No. 14-1492

United States Court of Appeals for the Federal Circuit

CARNEGIE MELLON UNIVERSITY,

Plaintiff-Appellee,

v.

MARVELL TECHNOLOGY GROUP, LTD. AND MARVELL SEMICONDUCTOR, INC.,

Defendants-Appellants.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF PENNSYLVANIA IN CASE NO. 2:09-CV-00290-NBF, HON. NORA B. FISCHER

ANSWERING BRIEF OF PLAINTIFF-APPELLEE CARNEGIE MELLON UNIVERSITY

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'839 patent (claim 4)

4. A method of determining branch metric values for branches of a trellis for a Viterbi-like detector, comprising:

> selecting a branch metric function for each of the branches at a certain time index from a set of signal-dependent branch metric functions; and
>
> applying each of said selected functions to a plurality of signal samples to determine the metric value corresponding to the branch for which the applied branch metric was selected wherein each sample corresponds to a different sampling time instant.

A456, col. 14:10-19.

'180 patent (claims 1 and 2)

1. A method of determining branch metric values in a detector, comprising:

> receiving a plurality of time variant signal samples, the signal samples having one of signal-dependent noise, correlated noise, and both signal dependent and correlated noise associated therewith;
>
> selecting a branch metric function at a certain time index; and
>
> applying the selected function to the signal samples to determine the metric values.

2. The method of claim 1, wherein the branch metric function is selected from a set of signal-dependent branch metric functions.

A487, col. 15:39-51.

CERTIFICATE OF INTEREST

Counsel for plaintiff-appellee certifies the following:

1. We represent Carnegie Mellon University.

2. That is the real name of the real party in interest.

3. Carnegie Mellon University has no parent corporations and no publicly held company owns 10 percent or more of its stock.

4. The following law firms and partners or associates appeared for Carnegie Mellon University in the United States District Court for the Western District of Pennsylvania or are expected to appear in this Court:

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TABLE OF ABBREVIATIONS

'839 patent – U.S. Patent No. 6,201,839

'180 patent – U.S. Patent No. 6,438,180

Broadcom Br. – Brief *Amici Curiae* of Broadcom Corp. et al.

CMU – Carnegie Mellon University

DSSC – Data Storage Systems Center

FIR – finite impulse response

HDD – hard disk drive

Law Profs. Br. – Brief *Amici Curiae* of Fifteen Professors of Intellectual Property Law

Marvell – Marvell Technology Group, Ltd. and Marvell Semiconductor, Inc.

MNP – media noise processor

NLD – non-linear detector

OB – Marvell Opening Brief

SNR – signal-to-noise ratio

SOC – system on chip

STATEMENT OF RELATED CASES

No other appeal involving this civil action was previously before this or any other appellate court. On January 4, 2014, an attorney at Ropes & Gray, without naming the real party in interest, requested *ex parte* reexamination of claim 4 of the '839 patent and claims 1 and 2 of the '180 patent. *See* Reexamination Control Nos. 90/013,125 and 90/013,124. The examiner confirmed patentability of claim 4 of the '839 patent. *See* Reexamination No. 90/013,125 Notice of Intent to Issue Ex Parte Reexamination Certificate (USPTO Sept. 19, 2014). Proceedings are ongoing.

INTRODUCTION

Your laptop's storage space once would have filled a room. It can now store 200 million times more data per square inch than the first hard disk drive ("HDD"). Cramming so much data into tiny spaces—like cramming millions of words onto a page—makes the data harder to read. The astronomical increase in "data density"—the amount of data that can be stored in the same area—would have been useless had engineers not figured out how to read it. In the 1990s, two Carnegie Mellon University ("CMU") engineers—Drs. José Moura and Aleksandar Kavcic—developed an ingenious solution. Marvell acknowledges that CMU's method is "optimal," OB13—and that it remains the "gold standard," A41,763.

Meanwhile, Marvell had made a near-fatal gamble on a different data-detection method. Marvell's method failed so spectacularly that its own executives ridiculed it: "Corvair, … unsafe at any speed." A33,980. Facing imminent demise, Marvell copied CMU's method—even naming its detector after CMU's Kavcic. "[M]ust have" technology, they called it. A35,093; *see* A46,674. Marvell knew CMU had patented it. That detector not only saved Marvell's business, but propelled it to

the top of the industry. It sold 2.35 *billion* chips incorporating CMU's method.

Having heard this story, and Marvell's defense, the jury found Marvell infringed—willfully. It awarded $1.17 billion in compensatory damages, which the district court enhanced by 23% for willfulness.

Marvell protests the sheer magnitude of the judgment, wondering, "How did this happen?" OB2. Simple. A billion-dollar verdict is what happens when your constant exploitation of a patented method trillions of times a day with millions of chips over the course of a decade saves your business from certain ruin, propels you to market leadership, and, in the process, generates over $10.3 billion in revenue and over $5 billion in operating profit. CMU did not argue to the jury that Marvell's total revenue and profits justified a large award. Instead, it presented compelling expert testimony that Marvell had no noninfringing alternative; that it would not have sold a single one of the 2.35 billion chips without infringing in the United States; and that, if forced to negotiate ex ante, Marvell would have shared 50¢ of the $2.16 in *profit* it made on each chip.

Marvell never disputed that it knew of CMU's patents, based its designs on CMU's method, used the method countless times in the U.S. to design, develop, and prove its chips, and would have made no sales had it not done so. Instead, Marvell suggests it should be excused because it did a "suboptimal" job of copying. OB13. That is no defense. Infringement is infringement, even if suboptimal. Marvell should not now complain about sharing a fraction of the profits it reaped with the institution that helped save its business.

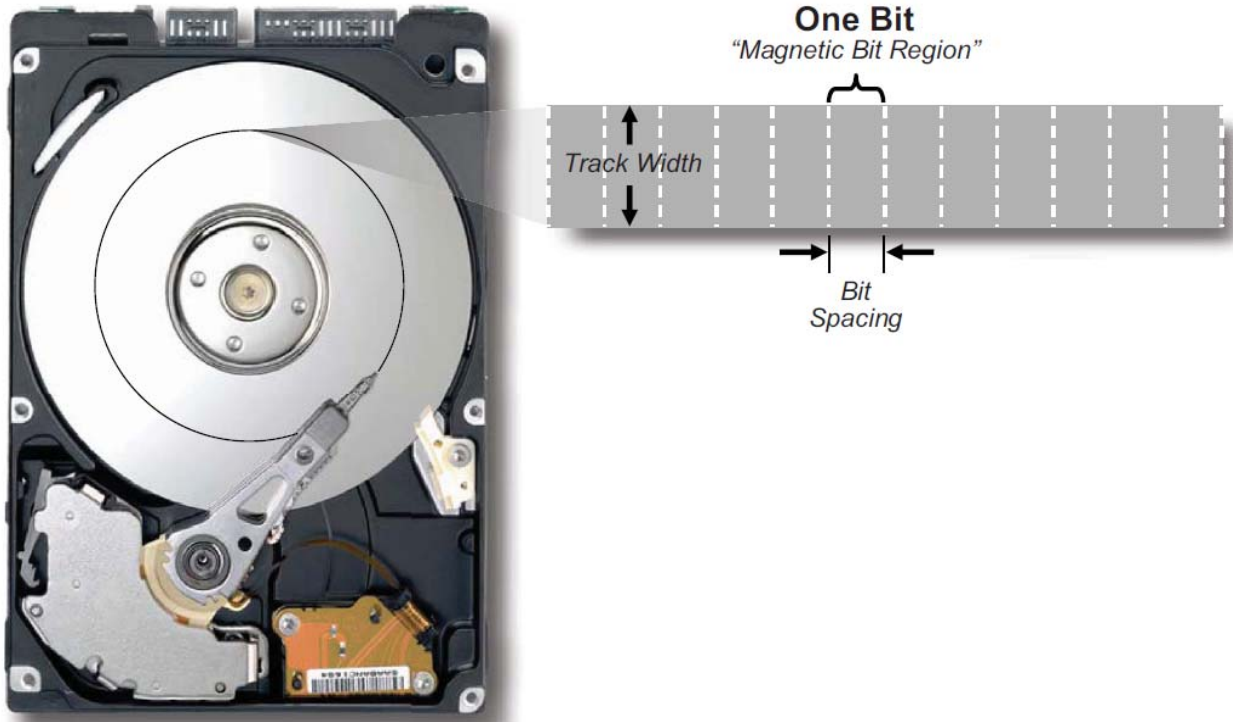
STATEMENT OF THE CASE

Reading Data Gets Harder As Density Increases

To appreciate the genius of CMU's invention, you must understand the engineering problems that hard drives pose. There is no better primer than the tutorial the district court watched (submitted as a Supplemental Video Appendix); we describe the basics here.

A hard drive (shown below) is like a record player. The disk is a flat, circular platter coated with magnetic material. A41,329. It has millions of concentric tracks, each 1/2000th the width of a human hair. A41,220. Each teeny track has millions of "bit regions." A150. Each bit region can be magnetized—or "polarized"—in one of two directions to turn each track into a row of millions of microscopic bar magnets,

arrayed to represent a sequence of binary data (0s and 1s). A150-51, 223, 41,218-19, 41,329.



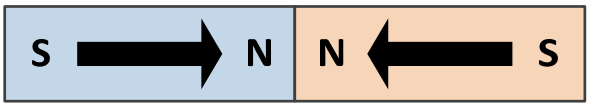
A2207.

An arm (like on a turntable) hovers above the disk. A41,329. A "head" at the end of the arm writes data to, and reads data from, the spinning disk. A34,826, 41,219, 41,329. The head writes data by polarizing the bit regions into a pattern corresponding to the 0s and 1s. A2223, 3510-11.

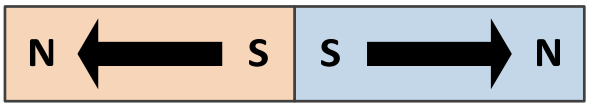
To later read that stored data, the head senses the magnetic fields emanating from the polarized bit regions speeding below it and

generates a "readback signal." A41,330; A34,827. Modern detectors take voltage readings at regularly spaced time intervals as the disk spins below the head, like an evenly spaced sequence of super-fast stop-action photographs, one sample for each bit region. A451, col. 4:4-7; *see* A3515.

A detector in a "read channel chip" processes the readback signal. In the detector described in the patent, a change in polarity—a "transition"—from one tiny bar magnet to another generates a pulse in the readback signal, which the detector reads as a 1; a repeat in polarity generates no pulse, which the detector interprets as a 0. A2209, 3512-13. A positive transition (where the "north" ends of the polarized bit regions abut) causes a +1 voltage pulse, and a negative transition (where the "south" ends abut), causes a -1.



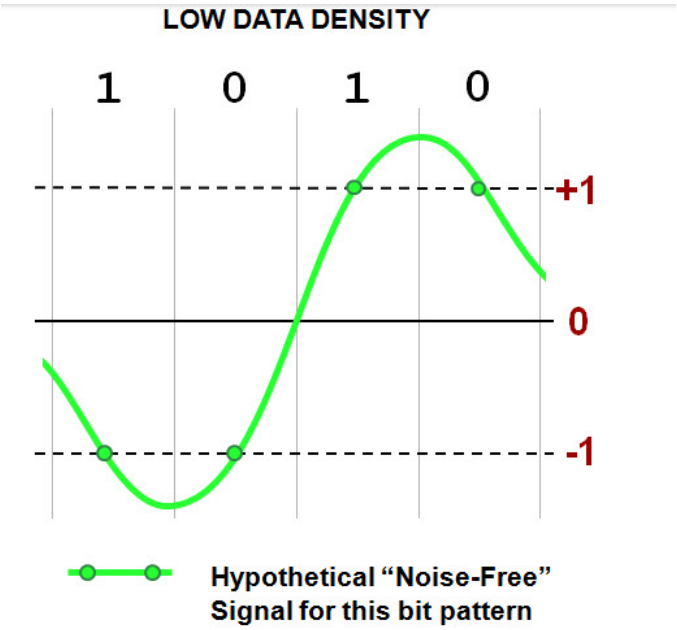
Positive Transition



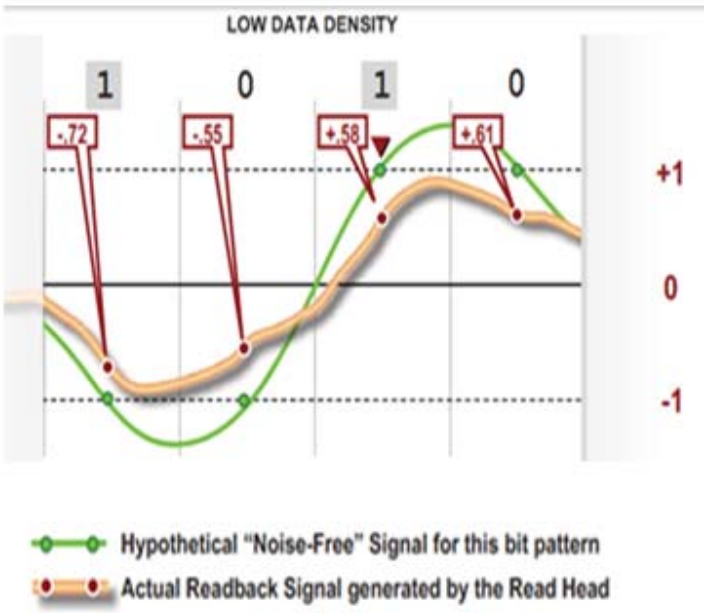
Negative Transition

See A3512-13; A451, col. 3:55-56.

If the readback signal were a series of ideal pulses and non-pulses corresponding perfectly to the data written on the disk, the sequence 1-0-1-0 would look like this:

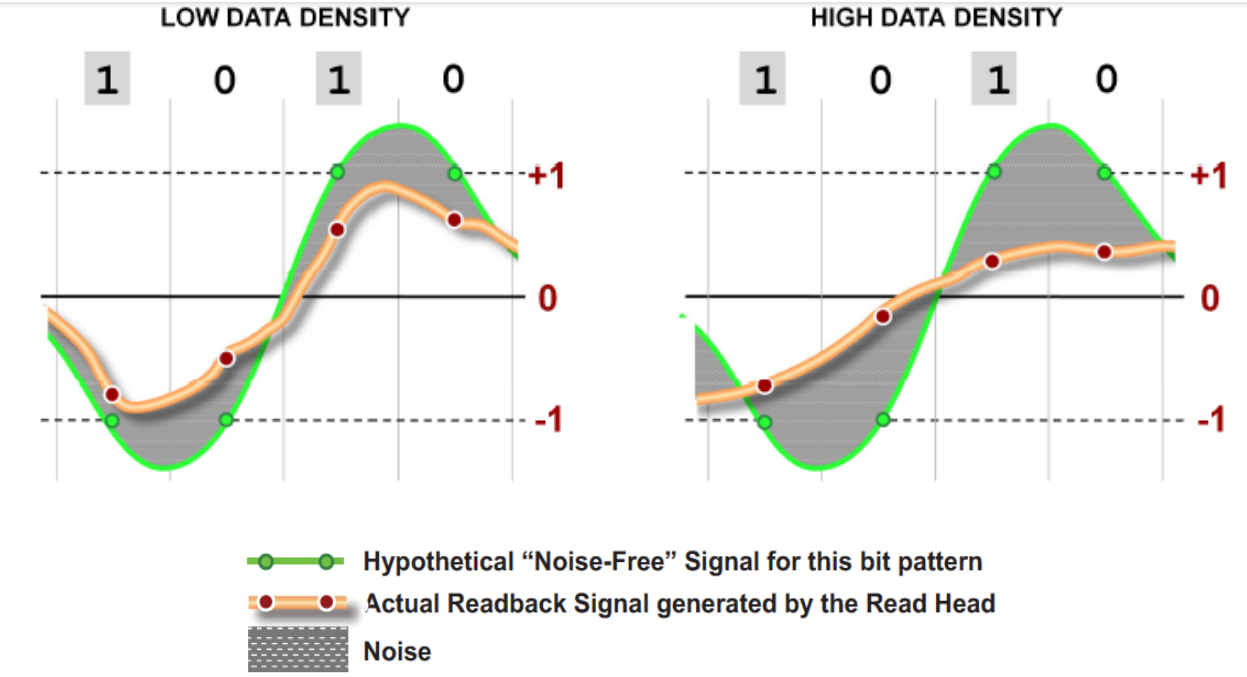


A2247. The actual readback signal, however, is distorted by "noise." A41,331. Consequently, the actual, noise-influenced readback signal (shown below in gold) could depart from the ideal (green):



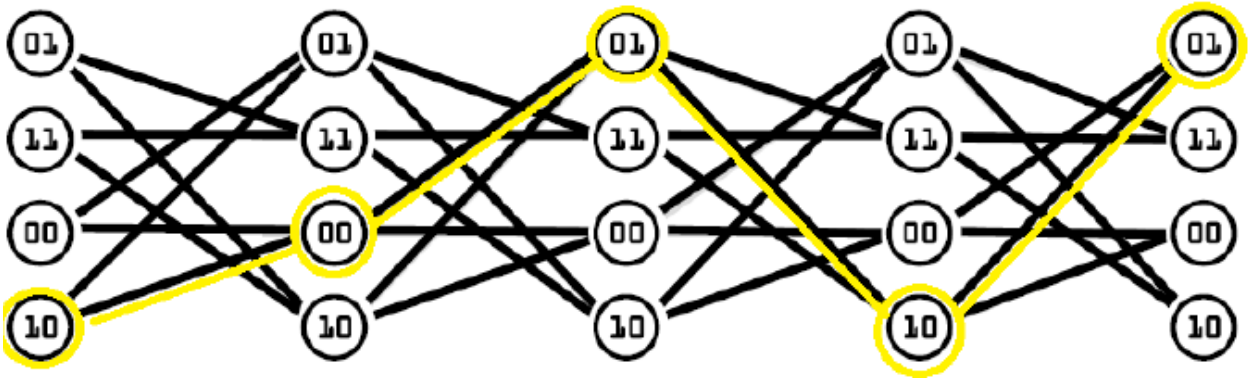
A2242.

The detector's challenge is to determine the sequence despite the noise. This was easier when data density was low because noise was relatively minor compared to the strength of the readback signal—in technical terms, the signal-to-noise ratio ("SNR") was high. A993-94. But as data density increased, noise (shown in gray below) did too. The peaks and valleys in the signal became less defined, increasing the difference between the ideal signal and the one actually read by the head. Detectors had trouble detecting the data in this increasingly noisy signal. A41,224.



A2247.

In the 1990s, the HDD industry migrated to "Viterbi" detectors. A41,224. Generally, a Viterbi detector uses a Viterbi algorithm to translate noise-infected signal samples into the likely data sequence written to the disk. A Viterbi detector's operation can be illustrated graphically with a "trellis." A41,333. This trellis, for instance, shows every possible sequence for six consecutive bits of data:



A152. The yellow path represents the sequence 1-0-0-1-0-1. (While each circle appears to contain two bits, the first bit duplicates the last bit of the previous circle, so that the first two yellow lines represent 1-0-0-1, not 1-0-0-0-0-1.) Each path is comprised of a series of branches, and each branch represents a specific data sequence. The first yellow branch is the 1-0-0 sequence, the second yellow branch is the 0-0-1 sequence, and so on. A34,830-39, 41,333-48.

Think of the Viterbi trellis as a map of interlocking tunnels of various lengths through a mountain. The challenge is to figure out

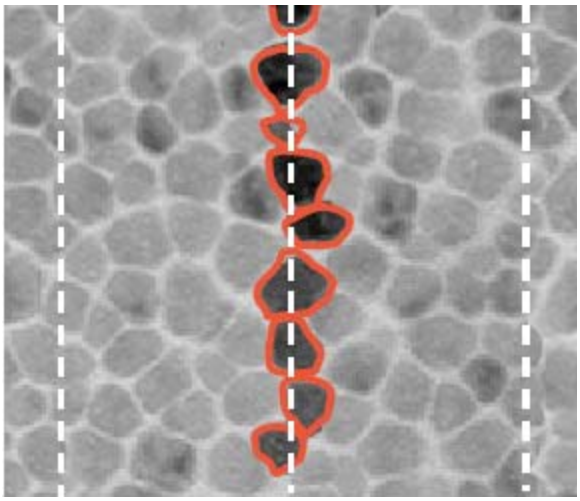
what path a miner took through the mountain when all you have are the actual times the miner took to traverse each tunnel and a table reflecting expected times a miner ideally would take. The actual sample readings (akin to the miner's *actual* times through each tunnel) are typically represented as r_1, r_2, etc. The expected, noise-free signal samples (akin to the miner's *ideal* times) are called "target values" or "ideal values." A34,839; *see* A3542.

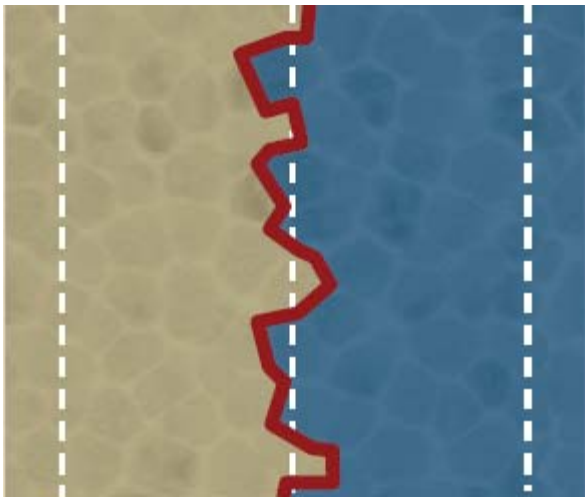
To determine the correct path, the Viterbi detector calculates a "branch metric value." The branch-metric value measures the difference between the *r* value for a branch (the miner's actual travel time through a tunnel) and the ideal value for that branch (the miner's expected travel time). A34,839. The detector does that with a "branch metric function." A788. The Viterbi detector then adds up the branch-metric values for the series of branches along possible paths through the trellis to determine "path metric values." A2296-99, 34,835-39. It determines the likely sequence of data by selecting the path with the lowest path-metric value, because that path has the least variation between the signal samples and the ideal values (the least cumulative

variation between the miner's actual times and expected times). A2296-99, 34,835-39.

Detectors Proved Inadequate As Media Noise Increased

Since the early 2000s, media noise has been "the dominant factor, … that limits" the detector's ability to accurately read data on the disk. A41,233; *see* A41,245-46. One cause of media noise is physical: A hard disk is covered in a mosaic of irregularly shaped magnetic grains that do not align with the ideal, straight boundaries of the bit regions. A41,349-50. Thus, the transitions, which the detector has to recognize to detect the binary data, are jagged. This jaggedness leads to a difference between the actual signal and the ideal.

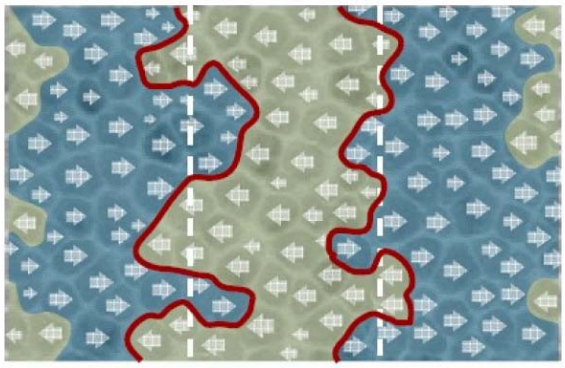




A2208, 2210.

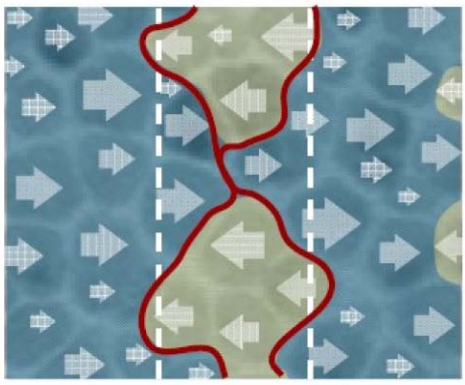
In the low data-density environment depicted below, the jaggedness of the transitions is not severe relative to the size of the bit region. A41,350.

Low-to-Moderate Density
(**30-60** grains per bit region)



A153. But as data density increases, bit regions shrink, and there are fewer grains per region. A41,351. Consequently, the jagged boundaries consume more of the bit region (magnified below), increasing the media noise:

High Density
(**15-25** grains per bit region)

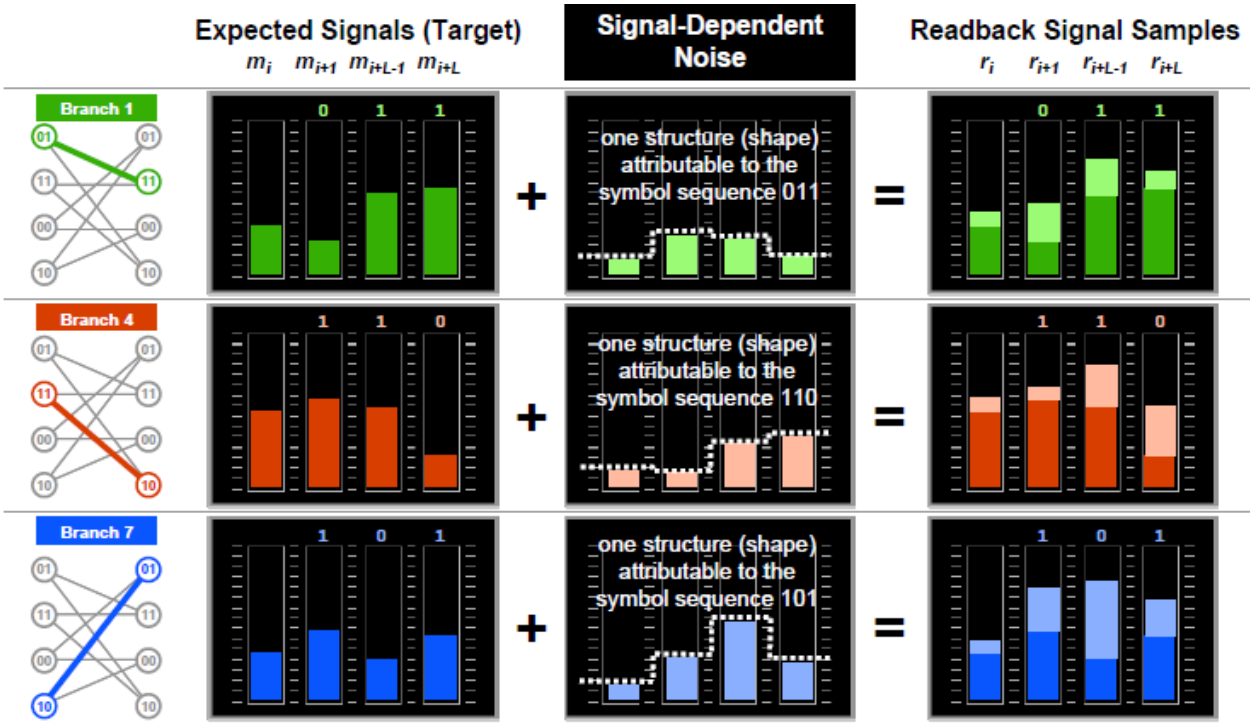


A153.

Critical here, media noise has two additional complicating characteristics. First, noise samples are "correlated"; they "tend[] to vary together." A3752. For example, the high media noise in the readback signal from a transition (i.e., a change in polarity) ripples through the sequence of samples in the neighborhood so that the samples in that sequence will also tend to have high noise. A41,361; *see* A34,849, 47,914.

Second, this correlated noise is "signal dependent"; noise has structure that is "attributable to a specific sequence of symbols" (bits) actually written on the disk. A3753; *see* A41,353-54. It is as if the tunnels in our analogy have different inclines and declines. For example, the miner's actual time through the fourth tunnel would depend on the specific sequence of the three previous tunnels because he may be winded and moving more slowly if those previous tunnels were steep.

The graphic below illustrates how different branches of the trellis (left column) have different corresponding expected signals (second column). But each branch has a unique noise signature (third column) that is attributable to the specific sequence of symbols associated with the branch. A41,367-69. That results in different actual readback signals (right column, which aggregates columns 2 and 3).



A34,850.

The branch-metric function of the original Viterbi detectors ignored the correlated and signal-dependent attributes of noise. A452, col. 5:59-64. As data density increased, this simplistic approach became untenable. Disk manufacturers could not continue to increase data

density without a more sophisticated detection method. A solution was critical. A42,138-41.

CMU's Engineers Partner With The HDD Industry To Solve The Media-Noise Problem

Nearly two decades before the media-noise problem became urgent, CMU foresaw that the U.S. HDD industry would have to increase data density to survive. A42,345-54. Toward that end, in 1983, CMU partnered with the industry on a design center, eventually named the Data Storage Systems Center ("DSSC"). A42,345-47. IBM, Seagate, and other industry heavyweights joined. A157-58, 42,361-62. Top industry associates paid a $250,000 annual membership fee. A42,361-62. Beyond that, they invested time, talent, and several hundred million dollars in the DSSC. A42,359-60. In return, these sponsors received access to the CMU talent and royalty-free licenses to intellectual property that *might* be developed *after* they joined. A42,361-62.

This academy-industry partnership supported the work of Moura and Kavcic. The duo toiled for years to develop a sequence-detection method that accounted for media noise. A41,378-79. For years, they hit dead ends. A34,855-66, 41,372-79. Frustrated, they went "back to the

drawing board" to revisit everyone's most basic assumptions. A41,378-80.

Their solution was counterintuitive. Common wisdom was that you either had to ignore correlated noise altogether or account for only correlated noise by using a *single* branch-metric function for every possible sequence—every trellis branch. A34,855-66, 41,370-79. The inventors realized that these approaches did not solve the problem and actually created other problems, including a "Whack-a-Mole" problem: Using a single branch-metric function to account for noise at one branch made it worse at another. A41,374-78; *see* A34,859-60. In our tunnel analogy, a single function optimized to account for time through a tunnel after a long, arduous climb would be wildly inaccurate for one following a steep decline.

So, the inventors had to "break[] the physics." A41,384-85. They realized the solution was to generate "a *set* of signal-dependent branch metric functions" that are applied to multiple signal samples. A41,403-04.[1] Each function in the set accounts for the noise-correlation

[1] Emphasis throughout this brief is added, unless otherwise indicated.

structure attributable to the specific symbol sequence associated with one branch. A41,392. Thus, when computing the branch-metric value for the 0-1-1 branch, the method selects the branch-metric function that is specific to the signal-dependent noise structure associated with that 0-1-1 branch, which differs from the function for the 0-1-0 branch. A41,401-03. It is like adjusting the miner's expected time throughout the current tunnel by accounting for how tired the miner should be due to the specific sequence of tunnels the miner ran through—long or short, uphill or downhill—en route to this tunnel.

This was a "major breakthrough." A41,378-79. While Marvell repeatedly asserts that the invention "was too … complex[] to implement in a real-world chip," OB13, CMU's expert testified that it was not "too complicated to implement," A41,844. Rather, the invention was simply years ahead of its time. At the time, no one had packed data so densely that the invention was needed to read it. A41,507-11. But data density (and the consequent noise) was doubling every year or two. A35,039, 35,081-82, 42,167-72. And "[m]edia noise became increasingly significant," A157, especially with the emergence of a technological development ("perpendicular recording") that

"dramatically extend[ed] data density," A42,108. *See* A42,163, 42,165-66, 42,187-89.

CMU's invention came in the nick of time, paving the way for further miniaturization of hard drives. A41,222-24. Mathematical proofs establish (and Marvell admits) that the CMU invention enables "optimal" data detection, OB13; *see* A41,246, 41,381-90, that eventually became an "industry standard," A42,163; *see* A42,162-71. Marvell itself agreed CMU's method was and remains the "gold standard." A41,763.

CMU Patents Its Groundbreaking Method

In May 1997, CMU filed the provisional application that led to the '839 and '180 patents.[2] A159, 439, 460. The relevant claims—claim 4 of the '839 patent and claim 2 of the '180 patent—are reproduced on the inside front cover of this brief. Equation 13 discloses the set of signal-dependent branch-metric functions described in the patents:

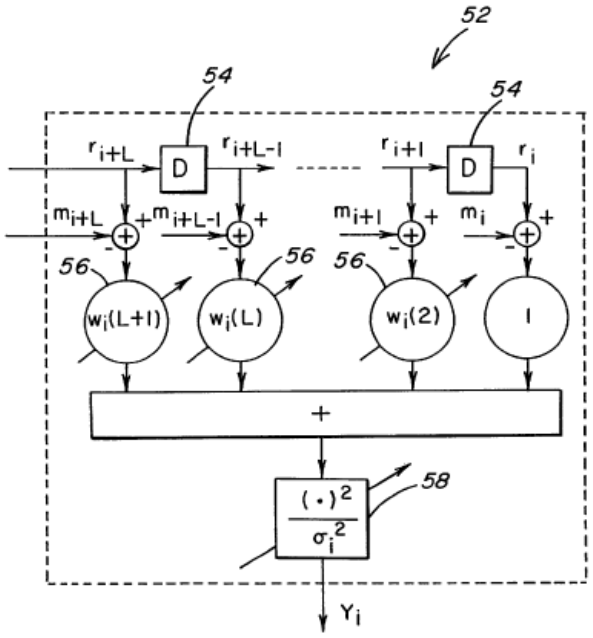
$$M_i = \log\frac{\det\ C_i}{\det\ c_i} + \underline{N}_i^T C_i^{-1} \underline{N}_i - \underline{n}_i^T c_i^{-1} \underline{n}_i$$

[2] For aspects of the patents that are identical, we cite only the '839 patent.

A453, col. 7:2. M_i is the metric for one sequence of symbols—i.e., one trellis branch. The patent teaches tuning the parameters of the algorithm for each branch of the trellis (M_1, M_2, etc.) to make up the set. A453, col. 8:6-23.

The patents also describe circuits that can implement the set of functions. A453, col. 7:10-67; *see* A441 (Fig. 3A). These circuits use a separate "finite impulse response" ("FIR") filter to implement the branch-metric function for each symbol sequence (each trellis branch) as depicted in Figure 3B:

FIG. 3B



A453, col. 7:44-67; *see* A443 (Fig. 3B). In this embodiment, the FIR filter for one branch computes the branch-metric value for that branch by comparing a "plurality of signal samples" from the readback signal (r_{i+L}, r_{i+L-1}, …, r_i) and the same number of expected (ideal) values for that branch (m_{i+L}, m_{i+L-1}, …, m_i). A453, col. 7:61-67. For each pairing of a signal sample and a corresponding ideal value, the FIR filter calculates a difference. It then weights each difference according to the tap weight ($w_i(L+1)$, $w_i(L)$ …), A41,400; *see* A453, col. 7:61-67, much like a stereo equalizer gives more or less emphasis to the bass, mid-range, or treble. A41,235, 41,397-403. Thus, each FIR filter implements its own signal-dependent branch metric function (its own stereo equalizer tuned for its specific symbol sequence), and the circuits collectively implement a *set* of such functions.

Facing Demise, Marvell Copies CMU's Method

In 1995, around the time CMU was "breaking the physics," Marvell was just breaking ground. Marvell manufactured read channel chips and, later, SOCs, which include a read channel and other HDD controls. A43,651; *see* A164-65, 43,844-47. In the early 2000s, Marvell faced a life-or-death problem—and bet on the wrong solution.

The problem was this: By then, manufacturers had figured out how to pack so much data onto disks that existing detectors had trouble reading it accurately. A42,107-08. Marvell's customers demanded a solution. By 2000, Marvell's customers fretted that Marvell's products were "1 year behind Lucent," a competitor, A46,271; *see* A35,085, 42,172, and warned Marvell that they were considering "moving to Kavcic's model," A46,266.

Marvell's near-fatal bet was on "iterative decoding." A42,172-73, 46,319. Its customers grew fidgety. In April 2001, Seagate cautioned Marvell that "putting all its eggs in one basket with iterative coding" was "risky" and that "Marvell is falling behind … in signal to noise ratio," A46,502; *see* A35,088, 42,174-75, the measurement that is the "life blood" for Marvell's customers, A42,138-39.

Marvell was years down the wrong path before it realized its folly. A163. Its iterative chip consumed so much power that it melted. A33,979-80, 42,175-76. Gallows humor set in. Marvell executives dubbed it the "coffee warmer." A42,175-76; *see* A14,844, 35,089. Or the "Corvair, … unsafe at any speed." A33,980. A senior Marvell executive

acknowledged that mistakes like this make "companies go out of business." A33,978-81.

The reason is that for Marvell's customers, picking a chip for a generation of hard drives is not like buying a suit off the rack. "[E]very chip that Marvell designs for a customer is specifically aimed for that particular customer"—they are "custom devices," A42,124. Thus, Marvell competes for "design win[s]," which are awarded (or not) only after "a lengthy, expensive sales cycle." A234. Component sellers like Marvell must participate in this sales cycle to obtain "design win[s]" to have any chance of shipping "large quantit[ies]" of its chips to manufactures for inclusion in a product line. A42,122; *see* A42,156. Sales cycles last three to four years, A42,122, and entail "formulat[ing] the concepts and basic designs, research[ing] and develop[ing] new products, [and] refin[ing] and evaluat[ing] chip designs," A234.

The stakes are astronomical. "[A] design win is generally a winner-take-all affair …." A234. The winner not only "becom[es] the exclusive supplier for the customer's specific hard drive"; it also gains an advantage for future "generation[s] of hard drives." A234; *see* A42,124. Marvell stipulated it could never make volume sales without

a design win, and it could not get a design win without dominating the lengthy U.S.-based sales cycle. A43,653-55, 45,443-47, 46,232. If a company "misses one" design win "it's pretty serious." A42,158. Miss another and "it could be fatal." A42,158.

Marvell's "coffee warmer" wager put it dangerously behind. A42,175-76. Even as "the market was going up"—and the number of competitors was dropping—sales of successive generations of Marvell's chips were falling. A43,066; *see* A35,355, 43,076, 43,151-53. Finding a solution meant "life or death." A42,127.

Marvell's solution: Copy CMU. In 2001, Gregory Burd, a Marvell engineer, read two papers in which CMU's inventors described their detector. A44,716; *see* A46,101-20. The papers were "virtually identical to what's described in the CMU patents." A41,775, 41,784-87; *see* A34,919-24.

The copying was blatant. Marvell's circuits look like "a cut and paste of Figure 3-B from the ['839] patent," A41,814, and Burd and other Marvell engineers put *Kavcic's name* all over the solution they were implementing. Burd named the first simulator he developed, "kavcicViterbi.cpp," A45,749-62; *see* A41,761-62, 46,399, and conceded

that the software "contains the implementation … of the IP which is taught in Professor Kavcic's paper, and consequently, in his patent," A41,875; *see* A23,031, 35,007. Then, Burd developed the "KavcicPP" (for "post processor"), reiterating that he had developed a "sub-optimal version of Kavcic's detector." A46,543. In January 2002, Marvell's top signal-processing engineer finally pronounced Marvell's iterative detector a "lost cause." A35,030; *see* A46,554. He directed engineers to "wrap up [the failed effort] as soon as possible" while still "[c]ontinu[ing] work on non-linear detector based upon Kavcic's model." A35,090; *see* 46,554, 41,764-65, 46,139, 46,146, 46,541.

Marvell charged ahead, fully aware that CMU had patented Kavcic's invention. Burd warned Marvell executives twice. First, in the email accompanying his write-up of the "KavcicPP," he admonished his superiors "Kavcic's detection scheme is patented (assignee: Carnegie Mellon Univ., 2001)." A46,542; *see* A41,781. Later, he virtually grabbed them by their lapels: "as I mentioned earlier, Kavcic detector is also patented." A46,548; *see* A41,782. But Marvell had to use CMU's invention or risk going out of business. A42,121, 42,162-71. So it ignored Burd's warnings.

Marvell barreled past other warnings, too. In August 2003, CMU sent Marvell two letters observing that "there has been an upsurge of interest … in correlation-sensitive adaptive sequence detectors," and noting that CMU held two patents on such technology and offering a license. A46,980; *see* A46,981. Marvell never responded. A167. In November 2004, Fujitsu, a Marvell customer, demanded Marvell's "opinion regarding [the] relationship between CMU's Patents and … Marvell's [read] channel." A47,038. No response. A167. Marvell did nothing to investigate. No one even read the patent claims. A196, 44,748.

Instead, Marvell tried to cover its tracks. It filed a patent application on the "KavcicPP" "claiming a suboptimal method to CMU's patents," A146—a knock-off that practiced CMU's claimed steps, A41,763, 41,770-73. Then, in January 2003, Marvell renamed its detector, from "KavcicPP" to "Media Noise Processor," or "MNP." A35,051; *see* A41,788-89, 46,780-82. A Marvell engineer assured his colleagues that only the name changed: "there is *no functional difference*." A35,051; *see* A41,789, 46,782. The MNP was Marvell's first

generation of chip incorporating CMU's method. Marvell sold about 1.3 billion of them. A38,635.

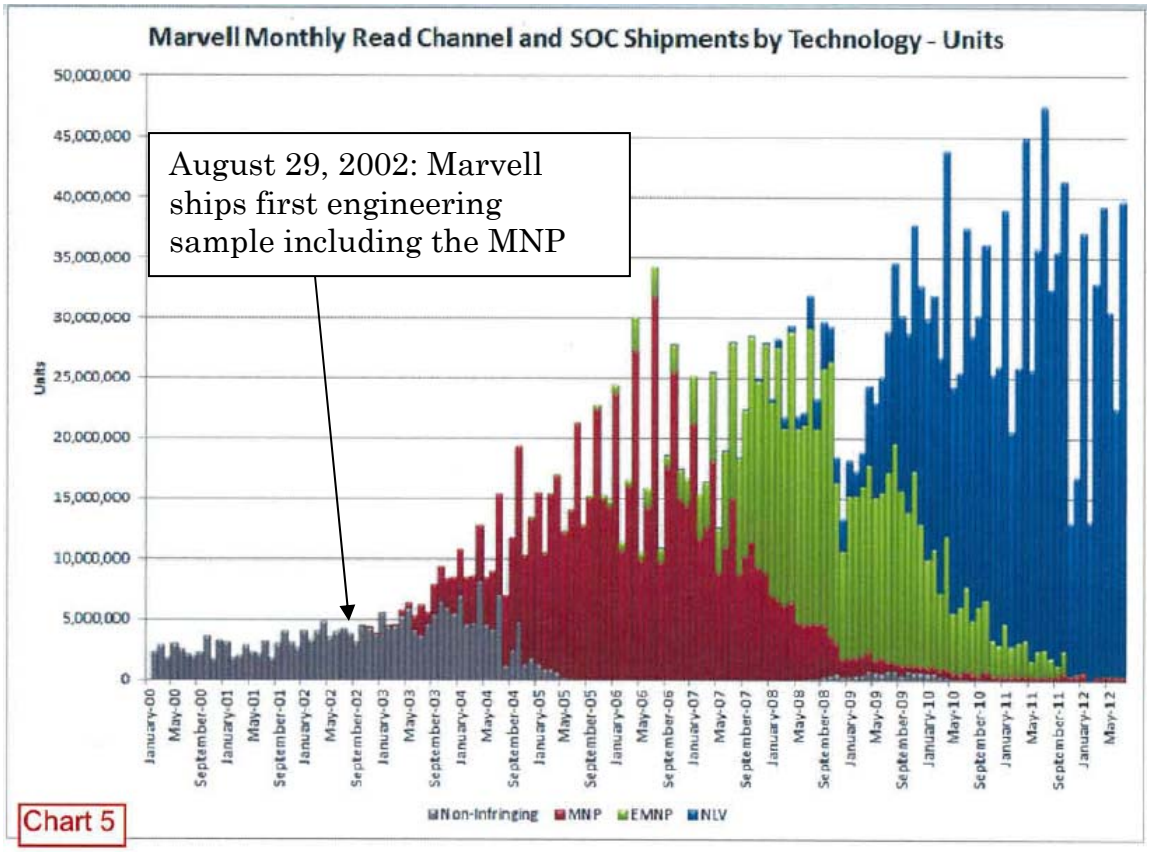
Next, Marvell doubled down on its copying. It incorporated CMU's method into a second-generation detector, which it called the "Non-Linear Detector" ("NLD"). A164, 188-90, 41,845, 41,855-56. In a January 10, 2003 email, Zining Wu, Marvell's lead signal-processing engineer, described the NLD as "the original structure that Kavcic proposed in his paper." A46,779.

Rampant Use Of The CMU Method Propels Marvell To The Top

Marvell rushed its MNP (f/k/a KavcicPP) to market. A43,067. "[W]e *must have* MNP … ASAP to be competitive," declared one Marvell executive in June 2002. A35,093; A46,674; *see* A46,621 (April 2002 Marvell email: "We *need to have* [MNP] to Toshiba by early to mid August!!"), 46,710 (August 2002 Marvell email: "MNP … is [a] *critical requirement* for Hitachi and Fujitsu"). Marvell told customers that the "only" or "key" difference between the old chips (88C5575 and 88C7500) and the new chips (88C5575***M*** and 88C7500***M***) was the addition of the MNP. A43,339-40, 46,630-34. Customers almost immediately abandoned those old chips. A35,597, 38,640; *see* A38,647-48. Marvell

never took another detector to market without CMU's invention. A38,651. It had no noninfringing alternative. A41,896-901, 43,119, 43,160-83.

Marvell's copying reversed its death spiral. Sales "increased rapidly." A43,061. Marvell's sales of chips without CMU's patented method (gray bars below) were dwarfed by sales of chips with it (green, red, and blue), quickly dwindling to zero as Marvell abandoned chips without CMU's method:



A38,637 (explanatory label added); *see* A38,638-39, 43,066. These skyrocketing sales—2.35 billion chips in all, A6—resulted from over 40 design wins that Marvell secured for chips incorporating CMU's method. A38,651.

Marvell marveled at how CMU's technology drove its success. In 2007, Marvell still described CMU's invention as a "must," A47,425; in 2008, it announced internally that the MNP "helped firmly establish Marvell as the market leader in the HDD IC business," A47,567-69. *See* A42,169, 42,187-93.

"[W]ith the exception of the chip making, which [happens in] a foundry in Taiwan, all the activities related to designing, simulating, … testing, evaluating, qualifying the chips by Marvell as well as by its customers occurs in the United States." A42,159; *see* A42,161. These U.S. activities included "closing the deal" on every design win. A34,015.

Marvell could never have secured those design wins without using CMU's method in the U.S. countless times at every step—literally, there is no way to count. The district court put the U.S. uses at "hundreds of millions of times *per second*," resulting in *trillions* of "infringing uses, *per single chip* or simulator, *per day*." A236. That is

for one chip. Marvell typically does not secure a design win until it has shipped one million chips. A42,289; *see* A42,293, 42,994.

CMU Sues Marvell And Proves Willful Infringement

Marvell was beginning to ride CMU's invention to dominance when CMU heard rumors, in mid-2003, that "chip vendors [we]re building chips" like the ones CMU had patented. A53,740. That was when CMU sent its unrequited letters to Marvell (and 13 other companies) informing them of its patents. A87-88; *supra* 24. But without access to Marvell's engineers or its circuit diagrams—which Marvell admits it never would have shared—it was impossible to determine how Marvell's circuits worked. A41,812-13, 42,117-19, 44,025-28. Not until Kavcic saw Marvell's patent in 2006—and realized it depended on CMU's method—did CMU have evidence that the rumors might be true. A41,667-77.

On March 6, 2009, CMU sued Marvell for infringement. Over the ensuing years, the district court invested extraordinary time and energy in this case. It heard a seven-hour tutorial and conducted a two-day *Markman* hearing. A175. The trial lasted 20 days. A177-78. Ultimately, the jury found that Marvell had directly and indirectly

infringed both patents, and that those patents were valid. A34,179-83. It found that Marvell had actual knowledge of both patents when it began infringing, lacked any objectively reasonable defense, and knew (or should have known) that its actions would infringe. A34,184-86. The jury awarded damages of 50¢ per chip—$1.17 billion for the 2.35 billion chips Marvell sold. A34,184.

After the verdict, the court considered extensive briefing, held two full days of hearings, and ultimately issued more than 300 pages of opinions. A4-305. It determined that Marvell had willfully infringed, A228-29, and enhanced damages by 23%, A19, 45-49. The total judgment was $1,535,889,387.60. A1-3.

SUMMARY OF ARGUMENT

Substantial evidence—much from Marvell's own documents and witnesses—supports the verdict. The record compels the conclusion reached by both the jury and the court; Marvell did not just infringe, but did so willfully: It knew of CMU's patents, failed to investigate, and failed to remediate its behavior. That behavior cannot be excused by the defenses Marvell ginned up for litigation, which were not only unpersuasive, but implausible. Any suggestion that Marvell was

unaware of its infringement is belied by the fact that its engineers "worked on multiple projects bearing Kavcic's name." A230.

The jury awarded damages commensurate with the value Marvell obtained from its wrongful use: Marvell's massive infringement saved its business. The district court and jury considered and properly rejected each of Marvell's challenges to the admissibility and sufficiency of CMU's expert testimony. The only actual *legal* challenge Marvell raises to the damages award—that it amounts to an extraterritorial application of U.S. law—founders on longstanding precedent and the undisputed evidence that Marvell not only conducts its sales cycle in the U.S. but that the resulting design wins (i.e., the sales) occurred here as well.

The district court properly rejected Marvell's laches defense based on this Court's repeated holding that laches will not rescue an infringer who engages in conscious copying of another's intellectual property, even if the elements of the defense are otherwise established.

STANDARD OF REVIEW

Anticipation is a question of fact and the jury's finding must stand if it is supported by substantial evidence. *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1323 (Fed. Cir. 2002).

"Obviousness is a question of law based on underlying factual findings …." *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012). Once the factual disputes underlying obviousness go to the jury, "[t]he question … becomes whether the jury verdict of nonobviousness was supported by substantial evidence." *Group One, Ltd. v. Hallmark Cards, Inc.*, 407 F.3d 1297, 1304 (Fed. Cir. 2005).

Under Third Circuit law, the court's denial of JMOL must be affirmed if "there is sufficient evidence to support the verdict, drawing all reasonable inferences in favor of the verdict winner." *Blum v. Witco Chem. Corp.*, 829 F.2d 367, 372 (3d Cir. 1987). Similarly, "new trials because the verdict is against the weight of the evidence are proper only when the record shows that the jury's verdict resulted in a miscarriage of justice or where the verdict, on the record, cries out to be overturned or shocks our conscience." *Williamson v. Consol. Rail Corp.*, 926 F.2d 1344, 1353 (3d Cir. 1991).

This Court has held that the willfulness inquiry under 35 U.S.C. § 284 contains objective considerations that are "best decided by the judge as a question of law subject to *de novo* review," and subjective,

factual considerations evaluated by the jury and then reviewed for substantial evidence. *Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.*, 682 F.3d 1003, 1007, 1008 (Fed. Cir. 2012). Based on *Highmark Inc. v. Allcare Health Management Systems, Inc.*, however, the proper standard of review is abuse of discretion because § 284 uses discretionary language similar to that of § 285. 134 S. Ct. 1744, 1748 (2014).

"The Third Circuit reviews a district court's ruling on admissibility of expert testimony for abuse of discretion." *Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc.*, 711 F.3d 1348, 1356 (Fed. Cir. 2013).

ARGUMENT

I. SUBSTANTIAL EVIDENCE SUPPORTS THE JURY'S DETERMINATION THAT THE WORSTELL PATENT DOES NOT INVALIDATE CMU'S PATENTED METHOD.

Marvell undertakes a near impossible task: To challenge the JMOL rulings on validity (addressed here) and infringement (addressed in Point II) Marvell must demonstrate that no reasonable juror could reject those defenses, in the face of the court's willfulness opinion panning each defense as objectively unreasonable. A219-29.

The jury found Marvell's anticipation and obviousness challenges—based on the Worstell patent—unpersuasive. The PTO examiner on reexamination likewise confirmed patentability. *Supra* xiii. The jury was doubtless influenced by Worstell's own exclamation, upon reviewing the invention disclosure that led to the asserted claims, that CMU's invention "goes beyond my work and is probably more interesting." A46,099; *see* A34,881-87, 42,360-65, 44,959-62. In this battle of experts, the jury credited CMU's McLaughlin over Marvell's Proakis. The district court explained why: "Dr. McLaughlin methodically laid out his opinions, cited the underlying factual support, [and] explained his reasoning with drawings and demonstratives," as compared to Dr. Proakis's "hurried, sometimes disjointed" testimony. A210-11; *see* A35. Plus, the jury likely rejected every word Proakis uttered because (as explained below) he was exposed to be misleading and self-contradictory. Nothing in Marvell's brief overcomes the jury's prerogative to credit the more persuasive witness.

A. Substantial Evidence Supports The Jury's Determination That Worstell Does Not Anticipate CMU's Patents.

Worstell does not anticipate unless it "describes each and every limitation set forth in the [asserted] patent claim[s]." *Trintec Indus., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295 (Fed. Cir. 2002). Marvell's attack on the non-anticipation verdict begins, inauspiciously, with a misstatement: that the district court failed to "identify a single element of the CMU claims not anticipated by the Worstell patent." OB31. The court identified two: (1) a "set of signal-dependent branch metric functions" and (2) applying a selected function to a "plurality of signal samples." A210-12.

In arguing that Worstell satisfies these limitations, Marvell presents its expert testimony as gospel, while scarcely acknowledging the evidence that demolished him. A44,941-45, 44,953-62.

"Set of signal-dependent branch metric functions." CMU presented substantial evidence that Worstell does not disclose *any* "signal-dependent branch metric function[]," much less "a set of" them. A211.

Marvell begins by arguing (OB35-36) that Worstell's Equation 20 is a signal dependent branch metric function, so that it (with another function discussed immediately below) is *part of* the required "set." Marvell never asserted this before—probably because its own expert admitted Equation 20 is *not* a signal-dependent branch-metric function. A44,661-62; *see* A35,604-05. Equation 20 applies the same filter (with a fixed set of tap weights) across all trellis branches. A44,944-45, 44,953-54. As Kavcic explained, such a function—which assumes each branch has the same noise structure regardless of the specific sequences of symbols leading up to it—is not "signal-dependent." A41,375-78. This creates the "Whack-a-Mole" problem the inventors were trying to avoid: Optimizing a single filter for one branch makes the problem even worse for other branches. A41,374-78; *supra* 15.

Next, to make the requisite "*set*" of "signal-dependent branch metric functions," Marvell re-asserts the argument it *did* make below: It isolates three sentences in Worstell—referring to a "further modified" metric. OB34-36. The jury justifiably rejected that argument for several reasons.

First, CMU demonstrated that Proakis misrepresented Worstell's "further modified" metric by adding to Equation 20 (in blue) a new term (highlighted in yellow):

Further modified branch metric:

$$B_{b,nt} = [X^2_{b,nt} - 2X_{b,nt} \sum X_{b,(n-i)t} W_i] \times [1/\sigma^2_{b,nt}]$$

Worstell Patent, Eq. 20 + 10:48-67

A34,380. As McLaughlin testified, "This is a made-up equation, this entire thing; it doesn't appear in the [Worstell] patent." A44,957. The jury learned that Proakis's contrary testimony was "misleading," A44,958, since Worstell teaches that its "further modified" noise term is *constant* across all branches (disproving Proakis's assertion that it varied), A53,697, col. 10:59-60; A44,957-58. Indeed, before trial, Proakis conceded that Worstell's "further modified branch metric" is "a 'single' branch metric function and not a 'set' of branch metric functions." A35,421, 44,667-69. Thus, Worstell's "further modified metric," is not, itself, a "set." A44,956-59.

Second, Worstell's "further modified" metric only "take[s] into account *transition noise*"—i.e., a change in polarity—not signal-dependent noise, A53,697, col. 10:48-59, as required by CMU's claims.

Marvell itself called it a "*transition* noise adjustment." A44,955-56. A single transition is not the same as a specific sequence of symbols before or after that single transition. CMU's expert explained: "The Kavcic invention is … intended to compensate for or address noise associated with a specified sequence of symbols, *not just say one transition*." A44,943. "[Worstell] doesn't do that." A44,957. In fact, Worstell's approach is "inappropriate for the present problem" addressed by the CMU patents. A451, col. 3:51-64. In our miner analogy, Worstell's transition noise adjustment would consider only whether there was a change in the tunnel's slope but not the direction of that change nor the sequence of preceding tunnels.

"Plurality of signal samples." Worstell's transition noise adjustment is also not applied "to a plurality of signal samples." A456, col. 14:15-16; *see* A481, col. 15:47-48. Addressing this limitation, Marvell merely quotes a passage of Worstell that refers to "one or more previous signal samples." A53,693, col. 2:4-5. But Marvell ignores McLaughlin's testimony that Worstell "doesn't say anything about" the "application of the transition noise adjustment to [a] plurality of signal samples." A44,959.

B. Marvell's Perfunctory Obviousness Argument Is Both Waived And Meritless.

Marvell makes a three-sentence, drive-by assertion that CMU's invention "would have been obvious, in view of Worstell's disclosure, or in view of the work of Zeng and Lee." OB36. "Such a conclusory assertion[,] unaccompanied by developed argumentation[,] does not preserve the issue for appeal." *Ajinomoto Co. v. ITC*, 597 F.3d 1267, 1278 (Fed. Cir. 2010); *see Voda v. Cordis Corp.*, 536 F.3d 1311, 1324 (Fed. Cir. 2008).

In fact, Marvell's argument is doubly waived because Marvell did not present an obviousness theory based on Zeng and Lee at trial. A44,651 (Marvell relied on "*a single reference* ...."); A44,656 (Marvell based obviousness on "*this patent*"—i.e., Worstell); A21,174-93 (Marvell's pretrial brief omits Zeng and Lee); A33,835-56 (Marvell's JMOL relies on Worstell and references Zeng and Lee as background); A44,634-36, 44,639 (Proakis likewise does not rely on combination with Zeng and Lee or testify on motivation to combine); *see Golden Bridge Tech., Inc. v. Nokia, Inc.*, 527 F.3d 1318, 1322-23 (Fed. Cir. 2008) (refusing to consider invalidity theory raised for the first time on appeal).

Even were the Court to consider Marvell's sparse and untimely argument, Marvell fails to overcome the extensive evidence that CMU's innovation was not obvious. A213; *see* A41,783-84, 41,879-82, 44,959-62 46,097-100. Nor can Marvell wish away the volumes of evidence of secondary considerations—which can "constitute independent evidence of nonobviousness ... and enable the court to avert the trap of hindsight," *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013) (quotations and citation omitted)—merely by declaring that "the evidence at trial shows an absence of secondary considerations." OB36. As the district court observed, CMU "explicitly listed examples of indicia to show non-obviousness," but "Proakis did not rebut" this testimony. A213.

II. SUBSTANTIAL EVIDENCE SUPPORTS THE JURY'S FINDINGS OF INFRINGEMENT.

As with validity, the district court did not just determine that "CMU presented sufficient evidence" that Marvell's "MNP[] and NLD chip technology and the Accused Simulator technology use a method that includes each and every method step" of the asserted claims. A193. It observed that "CMU's trial presentation on th[is] issue[] was very strong," A35—particularly since CMU presented "credible evidence"

that Marvell "deliberately copied CMU's Patents" every step along the way to developing its chips and simulators. A22; *see* A230-31. Accordingly, the court did "not believe that the issue[] of infringement ... w[as] close," A35, to a point where it found Marvell's noninfringement position to be objectively unreasonable, A220-26.

Here, again, Marvell is urging this Court to reweigh the evidence.

A. Substantial Evidence Supports The Jury's Finding That The NLD-Type Chips Infringe.

Marvell contends that the NLD-type chips do not infringe because they do not "appl[y] … the selected branch-metric function to a plurality of signal samples to determine branch metric values for branches in a trellis." OB39. This argument depends on Marvell's effort to draw a box around the FIR filters in these chips and label them "pre-filter circuit[s]" that are not part of the detector. OB39-40. Because CMU presented substantial evidence that the FIR filters *are* part of the detector—i.e., the circuitry that computes branch-metric values—Marvell's argument fails.

As CMU expert McLaughlin explained, the NLD has multiple FIR filters. Each filter is used in calculating a branch-metric value for a branch of the trellis. A41,847-57; *see* A34,976-87, 41,993, 47,353-54.

McLaughlin directly refuted Marvell's argument that the branch-metric computation occurs outside the NLD circuit, opining that the FIR filters and the rest of the NLD circuit "are actually not separate; they're all together." A41,856. It does not "matter whether or where Marvell's lawyers draw the box," he confirmed. A41,856.

Marvell's own evidence supports McLaughlin's conclusion. For example, Marvell admitted that the NLD's FIR filters perform "noise whitening." A34,979; *see* A47,420. Marvell further admitted the "noise whitening filter" is "a *parameter of [the] branch metric function*" that is used to determine a branch-metric value. A41,857; *see* A34,984, 34,987, 41,853-54, 44,044, 44,048. That means that the NLD's noise-whitening FIR filters are part of the branch-metric computation.

Marvell's engineers acknowledged as much years earlier. In 2003, Wu wrote that using a different noise-whitening filter for each branch was, in fact, "the original structure that Kavcic proposed in his paper." A46,779. While Marvell now claims that it ultimately implemented a variation of that approach, OB40, its 2006 "Application Note" for the NLD stated that the NLD "has *noise whitening built into the branch*

metric (BM) calculation." A34,979; *see* A47,420. That is enough to support the jury's finding.

In the face of all this, Marvell argues only that it moved the filters "out of the trellis." OB40. The claims do not recite filters "in a trellis," which is a non sequitur.[3] A trellis is not a circuit diagram, but "a *graphical representation* of the progression of states of a communications channel in time" as in Figure 4 of the patents. A790, 45,464. It merely depicts branches for which circuits—like the NLD or Figures 3A-3B—determine branch metric values. In any event, McLaughlin testified that Marvell's chips, including the "noise whitening" FIR filters of the NLD, are "built into" the "branch calculation[s] for every branch of the trellis." A41,849-50.

B. Substantial Evidence Supports The Jury's Finding That The MNP-Type Chips Infringe.

McLaughlin meticulously mapped CMU's claims onto the MNP chips. A34,941-65, 41,805-31 46,586-88, 47,920, 47,923-24, 53,555. In response, Marvell never says what limitation its MNP circuit fails to

[3] The word "trellis" does not appear in claim 2 of the '180 patent. While the preamble of claim 4 of the '839 patent refers to "determining branch metric values for branches *of* a trellis," it does not recite that the determination must be done "in a trellis," whatever that means.

satisfy. Instead, as with the NLD, Marvell's argument rests entirely on where it has chosen to "draw the box." A41,856.

The keystone of Marvell's argument, again, is the notion that "CMU's claims require" that "the determination of a branch metric value" for all the branches must occur "*in a trellis*," OB41, 42, 43—and that that is missing from the MNP. That argument fails here for the same reason it failed for the NLD: The claims require no such thing and a trellis is a graphical representation, not part of a circuit. *Supra* 42.

Marvell draws another artificial box when it asserts that the MNP "use[s] a post-processor," not a detector, to calculate "the difference between two path metrics." OB42. But it is undisputed that post-processors can be Viterbi-like *detectors*. A3743-49. Furthermore, McLaughlin explained (quoting Marvell's own documents) why the MNP's post-processor is a detector that computes branch-metric values for branches of a trellis. A41,816-19; *see* A46,567, 46,583, 46,963, 47,025, 47,927.

Marvell's own witnesses confirmed McLaughlin's testimony. Marvell's lead engineer agreed that "BM," as used in Marvell's own

"official" and "accurate" MNP specification, stands for "branch metric." A44,017-20; *see* A46,587-88. Marvell concedes as much (OB42), but insists that its own technical documents "should have been given no weight," OB43-44, in defiance of the many cases holding a fact finder may rely on "admissions of a party, whether in the form of marketing materials or otherwise" to decide infringement. *E.g.*, *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1351 (Fed. Cir. 2007); *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, 761 F.3d 1329, 1343 (Fed. Cir. 2014).

Marvell's witnesses also confirmed McLaughlin's testimony that the MNP computes path metrics, and that if the detector computes path metrics, it necessarily determines branch metrics for branches of a trellis. A44,016-20, 44,539-40. Marvell even admitted that in its MNP circuitry "a few … of the branches metrics are calculated." A38,707; *see* A18,435.

The jury was not required to reject all this evidence in favor of a seven-word excerpt from a 2001 Kavcic email suggesting that his invention is "in a trellis and NOT in [a] post-processor." OB41. Indeed, the district court rejected Marvell's attempt to limit the scope of the

claims based on this email. A3745. Further, Kavcic was comparing his work to a particular prior art post-processor, A41,630-32, not analyzing Marvell's MNP chips (as McLaughlin did). The jury was entitled to credit Kavcic's explanation that his invention includes post-processor implementations, and that the email commented only on a specific prior art post-processor that was very different from the MNP. A41,631-32.

C. Substantial Evidence Supports The Jury's Finding That The Simulators Infringe.

Marvell contends that its simulators do not infringe because they "are incapable of detecting actual signal samples," but merely use "copies of actual wave forms"—which, it says, means its simulators are not detectors. OB44. Using Marvell's documents, McLaughlin testified that Marvell's simulators "work on actual wave forms captured from real hard drives." A41,882; *see* A46,724-27, 47,042, 47,049. Dr. Christopher Bajorek, CMU's expert on the hard drive industry, similarly testified that simulators "consist of mathematical programs, that run on computers, *that process real signals*." A42,130. The jury was entitled to credit this evidence.

That is what distinguishes *Harris Corp. v. Ericsson Inc.*, 417 F.3d 1241, 1256 (Fed. Cir. 2005) (discussed at OB44-45). *Harris* held that a

"flow chart" describing a "simulation program" was insufficient to prove infringement of a claim that required the use of physical communications components, especially as there was no evidence that the claimed method was actually carried out when the accused infringer "runs this program." *Id*. at 1256. But here, consistent with the patents' express teaching that the claims can be carried out "on a computer," A455, col. 11:20-29, CMU adduced ample evidence that the simulators actually detect data from "real signals" while performing CMU's method, A42,130. *See* A34,993-35,005, 41,864-74, 41,882-84, 45,967-68, 46,724-34, 47,042-49.

III. THE DISTRICT COURT CORRECTLY DETERMINED MARVELL'S INFRINGEMENT WAS WILLFUL.

A. Marvell Disregarded An Objectively High Likelihood Of Infringement.

Marvell attacks the district court's willfulness finding without addressing the overwhelming evidence of its deliberate misbehavior. As the court documented in a lengthy opinion, CMU adduced plentiful evidence establishing objective recklessness.[4] A214-32.

[4] After *Octane Fitness, LLC v. Icon Health & Fitness, Inc.*, the proper standard is proof by a preponderance of the evidence. 134 S. Ct. 1749, 1758 (2014). *Octane* rejected the clear-and-convincing standard

1. Willfulness is akin to "reckless behavior"—acting "despite an objectively high likelihood that [one's] actions constituted infringement of a valid patent." *In re Seagate Tech., LLC*, 497 F.3d 1360, 1371 (Fed. Cir. 2007) (en banc); *Bard*, 682 F.3d at 1005. An infringer (like any other tortfeasor) behaves recklessly when it "wholly disregards the law … without making any reasonable effort to determine whether the plan [it] is following would constitute a violation of the law." *TWA, Inc. v. Thurston*, 469 U.S. 111, 126-27 (1985) (cited in *Seagate*, 497 F.3d at 1371).

Marvell exhibited multiple telltale signs of recklessness. First, Marvell had actual knowledge of CMU's patents, which is particularly salient when, as here, the infringer sets out to develop technology with "highly similar functionality." *i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 860 (Fed. Cir. 2010); *K-Tec, Inc. v. Vita-Mix Corp.*, 696 F.3d

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previously applied under § 285: "patent litigation has always been governed by a preponderance of the evidence standard," which is "the 'standard generally applicable in civil actions.'" *Id.* The same logic applies to § 284. *Octane Fitness* also rejected this Court's "unduly rigid" test for exceptional-case findings under § 285 in favor of considering the "totality of the circumstances." *Id.* at 1755-56. Like § 285, § 284 commits the relevant determination to the district court's equitable discretion. Given Marvell's flagrant disregard of CMU's patent rights, CMU's proof is ample under any substantive standard or standard of proof.

1364, 1378 (Fed. Cir. 2012). Marvell's engineers read the papers describing the CMU invention and knew that the patents "generally follow[ed] the papers." A41,785; *see* A23,040, 34,919-24, 41,773-75, 41,875. Marvell decided to copy the method into its chip designs and use it innumerable times anyway. A41,746-48, 41,761-90, 45,749-62.

Second, Marvell "fail[ed] ... to investigate the … patent situation." *Spectralytics, Inc. v. Cordis Corp.*, 649 F.3d 1336, 1348 (Fed. Cir. 2011); *see Clontech Labs. v. Invitrogen Corp.*, 406 F.3d 1347, 1357 n.6 (Fed. Cir. 2005) (failure to investigate "prior art and other information bearing on the quality of the patents" supports willfulness finding). Proceeding without taking even the slightest precaution is classic recklessness. Burd twice told Marvell's most senior engineering executives about CMU's patents. A46,542, 46,548. CMU invited Marvell to license the patents, and a customer requested an investigation. *Supra* 24. Yet, no one at Marvell bothered to read the patent claims, much less the file histories. A34,027-31; *see* A217-18, 44,344, 44,748-49. Instead, they buried their heads in the sand, disregarding a corporate policy requiring consultation with counsel about possible infringement. A218, 34,017-18. *Cf. Provenz v. Miller*,

102 F.3d 1478, 1490 (9th Cir. 1996) (disregard of "own internal policy for recognizing revenue" is probative of recklessness in securities fraud action).

Third, Marvell not only failed to remediate its infringement, it doubled down when it developed its NLD chip. *Supra* 25; *see* A41,842-46, 46,779. Aware that "the media noise problem is not going to go away," A41,902-03; *see* A35,032, Marvell neither developed an alternative technology nor took a license. As the court put it, "Marvell has continued to unabashedly infringe," A39; *see* A35,032, thereby "demonstrat[ing] Marvell's apparent acceptance of the business and legal risks," A143; *see i4i*, 598 F.3d at 860; *K-Tec*, 696 F.3d at 1378.

2. Marvell admits it was staring right at CMU's patents as it drove over them. OB71. It seeks to excuse its reckless behavior with defenses it ginned up for litigation. OB68-71. We explained (at 32-46) why the jury properly rejected them. But the defenses were worse than wrong: They were so utterly implausible that no "reasonable litigant could [have] realistically expect[ed]" them to succeed. *Bard*, 682 F.3d at 1008; *see* A219-28.

Marvell starts (OB68) with an anticipation defense so weak that it abandoned it for trial and does not describe it to this Court. It argues that this defense *must have* been objectively reasonable because the district court thought it "a 'close call' on summary judgment." OB68. As the district court explained (twice), that comment was irrelevant. A226, 24,632. Legal arguments that look good on paper may be factually false. The court did not "flip-flop[] on the *legal* merits of Marvell's invalidity defense." OB70. It considered Marvell's abandonment as part of "the record ultimately made." *Bard*, 682 F.3d at 1008 (internal quotation marks omitted). The court justifiably inferred that Marvell abandoned the defense because Marvell concluded that the defense was even weaker than the objectively unreasonable defenses it did present.

Marvell cites no support for its assertion that a court must find a defense objectively reasonable without regard to the facts asserted in support. If anything, the depth of analysis in the cases Marvell does cite (OB68-69) refutes Marvell's rule. *See DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1336 (Fed. Cir. 2009) (finding defense reasonable only after reversing summary judgment on

noninfringement and assessing extensive trial record); *Cohesive Techs., Inc. v. Waters Corp.*, 543 F.3d 1351, 1374 n.4 (Fed. Cir. 2008) (affirming finding of no willfulness based on its own conclusion that "claim construction was a sufficiently close question").

The defenses Marvell did put before the jury proved paper thin too. Its anticipation defense was based solely on the testimony of Proakis, who read the words "further modified" as a license to *make up* an equation flatly contradicted by the plain language of the Worstell patent. A44,647-48; *supra* 36. Recall that even Worstell thought CMU had invented something "beyond my work and … probably more interesting." A46,099; *supra* 33. The jury also heard Proakis contradict his sworn declaration, A44,667-70; *see* A35,421-22, and McLaughlin testify that Proakis's fabricated equation was "very misleading," A44,958; *supra* 36.

Marvell's noninfringement defenses were equally implausible—premised on where lawyers drew boxes, and contradicted by Marvell's own documents and employees. *Supra* 39-46. It was just not reasonable for Marvell to construct an entire noninfringement strategy around a single email that it never even saw before this litigation, *see*

OB71—particularly where the court held before trial that the intrinsic evidence "contradicted" Marvell's interpretation, A3745, and the email's author easily refuted Marvell's self-serving interpretation, A41,630-32.

Marvell argues that the district court improperly "deferr[ed] to the jury on objective willfulness." OB69. This imagines away the court's actual holding: "[T]he Court has considered the whole record, including all of the evidence; the jury's verdict on infringement and invalidity; Marvell's knowledge of the patents, and the reasonableness of their defenses; along with the jury's advisory verdict on objective reasonableness." A229. It said it was acting "as final arbiter" in finding "that Marvell acted in disregard of an objectively high likelihood that its actions constituted infringement." A229. This came after a lengthy—and accurate—recitation of the judge's and jury's respective roles based on this Court's decision in *Bard*. A221, 224, 227-29.

Marvell also complains that the district court "fault[ed] Marvell for maintaining attorney-client privilege rather than 'raising advice of counsel.'" OB69. What the court faulted was Marvell's attempt to imply that it had consulted counsel all along, after asserting repeatedly "that it is not raising advice of counsel as a defense," A222. Given

Marvell's conduct, the court correctly refused to let Marvell off the hook for inventing weak defenses long after the fact.

B. The Jury Properly Found Subjective Willfulness.

The conclusion that Marvell acted willfully finds further support in the fact that the infringement risk here "was either known or so obvious that it should have been known to" Marvell. *Bard*, 682 F.3d at 1005; *see Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2068-69 (2011). This is a jury question, *Bard*, 682 F.3d at 1008, which this jury answered affirmatively, A34,185-86.

Selectively citing the record, Marvell argues that it "took care to work around Kavcic's algorithm en route to its own patentable solution." OB71. A patent-savvy entity like Marvell knows (and admitted, A24,145), that having its own patent is not an infringement defense. As the district court understood, the patent "was merely a 'smoke screen' designed to mask [Marvell's] true infringing conduct from the outside world." A146.

What matters, in this posture, are the facts the court emphasized and Marvell does not refute: "Marvell's engineers worked on multiple projects bearing Kavcic's name, clearly indicating that those engineers

were aware that Dr. Kavcic had a hand in creating this technology. Moreover, Marvell's failure to investigate the patents despite the high likelihood of infringement militates against a finding that it had a subjectively reasonable basis for believing that it was not infringing or that the patents were invalid." A230. Marvell made the calculated judgment that the very high risk of an infringement verdict—if it ever got caught—was better than the certainty of imminent demise.

IV. THE JURY PROPERLY AWARDED DAMAGES COMMENSURATE WITH MARVELL'S MASSIVE INFRINGEMENT.

A royalty of $1.17 billion may seem large in absolute terms, but not when considered in light of the magnitude of the infringement, Marvell's dire circumstances, and the invention's pathbreaking value. CMU is entitled to no "less than a reasonable royalty for the *use … of the invention [made] by the infringer*." 35 U.S.C. § 284. When you use an invention

trillions of times a day

for millions of chips

for a decade

to secure 40-plus design wins—

and the result is

> the sale of 2.35 billion chips
>
> that saves you from near-fatal ruin à la the Corvair
>
> and indeed propels you to market dominance—

well, the royalties should be big. *Supra* 25-28. CMU did not argue (indeed, was not allowed to argue, A24,643-44) that it was entitled to a substantial award because Marvell earned $10.34 billion—and $5.05 billion in operating profits—as a result of its infringement. Instead, CMU put forward, and the jury based its award on, rigorous expert testimony that, under the circumstances, a 50¢ royalty was reasonable for a chip that, on average, sold for $4.42 and earned Marvell $2.16 in operating profits. A62, 43,002-03.

The jury understood that Marvell had no alternative to CMU's technology. A14,844, 33,979-80, 35,026-31, 41,896-902, 43,160-81, 43,451-52, 46,260-61, 46,514, 46,540, 46,554. When the hypothetical negotiation would have taken place, in March 2001, Marvell's sales for successive read channel chip models were declining even though the market was expanding and competitors were exiting the business. A38,638-40, 43,063-76, 43,131-34, 43,149-55. And Marvell was already

failing to achieve significant design wins in the rapidly consolidating market. A43,050-55, 51,729. Prospective customers told Marvell that they wanted to move to "Kavcic's model," A46,266, and warned Marvell it was "1 year behind," A46,271, which in this business might as well have been a light-year.

Worse yet, as the jury knew, by then Marvell realized that it had made a disastrous bet on its "coffee warmer." *Supra* 20-21. "[T]he CMU inventions were 'must have' for Marvell's survival as a company," A42,120-21—it was "life or death," A42,127. A company so far behind "would not achieve design wins. And failure to achieve design wins would result in zero chip sales." A42,171; *see* A42,158-59.

Fifty cents per chip is a bargain for the "must-have," A43,080, "cutting edge" technology, A35,009, that would rescue the company from its death spiral, A42,127, and propel it to the top of the market, A47,567-69. *See Finjan, Inc. v. Secure Computing Corp.*, 626 F.3d 1197, 1211 (Fed. Cir. 2010) (when infringer's own documents make clear that the infringed technology is "important" and "next wave," "the jury could infer that a substantial fraction of the accused products' profits

stemmed from" that technology). That is the answer to Marvell's rhetorical question, "How did this happen?" OB2.

But there is more. Marvell's expert and litigation strategy practically compelled the outcome. Like validity and infringement, damages boiled down to a battle of the experts. Here, too, CMU's experts ran circles around Marvell's, with a far more thorough and thoughtful analysis of the relevant evidence. The district court described CMU's Catharine Lawton, in particular, as "remarkable." A261. It had not seen "many witnesses (fact or expert) who have had such a grasp on all the facts and figures of a case." A261.

In contrast, Marvell's damages expert, Creighton Hoffman, "did not offer any analysis of his own of any sales data," A263, nor attempt to apportion the value of the chips' features, A44,107. He "appeared disjointed and did not demonstrate a comparably firm grasp of the facts and data." A270. He insisted that Marvell and CMU would have negotiated a paltry $250,000 lump-sum license, citing collaborative research agreements the court already had warned were "radically different from the hypothetical agreement under consideration." A17,428; *infra* 61-64. Hoffman "did not provide any other contrary

calculations or well-considered alternatives," A270, to Lawton's "in-depth" royalty analysis, A263. *See* A44,125. "In effect, Marvell let CMU create a one-sided expert exposition, because it did not argue for any per-chip royalty." A270. Marvell thus "left the jury in a tough spot, with no reasonable options for a damages award other than $250,000 or $1.169 billion." A270.

Without addressing its need for CMU's invention, and shirking responsibility for its own strategic blunders, Marvell presents a laundry list of attacks on CMU's evidence. They amount to little more than an impermissible demand that this Court reweigh the evidence in derogation of the jury's role—supplemented only by the taunt that "[n]o patent infringement judgment for more than a billion dollars has ever received this Court's imprimatur." OB1. There is no billion-dollar exception to the proper standard of review, which Marvell repeatedly ignores.

A. Compelling Evidence Supports The 50¢-Per-Chip Royalty.

The district court did not merely take its gatekeeping role "seriously," as it said. A33,415; *see* A42,967. It was downright dogged. It held a two-day *Daubert* argument before trial. *See generally* A16,915-

17,366, 17,433-44. Then, in the midst of trial, it held an unusual set of "hearings … which lasted well into the evenings." A33,399. It made CMU's counsel "essentially conduct[] his direct examination of Lawton," in advance, to permit the court to assess that testimony in full before letting the jury hear it. A33,399; *see generally* A42,763-832, 42,983-43,186, 43,301-501. By the time the trial ended, the court had "written over forty pages analyzing [Lawton's] qualifications and methods." A261.

Nevertheless, without so much as a nod to the court's discretion or the deference due to the jury, Marvell contends that Lawton's testimony was both inadmissible and insufficient. OB45-50, 60-66. It was neither.

1. Lawton was qualified to testify.

Lawton has over 27 years of experience consulting and testifying as an expert on damages. A33,403-06, 33,420, 42,765-71. She has worked on nearly 100 intellectual property cases. A33,404-05; *see* A42,766, 42,771. Courts have accepted her as an expert in every case in which she was proffered. A33,405-06, 42,767-68. These credentials easily satisfy the Third Circuit's "liberal" test for admissibility.

Holbrook v. Lykes Bros. S.S. Co., 80 F.3d 777, 782 (3d Cir. 1996); *see Elcock v. Kmart Corp.*, 233 F.3d 734, 743-44 (3d Cir. 2000).

Marvell objects that Lawton "has never negotiated a patent license." OB46. But that is no bar to admissibility; an expert can be "qualified … by … experience" *or* by "knowledge, skill, … training, or education." Fed. R. Evid. 702; *see Knight v. Otis Elevator Co.*, 596 F.2d 84, 88 (3d Cir. 1979). And Lawton has consulted for companies on licensing issues and patent valuation in non-litigation contexts. A33,406-07, 42,794, 42,805-16.

Marvell also complains that Lawton has no "experience with 'technical matters concerning Marvell's business.'" OB46. But "[e]xperts routinely rely upon other experts hired by the party they represent for expertise outside of their field." *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1321 (Fed. Cir. 2014); *see* Fed. R. Evid 703. Lawton appropriately relied on the expert testimony of McLaughlin and Bajorek. A42,800, 42,810, 42,820-21, 42,993, 43,008-09, 43,022-25, 43,057-59, 43,061, 43,073, 43,080, 43,122-23, 43,128-30, 43,164, 43,173. The court concluded that Lawton was "well-versed in the facts" and "very knowledgeable of her subject matter." A33,421.

2. The jury was entitled to credit Lawton's conclusion that the parties would have negotiated a per-unit royalty.

Lawton determined that the parties would have agreed to a per-unit royalty, given their likely desire to share in the potential upside of a growing market and the risk of the market not panning out, so that neither ultimately was over- or underpaid through a lump sum arrangement. A43,350-52. She further testified that both Marvell and CMU frequently entered into running royalty agreements around the time of the hypothetical negotiation. A246, 34,024, 43,353-54.

Marvell contends that the 50¢-per-chip running royalty must fail *as a matter of law* because CMU previously entered into "flat-fee" licensing agreements that covered the patents, and once made a "*speculative* licensing projection" that "contemplated only a flat … rate of $2 million." OB50-51; *see* OB46-47. The jury heard this same evidence—and Lawton's rejoinder—and found the argument unpersuasive, as it was entitled to do. A264-66.

Marvell first invokes the DSSC agreements under which contributing members paid $250,000 *annually* for a membership. A43,428-30. Those same members also invested "several hundred

million dollars" more than that. A42,359; *see* A43,429. One of the benefits they received in return for their ex ante financial support, guidance, and insight was a license to whatever inventions *might someday materialize* during the membership period. The original membership agreements setting the $250,000 annual membership fee all predated the hypothetical negotiation (and the invention) by a decade or more—which is reason enough to discount them. *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 78 (Fed. Cir. 2012).

But contrary to Marvell's suggestion (OB51), neither Lawton nor the court discounted them just because of timing. A265. Lawton explained that the DSSC agreements were nothing like the hypothetical licensing agreement between CMU and Marvell, because they were prospective. A43,085-87, 43,428-30. Bajorek confirmed that DSSC founders like IBM (his former employer) would have access to future inventions "at a very attractive price, with the expectation that once the center was developed, *future possible buyers … would then have to pay market price for* [a] *license*." A42,227. Members paid without knowing what, if any, technology ultimately would even be invented. A17,426-

27. These "radically different" agreements, A17,428, are more like venture-capital funding for a start-up than license agreements for known and proven technology, A42,227-28.

Marvell also touts a "special" 2004 proposal, in which CMU offered to license a portfolio of patents to Intel for $200,000 each. OB46-47. As the district court noted, A265, Lawton considered the proposal and testified that it was insufficiently comparable. A43,419-21; *see* A42,416-19, 43,114-15. Unlike Marvell, Intel would have derived little value from the invention because it was not in the read channel business. A41,299-01. So the offer to license was just an attempt to get Intel's "stamp of approval" for marketing purposes. A41,299-01. Moreover, as one of CMU's biggest financial supporters (over $150 million), Intel was "one of the most important" relationships CMU had "with an industrial partner," A42,416, which certainly cannot be said of Marvell. *See Finjan*, 626 F.3d at 1212 ("multiple differences … permitted the jury to properly discount the licenses").

Marvell claims that Lawton "took no meaningful account of … CMU's own projections valuing the patents-in-suit at $2 million *annually*." OB47. To the contrary, as the court recognized, Lawton

gave those projections ample consideration. A265-66. Lawton rejected them based on the testimony of CMU's Director of Technology Transfer, Robert Wooldridge (which the jury also heard). A43,115. Wooldridge testified the projections were "highly speculative"—as Marvell must acknowledge (OB51)—because they were not "data-driven" and were intended to show numbers "*outside* of [CMU's] normal revenues from existing licenses." A42,420. He testified that this "place holder" estimate was not generated through any actual evaluation of the extent to which Marvell used CMU's invention. A42,536; *see* A42,420-22, 42,550-51.

In sum, neither Lawton nor the district court was required to accept Marvell's tidbits as the right measures of the form or amount of damages. Indeed, even where, *unlike here*, a patentee has a history of entering into comparable lump-sum license agreements, it is not precluded from obtaining damages in the form of a running royalty. *LaserDynamics*, 694 F.3d at 81. "Marvell disagrees with Ms. Lawton's opinions regarding the importance of this evidence," but "the weight of these facts … was for the jury to decide." A266.

3. Lawton's royalty methodology was reliable, and the jury was entitled to credit it.

Marvell attacks the admissibility and, later, the sufficiency of Lawton's methodology for concluding that the parties would have negotiated a 50¢-per-chip running royalty.[5] OB46-52, 60-66. Merely describing Lawton's methodology refutes this argument. Lawton first analyzed Marvell's financial documents to determine the $2.16 average operating profit per chip. A43,002-03. Then, she used every relevant piece of evidence she could get her hands on to determine the economic value of CMU's invention, using the long-accepted *Georgia-Pacific* factors. *i4i*, 598 F.3d at 854. She ultimately produced a 500-page report and updated it twice. A9270-815, 19,283-324, 30,179-512.

To determine the royalty rate, Lawton was conservative, allocating "fair credit" to both Marvell and CMU for their contributions

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[5] Marvell also criticizes Lawton's use of an *alternative* 556,812,091-chip royalty base, OB47, which she provided in case the court agreed "to limit CMU's royalty to an estimate of chips that came back into the United States," A245. That criticism is not even relevant unless Marvell succeeds on its argument (OB52-60) that the court erred in allowing a royalty base that included all chips sold as a result of Marvell's infringing use of CMU's method in the U.S. The court did not err. *Infra* 76-92. In any event, Lawton's alternate estimate was admissible because it is based on well-accepted industry publications, which Marvell itself relied on. A37,489, 43,448-51.

to the chips' success. A43,309; *see* A43,326-28, 43,500. But as much as Marvell ignores it, there was no denying the realities confronting Marvell at the time of the hypothetical negotiation in March 2001. Critical here was industry-expert Bajorek's testimony that using CMU's technology was "life or death" for Marvell. A42,123-27.

Against this backdrop, Lawton calculated two separate benchmarks to help isolate the value of CMU's invention from Marvell's own contributions: (1) an analysis of excess profits; and (2) an analysis of an operating profits premium. A43,310. This Court has affirmed awards based on similar analyses. *Energy Transp. Group, Inc. v. William Demant Holding A/S,* 697 F.3d 1342, 1356-57 (Fed. Cir. 2012); *TWM Mfg. Co. v. Dura Corp.*, 789 F.2d 895, 899 (Fed. Cir. 1986); *see Georgia-Pacific Corp. v. U.S. Plywood-Champion Papers Inc.*, 446 F.2d 295, 299-300 (2d Cir. 1971).

Excess profits. Lawton "identif[ied] [the] amount of profits that Marvell would target in their business … that would be an acceptable return to it." A43,312. She relied on evidence provided by Marvell's own co-founder & CEO, as well as its Vice President of Marketing, Alan Armstrong. A43,327, 43,473-74. Armstrong testified that Marvell

would be doing "*really well*, in terms of both price and cost," if it achieved a 50% gross margin in the business unit responsible for the accused chips. A43,313.

To credit Marvell for the contributions it assertedly made to the chips, Lawton attributed to it "all the profits that are associated with that 50 percent gross margin." A43,327-28; *see* A43,312. Given that Marvell would have gone out of business and made no profits had it not infringed, *supra* 20-22, 25-26, that attribution was generous. *See Finjan*, 626 F.3d at 1211; *Fromson v. Western Litho Plate and Supply Co.*, 853 F.2d 1568, 1577-78 (Fed. Cir. 1988).

Lawton then identified "the total gross margin for the MNP and NLD-type chips" that was "in excess of 50 percent." A43,325. That excess amount was "9.6% of revenue," "or 42 cents per chip." A43,325-26. As Lawton explained, this figure was a benchmark for what "would be available to pay a royalty," which the parties would have considered in the hypothetical negotiation. A43,312; *see* A35,602, 43,411; *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970).

Operating profit premium. Lawton also calculated a second, separate benchmark: the operating profit premium. This analysis was "directed at looking at [the] increment of increased price and profits that Marvell itself, in its internal records, attributed to the MNP." A43,310, 43,328-39. Marvell did not sell or price the detector in its chips separately, A43,312, so Lawton went to great lengths to isolate the revenue and profits associated with the MNP. Armstrong, Marvell's Rule 30(b)(6) designee, testified that isolating the value of any feature in Marvell's chips required an "apples to apples" comparison of chips sold to the "[same] customer, with the same packaging, with the same data rate, and sold at about the same time." A43,328-29; *see* A34,012-13. Using those criteria, Lawton identified every chip pairing where the MNP was the "the only difference, or the principal difference." A43,334.

Marvell's documents revealed two pairs of chips satisfying these criteria. A38,647-48, 43,329-44; *supra* 25-26. For each pair, Lawton calculated the "price delta" "between the sale price of the chip[s] that had the MNP" and the chips that did not. A43,337; *see* A38,646, 38,648. After subtracting "the cost associated with the MNP" from this "price delta" (thus ensuring that Marvell would recoup its implementation

costs), she then calculated an "operating profit delta" range of 6¢ to 72¢ for the MNP (out of the $2.16 average operating profit for the entire chip). A43,338-39; *see* A35,602, 38,635, 38,648. As Lawton explained, this range was another data point the parties would have considered in the hypothetical negotiation.

Having isolated the range of operating profits attributable to the MNP, Lawton then carefully assessed how CMU and Marvell would have agreed to divide those profits. A35,591, 43,115-84, 43,301-412. She considered, for example, the market conditions facing the industry, A43,055, 43,074-79, as well as Marvell's declining chip-over-chip sales at that time, A43,066, and the absence of noninfringing alternatives, *supra* 25-26, 55. Given Marvell's desperate need for CMU's technology, she concluded that the appropriate royalty rate would fall at the upper end of the calculated range. A43,346, 43,411.

4. Marvell's challenges to Lawton's methodology are meritless.

Marvell's scattershot challenges to Lawton's methodology read more like a jury summation than a serious argument that Lawton's testimony was insufficient to support the verdict or outright

inadmissible. The district court correctly rejected them. *See* A258-59, 261-73, 17,433-44, 33,398-425.

Excess profits. Marvell takes several swipes at Lawton's excess profits analysis. OB48, 60-63. It contends that the 50% target gross margin is not even relevant because it was "Marvell's estimate of 'an adequate profit for its business,' not … tied to any particular product." OB62. Not so. How much profit a company expects to make generally—and especially how much profit would mean it was doing "really well" in the applicable segment of its business, A43,500—is at least relevant to its bargaining position and the "range of possible royalties the parties would have considered in a hypothetical negotiation" for exactly the reasons this Court described in *Energy Transport*, 697 F.3d at 1356. That is especially so here, because the invention was "a life or death matter for the company." A42,127. This "particular product" at this time *was* the business.

Marvell next argues that Lawton's analysis showed that certain of "Marvell's chips without the patented technology had greater or equal 'excess profits' to chips with the accused circuits," and therefore "a rational jury would conclude" that excess profits above the 50% target

gross margin are "not attributable to the accused technology." OB60-61. Wrong, again. As Lawton told the jury, Marvell identifies only two such chips with any significant sales volume. A43,498-99. As Marvell acknowledges (OB61), and the district court found, A267, Lawton explained to the jury why the margins on those chips did not undermine her analysis. A43,498-99. The jury was entitled to credit her explanation.

Marvell contends (OB48, 61-62) that Lawton did not properly apportion the excess profits under *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1318 (Fed. Cir. 2011). Marvell misapprehends the purpose of Lawton's excess profits calculations. Lawton used that calculation as a benchmark for the amount that "would be available to pay a royalty" for CMU's invention, A43,312—the amount that might be on the table after crediting Marvell with the profits it has said would be an acceptable return. A43,310-13, 43,475. That premise—that Marvell would hold out for a price that would leave it doing "really well" after paying CMU, A43,313—was quite generous to Marvell, in light of the extensive evidence that Marvell likely would have made *no sales at all* without copying CMU's invention. *Supra* 20-22, 25-26.

In addition to this bottom-up analysis, Lawton also performed a top-down analysis by analyzing Marvell's operating profit premiums. *See* A42,790, 42,802-03. That analysis (to which we turn next) zeroed in further on revenues and profits directly connected to Marvell's use of CMU's patented methods.

Operating profits premium. Marvell's challenges to Lawton's analysis of the operating profits premium also revolve largely around apportionment. OB48-49, 65-66. Specifically, Marvell asserts that Lawton erred in attributing the entire premium to the MNP. As Lawton explained, however, it was appropriate to do so because Marvell's own documents stated that the MNP was the "*key*" or "*only*" difference between the chips Lawton compared. *Supra* 25-26. Moreover, Marvell offered no evidence that any of the other features it claims to have introduced with the MNP were similarly "must have."

Marvell further asserts that even if the premium was due to the MNP, Lawton should have allotted some of the premium to Marvell based on the value of its "implementation" of the patented method "in silicon." OB65. Marvell asserts that "making a commercially viable circuit" required "'some effort.'" OB65-66. But "the law does not

require that an infringer be permitted to make a profit." *Monsanto Co. v. Ralph*, 382 F.3d 1374, 1384 (Fed. Cir. 2004). And as noted above (at 68-69), Marvell recovered all of its implementation costs under Lawton's analysis, including those associated with the MNP, as well as research-and-development, sales, and general and administrative expenses. It points to no evidence that its efforts were so significant as to warrant allocating it a portion of the *profits* associated with the MNP, nor does it dispute that CMU's method was the sine qua non of the MNP. Particularly given that hole, the jury was entitled to credit Lawton's testimony that that was all there was of real value.

Marvell also criticizes the sample size Lawton used in calculating the operating profit premium. OB48, 63-66. Marvell's criticism is built on a falsehood—that Lawton relied on merely "9,855 sample chips … offered to Maxtor." OB63. Maxtor purchased 147,519 accused chips at a premium price; that premium applied to sales of up to 9 million chips. A38,626; *see* A9754, 38,646, 43,345-46. And in total, Lawton's comparative analysis included approximately 354,000 chips (both accused and non-accused); the gross margins on chips containing the MNP were significantly higher. A38,647-48, 43,334-38.

In any event, Lawton was free to derive her opinion from "a small sample size" so long as she made a "reasonable attempt to value" the infringing product. *LaserDynamics*, 694 F.3d at 79.[6] Lawton's efforts were reasonable—as was her explanation of the sample size. As the district court noted, A262, Lawton used the *only* data that met Marvell's own "apples to apples" criteria. A43,329, 43,334-40, 43,497-500; *supra* 68-69. Why was that population small? Because CMU's technology was so revolutionary that Marvell's sales of noninfringing chips decreased to practically nothing. A43,498, 43,160, 35,597, 38,640, A43,332-34. Driving the noninfringing predecessor product into obsolescence generally leads damages to be increased, not vacated. *See Fromson*, 853 F.2d at 1577-78.

Marvell asserts that "Lawton was unable to show that Marvell's major customers like Western Digital, Samsung, Fujitsu, Hitachi, or Seagate ever paid any premium for the MNP." OB64. Marvell's

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[6] The cases Marvell cites (OB49) do not say otherwise. None of them involve expert testimony on damages, let alone patent damages. And in one, the expert actually conceded that his sample size was unrepresentative. *EEOC v. Kaplan Higher Educ. Corp.*, 748 F.3d 749, 750 (6th Cir. 2014).

assertion that all these customers paid nothing for the MNP defies the evidence and common sense. Western Digital, for example, bought a billion chips incorporating CMU's method. A38,594. Like the other customers, it enabled the MNP, A198, 53,557-72, and "saw gains" from its use, A257; *see* A34,002-03. Implementing the MNP meant "the chips … cost [Marvell] more to make." A42,170. So the jury was free to reject as illogical Marvell's argument that it added this "must have" technology to billions of chips for free. More important, Lawton explained that the pricing data for those customers were unusable because they did "not meet the criteria for comparability" set out by Armstrong. A43,335; *see* A43,485-86. Had Lawton drawn those comparisons, Marvell would be challenging the opinion on that basis.

At bottom, as the court found, Marvell's criticisms of Lawton's analyses are simply "challenges to the factual underpinnings of" her opinions that "go to the weight to be afforded" her testimony. A268. Before the jury, Lawton "addressed each and every one of [Marvell's] arguments and was cross-examined by Marvell" about them. A267. "The jury was tasked with evaluating the credibility of all of the

witnesses and the weight of the evidence … to reach its ultimate decision on damages. They did just that and found for CMU." A268.

B. The Jury Properly Awarded Damages Based On Marvell's Infringing Conduct In The U.S.

Marvell next asserts (OB53-57) that the award violates the presumption against applying U.S. law extraterritorially. As the district court explained in response to Marvell's "repeated[] challenge[s]," A239, "CMU has never asserted infringement against Marvell for any use of its patented method[] which did not occur in the United States, nor does it seek damages for instances of foreign infringement." A235-36; *see* A239, 241. As Marvell acknowledges (OB52), the court properly instructed the jury that "Marvell cannot be found to have directly or indirectly infringed in connection with chips that are never used in the United States." A45,456.

What CMU sought—and the jury awarded—was damages for Marvell's innumerable domestic uses of CMU's "must have" patented method during Marvell's U.S.-based sales cycle. As Marvell stipulated, in this business, before selling a single chip, a manufacturer must undertake a "three-to-four-year long process" alongside a prospective customer. A42,122, 45,443-47. Marvell and its U.S.-based customers

work "hand-in-glove," A42,157, conceptualizing the chip, simulating and designing it, testing engineering samples, and seeking "qualification of a chip," all to arrive at an end product that performs as promised, A42,122. *Supra* 21-22, 27-28. To achieve the design wins it needed, Marvell had to use (and induce its manufacturing customers to use) the chips and simulators—and therefore CMU's patented method—trillions of times a day for millions of chips or simulators, *supra* 27-28, throughout the sales cycles. A236, 42,159, 53,570-772, 53,612-13. Of necessity, this all takes place in California. A35,070-78, 35,080-82, 42,120-60.

Thus, Marvell's mantra (e.g., OB53) that the jury awarded damages "for foreign sales" is off base. It is also factually false. Marvell never disputed CMU's evidence that all the *relevant* sales—the design wins that manufacturers awarded Marvell, as opposed to the hard drives the manufacturers sold to their customers—occurred in California, where Marvell and its customers were so intensely collaborating. A248-53.

The jury's damage award reflects an economically rational hypothetical royalty negotiation, grounded in this Court's precedent, in

which CMU asserts, and Marvell agrees: "The only technology that gives your customers the performance gains they demand is ours. If you want to use our patented process trillions of times a day in California so you can sell billions of chips that use that process, we want a royalty on all the chip sales that result from all those uses." Valuing the *domestic use* of a method based on sales resulting directly from those critical infringing uses—wherever the sales occurred—is a valid means of assessing damages. Here, it was the only sensible way to calculate damages, and it was supported by ample evidence.

1. Infringing use in the U.S. is appropriately valued based on sales resulting from that use.

"[W]hen considering the amount of a use-based reasonable royalty …, a jury may consider not only the benefit to the patentee in licensing the technology, but also *the value of the benefit conferred to the infringer by use of the patented technology*." *Powell v. Home Depot U.S.A., Inc.*, 663 F.3d 1221, 1240 (Fed. Cir. 2011). The benefit to the infringer from the infringing use often is best valued by the infringer's resulting sales. *See U.S. Frumentum Co. v. Lauhoff*, 216 F. 610, 617 (6th Cir. 1914); *Fromson*, 853 F.2d at 1578.

Indeed, this Court has approved looking to *non*infringing sales to value infringing uses. In *Minco, Inc. v. Combustion Engineering,* 95 F.3d 1109, 1113 (Fed. Cir. 1996), the patent disclosed a furnace for fusing silica. There, the infringement was the *use* of an apparatus to make a product that was itself noninfringing. Yet, this Court affirmed a royalty applied to the defendant's noninfringing sales of that product. *Id.* at 1119-20; *see Union Carbide Chem. & Plastics Tech. Corp. v. Shell Oil Co.*, 425 F.3d 1366, 1370, 1378 (Fed. Cir. 2005) (patented catalytic process for making ethylene oxide with royalty based on sales of monoethylene glycol, a converted form of ethylene oxide); *Spectralytics*, 649 F.3d at 1339-41 (patented apparatus for making stents with a royalty based on the sales of the stents themselves). The sales were simply a way of valuing the benefit the defendant enjoyed from the infringing use.

Here, it was especially sensible to value how much Marvell would have paid to use CMU's method based on what Marvell stood to earn from selling the resulting chips rather than on a per-use royalty. A45,456. This is one of those cases where "[a] company licensing a patented method … has strong reasons not to tie the royalty amount

strictly to usage." *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1334 (Fed. Cir. 2009). That is why Marvell has never suggested, either here or before the district court, that any type of use-based royalty makes sense. Indeed, as the court recognized, "quantifying a per use fee in this case is nearly impossible," and would probably have yielded an even higher royalty. A236. What would it have even looked like? An infinitesimal fraction of a cent multiplied across trillions and trillions of uses? (Even an imponderably small per-use rate like 1/100th of a penny would mean royalties of hundreds of millions if not billions of dollars *per week*.) Marvell did not even keep records of specific uses. On top of all this, that sort of royalty would be particularly irrational for Marvell, because it would have required Marvell to pay upfront, even if its uses never resulted in a design win. The parties never would have negotiated that way.

2. Using resulting sales to value infringing use here does not violate the presumption against extraterritoriality.

Marvell tacitly concedes that noninfringing sales can be used to assess how much it would have paid for its infringing uses in the U.S.—at least as to chips that did end up in the U.S. It argues only that this

method represents an impermissible extraterritorial application of U.S. law when applied to chips that ended up in foreign countries. OB52-57. As to those chips, Marvell shifts the focus from its own domestic conduct to the conduct of the chips' end-users (i.e., the customers of Marvell's customers). On Marvell's account, CMU must prove that the end-users infringe, too, before it can recover damages for Marvell's infringing domestic use—in short, that CMU has to prove infringement twice to recover once.

The extraterritoriality doctrine does not compel any such absurdity. That doctrine generally precludes a court from applying U.S. laws to punish "foreign *conduct*." *E.g.*, *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 455 (2007); *Deepsouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 524 (1972). But when the conduct that is the "focus" of the relevant statute "occurs within the United States," the presumption does not apply. *Morrison v. Nat'l Australia Bank Ltd.*, 561 U.S. 247, 266 (2010); *id.* at 282 (Stevens, J., concurring); *see Envtl. Defense Fund, Inc. v. Massey*, 986 F.2d 528, 531 (D.C. Cir. 1993). When an infringer engages in infringing conduct in the U.S., the presumption does not

preclude the jury from assessing the full measure of damages that directly result from that conduct.

The Supreme Court settled that point over a century ago. In *Gould's Manufacturing Co. v. Cowing*, the Court ordered entry of a damages award based on sales of oil pumps the infringer manufactured in the U.S. but sold in markets in Pennsylvania and Canada. 105 U.S. 253, 256 (1881). The foreign sales did not infringe. But the defendant could not avoid damages for U.S. infringement by selling the products abroad. The Court reaffirmed the principle in *Dowagiac Manufacturing Co. v. Minnesota Moline Plow Co.*, 235 U.S. 641 (1915). It discussed *Gould's*, confirming the rule that as long as the defendant was the one who infringed in the U.S.—rather than some other manufacturer—the plaintiff could recover damages based on that infringer's resulting foreign sales, even when the products ended up abroad. *Id.* at 650; *cf. Sheldon v. Metro-Goldwyn Pictures Corp.*, 106 F.2d 45, 52 (2d Cir. 1939) (Hand, J.) (applying *Gould's* and *Dowagiac* in the copyright context).

This Court applied this reasoning more recently in *Railroad Dynamics, Inc. v. A. Stucki Co.*, 727 F.2d 1506, 1519 (Fed. Cir. 1984). The case involved an award that included royalties for hundreds of

"carsets"—shock absorbers for freight cars—"*sold to foreign customers* for installation in truck assemblies in *foreign countries*." *Id.* at 1519. "When [the defendant] made the … carsets in this country, it infringed …. Whether those carsets were sold in the U.S. or elsewhere is therefore irrelevant, and no error occurred in including those carsets among the infringing products on which royalty was due." *Id.* There is "no rule that a plaintiff cannot recover lost profits for foreign sales of infringing products manufactured in the United States." *Schneider (Eur.) AG v. SciMed Life Sys., Inc.*, 60 F.3d 839 (Table), 1995 WL 375949, at *3 (Fed. Cir. Apr. 26, 1995) (citing *Datascope Corp. v. SMEC, Inc.*, 879 F.2d 820 (Fed. Cir. 1989)).

The connection to the U.S. is even stronger here. Not only did Marvell's infringing use occur in the U.S., but as the district court held, CMU presented "more than sufficient evidence for a jury to find that the sales [to Marvell's manufacturer customers] occurred in the United States," too. A250. Marvell stipulated that it competes in the sort of "design wins market" discussed in *Broadcom*, 732 F.3d at 1337. The aim in Marvell's industry is "not a steady flow of discrete product sales" in diffuse markets. *Id.* "[T]he sales are 'design wins,'" essentially

winner-take-all commitments to buy from Marvell, earned through intense, sustained interactions with a "limited set of customers." *Id.*; *see* A45,443-47. These interactions occurred in the U.S. because Silicon Valley is where HDD makers shop for what Marvell sells. A250-51, 42,120-53, 45,443-47. Accordingly, Marvell's repeated assertion that its chips were "sold … abroad," e.g., OB52, is false. Marvell "introduced *no* evidence at trial that any aspect of its sales [to drive makers] took place outside the United States." A248 (emphasis in original). So not only did all of Marvell's infringing conduct take place in the U.S.—as in *Gould's* and *Railroad Dynamics*—but the benefits Marvell obtained all accrued within a U.S.-based design-win market, thus eliminating any possible concern about extraterritoriality. *Morrison*, 561 U.S. at 266.

Marvell ignores this authority.[7] Instead it invokes *Power Integrations,* 711 F.3d 1348. There, the patentee accused the defendant

[7] Marvell's amici acknowledge *Railroad Dynamics*' plain holding, but suggest it applies only when the defendant manufactures articles in the U.S. and sells those articles abroad. Broadcom Br. 11. Amici offer no reason why the extraterritoriality analysis depends on the *type* of infringing domestic conduct—manufacture, use, etc. As a matter of this Court's damages law, resulting sales are available to value infringing use, *Minco*, 95 F.3d at 1118, so all that is relevant under *Railroad Dynamics* is that the infringing use took place in the U.S.

of manufacturing and selling accused products in the U.S. But it sought to recover damages not only for the sale of those products, but also for sales of products manufactured and sold in other countries. *Id.* at 1370. All it could say was that the foreign sales were a "foreseeable" consequence of the U.S. sales. *Id.*; *see Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc.*, 589 F. Supp. 2d 505, 511 (D. Del. 2008). This Court rejected the patentee's theory because of a simple failure of proof. Both the district court and this Court found that the patentee had not demonstrated any link between domestic infringement (sales in the U.S.) and foreign sales. Its *own expert* admitted that his damages estimate was "*not* actually rooted in [defendant] Fairchild's [infringing] activity in the United States," and that "he did *not* quantify an amount of damages [caused by Fairchild] based on any offer for sale by Fairchild in the United States." *Power Integrations,* 711 F.3d at 1372. Thus, the patentee was seeking "an award of damages for sales consummated in foreign markets, *regardless of any connection to infringing activity in the United States*." *Id.* at 1371.

It was in this context that this Court uttered the one sentence on which Marvell rests its argument: that "the *entirely extraterritorial*

production, *use*, or sale of an invention patented in the United States is an independent, intervening act that, under almost all circumstances, cuts off the chain of causation initiated by an act of domestic infringement." *Id.* at 1371-72; OB54. As is evident from the emphasized phrase, this was not some sweeping new pronouncement that products sold abroad can never bear on a damages calculation even when they have a direct "connection to infringing activity in the United States." *Power Integrations,* 711 F.3d at 1371. A panel of this Court would not (and could not) have silently overruled *Gould's*, *Dowagiac*, *Railroad Dynamics*, and volumes of precedent allowing patentees to recover damages for the full benefit derived from infringing uses—and did not need to do so to reject the patentee's theory in that case.

Marvell tries to cram this case into *Power Integrations* with this non sequitur: "To the extent Marvell's sales may be considered an estimated measure of *use*, total sales are an impermissible measure because they correlate with the number of chips *used worldwide*, and thus do *not* estimate use of the patented method *in the United States*." OB55 (emphasis in original). As noted above (at 80-81), the "uses" to which Marvell refers here are not its own uses or its customers' induced

uses in the United States during the sales cycles, but those of the end-users who use hard drives containing Marvell chips. In other words, Marvell refers to its *customers' customers'* uses all over the world. But the jury did not consider sales as "an estimated measure of *use* … *worldwide*," OB55—and certainly not as a measure of uses abroad, outside of its sales cycles. The above-quoted jury instruction (at 76) ensured that the sales served only to determine how much Marvell would have paid to proceed with *its own* infringing uses in the U.S. A45,456. So Marvell's focus on end-users' conduct is misplaced.

As the district court correctly recognized, this case is nothing like *Power Integrations*. A245. Unlike the oddball damages theory in *Power Integrations* (using infringing sales to capture lost-sales damages for unconnected noninfringing sales), the damage award here is grounded in established authority (using noninfringing benefits of an infringing use to assess a royalty for that use). Unlike in *Power Integrations*, where the plaintiff sought damages from *foreign* sales, CMU sought damages from a sales cycle for which "[e]ssentially all the key activities … occur in the United States." A42,161. And unlike the expert there, CMU's expert testified to "a *direct link* between Marvell's

alleged use of the patented technology and its sales of the accused products." A42,216. The bottom line in this case: No U.S. use, no sales—and (in light of Marvell's "coffee warmer" fiasco) probably no Marvell. The jury here, unlike in *Power Integrations*, confronted an entirely domestic chain of events—it awarded CMU a reasonable royalty for Marvell's domestic infringement, tied directly by common sense and economic evidence to uses made and sales consummated in the U.S.

3. Marvell's policy arguments are meritless.

Marvell and its amici offer several policy arguments for why this Court should abandon settled precedent in favor of a rule that "foreign sales" have no place in any damages calculation. OB56-57. These arguments fail at the outset because every bit of record evidence showed that Marvell's sales were all made in the U.S. A248. But even apart from the flawed premise, Marvell's policy arguments are unpersuasive.[8]

[8] Marvell's law professor amici rehash Marvell's policy arguments (Law Profs. Br. 3-5). But they, too, critique a damages theory CMU never advanced. Their view that CMU's damages theory would "permit[] recovery of patent infringement damages for the extraterritorial exploitation of *domestic research*," *id.* at 1, for example, exhibits a fundamental misapprehension of what this case is about.

Marvell frets that "a U.S. defendant might be subject to … double recovery for sales that both infringe foreign patents and have some attenuated connection to an allegedly infringing use of a U.S. patent in the United States." OB56. As explained above, the link here is far from "attenuated"—Marvell's U.S. uses with its U.S.-based customers were essential to securing design wins, which, in this business, are the sales. More to the point, Marvell forgets that there should be no double recovery because an award in one jurisdiction typically is offset against any claim in another. *See MidAmerica Fed. Savings & Loan Ass'n v. Shearson/Am. Express, Inc.*, 962 F.2d 1470, 1473 (10th Cir. 1992); 7-20 Donald S. Chisum, *Chisum on Patents* § 20.03 (2014).

Next, Marvell worries that "the district court's approach opens the door for a patentee to recover damages for third-party use or sales without satisfying" the requirements for contributory or induced infringement. OB56-57. But this case is only about using *Marvell's* resulting sales to value *Marvell's* extensive use of CMU's method. Affirmance would offer no basis for ignoring the usual requirements for proving indirect infringement—including proof of direct infringement in the U.S.

Finally, Marvell invokes the boogeyman of off-shoring. OB57. But it offers only speculation. In this industry, fleeing the country is not an option. The sales cycle is the game, and Silicon Valley—thanks in part to the CMU-led resurgence in American data-storage research, *supra* 14—is the arena. It's where Marvell recruited its talent, while ensuring close proximity to its customers. A43,172-73.

4. The district court properly instructed the jury.

The court understood that "sales could be an indicator of the value of Marvell's use of the patents" only if "there was a causal link between the infringement and the sales." A254. It instructed the jury accordingly: "To the extent … Marvell achieved sales resulting from Marvell's alleged infringing use during the sales cycle, you may consider them in determining the value of the infringing use." A45,456.

Marvell contends that, even if CMU's damages theory did not represent an extraterritorial application of U.S. law, Marvell is nevertheless entitled to a new trial because the instruction did not "requir[e] the jury to find" that its sales "were 'solely' the result of Marvell's supposed infringing use of CMU's algorithm." OB58. Marvell cites no support for such a strict causation standard—literally, none.

This Court has never even arguably imposed so strict a nexus requirement except when determining the applicability of the entire market value rule. *E.g.*, *LaserDynamics*, 694 F.3d at 67. And Marvell itself acknowledges that this case does not involve that rule. A24,454-59, 24,643-44.

As a backup, Marvell asserts that the instruction is flawed because it did not "impos[e] any causal-nexus requirement whatsoever." OB58. That is false. Any juror would understand the "resulting from" language as a causation requirement. *Cf. United States v. Hatfield*, 591 F.3d 945, 947-50 (7th Cir. 2010) (discussing traditional tort causation principles embodied in statutory term "results from" and holding that proper jury instruction contains only that term).

In any event, any quibble about the instruction is inconsequential, because Marvell does not dispute that CMU's evidence of causation was overwhelming, and met a "but for" causation standard. *Supra* 21-22, 25-28; A253-58. In a design-win market, uses translate to design wins, and design wins are the sales—the nexus is airtight. *Broadcom*, 732 F.3d at 1337. So there is no risk that the jury included chips in the

royalty base that were not causally linked to infringing domestic uses during Marvell's sales cycle, under any plausible causation standard.[9]

V. THE DISTRICT COURT EXERCISED SOUND DISCRETION IN REJECTING MARVELL'S LACHES DEFENSE.[10]

On laches, the district court issued a thorough, balanced opinion that actually found in *Marvell's* favor on certain elements, A113-43, but ultimately concluded that "the equities clearly favor CMU … rather than Marvell, which copied CMU's patents consciously and deliberately for an entire decade," A145. In weighing the equities, the court observed that "Marvell's knowing infringement of CMU's patents is precisely the type of egregious misconduct which the Federal Circuit has recognized should significantly tip the scales of justice in favor of a

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[9] Marvell's amici advocate several disjointed principles of causation. Broadcom Br. 20-23. These artificial limitations on the reasonable royalty inquiry find no support in this Court's case law. But, in any event, amici do not so much as hint that the evidence presented to the jury fails to satisfy its unarticulated standard.

[10] *Petrella v. Metro-Goldwyn-Mayer, Inc.*, 134 S. Ct. 1962, 1967 (2014), raises doubts about the continued validity of this Court's rule that laches can defeat an infringement claim for damages within the statute of limitations, *see Aukerman*, 960 F.2d at 1030. A panel of this Court, however, recently reaffirmed that rule. *SCA Hygiene Prods. Aktiebolag v. First Quality Baby Prods., LLC*, No. 13-1564, 2014 WL 4627594, at *4, __ F.3d __ (Fed. Cir. Sept. 17, 2014). CMU reserves the right to challenge that ruling in future proceedings.

patentee and defeat an otherwise well-supported laches defense." *Id.* As the court observed, A144-45, this Court has repeatedly held that laches will not absolve an infringer who engages in "conscious copying" of intellectual property, even if the elements of laches are otherwise established; such copying weighs heavily in the overall, equitable analysis. *A.C. Aukerman Co. v. R.L. Chaides Constr. Co.*, 960 F.2d 1020, 1033 (Fed. Cir. 1992) (en banc). The court's careful decision—which was "committed to [its] sound discretion"—merits deference. *Id.* at 1032, 1036.

Marvell opens by arguing that its conduct was not *so* bad because it filed for its own patent. OB73. That is a *non sequitur* and a non-starter on this standard of review, especially in view of Marvell's admission that its patent is not a defense to infringement. A24,145; *see* A221. This must be why Marvell relegates it to one sentence.

Marvell's main argument, based on this Court's opinion in *Serdarevic v. Advanced Medical Optics, Inc.*, 532 F.3d 1352, 1361 (Fed. Cir. 2008), is that its egregious conduct cannot defeat laches because "there is no evidence that Marvell behaved surreptitiously in an effort to deceive CMU, to lull it into complacency, or to capitalize on its trust."

OB73-74. That argument is waived. Marvell's argument below was simply that its conduct was not egregious, and it did not so much as cite *Serdarevic*. A38,238.

The argument is meritless anyway. This Court, sitting en banc in *Aukerman*, pronounced that "egregious conduct" can defeat a laches defense, and that "[c]onscious copying may be … a factor weighing against the defendant" so as to "change the equities significantly in plaintiff's favor." 960 F.2d at 1033-34 (citation omitted); *see Gasser Chair Co. v. Infanti Chair Mfg. Corp.*, 60 F.3d 770, 775 (Fed. Cir. 1995); *Bott v. Four Star Corp.*, 807 F.2d 1567, 1576 (Fed. Cir. 1986); 6A-19 *Chisum on Patents* § 19.05[2][d]; John Skenyon et al., *Patent Damages Law and Practice* § 5:39 (2014). Thus, this Court has insisted that "a district court must weigh all pertinent facts and equities in making a decision on the laches defense." *Aukerman*, 960 F.2d at 1034; *SCA Hygiene*, 2014 WL 4627594, at *4. The district court did so here and found that Marvell's "deliberate and sustained copying," "smoke screen" patent, and failure to take any steps to remediate its behavior "after being notified of the patented methods" tilted the equities in CMU's favor. A146-47.

Serdarevic, which was not a patent infringement case, did not retreat from this rule. Rather, it stated that "in the context of an inventorship action, a plaintiff relying on the unclean hands doctrine to defeat a defense of laches must show not only that the defendant engaged in misconduct, but moreover that the defendant's misconduct was responsible for the plaintiff's delay in bringing suit." 532 F.3d at 1361. Citing *Aukerman* repeatedly, the Court expressly cabined its holding to "the context of an inventorship action." *Id.* at 1361.

CONCLUSION

The judgment should be affirmed.

Respectfully submitted,

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CERTIFICATE OF FILING AND SERVICE

I hereby certify that on this 20th day of October, 2014, I caused the foregoing Answering Brief of Plaintiff-Appellee Carnegie Mellon University to be filed electronically filed with the Clerk of the Court using the CM/ECF system, which will automatically serve all parties.

/s/ E. Joshua Rosenkranz
E. Joshua Rosenkranz

CERTIFICATE OF COMPLIANCE
UNDER FEDERAL RULES OF APPELLATE PROCEDURE
32(a)(7) AND FEDERAL CIRCUIT RULE 32

In an Order dated July 18, 2014, this Court granted Marvell 3,000 additional words for its opening brief, for a total of 17,000. The same extension applies to this brief pursuant to Federal Circuit Rule 28(c). Counsel for Plaintiff-Appellee Carnegie Mellon University certifies that the brief contained herein has a proportionally spaced 14-point typeface, and contains 16,903 words, based on the "Word Count" feature of Word 2007, including footnotes and endnotes. Pursuant to Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b), this word count does not include the words contained in the Certificate of Interest, Table of Contents, Table of Authorities, Abbreviations, and Statement of Related Cases.

Dated: October 20, 2014

Respectfully submitted,

/s/ E. Joshua Rosenkranz
E. Joshua Rosenkranz