown in ¶ 80 above. Further, on information and belief, the 993 Patent Infringing Products' control unit generates a first control signal for selecting one of the memory chips for read and write access.

83. In addition, on information and belief, the memory chips in one or more 993 Patent Infringing Products comprise an activatable terminating resistor that is activated for write access. Further, the control unit in these 993 Patent Infringing Products, on information and belief, generates a second control signal for activating the activatable terminating resistor of said one of the memory chips.

84. On information and belief NVIDIA has induced and continues to induce

infringement of one or more claims of the 993 Patent, including but not limited to Claims 1 - 3, pursuant to 35 U.S.C. § 271(b) by encouraging its customers and other third parties such as distributors, wholesalers, and retailers of the 993 Infringing Products (including, for example, manufacturers of tablets and automobiles incorporating NVIDIA Tegra X1 processors) to make, use, sell, offer to sell, and/or import in the United States without authorization the 993 Infringing Products as described above and by encouraging those same customers and third parties to use the claimed control component for controlling semiconductor memory. This use, without authorization, of the infringing products comprising the claimed control components and semiconductor memory modules constitutes direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 993 Patent by such customers and third parties. NVIDIA's acts of inducement include: providing its customers with 993 Patent Infringing Products and intending them to use the 993 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; advertising these products through its own and third-party websites (for example https://shield.nvidia.com/android-tv); encouraging customers and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; and providing instructions on how to use these products. For example, NVIDIA provides a user guide for its NVIDIA Shield Android TV, enabling users to use the product (for example http://support-shield.nvidia.com/android-tv-user-guide/index.htm#t=About_SHIELD.htm).

85. NVIDIA proceeded in this manner despite its actual knowledge since at least March 22, 2016, of the 993 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 993 Patent. At the very least, because NVIDIA has been and remains on notice

of the 993 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

86. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 993 Patent, including but not limited to Claims 1 - 3, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority components of systems that include the claimed control component for semiconductor memory, including, without limitation, components such as Tegra X1 processors and other Tegra system-on-chip devices configured to control LPDDR memory. These components supplied by NVIDIA are critical and material components to tablets, automobiles, and consoles that infringe one or more claims of the 933 Patent. For example, the Tegra X1 processors or other Tegra system-on-chip devices configured to control LPDDR memory comprise the claimed control component for semiconductor memory according to the claims of the 933 Patent. NVIDIA supplied and continues to supply these components, including, without limitation, Tegra X1 processors and other Tegra system-on-chip devices configured to control LPDDR memory, with the knowledge of the 993 Patent and with the knowledge that these components constitute critical and material parts of the claimed inventions of the 993 Patent. Moreover, NVIDIA knows at least by virtue of its knowledge of its own products and the 993 Patent, that these components are especially made and/or especially adapted for use as claimed in the 993 Patent and there is no substantial non-infringing use of the claimed elements of these components.

87. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 993 Patent.

88. NVIDIA's infringement of the 993 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris

placed NVIDIA on notice of infringement of the 993 Patent and identified NVIDIA infringing products, NVIDIA has had actual knowledge of infringement of the 993 Patent and has proceeded to infringe the 993 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 993 Patent. Despite knowledge of the 993 Patent, NVIDIA has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT IV:

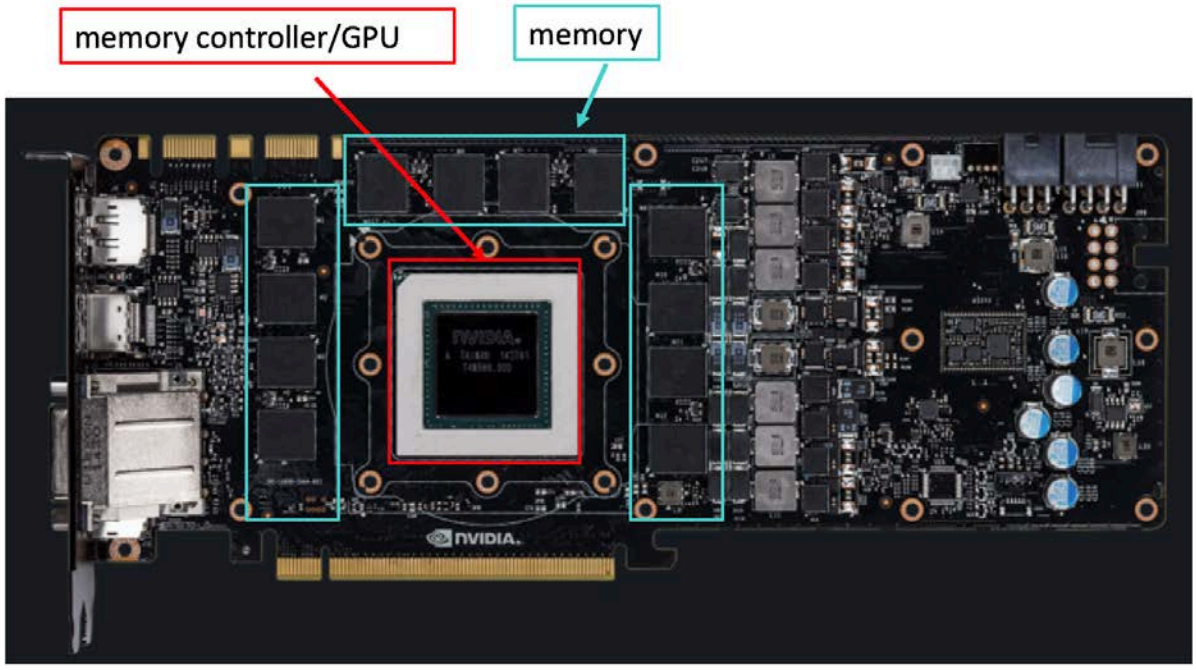
NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 7,886,122

89. Polaris incorporates and realleges paragraphs 1-50 above as if fully set forth herein.

90. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, 14, 20, and 21, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, NVIDIA graphics card and GPU products, devices, systems, and/or components of systems for providing clock signals to a GDDR5 or GDDR5X memory device, as required by the claims of the 122 Patent. These "NVIDIA 122 Patent Infringing Products," include, for example, at least NVIDIA's GeForce GTX 980 Ti graphics cards and GPUs, GeForce GTX 980M GPUs, Quadro M6000 graphics cards and GPUs, Quadro M5000M GPUs, GRID K2 graphics cards and GPUs, Tesla K80 graphics cards and GPUs, GeForce GTX 1070 graphics cards and GPUS, and GeForce GTX 1080

graphics cards and GPUs, which include clock signals to a memory device according to the claims of the 122 Patent.

91. The image of a representative NVIDIA 122 Patent Infringing Product (NVIDIA GeForce GTX 980 Ti) that performs the claimed methods for providing clock signals to a memory device is reproduced from NVIDIA's website below and annotated for illustration.



See Product Images, GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/product-images (annotations added).

92. On information and belief, the NVIDIA 122 Patent Infringing Products comprise a GPU. On information and belief, when NVIDIA, its customers (including but not limited to Dell), and other third parties operate the NVIDIA 122 Patent Infringing Products, the GPU provides, to a memory device (for example, the graphics dynamic random access memory GDDR5 devices mounted near the GPU on the graphics card), a first clock signal and a second clock signal (for example, signals respectively named CK and WCK), wherein a frequency of the first clock signal is less than a frequency of the second clock signal (for example, half the frequency). The GPU

provides command data to the memory device using the first clock signal (for example, where commands are to be registered at every rising edge of the clock signal). The GPU further performs a read operation from the memory device using the second clock signal (for example, where data is registered at every rising edge of the second clock signal and at every rising edge of the second clock signal's differential counterpart). The GPU performs a write operation to the memory device using the second clock signal (for example, where data is registered at every rising edge of the second clock signal and at every rising edge of the second clock signal's differential counterpart).

93. On information and belief, while the GPU in the NVIDIA 122 Patent Infringing Products is performing the read operation with the second clock signal, separate read data are read at rising and falling edges of a read clock signal generated from the second clock signal. On information and belief, while the GPU in the NVIDIA 122 Patent Infringing Products is performing the write operation with the second clock signal, separate write data are written at rising and falling edges of the second clock signal.

94. On information and belief, the frequency of the second clock signal is twice the frequency of the first clock signal.

95. On information and belief, the memory device to which the GPU in the NVIDIA 122 Patent Infringing Products provides clock signals is a dynamic, random access memory (DRAM) device.

96. On information and belief, the NVIDIA 122 Patent Infringing Products comprise an interface to a memory device (for example, the memory controller interface in the NVIDIA GPU, which is connected to separate GDDR5 DRAM chips), and circuitry configured to provide, to the memory device, a first clock signal and a second clock signal via the interface (for example, the CK and WCK signals sent to the memory chip by the memory controller through the memory

interface), with a frequency of the first clock signal less than a frequency of the second clock signal (for example, by providing a CK signal at half the frequency of the WCK signal), to provide command data to the memory device using the first clock signal (for example, by sending information over the CMD lines clocked using the CK clock signal, which is transmitted to the memory device over a differential line), to perform a read operation from the memory device using the second clock signal (for example, by receiving read data over the DQ lines clocked using the WCK clock signal, which is transmitted to the memory device over a differential line), and to perform a write operation to the memory device using the second clock signal (for example, by sending write data over the DQ lines clocked using the WCK clock signal, which is transmitted to the memory device over a differential line).

97. On information and belief, in the NVIDIA 122 Patent Infringing Products, while performing the read operation with the second clock signal, separate read data are read at rising and falling edges of a read clock signal generated from the second clock signal (for example, data on the DQ lines is read using a clock signal generated from the WCK signal such that data is read on the rising and falling edges of the WCK signal). Further, while performing the write operation with the second clock signal, separate write data are written at rising and falling edges of the second clock signal (for example, data to be written to memory is sent over the DQ lines and clocked at the rising and falling edges of WCK).

98. On information and belief, NVIDIA has induced and continues to induce infringement of one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, 14, 20, and 21, pursuant to 35 U.S.C. § 271(b) by encouraging its customers (including but not limited to Dell) and other third parties, such as third-party manufacturers of graphics cards using NVIDIA's product designs, manufacturers of computer products incorporating NVIDIA GPUs or

graphics cards, and distributors, wholesalers, and retailers of the NVIDIA 122 Infringing Products, to make, use, sell, offer to sell, and/or import in the United States without authorization products that provide clock signals to a memory device as claimed and/or by encouraging those same customers and other third parties to perform the claimed methods for providing clock signals to a memory device. These acts of making, using, selling, offering to sell, and importing in the United States without authorization, infringing products comprising the claimed devices and systems, and the performance of the claimed methods for providing clock signals to a memory device constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 122 Patent by such customers and third parties. NVIDIA's acts of inducement include: providing the NVIDIA 122 Patent Infringing Products to its customers (including but not limited to Dell) and other third parties and intending them to use the NVIDIA 122 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; providing its customers (including but not limited to Dell) and other third parties with components of the NVIDIA 122 Patent Infringing Products, for example, the memory controller/GPU products, and intending them to use these components with hardware and software and other infrastructure, including GDDR5 memory circuits, to make and use the NVIDIA 122 Patent Infringing Products and other infringing products; advertising the NVIDIA 122 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti and http://www.bestbuy.com/site/nvidia-geforce-gtx-980-4gb-gddr5-pci-express-3-0-graphics-card-silver-black/9855141.p?id=1219441205886&skuId=9855141); encouraging its customers and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; providing forums for its

customers and other third parties to communicate and discuss operating experiences, questions, and issues in connection with making and using the NVIDIA 122 Patent Infringing Products and components thereof, and providing information, feedback, solutions, instructions and tips to its customers and third parties in such forums (for example, https://forums.geforce.com/); providing documentation and instructions on how to install and use the NVIDIA 122 Patent Infringing Products (for example, the GeForce GTX 980 Ti User Guide, http://www.nvidia.com/content/geforce-gtx/GTX_980_Ti_User_Guide.pdf, the GeForce GTX 980 Ti Specifications, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/specifications, and an Overview of the GeForce GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti); and providing additional technical support to its customers and third parties for the NVIDIA 122 Patent Infringing Products (for example, GeForce Automatic Driver Updates, http://www.geforce.com/drivers).

99. NVIDIA proceeded in this manner despite its actual knowledge since at least November 5, 2015, of the 122 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 122 Patent. At the very least, because NVIDIA has been and remains on notice of the 122 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

100. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, 14, 20, and 21, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority components of systems that perform the claimed methods for providing clock signals to a memory device, including without limitation, components

such as NVIDIA memory controller/GPU products. These components supplied by NVIDIA are critical and material components to graphics cards and computer systems that infringe one or more claims of the 122 Patent. For example, the NVIDIA GPUs are critical and material components to providing clock signals to a memory device according to claimed methods, when operated according to their normal and expected use by NVIDIA in a computer system. NVIDIA supplied and continues to supply these components, including, without limitation, the NVIDIA 122 Patent Infringing Products, with the knowledge of the 122 Patent and with the knowledge that these components constitute material parts of the claimed inventions of the 122 Patent. Moreover, NVIDIA knows at least by virtue of its knowledge of its own products and the 122 Patent, that these components are especially made and/or especially adapted for providing clock signals to graphics memory as claimed in the 122 Patent and there is no substantial non-infringing use of the claimed elements of these components.

101. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 122 Patent.

102. NVIDIA's infringement of the 122 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of November 5, 2015, when Polaris placed NVIDIA on notice of infringement of the 122 Patent and identified NVIDIA infringing products, NVIDIA has had actual knowledge of infringement of the 122 Patent and has proceeded to infringe the 122 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 122 Patent. Despite knowledge of the 122 Patent, NVIDIA has acted, and is acting, in this manner despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been

known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

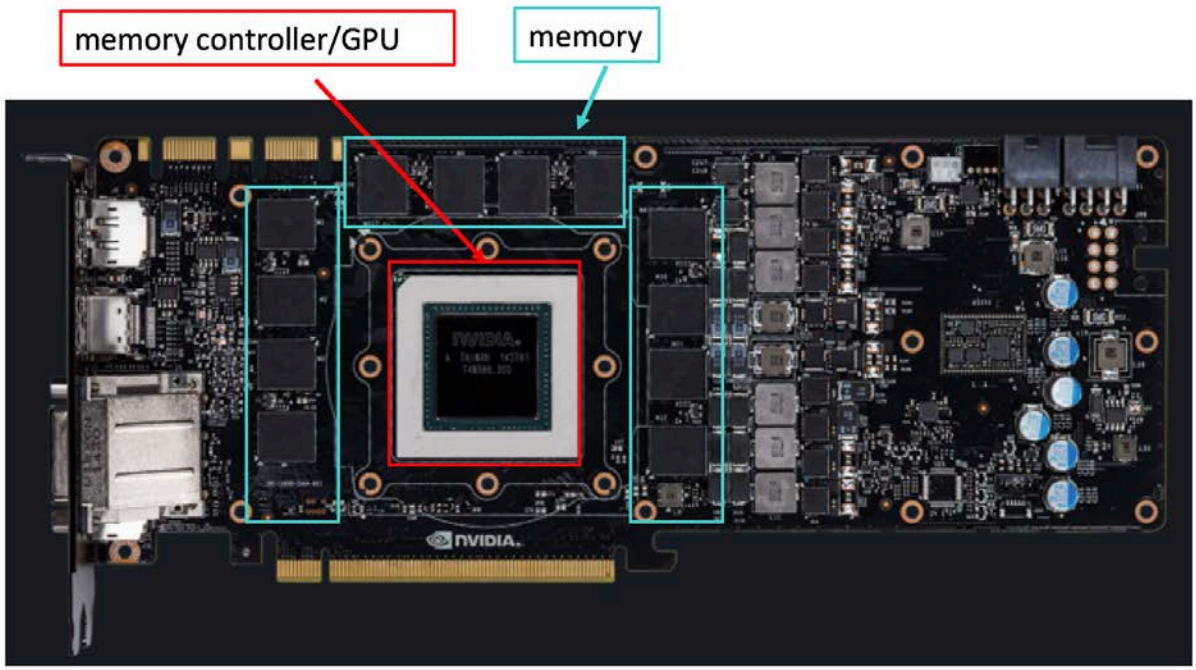
COUNT V:

NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 8,161,344

103. Polaris incorporates and realleges paragraphs 1-50 above as if fully set forth herein.

104. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 344 Patent, including but not limited to Claims 1, 2, 4, 8 - 12, 16, 18 - 20, 22, 26 - 30, 43 - 45, and 48 - 51, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, NVIDIA GPU and graphics card products, devices, systems, and/or components of systems that include a circuit for creating an error coding data block, as required by the claims of the 344 Patent, in a GDDR5 or GDDR5X memory system. These "NVIDIA 344 Patent Infringing Products," include, for example, at least NVIDIA's GeForce GTX 980 Ti graphics cards and GPUs, GeForce GTX 980M GPUs, Quadro M6000 graphics cards and GPUs, Quadro M5000M GPUs, GRID K2 graphics cards and GPUs, Tesla K80 graphics cards and GPUs, GeForce GTX 1070 graphics cards and GPUS, and GeForce GTX 1080 graphics cards and GPUs, which include a circuit for creating an error coding data block according to the claims of the 344 Patent.

105. The image of a representative NVIDIA 344 Patent Infringing Product (NVIDIA GeForce GTX 980 Ti graphics card) that includes the claimed circuit for creating an error coding data block is reproduced from NVIDIA's website below and annotated for illustration.



See Product Images, GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/product-images (annotations added).

106. On information and belief, the NVIDIA 344 Patent Infringing Products comprise a circuit for creating an error coding data block (for example, the cyclic redundancy check ("CRC") engine in the GPU's memory controller). This circuit comprises a first error coding path adapted to selectively create a first error coding data block in accordance with a first error coding (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory), a second error coding path adapted to selectively create a second error coding data block in accordance with a second error coding (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory), the first error coding path and the second error coding path being selected as a function of a control indicator (for example, as a function of whether a read or write operation is taking place), and at least the first error coding path comprising a data arrangement alteration device (for example, circuitry to implement read or write data bus inversion).

107. On information and belief, the first and second error coding paths in NVIDIA 344 Patent Infringing Products are adapted to perform the same data arrangement alteration algorithm for the first and second error codings (for example, both implement data bus inversion).

108. On information and belief, the first and second error coding paths in NVIDIA 344 Patent Infringing Products are adapted to perform the same error coding algorithm for the first and second error codings (for example, the CRC algorithm).

109. On information and belief, the data arrangement alteration device in NVIDIA 344 Patent Infringing Products is adapted to create a second data block, comprising a given number of data in a second arrangement, on the basis of the first data block comprising the given number of data in a first arrangement, in accordance with a data arrangement alteration algorithm (for example, using the data bus inversion algorithm, which outputs the same number of bits that it receives).

110. On information and belief, the NVIDIA 344 Patent Infringing Products comprise a parallel input to the circuit which may receive several data at the same time (for example, from the multiple parallel signals on the DQ bus).

111. On information and belief, the error coding device in NVIDIA 344 Patent Infringing Products is adapted to perform an error detection or error correction algorithm as an error coding algorithm (for example, the CRC error detection algorithm).

112. On information and belief, the error coding device in NVIDIA 344 Patent Infringing Products is adapted to perform a cyclic redundancy code algorithm as an error coding algorithm (for example, the CRC algorithm).

113. On information and belief, the control indicator in NVIDIA 344 Patent Infringing Products is dependent on an operating mode (for example, whether the memory controller is

reading or writing to memory).

114. On information and belief, certain of the NVIDIA 344 Patent Infringing Products, including for example and without limitation NVIDIA's GeForce GTX 980 Ti graphics card, comprise a processor (for example, a processor core in a graphics processing unit); a memory (for example, GDDR5 memory chips) and a circuit coupled between the processor and the memory (for example, a memory controller) for creating an error coding data block for a first data block. On information and belief, the circuit comprises a first error coding path adapted to selectively create a first error coding data block in accordance with a first error coding (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory), and a second error coding path adapted to selectively create a second error coding data block in accordance with a second error coding (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory). On information and belief, the first error coding path and the second data path are selected as a function of a control indicator (for example, as a function of whether a read or write is currently taking place), and at least the first error coding path comprising a data arrangement alteration device (for example, circuitry to implement data bus inversion).

115. On information and belief, this circuit in the NVIDIA 344 Patent Infringing Products is adapted to read out the information of the first data block along with the error coding data block in a reading operation (for example, receiving CRC data from the memory device embedded into the READ data stream), and to perform, by means of the error coding data block, an error detection or error correction for read-out information of the first data block (for example, deciding based on the checksum if the data was transmitted in error).

116. On information and belief, the NVIDIA 344 Patent Infringing Products comprise a first means for selectively performing a first error coding so as to create a first error coding data

block (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory); and a second means for selectively performing a second error coding so as to create a second error coding data block (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory). On information and belief, the first means and the second means are selected as a function of a control indicator (for example, as a function of whether a read or write is currently taking place), and at least the first means for performing the first error coding comprises a means for performing a data arrangement alteration algorithm (for example, with circuitry to implement data bus inversion).

117. On information and belief, the first means for performing the first error coding and the second means for performing the second error coding are adapted to perform the same data arrangement alteration algorithm for the first and second error codings (for example, data bus inversion).

118. On information and belief, the first means for performing the first error coding and the second means for performing the second error coding are adapted to perform the same error coding algorithm for the first and second error codings (for example, CRC).

119. On information and belief, the means for performing a data arrangement alteration algorithm is adapted to create a second data block, comprising a given number of data in a second arrangement, on the basis of the first data block comprising the given number of data in a first arrangement, in accordance with the data arrangement alteration algorithm (for example, using the data bus inversion algorithm, which outputs the same number of bits that it receives).

120. On information and belief, the error coding circuitry in the NVIDIA 344 Patent Infringing Products is adapted to receive several data at the same time (for example, from the multiple parallel signals on the DQ bus).

121. On information and belief, the means for performing an error coding algorithm is adapted to perform an error detection or error correction algorithm as the error coding algorithm (for example, the CRC error detection algorithm).

122. On information and belief, the means for performing an error coding algorithm is adapted to perform a cyclic redundancy code algorithm as the error coding algorithm (for example, the CRC algorithm).

123. On information and belief, the control indicator in NVIDIA 344 Patent Infringing Products is dependent on an operating mode (for example, whether the memory controller is reading or writing to memory).

124. On information and belief, when the 344 Patent Infringing Products are operated according to their normal and expected use by NVIDIA, the error coding circuitry in the NVIDIA 344 Patent Infringing Products (for example, in the memory controller in the GPU) creates an error coding block for a first data block by receiving the first data block, selectively performing a first error coding via a first path so as to create a first error coding data block (for example, encoding data to be written using the CRC algorithm when write operations are selected), selectively performing a second error coding via a second path so as to create a second error coding data block (for example, encoding data being read using the CRC algorithm when read operations are selected), the first error coding data block for the first data block and the second error coding data block being selectively created as a function of a control indicator (for example, whether read or write operations are selected), wherein at least the step of selectively performing the first error coding comprises the step of performing a data arrangement alteration algorithm (for example, the data bus inversion algorithm).

125. On information and belief, the error coding circuitry performs the first error

coding and the second error coding by performing the same data arrangement alteration algorithm (for example, the data bus inversion algorithm).

126. On information and belief, the error coding circuitry performs the first error coding and the second error coding by performing the same error coding algorithm (for example, the CRC algorithm).

127. On information and belief, when receiving the first data block, the error coding circuitry receives several data at the same time (for example, from the multiple parallel signals on the DQ bus).

128. On information and belief, the error coding algorithm used by the error coding circuitry is an error detection or an error correction algorithm (for example, the CRC algorithm).

129. On information and belief, the error coding algorithm used by the error coding circuitry is a cyclic redundancy code algorithm (for example, the CRC algorithm).

130. On information and belief, the value of the control indicator depends on an operating mode (for example, whether the memory controller is reading or writing to memory).

131. On information and belief, NVIDIA has induced and continues to induce infringement of one or more claims of the 344 Patent, including but not limited to Claims 1, 2, 4, 8 - 12, 16, 18 - 20, 22, 26 - 30, 43 - 45, and 48 - 51, pursuant to 35 U.S.C. § 271(b) by encouraging its customers (including but not limited to Dell) and other third parties, such as manufacturers of graphics cards using NVIDIA's product designs; manufacturers of computer products incorporating GPUs or graphics cards supplied by NVIDIA; and distributors, wholesalers, and retailers of the NVIDIA 344 Infringing Products, to make, use, sell, offer to sell, and/or import in the United States without authorization infringing products that comprise the claimed circuit for creating an error coding data block as described above and by encouraging those same customers

and other third parties to perform the claimed method of creating an error coding data block. These acts of making, using, selling, offering to sell, and/or importing in the United States without authorization, infringing products comprising the claimed devices and systems, and the performance of the claimed method of creating an error coding data block constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 344 Patent by such customers or third parties. NVIDIA's acts of inducement include: providing the NVIDIA 344 Patent Infringing Products to its customers (including but not limited to Dell) and other third parties, and intending them to use the NVIDIA 344 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; providing components of the NVIDIA 344 Patent Infringing Products, for example, the memory controller/GPU products to its customers and other third parties, including but not limited to Dell, and intending them to use these components with hardware and software and other infrastructure, including GDDR5 memory circuits, to make and use the NVIDIA 344 Patent Infringing Products and other infringing products; advertising the NVIDIA 344 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti and http://www.bestbuy.com/site/nvidia-geforce-gtx-980-4gb-gddr5-pci-express-3-0-graphics-card-silver-black/9855141.p?id=1219441205886&skuId=9855141); encouraging customers and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; providing forums for its customers and other third parties to communicate and discuss operating experiences, questions, and issues in connection with making and using the NVIDIA 344 Patent Infringing Products and components thereof, and providing information, feedback, solutions, instructions and tips to its

customers and third parties in such forums (for example, https://forums.geforce.com/); providing documentation and instructions on how to install and use the NVIDIA 344 Patent Infringing Products (for example, the GeForce GTX 980 Ti User Guide, http://www.nvidia.com/content/geforce-gtx/GTX_980_Ti_User_Guide.pdf, the GeForce GTX 980 Ti Specifications, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/specifications, and an Overview of the GeForce GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti); and providing additional technical support to its customers (including but not limited to Dell) and other third parties for the NVIDIA 344 Patent Infringing Products (for example, GeForce Automatic Driver Updates, http://www.geforce.com/drivers).

132. NVIDIA proceeded in this manner despite its actual knowledge since at least March 22, 2016, of the 344 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 344 Patent. At the very least, because NVIDIA has been and remains on notice of the 344 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

133. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 344 Patent, including but not limited to Claims 1, 2, 4, 8 - 12, 16, 18 - 20, 22, 26 - 30, 43 - 45, and 48 - 51, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority components of systems that include the claimed circuit for creating an error coding data block, including, without limitation, components such as NVIDIA memory controller/GPU products. These components supplied by NVIDIA are critical and material components to graphics cards and computer systems

that infringe one or more claims of the 344 Patent or are instrumentalities for performing the claimed methods. For example, the NVIDIA GPUs comprise the claimed circuit for creating an error coding data block and are critical and material components to creating an error coding data block according to claimed methods when operated according to their normal and expected use by NVIDIA in a computer system. NVIDIA supplied and continues to supply these components, including, without limitation, the NVIDIA 344 Patent Infringing Products, with the knowledge of the 344 Patent and with the knowledge that these components constitute material parts of the claimed inventions of the 344 Patent. Moreover, NVIDIA knows at least by virtue of its knowledge of its own products and the 344 Patent, that these components are especially made and/or especially adapted for error coding in the memory system as claimed in the 344 Patent and there is no substantial non-infringing use of the claimed elements of these components.

134. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 344 Patent.

135. NVIDIA's infringement of the 344 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed NVIDIA on notice of infringement of the 344 Patent and identified NVIDIA infringing products, NVIDIA has had actual knowledge of infringement of the 344 Patent and has proceeded to infringe the 344 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 344 Patent. Despite knowledge of the 344 Patent, NVIDIA has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to

attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

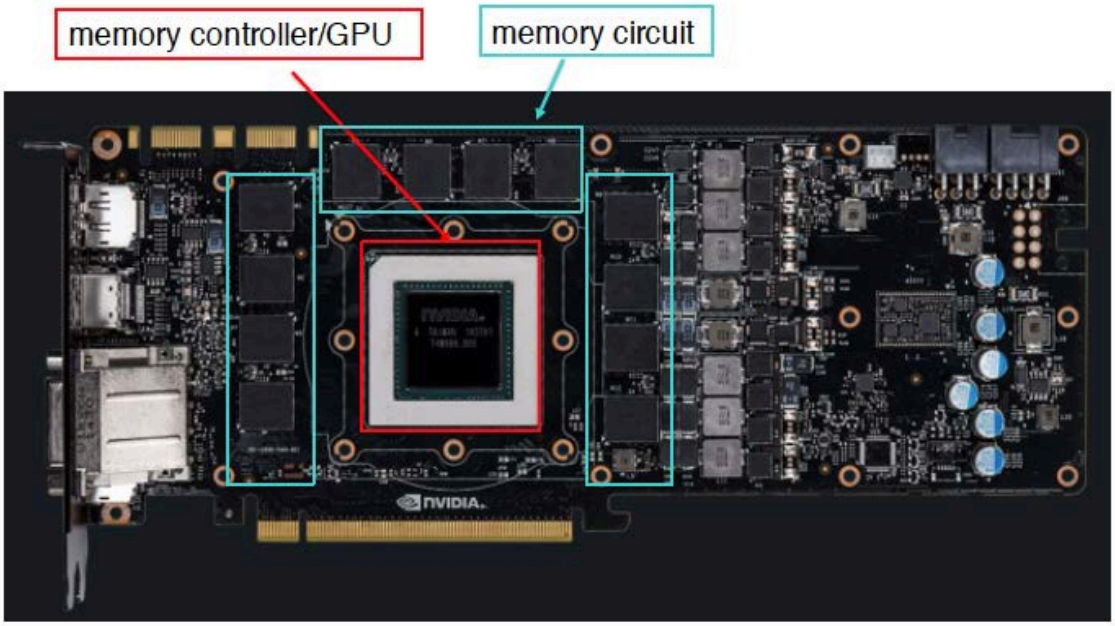
COUNT VI:

NVIDIA'S INFRINGEMENT OF U.S. PATENT NO. 8,207,976

136. Polaris incorporates and realleges paragraphs 1-50 above as if fully set forth herein.

137. On information and belief, NVIDIA has infringed and continues to infringe one or more claims of the 976 Patent, including but not limited to Claims 35 and 36, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, NVIDIA graphics products, devices, systems, and/or components of systems that include the memory circuits and memory controllers and/or GPUs, as required by the claims of the 976 Patent, and that are used in GDDR5 or GDDR5X memory systems. These "NVIDIA 976 Patent Infringing Products," including, for example, at least NVIDIA's GeForce GTX 980 Ti graphics cards, Quadro M6000 graphics cards, GRID K2 graphics cards, Tesla K80 graphics cards, GeForce GTX 1070 graphics cards, and GeForce GTX 1080 graphics cards, which include the memory circuits and memory controllers and/or GPUs according to the claims of the 976 Patent.

138. By way of example, the image of a representative NVIDIA 976 Patent Infringing Product, a GeForce GTX 980 Ti graphics card that uses the claimed memory circuit and memory controller/GPU is reproduced from NVIDIA's website and annotated below for illustration.



See Product Images, GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/product-images (annotations added).

139. On information and belief, the NVIDIA 976 Patent Infringing Products are memory systems comprising memory circuits, for example, a GDDR5 memory circuit as shown in the blue box above. *See* Specifications of GeForce GTX 980 Ti ("GeForce GTX 98 Ti Specifications"), http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/specifications. Such a memory circuit comprises an output buffer that comprises an input and an output; a data interface for transmitting and receiving data, which is coupled to the output of the output buffer; a command/address interface coupled to the input of the output buffer; a memory core coupled to the input of the output buffer; a second output buffer comprising an input and output, the output being coupled to the data interface or to a further output pin; an EDC circuit having an output coupled to the input of the second output buffer; a controller circuit adapted to cause data stored within the output buffer to be output to the data interface upon reception of a first signal, further adapted to cause data stored within the memory core to be output to the input of the output buffer upon

reception of a second signal so that the data is stored within the output buffer, further adapted to cause provision of data received at the command/address interface via an address portion thereof to the input of the output buffer upon reception of a third signal so that the data is stored within the output buffer, further adapted to cause data which is stored within the second output buffer to be output to the data interface or the further output pin, further adapted to cause data which is provided by the EDC circuit to be stored within the second output buffer, and further adapted to cause data which is received at the command/address interface to be stored within the second output buffer. On information and belief, the NVIDIA 976 infringing memory systems also comprise memory controllers, for example, a GTX-980 GPU as shown in the red box in the image above. *See* GeForce GTX 980 Ti Specifications; Overview of GeForce GTX 980 Ti ("GeForce GTX 980 Ti Overview"), http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti. The memory controller comprises a command/address interface; a data interface; and a synchronization circuit coupled to the command/address interface and to the data interface and adapted to output a transmit data pattern as the synchronization data on the command/address interface via an address portion thereof, further adapted to receive a receive data pattern from the data interface, and further adapted to perform a training operation on the data interface on the basis of the transmit data pattern and the receive data pattern, the transmit data pattern selected to perform one of a symbol training operation and a frame synchronization operation. The data interface of the memory circuit, and the data interface of the memory controller are coupled to one another, and the command/address interface of the memory circuit are coupled to the command/address interface of the memory controller in the infringing memory systems.

140. On information and belief, the NVIDIA 976 Patent Infringing Products are graphics systems comprising a GDDRX memory circuit, with X being a number designating a

GDDR standard, for example, a GDDR5 memory circuit as shown in the blue box above. *See* GeForce GTX 98 Ti Specifications. Such memory circuit comprises an output buffer that comprises an input and an output; a data interface for transmitting and receiving data, which is coupled to the output of the output buffer; a command/address interface coupled to the input of the output buffer; a memory core coupled to the input of the output buffer; a second output buffer comprising an input and output, the output of which is coupled to the data interface or to a further output pin; an EDC circuit having an output coupled to the input of the second output buffer; a controller circuit adapted to cause data stored within the output buffer to be output to the data interface upon reception of a first signal, further adapted to cause data stored within the memory core to be output to the input of the output buffer upon reception of a second signal so that the data is stored within the output buffer, further adapted to cause provision of data received at the command/address interface via an address portion thereof to the input of the output buffer upon reception of a third signal so that the data is stored within the output buffer, further adapted to cause data which is stored within the second output buffer to be output to the data interface or the further output pin, further being adapted to cause data which is provided by the EDC circuit to be stored within the second output buffer, and further being adapted to cause data which is received at the command/address interface to be stored within the second output buffer. On information and belief, the NVIDIA infringing graphics systems also comprise a GPU, for example, a GTX-980 GPU as shown in the red box in the image above. *See* GeForce GTX 980 Ti Specifications; GeForce GTX 980 Ti Overview. The GPU comprises a command/address interface; a data interface; and a synchronization circuit coupled to the command/address interface and to the data interface, and adapted to output a transmit data pattern as the synchronization data on the command/address interface via an address portion thereof, further adapted to receive a receive data

pattern from the data interface, and further adapted to perform a training operation on the data interface on the basis of the transmit data pattern and the receive data pattern, the transmit data pattern selected to perform one of a symbol training operation and a frame synchronization operation. The data interface of the GDDR5 memory circuit, and the data interface of the GPU are coupled to one another, and the command/address interface of the GDDR5 memory circuit are coupled to the command/address interface of the GPU in the infringing graphics systems.

141. On information and belief, NVIDIA has induced and continues to induce infringement of one or more claims of the 976 Patent, including but not limited to Claims 35 and 36, pursuant to 35 U.S.C. § 271(b) by encouraging its customers (including but not limited to Dell) and other third parties, such as manufacturers of graphics cards using NVIDIA's product designs; manufacturers of computer products incorporating NVIDIA GPUs or graphics cards; and distributors, wholesalers, and retailers of the NVIDIA 976 Infringing Products, to make, use, sell, offer to sell, and import in the United States without authorization infringing products that comprise the claimed memory circuit and memory controller/GPU as described above. These acts of making, using, selling, offering to sell, and/or importing in the United States without authorization, infringing products that comprise the claimed memory circuit and memory controller/GPU constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 976 Patent by such customers or other third parties. NVIDIA's acts of inducement include: providing the NVIDIA 976 Patent Infringing Products to its customers (including but not limited to Dell) and other third parties and intending them to use the NVIDIA 976 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; providing components of the NVIDIA 976 Patent Infringing Products, for example, the memory controller/GPU products, to its customers (including but not limited to

Dell) and other third parties, and intending its customers to use these components with hardware and software and other infrastructure, including GDDR5 memory circuits, to make and use the NVIDIA 976 Patent Infringing Products and other infringing products; encouraging customers (including but not limited to Dell) and other third parties to communicate directly with NVIDIA representatives about these products for purposes of technical assistance and repair as well as sales and marketing; advertising the NVIDIA 976 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti and http://www.bestbuy.com/site/nvidia-geforce-gtx-980-4gb-gddr5-pci-express-3-0-graphics-card-silver-black/9855141.p?id=1219441205886&skuId=9855141);

providing forums for its customers (including but not limited to Dell) and other third parties to communicate and discuss experiences, questions, and issues in connection with making and using the NVIDIA 976 Patent Infringing Products and components thereof, and providing information, feedback, solutions, instructions, and tips to its customers (including but not limited to Dell) and third parties in such forums (for example, https://forums.geforce.com/); providing documentation and instructions on how to install and use the NVIDIA 976 Patent Infringing Products (for example, the GeForce GTX 980 Ti User Guide, http://www.nvidia.com/content/geforce-gtx/GTX_980_Ti_User_Guide.pdf, the GeForce GTX 980 Ti Specifications, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti/specifications, and an Overview of the GeForce GTX 980 Ti, http://www.geforce.com/hardware/desktop-gpus/geforce-gtx-980-ti); and providing additional technical support to its customers (including but not limited to Dell) and other third parties for the NVIDIA 976 Patent Infringing Products (for example, GeForce Automatic Driver Updates, http://www.geforce.com/drivers).

142. NVIDIA proceeded in this manner despite its actual knowledge since at least

December 28, 2012, of the 976 Patent and its knowledge since at least March 22, 2016, that the specific actions it actively induced and continues to actively induce on the part of its customers (including but not limited to Dell) and other third parties constitute infringement of the 976 Patent. At the very least, because NVIDIA has been and remains on notice of the 976 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

143. On information and belief, NVIDIA has contributed to and continues to contribute to infringement of one or more claims of the 976 Patent, including but not limited to Claims 35 and 36, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing, and/or supplying in the United States without authority components of the products that infringe one or more claims of the 976 Patent, including but not limited to components such as memory controller/GPU products. These components supplied by NVIDIA, including for example, NVIDIA memory controller/GPU products, are critical and material components of the claimed memory and/or graphics systems, thus constituting critical and material parts of the claimed inventions of the 976 Patent. NVIDIA supplied and continues to supply these components with the knowledge of the 976 Patent and with the knowledge that these components constitute material parts of the claimed inventions of the 976 Patent. Moreover, NVIDIA knows at least by virtue of its knowledge of its own products and the 976 Patent, that these components are especially made and/or especially adapted for the read training of the graphics systems as claimed in the 976 Patent and there is no substantial non-infringing use of the claimed elements of these components.

144. Polaris has suffered and continues to suffer damages as a result of NVIDIA's infringement of the 976 Patent.

145. NVIDIA's infringement of the 976 Patent has been and continues to be willful,

deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed NVIDIA on notice of infringement of the 976 Patent and identified NVIDIA infringing products, NVIDIA has had actual knowledge of infringement of the 976 Patent and has proceeded to infringe the 976 Patent with full knowledge of that patent and its applicability to NVIDIA's products and without any substantive response to Polaris's offer to discuss terms for a license to the 976 Patent. Despite knowledge of the 976 Patent, NVIDIA has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to NVIDIA, and is also so obvious that it should have been known to NVIDIA. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT VII

DELL'S INFRINGEMENT OF U.S. PATENT NO. 7,886,122

146. Polaris incorporates and realleges paragraphs 1-50 and 89-100 above as if fully set forth herein.

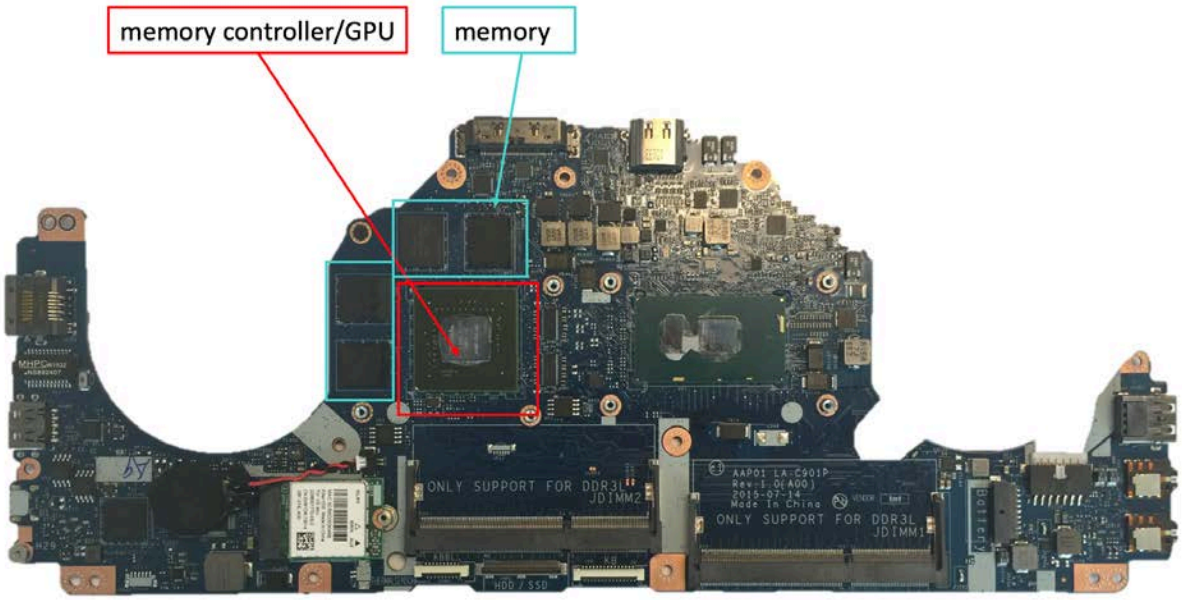
147. On information and belief, Dell has infringed and continues to infringe one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, 14, 20, and 21, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, Dell computer products, devices, systems, which comprise a device for providing clock signals to a GDDR5 memory device. These "Dell 122 Patent Infringing Products" include for example Dell's computer products that use NVIDIA's GDDR5 graphics cards and/or NVIDIA's GPUs in combination with GDDR5 memory, and GDDR5 graphics card products that use NVIDIA's product designs and/or configurations, such as Inspiron 15 7000 Series, certain models of XPS 15 Non-Touch Laptops

and 8900 Desktops, Precision 15 5000 Series (5510) and certain models of Tower 7000 Series (7810, 7910), Alienware 13 Gaming Laptop and certain models of X51 Gaming Desktop, and graphics cards using NVIDIA Quadro K2200 graphics card design and configurations.

148. By way of a non-limiting example, an image of a representative Dell 122 Patent Infringing Product, Dell's Alienware 13 Gaming Laptop, that provides clock signals to a memory device is reproduced from Dell's website below.

Alienware 13 Gaming Laptop Gallery, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC.

149. The front view of the mother board of Dell's Alienware 13 Gaming Laptop is shown in the image below and annotated for illustration.



150. On information and belief, the Dell 122 Patent Infringing Products comprise a GPU (for example, the NVIDIA GeForce GTX 960M GPU in the exemplary Alienware laptop) and DRAM chips (for example, the GDDR5 graphics memory in the exemplary Alienware laptop). On information and belief, when NVIDIA, its customers, and other third parties operate the Dell 122 Patent Infringing Products, the GPU provides, to a memory device (for example, the GDDR5 graphics memory devices mounted near the GPU on the exemplary Alienware laptop's motherboard), a first clock signal and a second clock signal (for example, signals respectively named CK and WCK), wherein a frequency of the first clock signal is less than a frequency of the second clock signal (for example, half the frequency). The GPU provides command data to the memory device using the first clock signal (for example, where commands are to be registered at every rising edge of the clock signal). The GPU further performs a read operation from the memory device using the second clock signal (for example, where data is registered at every rising edge of the second clock signal and at every rising edge of the second clock signal's differential counterpart). The GPU performs a write operation to the memory device using the second clock

signal (for example, where data is registered at every rising edge of the second clock signal and at every rising edge of the second clock signal's differential counterpart).

151. On information and belief, while the GPU in the Dell 122 Patent Infringing Products is performing the read operation with the second clock signal, separate read data are read at rising and falling edges of a read clock signal generated from the second clock signal. On information and belief, while the GPU in the Dell 122 Patent Infringing Products is performing the write operation with the second clock signal, separate write data are written at rising and falling edges of the second clock signal.

152. On information and belief, the frequency of the second clock signal is twice the frequency of the first clock signal.

153. On information and belief, the memory device to which the GPU in the Dell 122 Patent Infringing Products provides clock signals is a GDDR5 dynamic, random access memory ("DRAM") device.

154. On information and belief, the Dell 122 Patent Infringing Products comprise an interface to a memory device (for example, the interface between the NVIDIA GPU and the GDDR5 graphics memory), and circuitry configured to provide, to the memory device, a first clock signal and a second clock signal via the interface (for example, the CK and WCK signals sent to the memory chip by the memory controller through the memory interface), with a frequency of the first clock signal less than a frequency of the second clock signal (for example, by providing a CK signal at half the frequency of the WCK signal), to provide command data to the memory device using the first clock signal (for example, by sending information over the CMD lines clocked using the CK clock signal, which is transmitted to the memory device over a differential line), to perform a read operation from the memory device using the second clock

signal (for example, by receiving read data over the DQ lines clocked using the WCK clock signal, which is transmitted to the memory device over a differential line), and to perform a write operation to the memory device using the second clock signal (for example, by sending write data over the DQ lines clocked using the WCK clock signal, which is transmitted to the memory device over a differential line).

155. On information and belief, in the Dell 122 Patent Infringing Products, while performing the read operation with the second clock signal, separate read data are read at rising and falling edges of a read clock signal generated from the second clock signal (for example, data on the DQ lines is read using a clock signal generated from the WCK signal such that data is read on the rising and falling edges of the WCK signal). Further, while performing the write operation with the second clock signal, separate write data are written at rising and falling edges of the second clock signal (for example, data to be written to memory is sent over the DQ lines and clocked at the rising and falling edges of WCK).

156. In addition, on information and belief, Dell makes, uses, sells, offers to sell, and/or imports in the United States without authorization GDDR5 graphics products that include claimed memory circuits and memory controllers and/or GPUs and use NVIDIA's product designs and/or configurations, including, without limitations, NVIDIA's Quadro, Tesla and GeForce graphics cards, such as NVIDIA Quadro K2200 graphics cards. *See, e.g.*, http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD. *See also* ¶¶ 89 - 100 above.

157. On information and belief, Dell has induced and continues to induce infringement of one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, 14, 20, and 21, pursuant to 35 U.S.C. § 271(b), by encouraging its customers and other third parties, such as

manufacturers of computer products incorporating infringing graphics cards supplied by Dell, distributors and retailers, and end users of the Dell 122 Infringing Products, to make, use, sell, offer to sell, and/or import in the United States without authorization products that comprise the claimed devices and systems and by encouraging those same customers and other third parties to perform the claimed methods for providing clock signals to a memory device. These acts of making, using, selling, offering to sell, and/or importing in the United States without authorization, of infringing products that comprise the claimed systems and devices constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 122 Patent by such customers or third parties. Dell's acts of inducement include: providing the Dell 122 Patent Infringing Products to its customers and other third parties and intending them to use the Dell 122 Patent Infringing Products with hardware, software, and other infrastructure that enable and/or make use of these products; advertising the Dell 122 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC and http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD); encouraging its customers and other third parties to communicate directly with Dell representatives about these products (for example, through the "Click to Chat" feature on Dell's website) for purposes of technical assistance and repairs as well as sales and marketing; providing documentation, instructions, technical specifications, and service manuals on how to install, use and repair the Dell 122 Patent Infringing Products (for example, Alienware 13 Service Manual, http://www.dell.com/support/manuals/us/en/ukdhs1/alienware-13/Alienware13_SM-v1/Before-working-inside-your-computer?guid=GUID-5D3B1051-9384-409A-8D5B-9B53BD496DE8&lang=en-us and Tech Specs of Dell's 4 GB NVIDIA Quadro K2200 Graphic

Card, http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD&mfgpid=238969); and providing additional product support, including but not limited to Driver downloads, diagnostic tools, and replacement parts, to its customers and third parties for the Dell 122 Patent Infringing Products (for example, Alienware 13 R2 Product Support, http://www.dell.com/support/home/us/en/19/product-support/product/alienware-13-r2/diagnose).

158. Dell proceeded in this manner despite its actual knowledge since at least March 22, 2016, of the 122 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 122 Patent. At the very least, because Dell has been and remains on notice of the 122 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

159. Polaris has suffered and continues to suffer damages as a result of Dell's infringement of the 122 Patent.

160. On information and belief, Dell has contributed to and continues to contribute to infringement of one or more claims of the 122 Patent, including but not limited to Claims 9, 10, 13, and 14, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority, components of systems that comprise a key element of a system for providing clock signals to a memory device, including without limitation, the component comprising the NVIDIA GPU, or the component comprising the combination of a NVIDIA GPU and a GDDR5 graphics memory, components that are key to providing clock signals to a memory device according to asserted claims. Dell supplied and continues to supply these components, including, without limitation, the Dell 122 Patent Infringing Products, with the knowledge of the 122 Patent and with the knowledge that these components constitute material

parts of the claimed inventions of the 122 Patent. Moreover, Dell knows at least by virtue of its knowledge of its own products and the 122 Patent, that these components are especially made and/or especially adapted for providing clock signals to graphics memory as claimed in the 122 Patent and there is no substantial non-infringing use of the claimed elements of these components.

161. Dell's infringement of the 122 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed Dell on notice of infringement of the 122 Patent and identified Dell infringing products, Dell has had actual knowledge of infringement of the 122 Patent and has proceeded to infringe the 122 Patent with full knowledge of that patent and its applicability to Dell's products and without any response to Polaris's offer to discuss terms for a license to the 122 Patent. Despite knowledge of the 122 Patent, Dell has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to Dell, and is also so obvious that it should have been known to Dell. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT VIII:

DELL'S INFRINGEMENT OF U.S. PATENT NO. 8,161,344

162. Polaris incorporates and realleges paragraphs 1-50 and 103-135 above as if fully set forth herein.

163. On information and belief, Dell has infringed and continues to infringe one or more claims of the 344 Patent, including but not limited to Claims 1, 2, 4, 8 - 12, 16, 18 - 20, 22, 26 - 30, 43 - 45, and 48 - 51, pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States

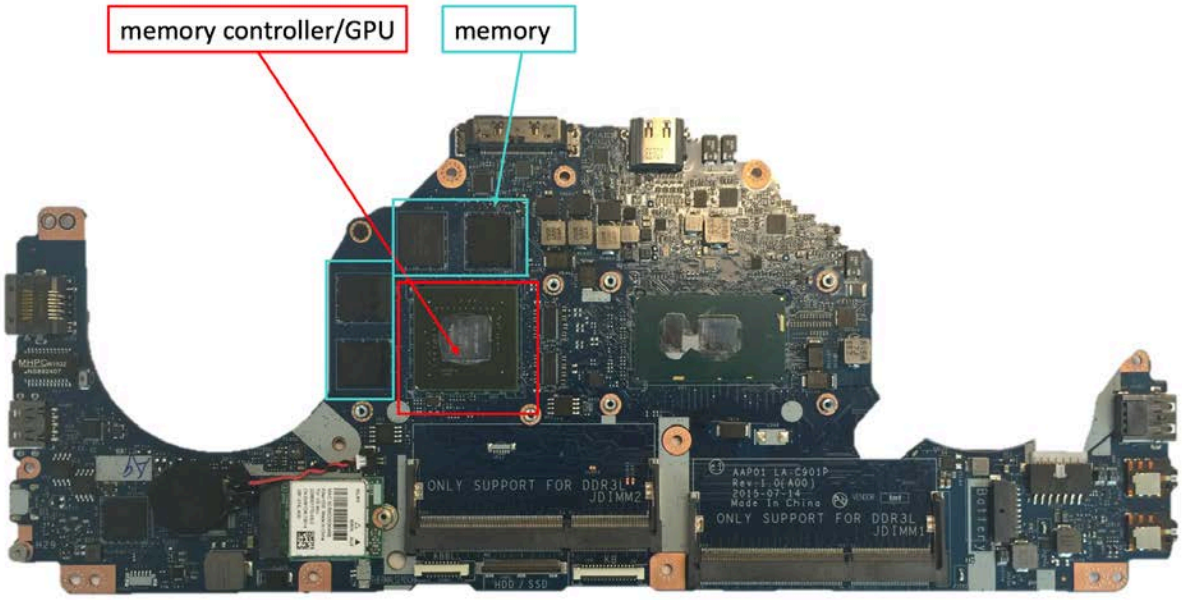
without authority, Dell computer products, devices, and systems that include a circuit for creating an error coding data block and that are used in combination with GDDR5 memory devices. These "Dell 344 Patent Infringing Products," include for example Dell's computer products that use NVIDIA's GDDR5 graphics cards and/or NVIDIA's GPUs in combination with GDDR5 memory, and GDDR5 graphics card products that use NVIDIA's product designs and/or configurations, such as Inspiron 15 7000 Series, certain models of XPS 15 Non-Touch Laptops and 8900 Desktops, Precision 15 5000 Series (5510) and certain models of Tower 7000 Series (7810, 7910), Alienware 13 Gaming Laptop and certain models of X51 Gaming Desktop, and graphics cards using NVIDIA Quadro K2200 graphics card design and configurations.

164. By way of a non-limiting example, an image of a representative Dell 344 Patent Infringing Product, Dell's Alienware 13 Gaming Laptop, that performs the claimed methods for providing clock signals to a memory device is reproduced from Dell's website below.

Alienware 13 Gaming Laptop Gallery, http://www.dell.com/us/p/alienware-13-

r2/pd?ref=PD_OC.

165. The front view of the mother board of Dell's Alienware 13 Gaming Laptop is shown in the image below and annotated for illustration.



166. On information and belief, the Dell 344 Patent Infringing Products comprise a circuit for creating an error coding data block (for example, the cyclic redundancy check ("CRC") engine in the memory controller in the NVIDIA GeForce GTX 960M GPU in the exemplary Alienware laptop). This circuit comprises a first error coding path adapted to selectively create a first error coding data block in accordance with a first error coding (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory), a second error coding path adapted to selectively create a second error coding data block in accordance with a second error coding (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory), the first error coding path and the second error coding path being selected as a function of a control indicator (for example, as a function of whether a read or write operation is taking place), and at least the first error coding path comprising a data

arrangement alteration device (for example, circuitry to implement read or write data bus inversion).

167. On information and belief, the first and second error coding paths in Dell 344 Patent Infringing Products are adapted to perform the same data arrangement alteration algorithm for the first and second error codings (for example, both implement data bus inversion).

168. On information and belief, the first and second error coding paths in Dell 344 Patent Infringing Products are adapted to perform the same error coding algorithm for the first and second error codings (for example, the CRC algorithm).

169. On information and belief, the data arrangement alteration device in Dell 344 Patent Infringing Products is adapted to create a second data block, comprising a given number of data in a second arrangement, on the basis of the first data block comprising the given number of data in a first arrangement, in accordance with a data arrangement alteration algorithm (for example, using the data bus inversion algorithm, which outputs the same number of bits that it receives).

170. On information and belief, the Dell 344 Patent Infringing Products comprise a parallel input to the circuit which may receive several data at the same time (for example, from the multiple parallel signals on the DQ bus).

171. On information and belief, the error coding device in Dell 344 Patent Infringing Products is adapted to perform an error detection or error correction algorithm as an error coding algorithm (for example, the CRC error detection algorithm).

172. On information and belief, the error coding device in Dell 344 Patent Infringing Products is adapted to perform a cyclic redundancy code algorithm as an error coding algorithm (for example, the CRC algorithm).

173. On information and belief, the control indicator in Dell 344 Patent Infringing Products is dependent on an operating mode (for example, whether the memory controller is reading or writing to memory).

174. On information and belief, the Dell 344 Patent Infringing Products comprise a processor (for example, the NVIDIA GeForce GTX 960M GPU in the exemplary Alienware laptop), a memory (for example, the GDDR5 graphics memory in the exemplary Alienware laptop), and a circuit coupled between the processor and the memory (for example, a memory controller) for creating an error coding data block for a first data block. On information and belief, the circuit comprises a first error coding path adapted to selectively create a first error coding data block in accordance with a first error coding (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory), and a second error coding path adapted to selectively create a second error coding data block in accordance with a second error coding (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory). On information and belief, the first error coding path and the second data path are selected as a function of a control indicator (for example, as a function of whether a read or write is currently taking place), and at least the first error coding path comprising a data arrangement alteration device (for example, circuitry to implement data bus inversion).

175. On information and belief, this circuit in the Dell 344 Patent Infringing Products is adapted to read out the information of the first data block along with the error coding data block in a reading operation (for example, receiving CRC data from the memory device along with data being read from memory), and to perform, by means of the error coding data block, an error detection or error correction for read-out information of the first data block (for example, comparing the CRC data received with the data read out and determining that there is an error if

the two do not match).

176. On information and belief, the Dell 344 Patent Infringing Products comprise a first means for selectively performing a first error coding so as to create a first error coding data block (for example, circuitry in the memory controller using CRC encoding to encode data being read from memory); and a second means for selectively performing a second error coding so as to create a second error coding data block (for example, circuitry in the memory controller using CRC encoding to encode data being written to memory). On information and belief, the first means and the second means are selected as a function of a control indicator (for example, as a function of whether a read or write is currently taking place), and at least the first means for performing the first error coding comprises a means for performing a data arrangement alteration algorithm (for example, with circuitry to implement data bus inversion).

177. On information and belief, the first means for performing the first error coding and the second means for performing the second error coding are adapted to perform the same data arrangement alteration algorithm for the first and second error codings (for example, data bus inversion).

178. On information and belief, the first means for performing the first error coding and the second means for performing the second error coding are adapted to perform the same error coding algorithm for the first and second error codings (for example, CRC).

179. On information and belief, the means for performing a data arrangement alteration algorithm is adapted to create a second data block, comprising a given number of data in a second arrangement, on the basis of the first data block comprising the given number of data in a first arrangement, in accordance with the data arrangement alteration algorithm (for example, using the data bus inversion algorithm, which outputs the same number of bits that it receives).

180. On information and belief, the error coding circuitry in the Dell 344 Patent Infringing Products is adapted to receive several data at the same time (for example, from the multiple parallel signals on the DQ bus).

181. On information and belief, the means for performing an error coding algorithm is adapted to perform an error detection or error correction algorithm as the error coding algorithm (for example, the CRC error detection algorithm).

182. On information and belief, the means for performing an error coding algorithm is adapted to perform a cyclic redundancy code algorithm as the error coding algorithm (for example, the CRC algorithm).

183. On information and belief, the control indicator in Dell 344 Patent Infringing Products is dependent on an operating mode (for example, whether the memory controller is reading or writing to memory).

184. On information and belief, when Dell, its customers, and other third parties operate the Dell 344 Patent Infringing Products, the error coding circuitry (for example, in the memory controller in the GPU) creates an error coding block for a first data block by receiving the first data block, selectively performing a first error coding via a first path so as to create a first error coding data block (for example, encoding data to be written using the CRC algorithm when write operations are selected), selectively performing a second error coding via a second path so as to create a second error coding data block (for example, encoding data being read using the CRC algorithm when read operations are selected), the first error coding data block for the first data block and the second error coding data block being selectively created as a function of a control indicator (for example, whether read or write operations are selected), wherein at least the step of selectively performing the first error coding comprises the step of performing a data arrangement

alteration algorithm (for example, the data bus inversion algorithm).

185. On information and belief, the error coding circuitry performs the first error coding and the second error coding by performing the same data arrangement alteration algorithm (for example, the data bus inversion algorithm).

186. On information and belief, the error coding circuitry performs the first error coding and the second error coding by performing the same error coding algorithm (for example, the CRC algorithm).

187. On information and belief, when receiving the first data block, the error coding circuitry receives several data at the same time (for example, from the multiple parallel signals on the DQ bus).

188. On information and belief, the error coding algorithm used by the error coding circuitry is an error detection or an error correction algorithm (for example, the CRC algorithm).

189. On information and belief, the error coding algorithm used by the error coding circuitry is a cyclic redundancy code algorithm (for example, the CRC algorithm).

190. On information and belief, the value of the control indicator depends on an operating mode (for example, whether the memory controller is reading or writing to memory).

191. In addition, on information and belief, Dell makes, uses, sells, offers to sell, and/or imports in the United States without authorization GDDR5 graphics products that include claimed memory circuits and memory controllers and/or GPUs and use NVIDIA's product designs and/or configurations, including, without limitations, NVIDIA's Quadro, Tesla and GeForce graphics cards, such as NVIDIA Quadro K2200 graphics cards. *See, e.g.,* http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD. *See also* ¶¶ 103 - 135 above.

192. On information and belief, Dell has induced and continues to induce infringement of one or more claims of the 344 Patent including but not limited to Claims 1, 2, 4, 8 - 12, 16, 18 - 20, 22, 26 - 30, 43 - 45, and 48 - 51, pursuant to 35 U.S.C. § 271(b) by encouraging its customers and other third parties, such as manufacturers of computer products incorporating infringing graphics cards supplied by Dell and distributors and retailers of the Dell 344 Infringing Products, to make, use, sell, offer to sell, and/or import in the United States without authorization products that include the claimed circuit for creating an error coding data block and by encouraging those same customers and other third parties to use the same circuit for creating an error coding data block. These acts of making, using, selling, offering to sell, and/or importing in the United States without authorization, of products that comprise the claimed circuit for creating an error coding data block constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 344 Patent by such customers or third parties. Dell's acts of inducement include: providing the Dell 344 Patent Infringing Products to its customers and other third parties and intending them to use the Dell 344 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; advertising the Dell 344 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC and http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD); encouraging its customers and other third parties to communicate directly with Dell representatives about these products (for example, through the "Click to Chat" feature on Dell's website) for purposes of technical assistance and repair as well as sales and marketing; providing documentation, instructions, technical specifications, service manuals on how to install, use and repair the Dell 344 Patent Infringing Products (for example, Alienware 13 Service Manual,

http://www.dell.com/support/manuals/us/en/ukdhs1/alienware-13/Alienware13_SM-v1/Before-working-inside-your-computer?guid=GUID-5D3B1051-9384-409A-8D5B-9B53BD496DE8&lang=en-us and Tech Specs of Dell's 4 GB NVIDIA Quadro K2200 Graphic Card, http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD&mfgpid=238969); and providing additional product support, including not limited to Driver downloads, diagnostic tools, and replacement parts to its customers and third parties for the Dell 344 Patent Infringing Products (for example, Alienware 13 R2 Product Support, http://www.dell.com/support/home/us/en/19/product-support/product/alienware-13-r2/diagnose).

193. Dell proceeded in this manner despite its actual knowledge of the 344 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 344 Patent. At the very least, because Dell has been and remains on notice of the 344 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

194. On information and belief, Dell has contributed to and continues to contribute to infringement of one or more claims of the 344 Patent, including but not limited to Claims 43 - 45 and 48 - 51, pursuant to 35 U.S.C. § 271(c) by selling, offering to sell, importing and/or supplying in the United States without authority components that include the claimed circuit for creating an error coding data block, including without limitation, the component comprising the NVIDIA GPU, components that are critical and material to creating an error coding data block according to asserted claims. Dell supplied and continues to supply these components, including, without limitation, the Dell 344 Patent Infringing Products, with the knowledge of the 344 Patent and with the knowledge that these components constitute material parts of the claimed inventions of the 344

Patent. Moreover, Dell knows at least by virtue of its knowledge of its own products and the 344 Patent, that these components are especially made and/or especially adapted for creating an error coding data block as claimed in the 344 Patent and there is no substantial non-infringing use of the claimed elements of these components.

195. Polaris has suffered damages and continues to suffer as a result of Dell's infringement of the 344 Patent.

196. Dell's infringement of the 344 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed Dell on notice of infringement of the 344 Patent and identified Dell infringing products, Dell has had actual knowledge of infringement of the 344 Patent and has proceeded to infringe the 344 Patent with full knowledge of that patent and its applicability to Dell's products and without any response to Polaris's offer to discuss terms for a license to the 344 Patent. Despite knowledge of the 344 Patent, Dell has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to Dell, and is also so obvious that it should have been known to Dell. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

COUNT IX:

DELL'S INFRINGEMENT OF U.S. PATENT NO. 8,207,976

197. Polaris incorporates and realleges paragraphs 1-50 and 136-145 above as if fully set forth herein.

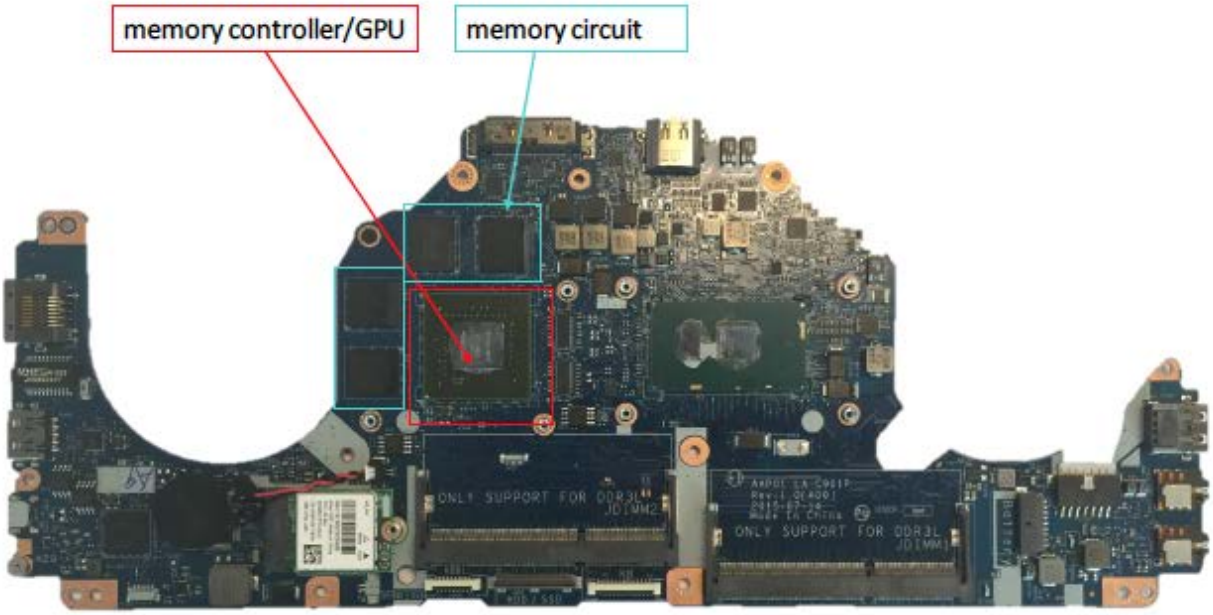
198. On information and belief, Dell has infringed and continues to infringe one or more claims of the 976 Patent, including but not limited to Claims 35 and 36, pursuant to 35 U.S.C.

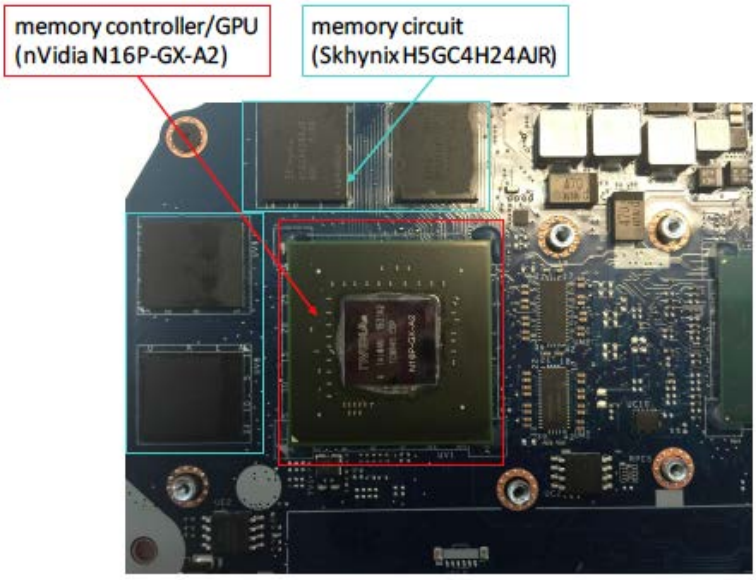
§ 271(a), literally or under the doctrine of equivalents, by making, using, selling, offering to sell, and/or importing in the United States without authority, Dell computer products, devices, systems that include the claimed memory circuits and memory controllers and/or GPUs, and which are used in combination with GDDR5 memory devices. These "Dell 976 Patent Infringing Products," include, for example, Dell's computer products that use NVIDIA's GDDR5 graphics cards and/or NVIDIA's GPUs in combination with GDDR5 memory, and GDDR5 graphics card products, such as Inspiron 15 7000 Series, certain models of XPS 15 Non-Touch Laptops and 8900 Desktops, Precision 15 5000 Series (5510) and certain models of Tower 7000 Series (7810, 7910), Alienware 13 Gaming Laptop and certain models of X51 Gaming Desktop, and graphics cards using NVIDIA Quadro K2200 graphics card design and configurations.

199. By way of a non-limiting example, an image of a representative Dell 976 Patent Infringing Product, Dell's Alienware 13 Gaming Laptop, that comprises the claimed memory circuit and memory controller and/or GPU is reproduced from Dell's website below.

Alienware 13 Gaming Laptop Gallery, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC.

200. The front view of the mother board and its graphics components of Dell's Alienware 13 Gaming Laptop is shown in the image below and annotated for illustration.





201. On information and belief, the Dell 976 Patent Infringing Products are memory

systems comprising a memory circuit, for example, a GDDR5 memory circuit (SKhynix H5GC4H24AJR) as shown in the blue box above. *See also,* Alienware 13 Gaming Laptop Configurations (hereafter "Alienware 13 Configurations"), http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC ("Video Cards: NVIDIA® GeForce® GTX 960M with 2GB GDDR5"). Such a memory circuit comprises an output buffer that comprises an input and an output; a data interface for transmitting and receiving data, which is coupled to the output of the output buffer; a command/address interface coupled to the input of the output buffer; a memory core coupled to the input of the output buffer; a second output buffer comprising an input and output, the output being coupled to the data interface or to a further output pin; an EDC circuit having an output coupled to the input of the second output buffer; a controller circuit adapted to cause data stored within the output buffer to be output to the data interface upon reception of a first signal, further adapted to cause data stored within the memory core to be output to the input of the output buffer upon reception of a second signal so that the data is stored within the output buffer, further adapted to cause provision of data received at the command/address interface via an address portion thereof to the input of the output buffer upon reception of a third signal so that the data is stored within the output buffer, further adapted to cause data which is stored within the second output buffer to be output to the data interface or the further output pin, further being adapted to cause data which is provided by the EDC circuit to be stored within the second output buffer, and further being adapted to cause data which is received at the command/address interface to be stored within the second output buffer. On information and belief, the Dell infringing memory systems also comprise a memory controller, for example, an NVIDIA GTX 960M GPU (NVIDIA N16P-GX-A2), as shown in the red box in the image above. *See* Alienware 13 Configurations ("Video Cards: NVIDIA® GeForce® GTX 960M with 2GB GDDR5"). The memory controller comprises a

command/address interface; a data interface; and a synchronization circuit coupled to the command/address interface and to the data interface, adapted to output a transmit data pattern as the synchronization data on the command/address interface via an address portion thereof, further adapted to receive a receive data pattern from the data interface, and further adapted to perform a training operation on the data interface on the basis of the transmit data pattern and the receive data pattern, the transmit data pattern selected to perform one of a symbol training operation and a frame synchronization operation. The data interface of the memory circuit, and the data interface of the memory controller are coupled to one another, and the command/address interface of the memory circuit are coupled to the command/address interface of the memory controller in the infringing memory systems.

202. On information and belief, the Dell 976 Patent Infringing Products are graphics systems comprising a GDDRX memory circuit, with X being a number designating a GDDR standard, for example, a GDDR5 memory circuit (SKhynix H5GC4H24AJR) as shown in the blue box above. *See* Alienware 13 Configurations ("Video Cards: NVIDIA® GeForce® GTX 960M with 2GB GDDR5"). Such memory circuit comprises an output buffer that comprises an input and an output; a data interface for transmitting and receiving data, which is coupled to the output of the output buffer; a command/address interface coupled to the input of the output buffer; a memory core coupled to the input of the output buffer; a second output buffer comprising an input and output, the output of which is coupled to the data interface or to a further output pin; an EDC circuit having an output coupled to the input of the second output buffer; a controller circuit adapted to cause data stored within the output buffer to be output to the data interface upon reception of a first signal, further adapted to cause data stored within the memory core to be output to the input of the output buffer upon reception of a second signal so that the data is stored within

the output buffer, further adapted to cause provision of data received at the command/address interface via an address portion thereof to the input of the output buffer upon reception of a third signal so that the data is stored within the output buffer, further adapted to cause data which is stored within the second output buffer to be output to the data interface or the further output pin, further adapted to cause data which is provided by the EDC circuit to be stored within the second output buffer, and further adapted to cause data which is received at the command/address interface to be stored within the second output buffer. On information and belief, the Dell infringing graphics systems also comprise a GPU, for example, an NVIDIA GTX 960M GPU (NVIDIA N16P-GX-A2) as shown in the red box in the image above. *See* Alienware 13 Configurations ("Video Cards: NVIDIA® GeForce® GTX 960M with 2GB GDDR5"). The GPU comprises a command/address interface; a data interface; and a synchronization circuit coupled to the command/address interface and to the data interface, and adapted to output a transmit data pattern as the synchronization data on the command/address interface via an address portion thereof, further adapted to receive a receive data pattern from the data interface, and further adapted to perform a training operation on the data interface on the basis of the transmit data pattern and the receive data pattern, the transmit data pattern selected to perform one of a symbol training operation and a frame synchronization operation. The data interface of the GDDR5 memory circuit, and the data interface of the GPU are coupled to one another, and the command/address interface of the GDDR5 memory circuit are coupled to the command/address interface of the GPU in the infringing graphics systems.

203. In addition, on information and belief, Dell makes, uses, sells, offers to sell, and/or imports in the United States without authorization, GDDR5 graphics products that include claimed memory circuits and memory controllers and/or GPUs and use NVIDIA's product designs

and/or configurations, including, without limitations, NVIDIA's Quadro, Tesla and GeForce graphics cards, such as NVIDIA Quadro K2200 graphics cards. *See, e.g.,* http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD. *See also* ¶¶ 136 - 145.

204. On information and belief, Dell has induced and continues to induce infringement of one or more claims of the 976 Patent, including but not limited to Claims 35 and 36, pursuant to 35 U.S.C. § 271(b) by encouraging its customers and other third parties, such as manufacturers of computer products incorporating infringing graphics cards supplied by Dell and distributors and retailers of the Dell 976 Infringing Products, to make, use, sell, offer to sell, and/or import in the United States without authorization, products that comprise the claimed memory circuit and memory controller/GPU. These acts of making, using, selling, offering to sell, and/or importing in the United States without authorization of products that comprise the claimed memory circuit and memory controller/GPU constitute direct infringement, literally or under the doctrine of equivalents, of one or more claims of the 976 Patent by such customers or third parties. Dell's acts of inducement include: providing its customers with the Dell 976 Patent Infringing Products and intending its customers to use the Dell 976 Patent Infringing Products with hardware, software and other infrastructure that enable and/or make use of these products; advertising the Dell 976 Patent Infringing Products and its components through its own and third-party websites (for example, http://www.dell.com/us/p/alienware-13-r2/pd?ref=PD_OC and http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD); encouraging its customers and other third parties to communicate directly with Dell representatives about these products (for example, through the "Click to Chat" feature on Dell's website) for purposes of technical assistance and repair as well as sales and marketing; providing

documentation, instructions, technical specifications, service manuals on how to install, use and repair the Dell 976 Patent Infringing Products (for example, Alienware 13 Service Manual, http://www.dell.com/support/manuals/us/en/ukdhs1/alienware-13/Alienware13_SM-v1/Before-working-inside-your-computer?guid=GUID-5D3B1051-9384-409A-8D5B-9B53BD496DE8&lang=en-us and Tech Specs of Dell's 4 GB NVIDIA Quadro K2200 Graphic Card, http://accessories.us.dell.com/sna/productdetail.aspx?c=us&l=en&s=gen&sku=490-BCGD&mfgpid=238969); and providing additional product support, including but not limited to Driver downloads, diagnostic tools, and replacement parts to its customers and third parties for the Dell 976 Patent Infringing Products (for example, Alienware 13 R2 Product Support, http://www.dell.com/support/home/us/en/19/product-support/product/alienware-13-r2/diagnose).

205. Dell proceeded in this manner despite its actual knowledge since at least March 22, 2016, of the 976 Patent and its knowledge that the specific actions it actively induced and continues to actively induce on the part of its customers and other third parties constitute infringement of the 976 Patent. At the very least, because Dell has been and remains on notice of the 976 Patent and the accused infringement, it has been and remains willfully blind regarding the infringement it has induced and continues to induce.

206. Polaris has suffered and continues to suffer damages as a result of Dell's infringement of the 976 Patent.

207. Dell's infringement of the 976 Patent has been and continues to be willful, deliberate, and in disregard of Polaris's patent rights. At least as of March 22, 2016, when Polaris placed Dell on notice of infringement of the 976 Patent and identified Dell infringing products, Dell has had actual knowledge of infringement of the 976 Patent and has proceeded to infringe the 976 Patent with full knowledge of that patent and its applicability to Dell's products and without

any response to Polaris's offer to discuss terms for a license to the 976 Patent. Despite knowledge of the 976 Patent, Dell has acted and is acting despite an objectively high likelihood that its actions constitute patent infringement. This objective risk was and is known to Dell, and is also so obvious that it should have been known to Dell. Such willful and deliberate conduct entitles Polaris to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

PRAYER FOR RELIEF

Polaris respectfully prays for relief as follows:

(a) A judgment that Dell and NVIDIA have infringed and continue to infringe one or more claims of the Asserted Patents;

(b) A judgment that Dell and NVIDIA have induced infringement and continue to induce infringement of one or more claims of the Asserted Patents;

(c) A judgment that Dell and NVIDIA have contributed to and continue to contribute to the infringement of one or more claims of the Asserted Patents;

(d) A judgment that Dell and NVIDIA have willfully infringed one or more claims of the Asserted Patents;

(e) A judgment awarding Polaris all damages adequate to compensate for Dell's and NVIDIA's infringement, and in no event less than a reasonable royalty for Dell's and NVIDIA's acts of infringement, including all pre-judgment and post-judgment interest at the maximum rate allowed by law;

(f) A judgment awarding Polaris treble damages pursuant to 35 U.S.C. § 284 as a result of Dell's and NVIDIA's willful conduct;

(g) A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding Polaris its reasonable attorneys fees; and

(h) A judgment awarding Polaris such other relief as the Court may deem just and equitable.

DEMAND FOR JURY TRIAL

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Plaintiff Polaris demands a trial by jury of this action.

Dated: May 16, 2016

/s/ Henry B. Gonzalez III

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