

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENNOX INDUSTRIES INC.,
Petitioner,

v.

ROSEN TECHNOLOGIES LLC,
Patent Owner.

Case No. IPR2023-00715
Patent 6,619,555

**DECLARATION OF R. JACOB BAKER, PH.D., P.E. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 18 AND 20 OF
U.S. PATENT NO. 6,619,555**

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Appendix A: CV of R. Jacob Baker, Ph.D., P.E.

I, R. Jacob Baker, Ph.D., P.E., declare as follows:

I. INTRODUCTION

1. My name is R. Jacob Baker Ph.D., P.E., and I am a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas. I have been retained by counsel for Lennox Industries Inc. (the “Petitioner”) in connection with the above-captioned *inter partes* review (“IPR”) of Claims 18 and 20 U.S. Patent No. 6,619,555 (“the ‘555 Patent”), entitled “Thermostat System Communicating with a Remote Correspondent for Receiving and Displaying Diverse Information,” by named inventor Howard Rosen. I understand that the ‘555 Patent is assigned to Rosen Technologies LLC (the “Patent Owner”). I have been asked to provide technical review, analysis, insights, and opinions regarding the ‘555 Patent and the prior art references that form the basis for the ground of unpatentability set forth in the Petition for *Inter Partes* Review of the ‘555 Patent (the “Petition”). I have been asked to provide a declaration regarding my opinions on the validity of Claims 18 and 20 of the ‘555 Patent.

2. This declaration sets forth the opinions I have formed in this IPR and provides the bases and reasons for those opinions. I have summarized in this section my educational background, professional experience, and publications. My education and professional experience are described in my curriculum vita, attached to this declaration as Appendix A.

3. This declaration is based on information currently available to me. I declare that I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

4. I am being compensated at my usual consulting rate of \$765 per hour for my work on this matter. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding. I have no other interests in this proceeding or with Petitioner or Patent Owner.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

5. My qualifications generally are set forth in my Curriculum Vitae, which is attached as **Appendix A**. Appendix A also includes a list of the publications I have authored and a list of the other cases in which I have testified during the last four years.

6. I have been working as an Engineer since 1985 and I have been teaching Electrical and Computer Engineering courses since 1991. I am currently a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas (“UNLV”).

7. I received B.S. and M.S. degrees in Electrical Engineering from UNLV in 1986 and 1988, respectively. I received my Ph.D. in Electrical Engineering from the University of Nevada, Reno, in 1993.

8. My doctoral research, culminating in the award of a Ph.D., investigated the use of power MOSFETs in the design of very high peak power, and high-speed, instrumentation. I developed techniques to reliably stack power MOSFETs to switch higher voltages, that is, greater than 1,000 V and 100 Amps of current with nanosecond switching times. This work was reported in the paper entitled “Transformerless Capacitive Coupling of Gate Signals for Series Operation of Power MOSFET Devices,” published in the IEEE Transactions on Power Electronics. The paper received the Best Paper Award in 2000.

A. Industry Experience

9. I have done technical and expert witness consulting for over 200 companies and their subsidiaries since I started working as an engineer in 1985. From 1985 to 1993, I worked for EG&G Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapon tests at the Nevada test site. During this time, I designed, and oversaw the fabrication of, over 30 electronic and electro-optic instruments, including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame and bit-syncs, data converters, streak-camera sweep circuits, Pockel’s cell drivers, micro-channel plate gating circuits, charging circuits for battery backup of equipment for recording test data, and analog oscilloscope electronics.

10. My work during this time, as one example, had a direct impact on my doctoral research work using power MOSFETs, subsequent publishing efforts, and industry designs. In addition to the 2000 Best Paper Award from the IEEE Power Electronics Society, I published several other papers in related areas while working in industry. I hold a patent, Patent No. 5,874,830, in the area of power supply design, titled, “Adaptively biased voltage regulator and operating method,” which was issued on February 23, 1999. I have designed dozens of linear and switching power supplies for commercial products and scientific instrumentation.

11. I am a licensed Professional Engineer and have extensive industry experience in circuit design, fabrication, and manufacture of Dynamic Random Access Memory (DRAM) semiconductor integrated circuit chips, Phase-Change Random Access Memory (PCRAM) chips, and CMOS Image Sensors (CISs) at Micron Technology, Inc. (“MTI”) in Boise, Idaho. I spent considerable time working on the development of flash memory chips while at MTI. My efforts resulted in more than a dozen patents relating to flash memory. One of my projects at MTI included the development, design, and testing of circuit design techniques for a multi-level cell (MLC) flash memory using signal processing. This effort resulted in higher-density memories for use in solid-state drives and flash memory cards having an ATA interface that are ubiquitous in consumer electronics, including cameras and data storage systems. Further, the use of higher-density memory can result in fewer

changes in the flash translation layer for logical-to-physical addressing, less need for garbage collection, and larger data segments that can improve a computing system's performance. Another project I worked on at MTI focused on the design of buffers for high-speed double-data rate DRAM, which resulted in around 10 U.S. patents in buffer design. Among many other experiences, I led the development of the delay locked loop (DLL) in the late 1990s so that MTI DRAM products could transition to the DDR memory protocol, used in mobile and non-mobile (server, desktop, cell phones, tablets, etc.) computing systems as main computer memory, for addressing and controlling accesses to memory via interprocess communications (IPC) with the memory controller (MC). I provided technical assistance with MTI's acquisition of Photobit during 2001 and 2002, including transitioning the manufacture of CIS products into MTI's process technology. Further, I did consulting work at Sun Microsystems and then Oracle on the design of memory modules during 2009 and 2010. This work entailed the design of low-power, high-speed, and wide interconnection methods with the goal of transmitting data to/from the memory module and the MC at higher speeds.

12. I have extensive experience in the development of instrumentation and commercial products in a multitude of areas including: integrated electrical/biological circuits and systems, array (memory, imagers, and displays) circuit design, CMOS analog and digital circuit design, diagnostic electrical and

electro-optic instrumentation for scientific research, CAD tool development and online tutorials, low-power interconnect and packaging techniques, design of communication/interface circuits (to meet commercial standards such as USB, firewire, DDR, PCIe, SPI, etc.), circuit design for the use and storage of renewable energy, and power electronics. For example, a part of my research at Boise State, for many years, focused on the use of Thru-Silicon-Vias (TSVs), aka Thru-Wafer Vias (TWVs), for high-density packaging. These packaging techniques were utilized in the memory module development work I did with Sun Microsystems and Oracle. As another example, I designed circuitry for use in implementing Universal Serial Bus (USB) interface circuits while I did consulting at Tower Semiconductor. I designed PCI communication circuits for IPC between a Graphics Processor Unit (GPU) and memory while consulting for Rendition, Inc.

13. My current research work is focused in part on the design of integrated circuits for wireless sensing using LIDAR (Light Detection And Ranging). I have worked with several companies in the development of these circuits and systems including Freedom Photonics, Aerius Photonics, and FLIR. In the early 1990s, I worked on wireless systems for wideband impulse radar while at Lawrence Livermore Laboratory. Further, part of my research for several years focused on the digitization of IQ channels using delta-sigma modulation. The knowledge and experience gained from this effort are reflected in my textbook CMOS Mixed-Signal

Circuit Design and a presentation, which I have presented at several universities and companies, http://cmosedu.com/jbaker/papers/talks/BP_DSM_talk.pdf.

B. Academic Experience

14. I was an adjunct faculty member in the Electrical Engineering departments of UNLV and UNR from 1991-1993. From 1993 to 2000, I served on the faculty at the University of Idaho as an Assistant Professor and then as a tenured Associate Professor of Electrical Engineering. In 2000, I joined a new Electrical and Computer Engineering program at Boise State University (“BSU”), where I served as department chair from 2004 to 2007. At BSU, I helped establish graduate programs in Electrical and Computer Engineering including, in 2006, the university’s second Ph.D. degree. In 2012, I re-joined the faculty at UNLV. Over the course of my career as a professor, I have advised more than 100 masters and doctoral students.

15. I have been recognized for my contributions as an educator in the field. While at Boise State University, I received the President’s Research and Scholarship Award (2005), Honored Faculty Member recognition (2003), and Outstanding Department of Electrical Engineering Faculty recognition (2001). In 2007, I received the Frederick Emmons Terman Award (the “Father of Silicon Valley”). The Terman Award is bestowed annually upon an outstanding young electrical/computer engineering educator in recognition of the educator’s contributions to the profession.

In 2011, I received the IEEE Circuits and Systems Education Award. I received the Tau Beta Pi Outstanding Electrical and Computer Engineering Professor Award every year it was awarded while I have been back at UNLV.

16. I have authored several books and papers in the electrical and computer engineering area. My published books include CMOS Circuit Design, Layout, and Simulation (Baker, R.J., Wiley-IEEE, ISBN: 9781119481515 (4th ed., 2019)) and CMOS Mixed-Signal Circuit Design (Baker, R.J., Wiley-IEEE, ISBN: 9780470290262 (2nd ed., 2009) and ISBN: 9780471227540 (1st ed., 2002)). I co-authored DRAM Circuit Design: Fundamental and High-Speed Topics (Keeth, B., Baker, R.J., Johnson, B., and Lin, F., Wiley-IEEE, ISBN: 9780470184752 (2008)), DRAM Circuit Design: A Tutorial (Keeth, B. and Baker, R.J., Wiley-IEEE, ISBN: 0-7803-6014-1 (2001)), and CMOS Circuit Design, Layout and Simulation (Baker, R.J., Li, H.W., and Boyce, D.E., Wiley - IEEE, ISBN: 9780780334168 (1998)). I contributed as an editor and co-author on several other electrical and computer engineering books.

C. Other Relevant Experience

17. I have performed technical and expert witness consulting for more than 200 companies and their subsidiaries and given more than 50 invited talks at conferences, companies, and universities. Further, I am the author or co-author of

more than 100 papers and presentations in the areas of electrical and computer engineering design, fabrication, and packaging.

18. I currently serve, or have served, as a volunteer on the IEEE Press Editorial Board (1999-2004); as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018); as the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015); on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016); as a Distinguished Lecturer for the SSCS (2012-2015); the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for IEEE Solid-State Circuits Magazine; IEEE Kirchhoff Award Committee (2020-2023); and advisor for the student branch of the IEEE at UNLV (2013-present). These meetings, groups, and publications are intended to allow researchers to share and coordinate research. My active participation in these meetings, groups, and publications allowed me to see what other researchers in the field have been doing.

19. In addition to the above, I am an IEEE Fellow for contributions to semiconductor memory design and a member of the honor societies Eta Kappa Nu and Tau Beta Pi.

III. MATERIALS CONSIDERED

20. The analysis that I provide in this declaration is based on my education, research, experience, and professional judgment, as well as the documents I have

considered, including the '555 Patent (Exhibit 1001) and its prosecution history (Exhibit 1003). I have reviewed and am familiar with the specification of the '555 Patent. I have reviewed and am familiar with the file history of the '555 Patent.

21. In preparing this declaration, I have also reviewed and am familiar with the following prior art used in the Petition and this declaration:

Exhibit 1004 – *Shamoon* (U.S. Patent Publication No. 2003/0034898) was filed on November 13, 2001. EX1004 at Cover. I understand from counsel that *Shamoon* is prior art to the '555 Patent at least under 35 U.S.C. § 102 (e). *Shamoon* was not *cited* or considered during prosecution of the '555 Patent. EX1001, (56).

Exhibit 1005 – U.S. Patent No. 7,398,821 to *Rainer* (“*Rainer*”) entitled “Integrated Ventilation Cooling System,” was filed March 12, 2001 and published on September 12, 2002. I understand from counsel for Petitioner that *Rainer* qualifies as prior art under at least pre-AIA 35 U.S.C. §§102(a) and (e).

Exhibit 1006 – EP Application No. 1085399 by *Inoue* (“*Inoue*”) was filed on March 29, 2000 and published on March 21, 2001. I understand from counsel for Petitioner that *Inoue* qualifies as prior art to the '555 Patent under at least pre-AIA 35 U.S.C. §§ 102(a) and (e).

Exhibit 1007 – U.S. Patent No. 6,470,289 to *Peters* (“*Peters*”) was filed

August 5, 1999. I understand from counsel for Petitioner that *Peters* qualifies as prior art to the '555 Patent under at least pre-AIA 35 U.S.C. §§102(a)-(b).

Exhibit 1008 – *Weather.com* is a website available and used by others in the United States since at least January 26, 1997. I understand from counsel for Petitioner that *weather.com* qualifies as prior art to the '555 Patent under at least pre-AIA 35 U.S.C. §§ 102(a)-(b).

Exhibit 1009 – U.S. Patent No. 5,926,776 to Glorioso (“*Glorioso*”) was filed on June 4, 1997 and issued on July 20, 1999. I understand from counsel that *Glorioso* therefore qualifies as prior art under at least pre-AIA 35 U.S.C. §§102(a)-(b).

Exhibit 1010 – U.S. Patent No. 6,621,507 to Shah (“*Shah*”) was filed on November 3, 2000. I understand from counsel that *Shah* qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e).

22. I have considered the following documents in my analysis below:

Ex[No.] ¹	Description of Documents
1001	U.S. Patent No. 6,619,555 (“’555 Patent”)
1003	Prosecution File History of the ’555 Patent

¹ Citations to issued patents and to EX1012 are made by column and line number. Citations to patent application publications and to Exhibit 1002 are made by paragraph number. Citations to Exhibit 1003 is to the page number added by the exhibit label. All other citations are to the original page numbering in the exhibit.

Ex[No.] ¹	Description of Documents
1004	U.S. 2003/0034898 (“ <i>Shamoon</i> ”)
1005	U.S. Patent No. 7,398,821 (“ <i>Rainer</i> ”)
1006	EP 1085399 (“ <i>Inoue</i> ”)
1007	U.S. Patent No. 6,470,289 (“ <i>Peters</i> ”)
1008	Archived 1999 source code for weather.com, available at https://web.archive.org/web/19991128144159/http://www2.weather.com/ (LNX00229114)
1009	U.S. Patent No. 5,926,776 (“ <i>Glorioso</i> ”)
1010	U.S. Patent No. 6,621,507 (“ <i>Shah</i> ”)
1011	Scheduling Order, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K, Dkt. 29 (N.D. Tex. Sept. 1, 2022)
1012	Transcript of Deposition of Howard J. Rosen, December 14, 2022, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex.)
1013	Affidavit of Nathaniel E. Frank-White dated November 28, 2022 & Exhibit A
1014	Ari Luotonen, Web Proxy Servers (1998).
1015	Andrew S. Tanenbaum, Computer Networks (3d ed. 1996).
1016	Joint Claim Construction and Prehearing Statement, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K, Dkt. 54 (N.D. Tex. February 23, 2023)
1017	Plaintiff’s Amended Disclosure of Asserted Claims and Preliminary Infringement Contentions & Exhibit A, dated November 21, 2022, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K, (N.D. Tex. Nov. 21, 2022)
1018	U.S. Patent No. 6,032,867 (“ <i>Dushane</i> ”)
1019	U.S. Patent No. 6,754,485 (“ <i>Obradovich</i> ”)
1020	U.S. Patent No. 6,615,175 (“ <i>Gazdzinski</i> ”)
1021	U.S. Patent No. 5,460,327 (“ <i>Hill</i> ”)
1022	U.S. Patent No. 7,084,859 (“ <i>Pryor</i> ”)
1023	Gillet, Sharon Eisner et al., A Taxonomy of Internet Appliances, Telecommunications Policy Research Conference (2000)

Ex[No.] ¹	Description of Documents
1024	Cardio Manual, Secant Home Automation Inc (“Cardio Manual”)
1025	KR1998/0701245 (“Ehers”) translated with certification
1026	U.S. Patent No. 6,161,133 (“Kikinis”)
1027	U.S. Patent No. 5,784,291 (“Chen”)
1028	U.S. Patent No. 6,665,163 (“Yanagisawa”)
1029	Statutory Disclaimer and Declaration of Howard Rosen entered in U.S. Patent No. 6,824,069
1030	U.S. Patent Pub. No. 2002/0103878 (“Moncibais”)
1031	U.S. Patent No. 6,496,361 (“Kim”)
1032	U.S. Patent No. 5,485,614 (“Kocis”)
1033	U.S. Patent No. 6,804,792 (“Nishikawa”)
1034	U.S. Patent No. 6,023,587 (“Watts”)
1035	U.S. Patent No. 6,098,092 (“Padzensky”)
1036	CA 2,265,292 (“Weiss”)
1037	Lin et al., Internet-Based Monitoring and Controls for HVAC Appliances, IEEE Industry Appliance Magazine (Jan.-Feb. 2002)
1038	U.S. Patent No. 6,868,293 (“Schurr”)
1039	U.S. Patent No. 5,950,709 (“Krueger”)
1040	Dokter, D.A., From Glosser-RuG to Glosser-WeB (Apr. 18, 1997)
1041	Major, April., Copyright Law Tackles Yet Another Challenge: The Electronic Frontier of the World Wide Web, 24 Rutgers Computer Tech. L. J. 75 (1998)
1042	Mefford, FDFiles: Find Dead Files, PC Magazine (December 17, 1996)
1043	Gilster, Ron, PC Hardware: A Beginner’s Guide (2001).
1044	Andrew T. Dufresne, Nathan K. Kelley, & Lori Gordon, <i>How reliable are trial dates relied on by the PTAB in the Fintiv analysis?</i> , PERKINS COIE 1600 PTAB & BEYOND, Oct. 29, 2021
1045	Katherine K. Vidal, Memorandum: Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022)
1046	Dani Kass, <i>Fintiv Fails: PTAB Uses ‘Remarkably Inaccurate’ Trial Dates</i> , LAW360, Nov. 2, 2021
1047	Docket Sheet as of March 19, 2023, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex.)

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

23. Although I am not an attorney, I have a general understanding of the applicable legal standards pertaining to the patentability issues presented in this proceeding. My understanding of legal principles as described in this section is based on communication of those principles to me by Petitioner's legal counsel. The analysis in this declaration is in accordance with the legal principles outlined below.

24. I understand that, in this *inter partes* review, Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

A. My Understanding of Claim Construction

25. I have been informed by counsel that a purpose of claim construction is to determine what a person of ordinary skill in the art ("POSITA") would have understood the claim terms to mean. I understand that during an IPR proceeding, claims are to be construed in light of the specification as would be read by a POSITA at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSITA in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

26. I understand that the prosecution history can inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. I understand that extrinsic evidence may also be consulted in construing the claim terms, such as dictionary definitions and expert testimony.

27. I further understand that 35 U.S.C. § 112 ¶ 6 created an exception to the general rule of claim construction. I understand that patent claims may be drafted in means-plus-function format, in which a claim limitation is expressed as a means or step for performing a specified function, without a recital of structure. I understand that, under § 112 ¶ 6, a limitation will be presumed to be a “means-plus-function” limitation if (a) the claim limitation uses the word “means”; (b) the word “means” is modified by functional language; and (c) the word “means” is not modified by sufficient structure for achieving the specified function.

28. I understand that a means-plus-function limitation should be interpreted to cover only the recited function and the corresponding structure for performing the function as described in the specification, as well as equivalent structures. I understand that a structure is deemed equivalent to the corresponding structure in the specification only if the difference between them is insubstantial. For example, two structures may be deemed equivalent if they perform the same function in

substantially the same way to achieve substantially the same result. I further understand that a structural equivalent must have been available at the time of issuance of the claim.

B. My Understanding of Obviousness

29. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of the prior art to yield the patent claim. I also understand that it is not required (although it is acceptable) that each element of a patent claim be found in a single reference in order to find a patent claim obvious. This means that even if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid. For a patent claim to be found obvious, all the elements of the patent claim may be found in a combination of references at which a POSITA would have been reasonable expected to arrive.

30. I understand that the following factors should be considered in analyzing obviousness: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the pertinent art; and (4) other objective considerations identified below. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSITA at the time the invention was made.

31. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of references. I understand that in consideration of the issue of obviousness it is important to identify whether a reason existed at the time of the invention that would have led a person of ordinary skill in the pertinent art to combine elements of the references in a way that yields the claimed invention.

32. I understand that a POSITA is assumed to have knowledge of all prior art references. I also understand that when considering the obviousness of a patent claim, one may consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

33. I understand that a POSITA can combine various prior art references based on the teachings of those prior art references, the general knowledge present in the art, or common sense. I understand that a motivation to combine the references may be implicit in the prior art, and there is no requirement that there be an actual or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a POSITA would employ to combine the known elements in the prior art in the manner claimed by the patent-at-issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an

obviousness analysis. This does not mean, however, that a POSITA does not have recourse to common sense for purposes of the obviousness inquiry.

34. I understand that a claim may be considered unpatentable for obviousness for various reasons. I have been informed that the following exemplary rationales may support a finding of obviousness:

- A) combining prior art elements according to known methods to yield predictable results;
- B) simply substituting one known element for another to obtain predictable results;
- C) use of a known technique to improve similar devices (methods, or products) in the same way;
- D) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- E) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;
- F) a predictable variation of work in the same or a different field of endeavor, which a POSITA would be able to implement;
- G) if, at the time of the alleged invention, there existed a known problem for which there was an obvious solution encompassed by the patent's claim;

H) known work in one field of endeavor that prompts variations of it for use in either the same field or a different field based on technological incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and/or

I) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior-art reference or to combine multiple prior-art references or teachings to arrive at the claimed invention.

35. I understand that even if a prima facie case of obviousness is established, the final determination of obviousness must also consider objective indicia of nonobviousness, which I understand are also referred to as “secondary considerations,” if presented. I understand that these objective indicia can be important evidence as to whether a patent is obvious or nonobvious. Such secondary considerations include: (1) commercial success of products covered by the patent claims; (2) a long-felt but unsolved need for the invention; (3) failed attempts by others to make the invention; (4) copying of the invention by others in the field; (5) unexpected results achieved by the invention as compared to the closest prior art; (6) praise of the invention by the infringer or others in the field; (7) the taking of licenses under the patent by others; (8) expressions of surprise by experts and those skilled in the art at the making of the invention; and (9) the patentee proceeded contrary to the accepted wisdom of the prior art. I further understand that secondary

considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention.

36. I also understand that “obviousness” is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the prior art, and any objective indicia of non-obviousness. For that reason, although based upon my analysis I believe the challenged claims of the ’555 Patent should be invalidated in light of prior art, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness, and when I use the term obvious, I am referring to the perspective of a POSITA at the time of invention.

C. Level of Ordinary Skill in the Art

37. I understand that an assessment of the claims of the ’555 Patent should be undertaken from the perspective of a POSITA as of the earliest claimed priority date. I understand that a POSITA is presumed to be aware of all pertinent art, thinks consistently with conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

38. I understand that to determine the appropriate level of a POSITA, the following factors may be considered: (1) the types of problems encountered by those

working in the field and prior art solutions thereto; (2) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (3) the educational level of active workers in the field; and (4) the educational level of the inventor.

D. Priority Date

39. I understand that, subject to the next paragraph, the asserted “priority date” of a patent is the earlier of: (a) the date on which a patent application is filed; or (b) the date on which an earlier-filed patent application is filed if the patentee claims the benefit of priority to that earlier-filed patent application.

40. I understand that it is not enough for a patent to merely claim the benefit of an earlier-filed application, but that additional criteria must be met. In particular, the prior application itself must describe the claimed invention, and must do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought. First, I understand that a priority-date analysis is on a claim-by-claim basis. Second, I understand that, in order for a patent claim to be entitled to the filing date of an earlier patent application, a “Section 112 analysis” must be conducted. I am informed that a “Section 112” analysis encompasses looking to the earlier patent application, and ascertaining whether that earlier patent application meets both the written-description and enablement requirements as of the filing date of the earlier application. I understand

that it is not enough that the claim would have been obvious from the earlier application, but that application itself must describe the claimed invention.

41. I understand that in order to satisfy the written description requirement the earlier application must reasonably convey to those skilled in the art that the inventors had possession of the subject matter of the patent as of the filing date of the earlier application. I have been informed that it is the disclosures of the earlier patent application that count, and that while the meaning of terms, phrases, or diagrams in the earlier patent application must be interpreted from the vantage point of one skilled in the art, all of the claimed limitations must appear in the specification. Further, I understand that this analysis is not a question of whether one skilled in the art might be able to construct the claimed invention from the teachings of the disclosure. The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification; rather, I understand that an earlier application must itself describe each of the claim limitations.

42. I also understand that in order to satisfy the enablement requirement, the earlier application must enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

V. OVERVIEW OF THE '555 PATENT

43. I have reviewed the '555 Patent, which is entitled "Thermostat System Communicating with a Remote Correspondent for Receiving and Displaying

Diverse Information.” Ex. 1001 at Cover. I understand that the ’555 Patent was filed on February 13, 2002. For purposes of my analysis, I have assumed the ’555 Patent is entitled to a February 13, 2002 priority date.

A. Subject Matter

44. The ’555 Patent concerns a thermostat system that receives information from a “remote correspondent” that is a “source of current information, such as local weather” or stock quotes. EX1001, 4:10-15, 4:45-49, 5:2-16. For example, the ’555 Patent discloses “a site providing local Montreal weather” as an example of the remote correspondent, from which current weather information is downloaded. *Id.*, 4:45-49. The ’555 Patent describes that the remote correspondent may have an Internet address or may be another thermostat system. *Id.*, 5:31-33, 6:19-45, Fig. 4. The thermostat system can display an alphanumeric message on its screen, such as the weather or a stock quote. *Id.*, Abstract, 4:40-5:16.

B. Prosecution History

45. The ’555 Patent was filed as Application No. 10/075,886 on February 13, 2002. In response to a rejection over the prior art, Applicant amended element 18[e] Claim 18 to add the following limitations:

a program stored in said memory for displaying messages received from said first remote correspondent, which received messages do not pertain to the operation of said thermostat system, on said liquid crystal display.

EX1003, 5/6/2003 Amendment, 65, 69.

46. Applicant distinguished the prior art because the claimed message “is not a pre-stored response to be displayed upon receipt of a particular command.” :

The present invention operates very differently. The initiative for getting the claimed ‘message’ as diverse information does not originate with an outside source, i.e., the remote correspondent. The outside source is simply that: viz. a source of diverse information, not a source of control. In claim 11, the claimed displayed ‘message’ is obtained from the remote correspondent. The claimed ‘message’ is not a pre-stored response to be displayed upon receipt of a particular command.

Id., 73. The Proffitt reference is what was being distinguished:

Proffitt’s display may then show that an overrideable setback mode is currently operating in the thermostat to control the HVAC equipment connected with the thermostat. Although described as a “message” in Proffitt, the communications between the energy provider and the processor in the thermostat cannot be construed as the equivalent of a “message” as described and employed in the subject application. Unless the command is shown in the form of the lines of code that cause it to occur, Proffitt does not describe directly displaying at the thermostat a setback command as a “message” obtained from an external source. The “message” displayed as in Proffitt is pre-stored information which is displayed when the thermostat operates in a mode commanded by the energy provider/external source. Proffitt has defined “message” to

Id., 72. Thus, what is displayed on the thermostat in Proffitt is that an “overrideable setback mode is currently operation to control the HVAC equipment.” That message is displayed based upon a prestored response to a command.

C. Priority Date

47. I have been asked by counsel for Petitioner to assume that the Challenged Claims are entitled to a February 13, 2002 priority date. I understand from counsel that the '555 Patent is subject to the pre-AIA provisions of 35 U.S.C. §§ 102 and 103.

D. Level of Ordinary Skill in the Art

48. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. My opinions regarding the level of ordinary skill in the art are based on, among other things, my nearly 40 years of experience in the field of electrical engineering and computer science, as well as: the levels of education and experience of persons working in the field, the types of problems encountered in the field; and the sophistication of the technology.

49. Based on the disclosure of the '555 Patent, in my opinion a POSITA as of February 13, 2002 would have had a Bachelor of Science degree in Electrical Engineering or a year or two of experience working with or designing processor-based systems with network connectivity. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa.

50. Based on my education and experience, I meet this definition of one of ordinary skill in the art, and I believe that I am qualified to provide opinions about

how a POSITA at the relevant time would have interpreted and understood the '555 Patent and the prior art relied upon herein. Although my qualifications and experience exceed those of a POSITA, both in February 2002 and today, I have nevertheless applied the perspective of a POSITA in rendering my opinions below.

51. My opinions below explain how a POSITA would have understood the technology described in the '555 Patent and the prior art references I have identified herein around the February 13, 2002 timeframe. For purposes of this declaration, in general, and unless otherwise noted, my testimony below refers to the knowledge of one of ordinary skill in the art during the time period around the priority date of the '555 Patent. I would have been a person with at least ordinary skill in the art at that time.

E. Listing of Challenged Claims

52. Below I provide a listing of Claims 18 and 20 '555 Patent. I will refer throughout this declaration to the elements of the claims with reference to the number and letter designations that have been added in the left column (*e.g.*, “1[pre],” “1[a],” “1[b],” etc.).

Claim 18	
18[Pre]	18. A thermostat system for controlling space conditioning equipment comprising:
18[a]	A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature

	sensor is situated;
18[b]	B) a liquid crystal display for selectively displaying an alphanumeric message;
18[c][1]	C) a processor, said processor including: 1) a central processing unit;
18[c][2]	2) a real time clock;
18[c][3]	3) a memory coupled to said central processing unit for storing program and data information; and
18[c][4]	4) an input/output unit including:
18[c][4][a]	a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;
18[c][4][b]	b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and
18[c][4][c]	c) a communications interface adapted to establish bi-directional communications between said processor and a first remote correspondent which is a source of current information; and
18[d]	D) means coupling said communications interface and said first remote correspondent; and
18[e]	a program stored in said memory for displaying messages received from said first remote correspondent, which received messages do not pertain to the operation of said thermostat system, on said liquid crystal display.
Claim 20	
20	20. The thermostat system of claim 18 in which communications between said first remote correspondent and said communications interface is carried out via the Internet.

F. Claim Construction

53. It is my understanding that in order to properly evaluate the '555 Patent, the terms of the claims must first be interpreted. It is my understanding that the claims are to be construed according to the same claim construction standard that district courts use. I have been informed by counsel for Petitioner that the challenged claims of the '555 Patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the specification and the prosecution history pertaining to the patent.

54. In order to construe the claims, I have reviewed the entirety of the '555 Patent along with the prosecution history of the '555 Patent. Except as set forth below, it is my opinion that a POSITA would have understood each term of the challenged claims according to their plain and ordinary meaning as understood by a person of ordinary skill in the art.

55. As explained in the sections that follow, for purposes of this declaration, I have been asked to make certain assumptions regarding the meaning of the claim language and provide an opinion as to obviousness based upon those assumptions.

56. The challenged claims of the '555 Patent include a claim limitation that recites “means” for performing various functions. Element 18[d] recites “means coupling.” EX1001, Claim 18. I understand from counsel that use of the word

“means” creates a presumption that § 112, ¶6 applies. Further, I have reviewed element 18[d] and found no structure within the claim itself for the claimed coupling means.

57. In the related district court litigation, I understand that the parties agree that “means coupling” recited in Element 18[d] is governed by 35 U.S.C. § 112, ¶6. EX1016, 2-5. Petitioner has argued in the related district court litigation that these terms are indefinite for lacking disclosure of the corresponding structure. *Id.* Patent Owner disagrees. *See id.* Without conceding that these claim elements satisfy 35 U.S.C. § 112, I have been asked by counsel for Petitioner to apply Patent Owner’s proposed constructions for this limitation:

Limitation	Structure and Function
“means coupling said communications interface and said first remote correspondent;”	<u>Function</u> : coupling the communications interface and the remote correspondent <u>Structure</u> : a serial link and/or data link and any equivalents <i>See</i> EX1001, Fig. 1, 4:4-15, 6:1-18

58. In the related district court litigation, I understand that Patent Owner contends that the following limitations of 18[c] and 18[e] reciting a “sensor input,” a “control output,” a “communications interface,” and a “program” to perform certain recited functionality are not subject to 35 U.S.C. § 112, ¶6. EX1016, 5-17,

26-30. I have been asked by counsel for Petitioner to apply Patent Owner’s “plain and ordinary meaning” interpretations here, without conceding they are correct.

59. Finally, in district court litigation, I understand that Petitioner has taken the position that “current information” and “which received messages” are indefinite. EX1016, 31-37. I also understand Patent Owner contends that these terms do not need to be construed and should be afforded their plain and ordinary meaning. *Id.* For purposes of this Petition, I have been asked by counsel for Petitioner to address these limitations in the manner in which Patent Owner is interpreting them. In their infringement contentions in district court Patent Owner has asserted that current weather information meets the requirement for “current information.” EX1017, Ex. A, 17 (“The thermostats have a humidification window protection program that uses the *weather information received from the internet* (*i.e.* the first remote correspondent). The thermostats also *display weather data on the LCD touchscreen.*”) (emphasis added).

VI. TECHNOLOGY BACKGROUND AND STATE OF THE ART

60. Before providing my analysis of the ’555 Patent and the prior art references, as included below, a background discussion of the state of the art of thermostat systems and the technologies they employ is helpful.

A. Connecting a thermostat to the Internet was well known.

61. The '555 Patent covers a thermostat connected to the Internet that displays “current information” retrieved from the Internet. There was nothing new about that concept. The idea of connecting a thermostat to the Internet and displaying “current information” that did not pertain to the operation of the thermostat was common knowledge of a POSITA. But it was well known to a POSITA to connect a thermostat to the Internet at the time of the alleged invention (February 2002).

62. Numerous references before the time of the alleged invention teach the connection of a thermostat to the Internet. For example, an article from 2000 indicates that it “makes sense” to connect a thermostat to the Internet so that it can be remotely controlled. EX1023, 9 n.10. Thermostats were long known to be examples of Internet “appliances” that could be connected to the Internet. EX1026, 4:38-52. Another reason to connect a thermostat to the Internet is so the user can configure the thermostat for their desired language. EX1010, Abstract, 1:41-51, 3:49-65. As another example, a reference from 2001 describes accessing a web browser on a thermostat. EX1037, 50, 52. Other references teach connection of systems including thermostats to the Internet for purposes of displaying information. EX1026, 4:46-52; EX1022, 55:14-57; EX1005, 4:31-34, 5:28-31; EX1020, 3:19-26; EX1019, 1:18-30.

B. It was well known to obtain current information from a remote correspondent and display it.

63. Second, numerous references also teach the desirability of displaying messages from a “remote correspondent.” For example, the article from 2000 indicates that if cheap enough it makes sense to have a device in the bedroom to check the weather. EX1023, 6 n.6. Another reference teaches obtaining weather information for a thermostat system for control and display purposes. EX1005, 4:31-34, 5:28-31. A car thermostat system can be used for Internet surfing as well. EX1022, 55:54-56 (“One moment it can be used for heat and radio volume, the next for internet surfing, or camera image viewing (*e.g.* of the road behind the car) etc”). It was further common knowledge that a thermostat system could display announcements, promotions, or the customer’s energy bill. EX1009, 5:62-6:1; EX1005, 5:37-41. Other types of information displayable by thermostat systems included stock quotations, breaking news headlines, and weather. EX1020, 3:19-26. Thermostat systems could also be used to receive local news and alerts, such as weather alerts. EX1025, 65-2-65-3, 65-17.

64. As I discuss above, prior to the February 2002 priority date of the ’555 Patent, all of the technology at issue in the challenged claims was well known and broadly applied in various commercial applications. In my opinion, no individual elements of the challenged claims of the ’555 Patent were novel at the time of the

alleged invention, and there was nothing novel or inventive about the manner in which those elements were combined in the challenged claims. Further, there were no technological barriers to combining these known elements to form the claimed inventions. Indeed, combining these elements would have yielded predictable results.

C. It was well known for thermostat systems to include conventional components.

65. The hardware elements in Claim 18 were well known and used in thermostat systems for many years before the '555 Patent. Indeed, the admissions in the specification of the '555 Patent demonstrate that most of these elements would have been well known to a POSITA before the priority date. It was also well known to connect appliances—such as thermostat systems—to the Internet to obtain current information, as I have discussed above. *Supra*, §VI.

66. It was well known to a POSITA that thermostat systems would have included a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space, as acknowledged by the '555 Patent. EX1001, 1:28-47, 3:31-53. Moreover, Inventor Rosen admits that the '555 Patent's sensor is not inventive. EX1012, 289:14-24.

67. It was well known to a POSITA that thermostat systems would have included the ability to display alphanumeric messages on an LCD display, as acknowledged by the '555 Patent. EX1001, 1:48-55.

68. It was well known to a POSITA that thermostat systems would have included a processor, as acknowledged by the '555 Patent. EX1001, 1:28-47. Moreover, Inventor Rosen admits that the '555 Patent's CPU or microprocessor is not inventive. EX1012, 287:22-24, 288:16-19.

69. It was well known to a POSITA that thermostat systems would have included a real time clock, as acknowledged by the '555 Patent. EX1001, 1:28-47. Moreover, Inventor Rosen admits that the '555 Patent's real-time clock is not inventive. EX1012, 287:22-24, 288:8-11.

70. It was well known to a POSITA that thermostat systems include a memory storing a program and that is programmable so that the thermostat set points may vary with the day of the week (thus necessitating the storage of data), as acknowledged by the '555 Patent. EX1001, 1:28-55. Moreover, Inventor Rosen admits that the '555 Patent's memory is not inventive. EX1012, 287:22-288:7.

71. It was common knowledge of a POSITA that thermostat systems would have included a sensor input and control output, as acknowledged by the '555 Patent. EX1001, 1:28-55 (noting that processor accurately measures temperature of a sensor and sends control signals to equipment). The '555 Patent admits "all the processor

components” are available off the shelf. EX1001, 3:54-60. Inventor Rosen also admits that the ’555 Patent’s sensor input and input/output unit are not inventive. *Id.*, 287:22-24, 289:18-21, 290:8-11. Inventor Rosen also admits that the ’555 Patent’s control output for space conditioning equipment is not inventive. EX1012, 287:22-24, 289:33-13.

72. It was well known to a POSITA that a thermostat could have been connected to the Internet as an Internet Appliance. *Supra*, §VI.A. The ’555 Patent discloses that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner,” thus admitting this element is obvious as common knowledge. EX1001, 6:1-11. It was common knowledge that a modem can be used to connect to an Internet service provider that then completes a connection to the Internet and, thus, the “first remote correspondent.” *See id.*; *see also, e.g.*, EX1005, 5:28-31; EX1019, 1:19-30, 5:26-30; EX1020, 5:60-63, 11:7-57; EX1023, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51. Inventor Rosen admits that the ’555 Patent’s communications interface is not inventive. EX1012, 290:19-291:14.

VII. APPLICATION OF THE PRIOR ART TO THE CHALLENGED CLAIMS

73. I have been asked to provide my opinion as to whether the challenged claims of the ’555 Patent would have been obvious in view of the prior art. My

discussion below provides a detailed analysis of how the prior art references I reviewed disclose, teach, or suggest the limitations of the challenged claims of the '555 Patent.

74. As part of my analysis, I have considered the scope and content of the prior art and any potential differences between the claimed subject matter and the prior art. I have conducted my analysis as of the priority date of the '555 Patent: February 13, 2002. I have also considered the level of ordinary skill in the pertinent art as of that date.

75. Below, I describe in detail the scope and content of the prior art, as well as any differences between the subject matter claimed and the prior art, on an element-by-element basis for each challenged claim of the '555 Patent. The analysis supports my finding that the differences between the claims of the '555 Patent and the prior art discussed herein are such that the subject matter as a whole would have been obvious at the time of the priority date of the '555 Patent to a POSITA.

76. In the grounds below, I describe on an element-by-element basis how the prior art discloses or teaches all elements of Claims 18 and 20 of the '555 Patent.

A. Grounds of Unpatentability

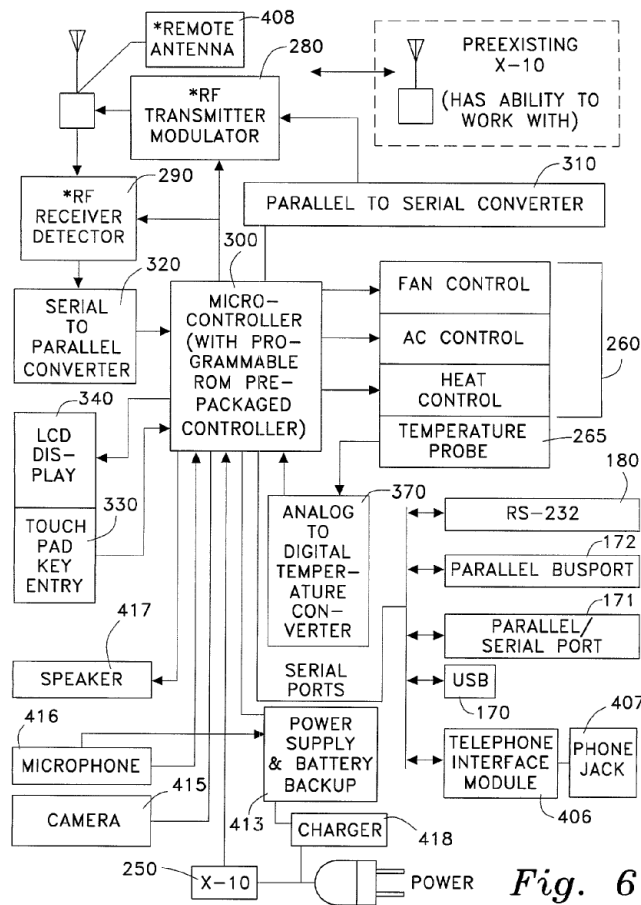
77. I have reviewed and analyzed the prior art references and materials listed in Section 5 above. In my opinion, the challenged claims of the '555 Patent are rendered obvious based on the following prior art set forth in Grounds 1-3 below:

Ground	'555 Patent Claims	Basis for Challenge
1	18, 20	Obvious under §103 based on <i>Shamoon</i> in view of <i>Rainer</i>
2	18, 20	Obvious under §103 based on <i>Inoue</i> in view of <i>Peters</i> and weather.com
3	18, 20	Obvious under §103 based on <i>Glorioso</i> in view of <i>Shah</i>

B. Summary of Prior Art

1. *Shamoon* (EX1004)

78. *Shamoon* discloses a “web-based” thermostat connected to the Internet. EX1004, ¶¶[0035], [0083], Fig. 7. Figure 6 of *Shamoon* “is a block diagram of a remote control apparatus and its thermostat and X-10 components according to the present invention.” EX1004, ¶[0034].



Id., Fig. 6. While *Shamoon* teaches the ability to remote control a thermostat, it indicates “[t]he wall thermostat controller of the invention uses the same operating system as the handheld controller, has similar hardware, and performs pretty much the same.” EX1004, ¶[0040]. Thus, a POSITA would understand that *Shamoon*’s wall thermostat includes the features of Figure 6. I further note that Figure 6 of *Shamoon* discloses features such as connection to a telephone jack that are more consistent with a wall mounted unit. *Id.*, Figure 6. This makes sense because Figure 6 illustrates connections to controls for space conditioning equipment and to a standard telephone jack. *Shamoon* teaches connection of the thermostat to the

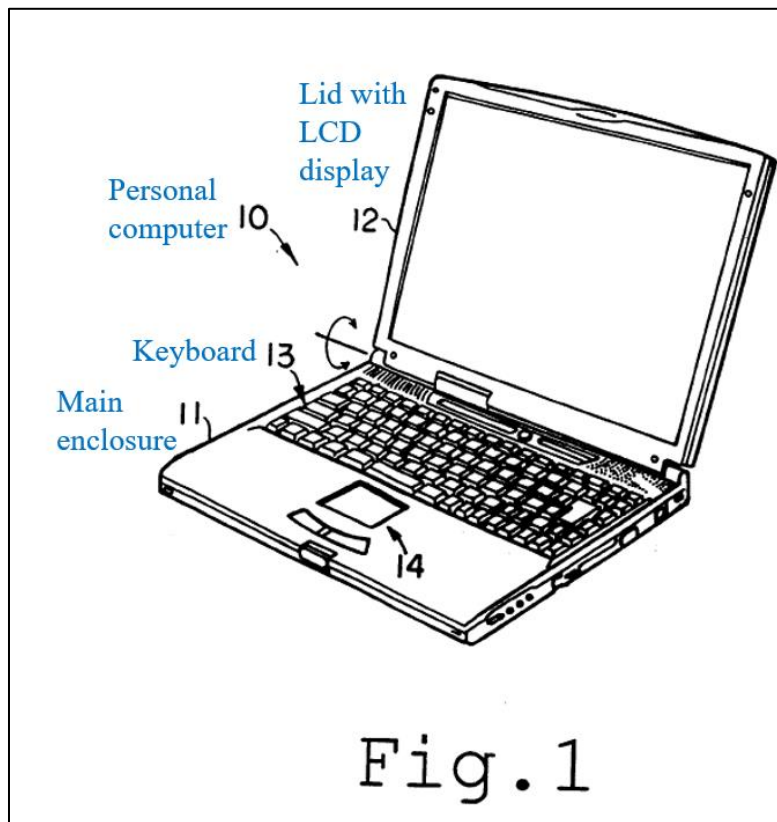
Internet. EX1004, ¶[0083].

2. *Rainer* (EX1005)

79. *Rainer* discloses a thermostat connected to the Internet. EX1005, 3:28-32, 4:31-34, 5:28-31, Fig. 2. *Rainer* discloses that the thermostat can obtain weather information from the Internet for “control and display purposes.” *Id.*, 4:31-34, 5:28-31, 5:37-41. *Rainer*’s thermostat also controls “ventilation, cooling, heating, air conditioning, and fresh air ventilation” and uses temperature predictions for improved temperature control. *Id.*, 3:21-32, Fig. 2. *Rainer* discloses a communications link 32 that is an Internet link. *Id.*, 5:28-31, Fig. 1.

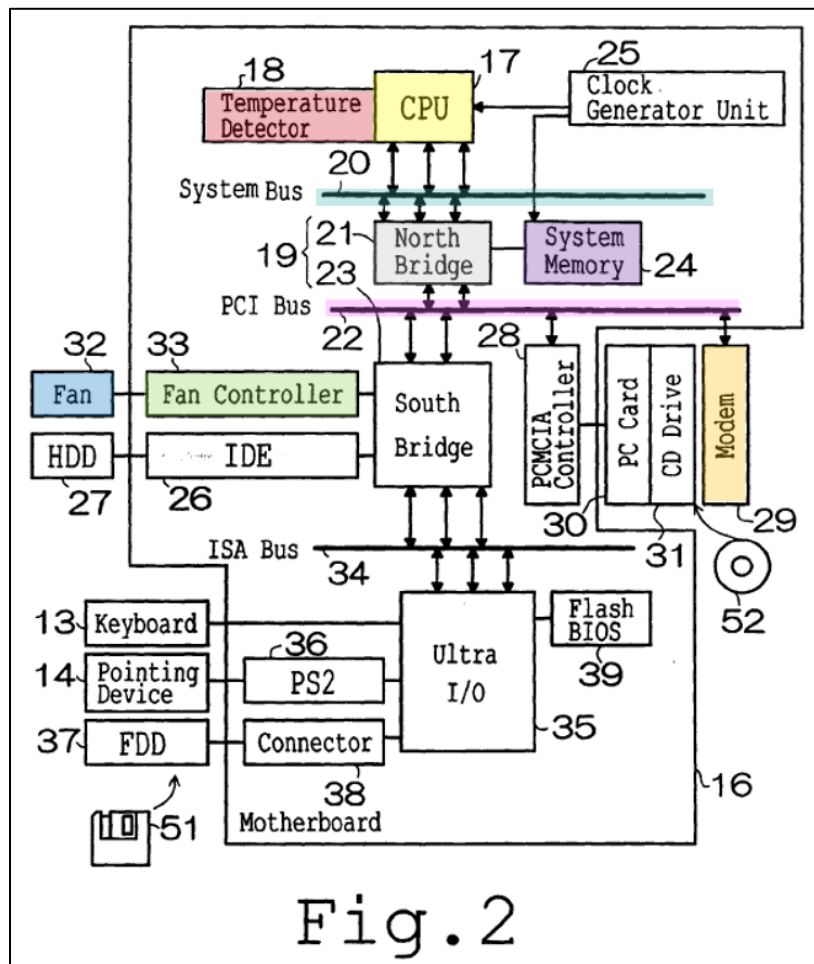
3. *Inoue* (EX1006)

80. *Inoue* discloses a “notebook type personal computer 10 as an electronic apparatus,” illustrated below, which “comprises a main enclosure 11 in which a central processing unit (CPU) and other electronic components are incorporated,” as well as a “liquid crystal display (LCD).” EX1006, ¶[0020].



EX1006, Fig. 1 (annotated).

81. *Inoue's* motherboard, illustrated below, includes a CPU (yellow), a temperature detector or thermal sensor (red), a cooling fan (blue), a fan controller (green), memory (purple), a modem (peach), a North Bridge chip (grey), a system bus (turquoise) and a PCI bus (pink), among other components (white), as illustrated in Figure 2 below:



EX1006, Fig. 2 (annotated). The cooling fan (blue) generates air to suppress heat or an increase in temperature in the device. EX1006, ¶¶[0002], [0011], [0015], [0029], [0038]. The thermal sensor (red) “measure[s] the actual temperature within the enclosure of the electronic apparatus.” EX1006, ¶[0013]. The modem (peach) connects the CPU (yellow) to a network like the Internet. EX1006, ¶[0028]; Fig. 2. The CPU connects to the modem utilizing a System Bus (turquoise) and PCI Bus (pink).

4. *Weather.com* (EX1008)

82. Weather.com is documentation concerning the website published on January 26, 1997. EX1013, ¶[0005]. The inventor of the '739 Patent Mr. Rosen admitted to using the weather.com website in the 1990s:

Q. Did you ever use the weather.com website in the 1990s?

A. In the '90s?

Q. Yes.

A. Perhaps, if I had a computer, which I probably did, yes.

See also EX1012, 223:12-17.

83. Weather.com provides an example of a website that can be accessed via the Internet on an electronic device, including a thermostat or a laptop, to access current information such as the weather. I rely on the weather.com printed publication and not the system itself.

84. When a user uses weather.com, the website displays a screen to obtain a zip code and then returns weather information and that weather information is displayed. EX1008, 6, 9; EX1013, 5. Corresponding to the display of the website graphic shown above is the source code in EX1008. That source code is provided by *weather.com* to the web browser displaying the website information. Note that all of the code associated with the web page is stored in the memory of the computer running the web browser displaying the web page. The type of the script is a CGI script (“cgi-bin” and “.cgi”). The CGI script, having determined the local weather

information based on the ZIP code or city name, includes the weather in the HTML that is returned to the web browser. The web browser automatically displays this new HTML file in place of the old HTML which display the field for entering the ZIP or city name. Thus, from the user's perspective, the screen is updated with local weather information. This behavior is inherent in the process.

85. I am only relying upon the printed information about *weather.com* obtainable from that website in 1997 and not on the system itself. I understand from counsel that the reference is a printed publication. I also note that both the HTML code itself and the HTML code rendered by the browser were both publicly available.

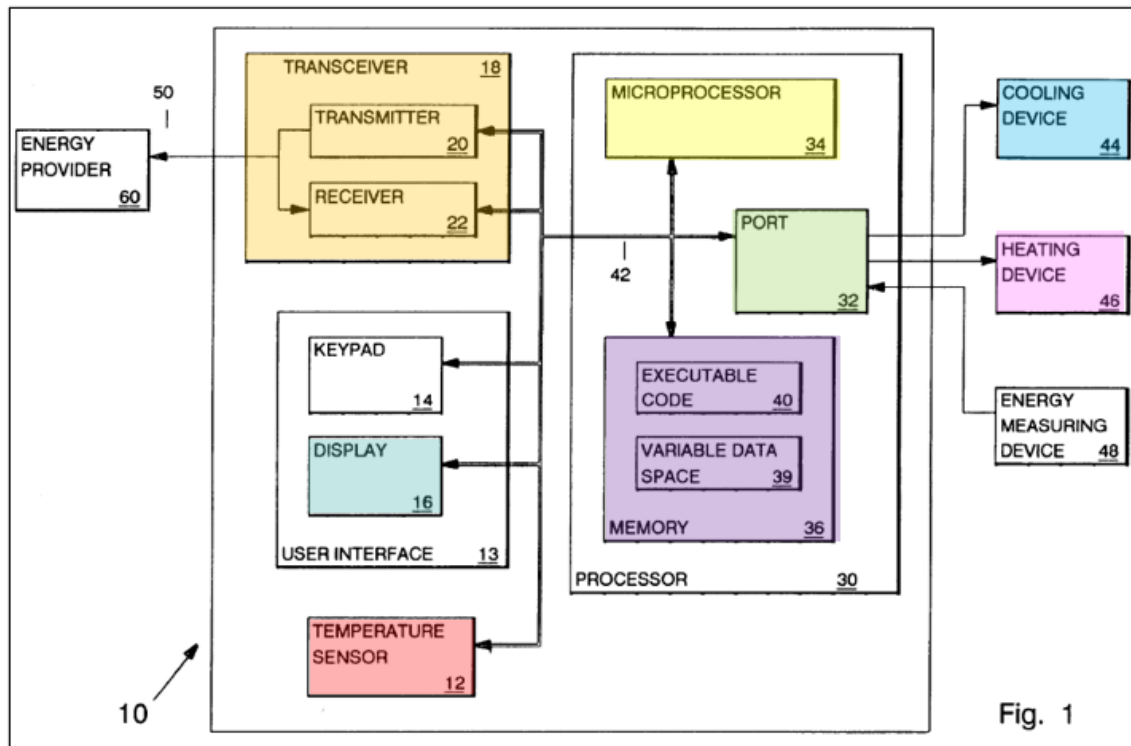
5. *Peters* (EX1007)

86. *Peters* discloses “[a] computer system having thermal control logic that efficiently cools the computer system,” where “the thermal control logic couples to a CPU module and a fan.” EX1007, Abstract, 3:50-4:6, 5:19-31, Fig. 1. *Peters* discloses two temperature sensors, one of which measures the temperature of the CPU core and one that measures the temperature near the exterior surface of the CPU. See, e.g., *id.*, EX1007, Abstract, 4:7-31, 6:12-21. The latter sensor is able to measure the temperature of “a region away from the die 105, such as an exterior region 109 of the CPU 102.” *Id.*, 5:32-52. The thermal control logic controls the

fan to cool the computer in response to temperature monitored by sensors. *See, e.g., id.*, 2:65-3:8, 7:5-10, 7:40-59, 13:24-48, 16:52-65.

6. *Glorioso* (EX1009)

87. *Glorioso* discloses a “smart thermostat” as illustrated in Figure 1 below:



EX1009, Fig. 1 (annotated). *Glorioso*’s thermostat includes a temperature sensor (red), a microprocessor (yellow), memory (purple), transceiver (including a transmitter and receiver) (peach), port (green), and display (turquoise). EX1009, Abstract, 2:54-3:8, 4:1-17, Fig. 1. The thermostat controls a cooling device (such as an air conditioner) (blue) or a heating device (such as a furnace) (pink). EX1009, 2:54-3:8, 4:1-18, Fig. 1. *Glorioso*’s thermostat communicates to an energy provider

through a communication network to receive information, including the current price level for energy, billing, “outages, announcements, promotions, or the like.” *Id.*, 3:8-10, 4:1-4, 4:39-44, 4:52-5:16, 6:4-30, Fig. 2.

7. *Shah* (EX1010)

88. *Shah* discloses a thermostat system connected to the Internet with a CPU, memory, and display. EX1010, Abstract, 3:44-65, Fig. 1. *Shah* discloses its thermostat includes a network interface such as a modem. *Id.*, 3:44-65. *Shah* discloses a liquid crystal display (LCD) with a touch-screen that allows the user to *e.g.*, input data or select a preferred language. *Id.*, Abstract, 2:41-55, Fig. 2. *Shah*’s display can also display other data “such as a current date, day of the week, indoor and/or outdoor relative humidity, etc.” as well as the “time and temperature.” *Id.*, 3:9-20, Fig. 2. *Shah* also discloses storing control algorithms stored in memory in the CPU of the thermostat. *Id.*, 3:1-8.

C. Ground 1: Claims 18 and 20 are obvious over *Shamoon* in view of *Rainer*.

89. In my opinion, Claims 18 and 20 would have been obvious over *Shamoon* in view of *Rainer*. The hardware elements in the challenged claims were well known and used in thermostat systems for many years before the ’555 Patent, as I have discussed above. *Supra*, §VI.C. Indeed, the admissions in the specification of the ’555 Patent demonstrate that most of these elements would have been well

known to a POSITA before the priority date. To the extent Patent Owner contends any of these elements are missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat.

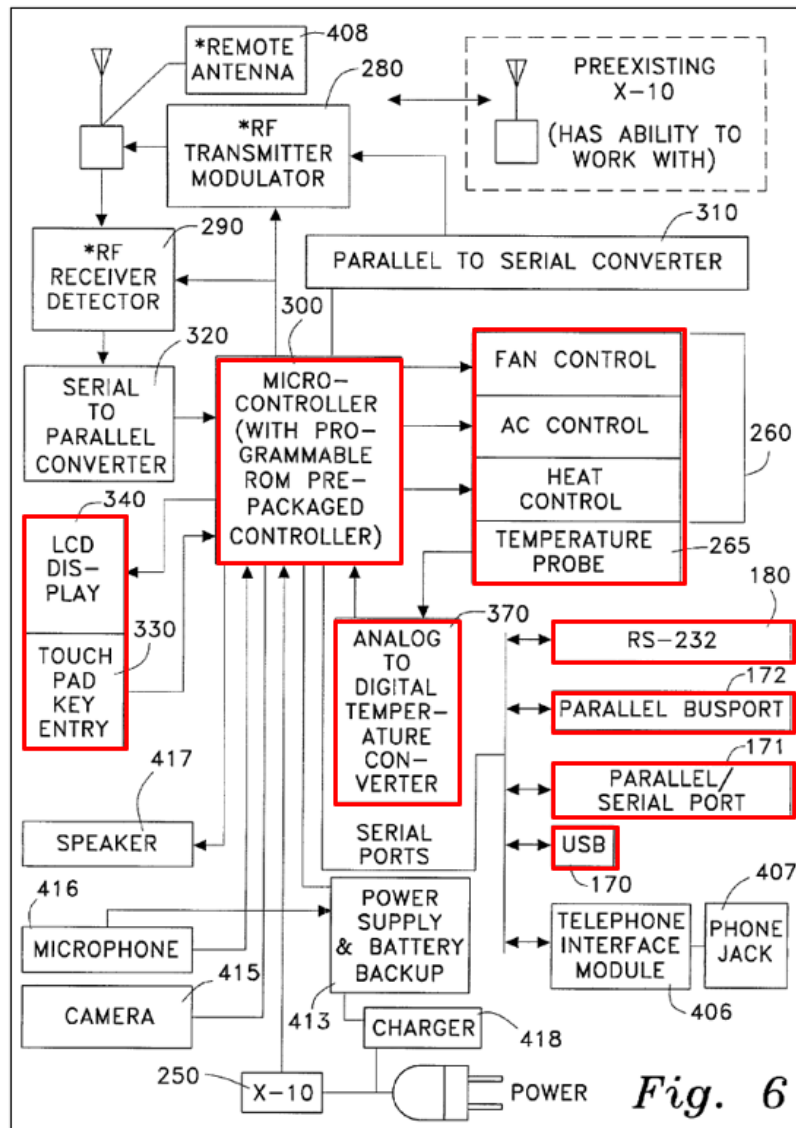
90. Based on the following analysis, I conclude that a POSITA at the relevant time would have understood the limitations of Claims 18 and 20 were expressly disclosed, taught, or suggested by Shamoon in combination with Rainer and wather.com, and it would have been obvious to a POSITA to combine them to arrive at the challenged claims.

1. A POSITA Would Have and Could Have Combined Shamoon with Rainer.

91. A POSITA would have been motivated to combine *Shamoon* with *Rainer* to arrive at the claimed invention. *Shamoon* and *Rainer* are analogous art in the same field of endeavor as they both relate to thermostats connected to the Internet. *Shamoon* discloses a “web-based thermostat” connected to the Internet (EX1004, ¶[0083]) and that a “principal thrust of the invention is to eliminate the need for a PC for the many and myriad applications discussed herein below” (EX1004, ¶[0039]). *Shamoon* also discloses a computer that may be handheld or

wall mounted. EX1004, ¶¶[0039]-[0040]. While *Shamoon* discloses a thermostat connected to the Internet and selectively displaying alphanumeric messages on the thermostat's LCD screen, *Shamoon* does not disclose obtaining current information that does not pertain to the operation of the thermostat from the Internet and displaying it on the thermostat, as is disclosed in *Rainer*. *Rainer* similarly discloses a thermostat connected to the Internet. EX1005, 3:28-32, 5:28-31, Fig. 2. *Shamoon*'s thermostat and display already would have included the hardware, software, and circuitry for a combination with *Rainer*. A POSITA would have readily been able to combine the hardware, software, or both of *Shamoon* with *Rainer*. For example, a POSITA would have been able to obtain the type of information disclosed by *Rainer* and display it on a screen in *Shamoon* with only a software modification.

92. As I discuss above, a POSITA would have understood that Shamoon's wall thermostat includes the features of Figure 6, below:



EX1004, ¶[0040], Fig. 6; *supra*, VII.B.1.

93. It would have been obvious to a POSITA to modify or combine *Shamoon*'s "web based thermostat" with that of *Rainer* that is connected to the Internet to obtain current information. EX1004, ¶¶[0062], [0083]-[0084], Fig. 7; EX1005, 4:31-34, 5:28-31, Fig. 1 (link 32). A POSITA looking to implement *Shamoon*'s web based thermostat would have looked to similar references such as

Rainer, which also discloses a thermostat connected to the Internet, for implementation details and use cases regarding the types of information that can be obtained via the Internet connection. A POSITA would have looked to *Rainer* for additional features to include, especially those that eliminate the need for a PC as taught by *Shamoon*. *Rainer* discloses a communications link (link 32) that connects to the processor and is used to obtain “current utility pricing information.” EX1005, 4:31-34, 5:37-41, 6:14-19, 7:15-19, Fig. 1. This eliminates the need for a PC for getting such information.

94. It would have been well known and common knowledge to a POSITA that the Internet is a source of diverse current information and that numerous types of information could be displayed by a thermostat. *Supra*, §VI.A-B. As of the priority date, news, weather, dictionaries, social media, stock quotes, corporate and personal websites, e-mail, text messages, and files were all available on the Internet. *See* EX1001, 5:2-23. A reason that multiple references teach providing “current information” for display on thermostats is that the information is considered useful to the user—otherwise there would be no reason to provide the information. Once a thermostat is connected to the Internet it would have been obvious that copious amounts of information could be displayed on a thermostat of any type—whether current or not. The type of information to display is a matter of design choice. As was common knowledge, a “network (e.g., Internet) interface” on a control system

“provide[s] rapid access to a variety of web sites or URLs of interest, such as those providing local weather, directions from the elevator to local points of interest, stock market quotations, breaking news headlines, etc.” EX1020, 3:22-25. It would have been obvious that once a thermostat is connected to the Internet, that any type of information could be displayed on the screen of the thermostat from the Internet, especially the kinds of information that prior art teaches could be displayed on the screen of a thermostat, such as the information taught by *Rainer*.

95. A POSITA would have had a reasonable expectation of success in such a combination or modification, because *Shamoon* already includes the hardware, software, and circuitry for such a modification. EX1004, Fig. 6 (annotated above). Such a modification would not have involved a substantial modification or undue experimentation. Rather, it would have involved combining known prior art elements (communications links to the Internet and thermostats) according to known methods (coupling) to yield predictable results (connecting the thermostat to the Internet to obtain current information). A POSITA would have readily been able to combine the hardware, software, or both of *Shamoon* with *Rainer*. Modifying the thermostat of *Shamoon* to obtain information from the Internet would have involved a simple software change because web browser software could be used to obtain the information. EX1026, Abstract, 2:38-41, 4:42-50, 6:57-64. It would have been a

matter of design choice to use the communications interface of *Shamoon* or *Rainer* to connect the *Shamoon-Rainer* thermostat to the Internet.

96. It would have been obvious to a POSITA to modify or combine *Shamoon*'s LCD display displaying alphanumeric messages with that of *Rainer*'s LCD display displaying current information received from the Internet. EX1004, ¶¶[0040], [0061], [0065]-[0066], [0070]; Figs. 2 & 6; EX1005, 4:31-34, 5:37-41, 5:47-52, Fig. 1. As addressed above, it would have been obvious and a POSITA would have understood that the *Shamoon-Rainer* thermostat connected to the Internet would obtain current information. It would have been a matter of common sense to then display that received information on the *Shamoon-Rainer* thermostat's display. The purpose of obtaining the information in *Rainer* was to display it. EX1004, 4:31-34. If the *Shamoon* LCD could not display the received information, it would have been obvious to use *Rainer*'s display which is suitable to display the information. Displaying the received information on the display is one of a finite number of options for communicating the received information to the user. A POSITA would have recognized the benefits of displaying such an information, for example, to communicate the information to the user and/or to further *Shamoon*'s goal of "eliminat[ing] the need for a PC for the many and myriad applications." EX1004, ¶[0039].

97. A POSITA would have had a reasonable expectation of success in such a combination as it would have involved minimal, if any, modification to *Shamoon*'s LCD display. *Shamoon*'s thermostat and display already would include the hardware, software, and circuitry for such an implementation. A POSITA would have readily been able to combine the hardware, software, or both of *Shamoon* with *Rainer*. For example, a POSITA would have been able to obtain the type of information disclosed by *Rainer* and display it on a screen in *Shamoon* with only a software modification. LCDs are made from dot-matrix screens, so their layout can be changed via software. Additionally, it is a routine use of the skill of a POSITA to modify a layout of a screen to include display of additional information. Using *Rainer*'s display is a simple matter of design choice.

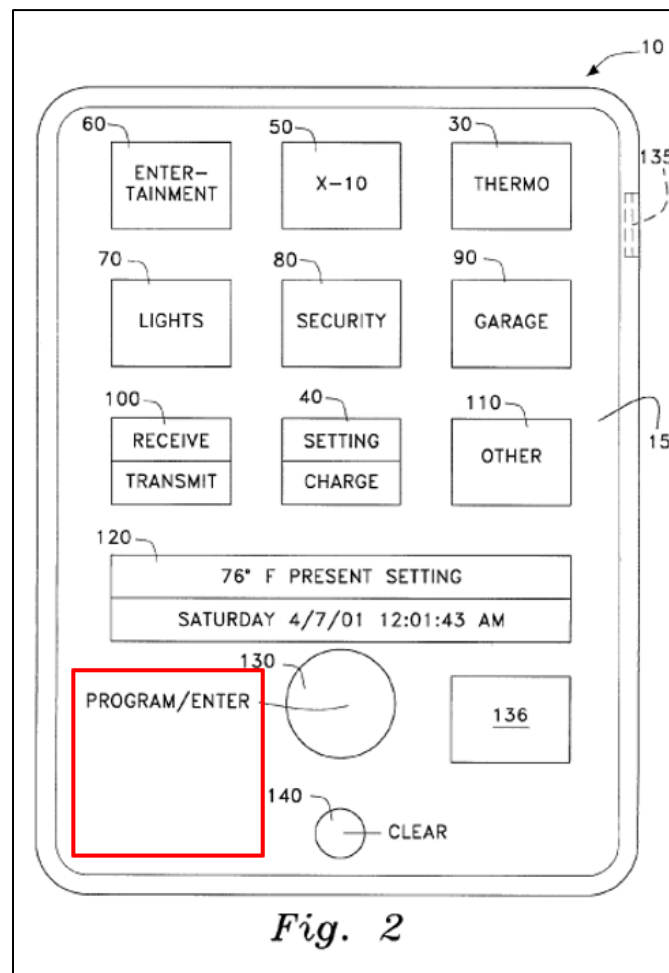
98. Moreover, it would have been obvious to modify the *Shamoon-Rainer* combination's display of alphanumeric messages to display the messages "selectively." For example, it would have been obvious to a POSITA to display current utility price information and/or weather information "selectively" in response to the user requesting such information, for example through buttons and/or a keyboard. EX1005, 5:48-49 (*Rainer*'s LCD screen including buttons), Fig. 1; EX1004, ¶[0048], [0065], Fig. 2 (*Shamoon*'s thermostat including buttons and ability to receive input from an external keyboard). A POSITA would have been motivated by the benefits of such a "selective" display as allowing for efficient use

of screen space, and rendering the designing and managing screen layout easier. With information displayed “selectively,” there will not be deficient screen area.

99. A POSITA would have recognized design and market incentives and benefits of such selective display, for example to shape consumer behavior. For example, a POSITA would have recognized and it would have been obvious to a POSITA to display current utility price information “selectively” such as only when the pricing changes or updates, or only during periods of peak usage. A POSITA would have recognized the benefits of displaying such price information to mitigate peak load and encourage energy savings during those times. For example, *Rainer* discloses the benefits of “reduction of the peak electric load and mitigating the need to construct new power plants” as well as the need to “prevent[] operation specifically during utility peak power use periods or during power shortage alerts.” EX1005, 1:27-34, 3:11-16. It has long been known to place prices on goods and services, such for gasoline, cars, food. It is routine to provide pricing information up front to consumers.

100. A POSITA would have had a reasonable expectation of success in modifying the *Shamoon-Rainer* combination’s display of alphanumeric information to display “selectively.” As addressed above, the thermostat already included the hardware and software for implementing such a modification. The modification represents a trivial modification well within the skill set of a POSITA to implement

without substantial modification or undue experimentation. Moreover, Shamoon already discloses selective display of information. EX1004, Fig. 2. As shown in Figure 2 below, there is plenty of room just to the left of the “Program Entry” icon button 130 (as shown by the red box below) to add another button to allow the selective display of the information taught by *Rainer*.



EX1004, ¶[0048], Fig. 2 (annotated). And in any event, the information also could be displayed on a separate screen for the thermostat itself.

101. Finally, it would have been obvious to a POSITA to modify *Shamoon-Rainer*'s thermostat to include a program stored in memory for displaying the information received from the Internet. It was common knowledge that web browsers could be used with Internet appliances, such as thermostats. EX1026, Abstract, 2:31-44, 2:38-41, 4:38-52, 6:56-7:5. A POSITA would have recognized the benefits of such a modification to facilitate displaying the received information. Further, a POSITA would have understood that a program stored in memory is the primary way to display information received from the Internet. *See, e.g.*, EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5; EX1040, 4; EX1041, 82, 93. I am not aware of any other way that a microprocessor or microcontroller driven device causes information to be displayed on an LCD. A POSITA would have had a reasonable expectation of success as incorporating such a program would have involved little, if any, modification to *Shamoon-Rainer*'s thermostat. As addressed below in 18[e], the *Shamoon-Rainer* thermostat already would have included the hardware, software, and circuitry to incorporate such a program. Moreover, such a modification would have involved combining well known prior art elements (programs and memory) according to known methods (storing programs in memory) to achieve predictable results (displaying information).

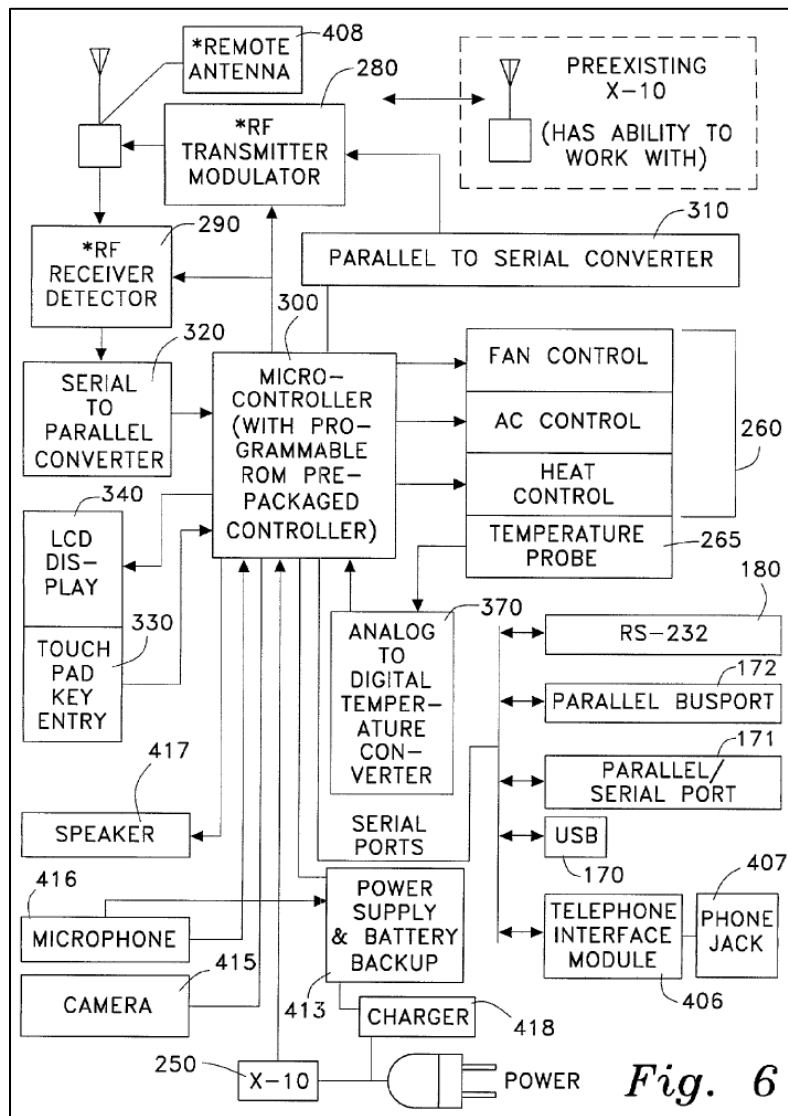
2. Claim 18

a) 18[Pre]: A thermostat system for controlling space conditioning equipment comprising:

102. If the preamble is limiting, the *Shamoon-Rainer* combination discloses it.

103. *Shamoon* discloses a thermostat system for controlling space conditioning equipment. *Shamoon* discloses an “***an intelligent thermostat which can control***, monitor and communicate to ***a HVAC system*** and a thermostat and remote controller apparatus.” EX1004, ¶[0025] (emphasis added). “The thermostat 260 and temperature probe 265” of *Shamoon* “are the controlling devices for a user’s heating and air conditioning equipment.” *Id.*, ¶[0057]; *see also id.*, ¶[0040].

104. Figure 6 of *Shamoon*, reproduced below, depicts a thermostat for controlling space conditioning equipment.



EX1004, Fig. 6. Accordingly, *Shamoon* discloses 1[Pre].

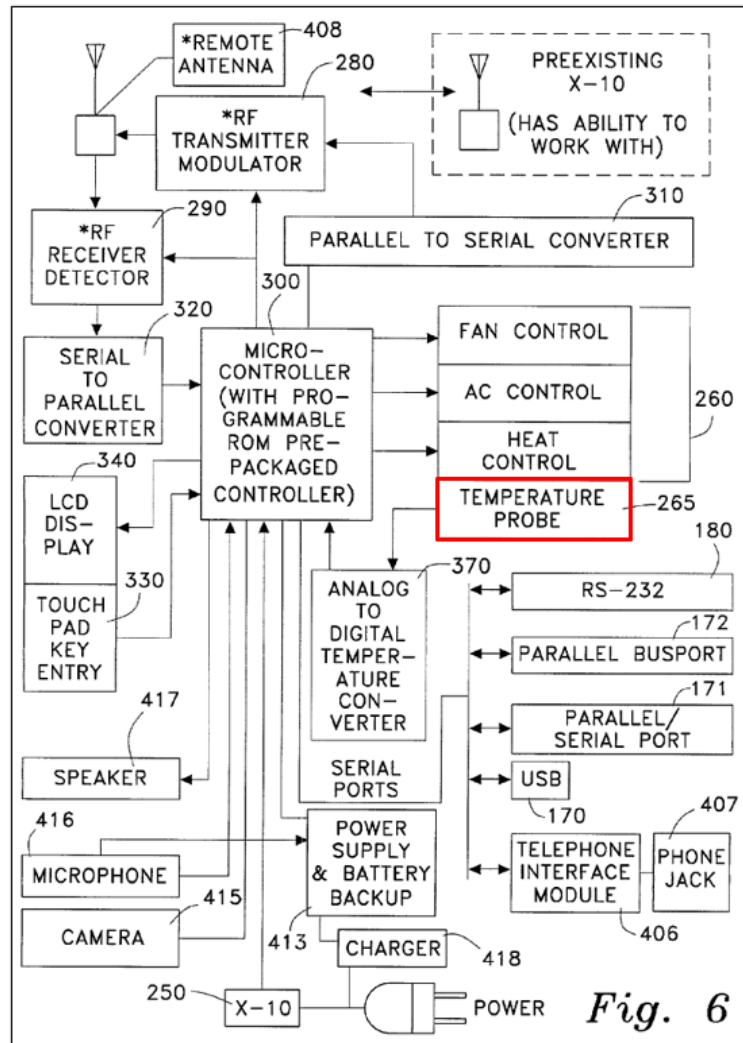
b) 18[a]: A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated;

105. The *Shamoon-Rainer* combination discloses 18[a].

106. *Shamoon* discloses a temperature sensor. *Shamoon's* thermostat system includes a “temperature probe 265” that “sends a signal to an analog to digital

temperature converter 370, which sends a signal to the microcontroller 300.” *Id.*,

¶[0071]. It is shown in Figure 6:



EX1004, Fig. 6 (annotated).

107. *Shamoon*’s temperature sensor provides an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. For example, *Shamoon* discloses that “temperature probe 265 also sends a signal to

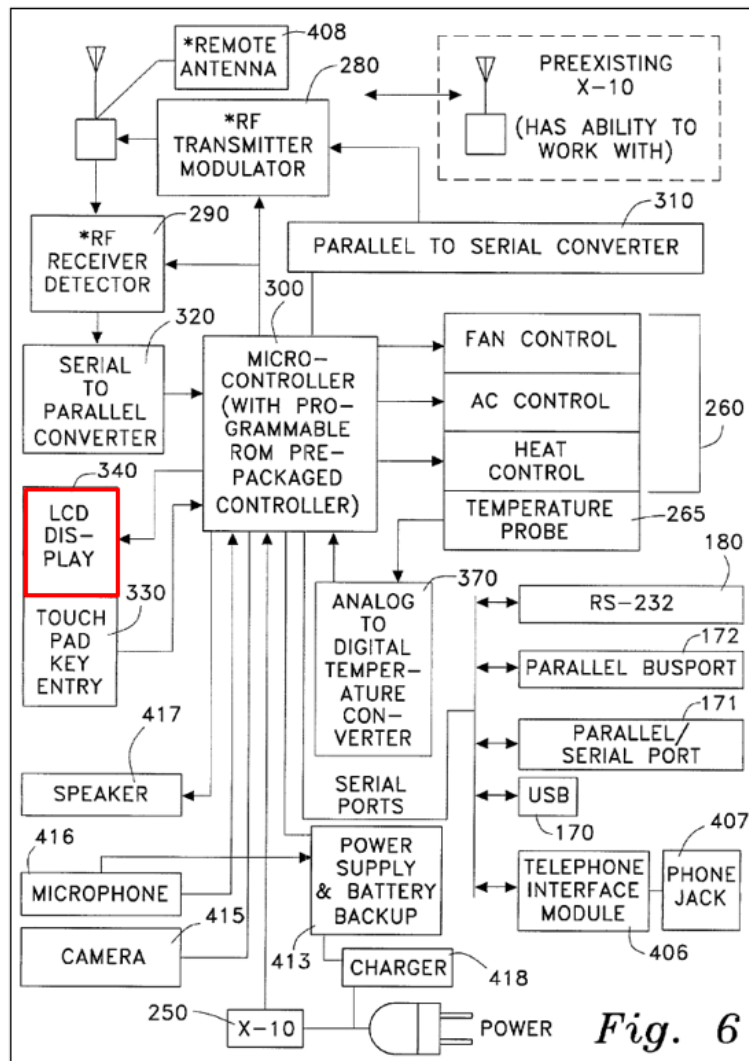
an analog to digital temperature converter 370 which sends a signal to the microcontroller 300.” EX1004, ¶[0071].

108. It was well known to a POSITA that thermostat systems would have included a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space, as acknowledged by the ’555 Patent. EX1001, 1:28-47, 3:31-53. To the extent Patent Owner contends this element is missing from *Shamoon* or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the ’555 Patent’s admissions to supply a missing claim element. These admissions demonstrate this element would have been well known to a POSITA and would have been obvious to use in a thermostat. Moreover, Inventor Rosen admits that the ’555 Patent’s sensor is not inventive. EX1012, 289:14-24.

c) 18[b]: B) a liquid crystal display for selectively displaying an alphanumeric message;

109. The *Shamoon-Rainer* combination discloses 18[b].

110. *Shamoon* discloses a liquid crystal display. *Shamoon* discloses an LCD display such as liquid crystal diode (LCD) display 340 of the thermostat. *See, e.g.*, EX1004, ¶¶[0061], [0065], [0070], Fig. 6.



EX1004, Fig. 6 (annotated); *see also id.*, ¶[0040] (“The wall thermostat controller of the invention uses the same operating system as the handheld controller, has similar hardware, and performs pretty much the same.”). As show in Figure 2, the handheld controller, which “performs pretty much the same” as the “wall thermostat” displays alphanumeric messages on the screen, such as the time and temperature settings. EX1001, Fig. 2. Based upon the teachings of Paragraph 40, the wall thermostat would have all the functionality of the handheld controller except

it would not have the functionality to control things like the entertainment system. It does indicate that the wall thermostat will still be able to perform the security functions as well. Thus, a POSITA would understand that the wall thermostat includes the features of Figure 6. I further note that Figure 6 discloses features such as connection to a telephone jack that are more consistent with a wall mounted unit.

111. *Shamoon*'s liquid crystal display selectively displays an alphanumeric message. As show in Figure 2, the handheld controller, which “performs pretty much the same” as the “wall thermostat” (EX1004, ¶[0040]) displays alphanumeric messages on the screen, such as the time and temperature settings. EX1004, Fig. 2; A POSITA would have understood based on the disclosure that the wall thermostat is “essentially the same” that the time and temperature information relevant to the thermostat would have been displayed identically or very similar on the LCD of the wall thermostat. They are “selectively” displayed because they can be disabled. EX1004, ¶[0048]. The display can show “programming and messaging.” EX1004, ¶¶[0040], [0070]. It would have been well known to a POSITA that software would be able to facilitate the selective display of an alphanumeric message by determining when to display it. EX1004, ¶[0066].

112. *Shamoon* also discloses that its microcontroller sends information to the LCD display. EX1004, ¶[0070] (“The microcontroller then sends a signal to the LCD display 340.”). This can prompt a user to enter “desired information.” *Id.* A

POSITA would have understood that *Shamoon*'s liquid crystal display therefore selectively displays an alphanumeric message, for example, to "prompt" a user to enter "desired information." It would have been well known to a POSITA that internal software would be able to facilitate the selective display of an alphanumeric message, for example, as disclosed in *Shamoon*. EX1004, ¶[0066] ("There is, of course, software internally of apparatus 10 which provides the interface between control, communications and software functions, and the LCD display, touch screen and I/O port data. The software allows the apparatus 10 to accept and process the various I/O stimuli received for controlling, monitoring and processing information.").

113. Additionally, *Rainer* discloses a thermostat with a wall display unit including liquid crystal display. EX1005, 5:47-52; Fig. 1. *Rainer*'s wall display unit "provides text-based onscreen instructions to the user, and instructions explaining control functions and facilitating user understandings of control settings and system operation." *Id.*, 4:26-30. *Rainer*'s display also displays current utility price information and weather information received from an Internet communications link. *Id.*, 4:31-34, 5:37-41. A POSITA would have understood that not all of this information is displayed at once and, therefore, the display is selective.

114. It was common knowledge and well known to a POSITA that thermostat systems would have included the ability to display alphanumeric

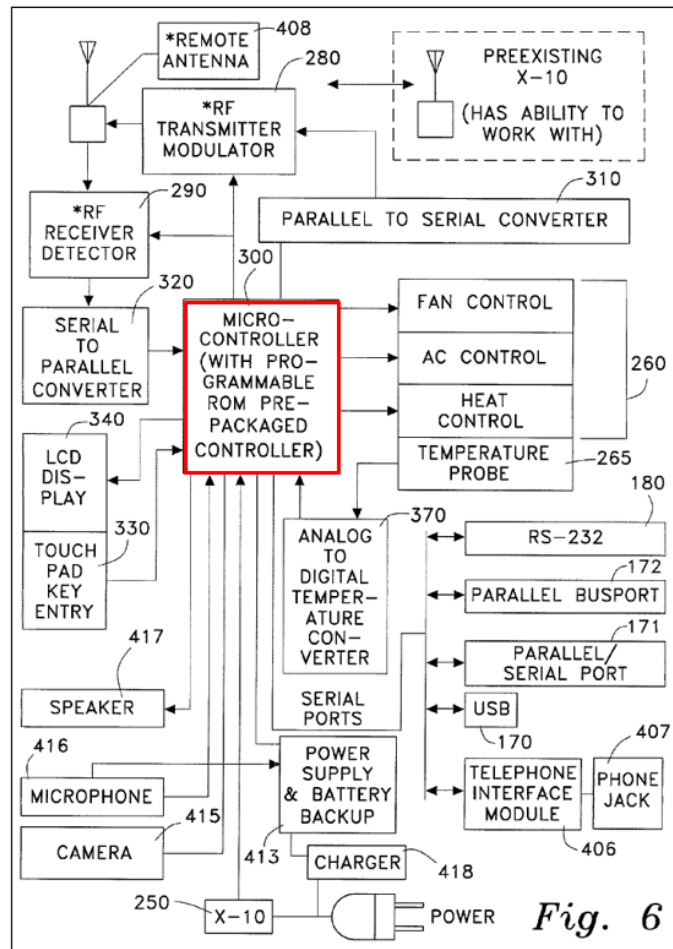
messages on an LCD display, as acknowledged by the '555 Patent. EX1001, 1:48-55. To the extent Patent Owner contends this element is missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. These admissions demonstrate this element was well known to POSITA and would have been obvious to use in a thermostat.

115. To the extent Patent Owner contends that the alphanumeric messages displayed must be received from the remote correspondent, the *Shamoon-Rainer* combination discloses this as addressed in 18[e]. *See infra*, VII.C(2)(i).

d) 18[c][1]: C) a processor, said processor including: 1) a central processing unit;

116. The *Shamoon-Rainer* combination discloses 18[c][1].

117. *Shamoon* discloses a processor. Figure 6 of *Shamoon* shows the processor as microcontroller 300.



EX1004, Fig. 6 (annotated); *see also id.*, ¶[0040] (“The wall thermostat controller of the invention uses the same operating system as the handheld controller, has similar hardware, and performs pretty much the same.”).

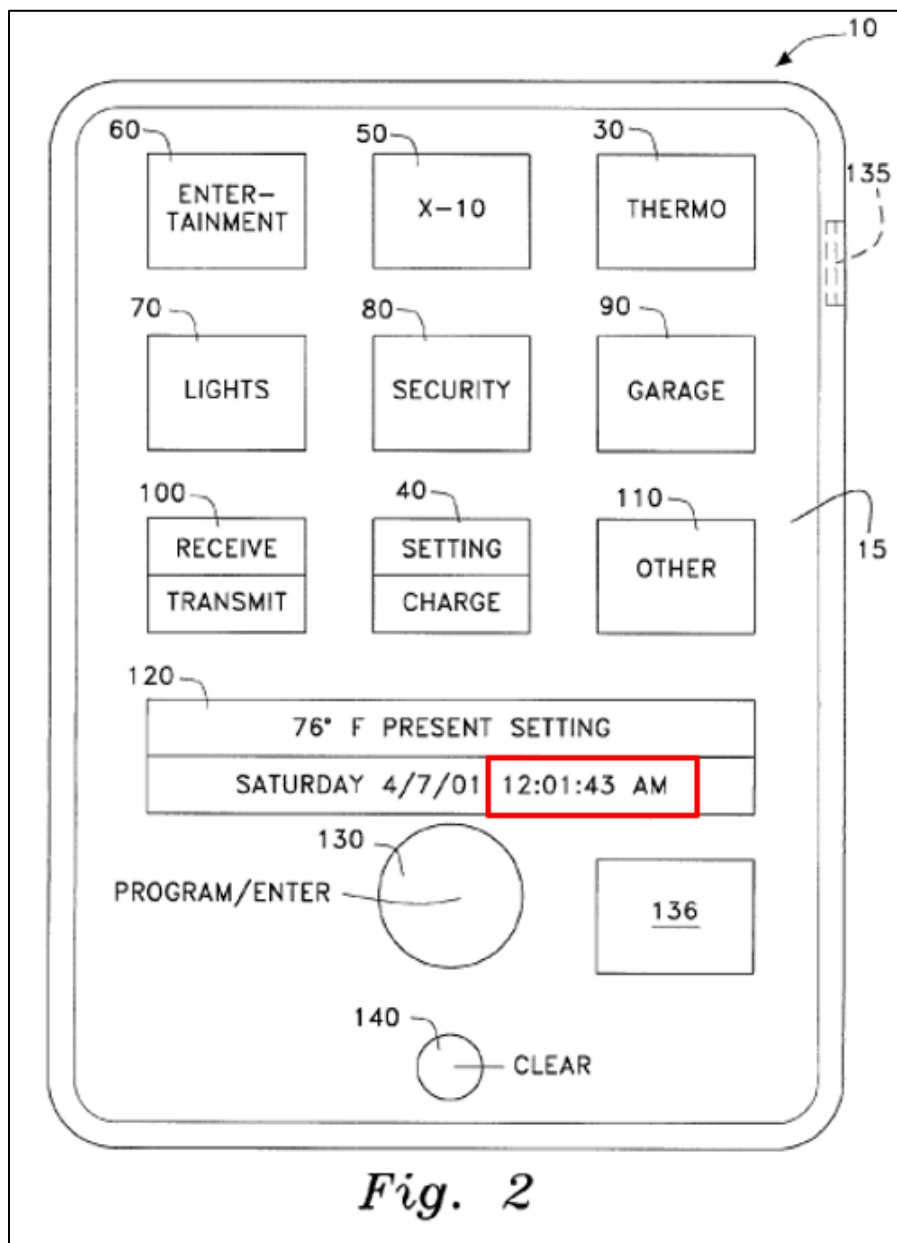
118. It would have been well known to a POSITA that a processor such as microcontroller 300 would have included a central processing unit. EX1012, 121:14-22. Inventor Rosen agrees. EX1012, 101:14-20. Thus, *Shamoon* discloses element 18[c][1].

119. It was well known to a POSITA that thermostat systems would have included a processor, as acknowledged by the '555 Patent. EX1001, 1:28-47. To the extent Patent Owner contends this element is missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat. Moreover, Inventor Rosen admits that the '555 Patent's CPU or microprocessor is not inventive. EX1012, 287:22-24, 288:16-19.

e) 18[c][2]: 2) a real time clock

120. The *Shamoon-Rainer* combination discloses 18[c][2].

121. *Shamoon*'s processor includes a real time clock. *Shamoon* discloses a “***built-in clock on the thermostat*** and remote control apparatus 10 that is synchronized to the thermostat 260.” EX1004, ¶[0074]. *Shamoon* discloses a real time clock as shown in Figure 2 below:



Id., Fig. 2 (annotated). *Shamoon*’s “thermostat and remote control apparatus 10 can provide ... the time ... for the HVAC.” *Id.*, ¶[0059].

122. A POSITA would have understood that *Shamoon*’s built-in clock is a real-time clock. *Shamoon* discloses and illustrates displaying the date and time. *Id.*, Abstract (“A thermostat . . . that is made up of . . . a display screen, indicating the

current temperature setting, time and date”), ¶[0019] (“The invention is a thermostat . . . that is made up of . . . a display screen, which indicates the current temperature setting, time and date”); ¶[0048] (“Thermostat setting and time and date are continually displayed on the screen”); ¶[0059] (“The thermostat . . . can provide . . . the time”); ¶[0073] (“Date, time and thermostat settings are updated . . . periodically”); *see also id.*, ¶¶[0069], [0075], Fig. 2. A POSITA would have understood, based on *Shamoon*’s disclosure, that *Shamoon*’s built-in clock would have been included in *Shamoon*’s processor in order to read the current date and time for display on the thermostat’s display.

123. It would have been well known to a POSITA that thermostat systems would have included a real time clock, as acknowledged by the ’555 Patent. EX1001, 1:28-47. To the extent Patent Owner contends this element is missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the ’555 Patent’s admissions to supply a missing claim element. These admissions demonstrate this element would have been well known to a POSITA and would have been obvious to use in a thermostat. Moreover, Inventor Rosen admits that the ’555 Patent’s real-time clock is not inventive. EX1012, 287:22-24, 288:8-11.

f) 18[c][3]: 3) a memory coupled to said central processing unit for storing program and data information; and

124. The *Shamoon-Rainer* combination discloses 18[c][3].

125. *Shamoon*'s processor includes a memory. *Shamoon* discloses memory that is part of the microcontroller that runs programs to control the thermostat. EX1004, ¶[0060]. The '555 Patent inventor Mr. Rosen agrees that a prior art microcontroller would have included the CPU, memory, and communications interface. EX1012, 101:6-20; 121:14-22.

126. The memory of *Shamoon*'s processor is coupled to the central processing unit as it is part of the microcontroller. EX1004, ¶[0060]. *Shamoon* discloses that microcontroller "process[es] information and data." EX1004, Abstract, ¶[0019]. A POSITA accordingly would have understood that microcontroller 300 is coupled to a central processing unit, as would have been well known.

127. The memory of *Shamoon*'s processor is for storing program and data information. As noted above, the memory includes programs that run the thermostat. EX1004, ¶[0060]. A POSITA would have understood that the memory stores data because *Shamoon* indicates that the microcontroller processes data, and because some of the memory is RAM which would not be needed if there were no data. EX1004, Abstract, ¶¶[0019], [0054], [0060]. A POSITA also would have understood that *Shamoon*'s memory stores data such as program information. *Shamoon*'s "microcontroller 300 is also provided with programmable memory (such

as RAM, PROM and *flash PROM*.” *Id.*, ¶[0060] (emphasis added). Flash PROM is a non-volatile random access memory. EX1012, 7:29-32 (“The non-volatile RAM 108 may be an electrically erasable PROM or a ‘flash’ PROM which saves its contents even when power is lost.”). *Shamoon*’s “auxiliary memory may include ... random access memory (RAM).” EX1004, ¶[0054]. Moreover, *Shamoon* discloses “prepackaged software” and “applications” running on microprocessor 300, which a POSITA would have understood involves memory storing program information. *Id.*, ¶¶[0060], [0065].

128. It would have been well known to a POSITA that thermostat systems include a memory storing a program and that is programmable so that the thermostat set points may vary with the day of the week (thus necessitating the storage of data), as acknowledged by the ’555 Patent. EX1001, 1:28-55. To the extent Patent Owner contends this element is missing from the *Shamoon-Rainer* or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the ’555 Patent’s admissions to supply a missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat. Moreover, Inventor Rosen admits that the ’555 Patent’s memory is not inventive. EX1012, 287:22-288:7.

g) 18[c][4]: 4) an input/output unit including:

129. The *Shamoon-Rainer* combination discloses 18[c][4] as detailed below. *Infra*, §VII.C(2)(g)(a)-(d). The input/output unit is the combination of the structures disclosed for elements 18[c][4][a]-[c] discussed below and I incorporate by reference that discussion here. See also EX1004, ¶[0066].

130. It is not clear if Claim 18 requires the components of the input/output unit to be in a single chip. Whether *Shamoon's* unit is one chip or multiple chips is irrelevant. At the very least this element would have been obvious because, as Inventor Rosen admits, a POSITA would have understood that different functions can be combined into a single chip or separated among multiple chips in a microprocessor system. EX1012, 101:6-16. Providing the input/output unit in a single chip would have been nothing more than a simple design choice. The '555 Patent's sensor input and input/output unit are not inventive. EX1012, 287:22-24, 289:18-21, 290:8-11. It was common knowledge that thermostat systems would have included a sensor input and control output, as acknowledged by the '555 Patent. EX1001, 1:28-55. The '555 Patent admits "all the processor components" are available off the shelf. EX1001, 3:54-60. It accordingly would have been obvious to implement the input/output unit using an off the shelf component.

(a) 18[c][4][a]: a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;

131. The *Shamoon-Rainer* combination discloses 18[c][4][a].

132. *Shamoon's* processor includes an input/output unit. EX1004, ¶[0066]. The “software internally of apparatus 10 which provides the interface between control, communications and software functions, and the LCD display, touch screen and I/O port data. The software also allows the apparatus 10 to accept and process the various I/O stimuli received for controlling, monitoring and processing information.” *Id.* The microcontroller receives electrical signals from a temperature sensor 265 through analog to digital converter 370. EX1004, ¶[0071]. The circuitry within the microcontroller that receives the signal and/or that circuitry in combination with converter 370 are a sensor input that forms part of the input/output unit. The microcontroller outputs electrical signals to control space conditioning equipment. EX1004, ¶[0071]. Thus, the microcontroller contains an input/output unit as required by element 18[c][4]. The components making up the input/output unit are identified below for elements 18[c][4][a]-[c] and that discussion is incorporated by reference here.

133. *Shamoon's* input/output unit includes a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom. As discussed above with respect to element 18[a], *Shamoon's* temperature probe 265 is a temperature sensor. The temperature sensor connects to an analog to digital converter where the temperature sensor analog signal is converted to a digital signal sent to the microcontroller. EX1004, ¶[0071], Fig. 6; *see also id.*, ¶[0040]. The

circuitry within the microcontroller that receives the digital signal and/or that circuitry in combination with converter 370 constitute a sensor input that forms part of the input/output unit. That circuitry is coupled to the temperature sensor as shown in Figure 6 and receives an electrical signal therefrom as required by element 1[i]. EX1004, Fig. 6, ¶[0071].

134. It was common knowledge of a POSITA that thermostat systems would have included a sensor input and control output, as acknowledged by the '555 Patent. EX1001, 1:28-55 (noting that processor accurately measures temperature of a sensor and sends control signals to equipment). To the extent Patent Owner contends this element is missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. The '555 Patent admits "all the processor components" are available off the shelf. EX1001, 3:54-60. It accordingly would have been obvious to implement the input/output unit using an off the shelf component. These admissions demonstrate this element was well known to POSITA and it would have been obvious to use in a thermostat. It is not clear if Claim 18 requires the components of the input/output unit to be in a single chip. Whether *Shamoon's* unit is one chip or multiple chips is irrelevant. At the very least this element would have been obvious because, as Inventor Rosen admits, a POSITA would have understood that different functions can be combined into a single chip

or separated among multiple chips in a microprocessor system. EX1012, 101:6-16, 323:14-324:22. Providing the input/output unit in a single chip would have been nothing more than a simple design choice. Inventor Rosen also admits that the '555 Patent's sensor input and input/output unit are not inventive. *Id.*, 287:22-24, 289:18-21, 290:8-11.

(b) 18[c][4][b]: b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and"

135. The *Shamoon-Rainer* combination discloses element 18[c][4][b].

136. *Shamoon's* input/output unit also has a control output coupled to the space conditioning equipment for issuing control signals. *Shamoon's* thermostat includes "fan control," "AC [Air Conditioning] Control," and "heat control," as illustrated above in Figure 6 of *Shamoon*. EX1004, Fig. 6. The fan, air conditioning and heat as controlled by *Shamoon's* system are examples of space conditioning equipment as claimed. EX1012, 96:5-8 (Testimony from the inventor of the '555 Patent confirming that "space conditioning equipment can refer to a furnace, an air conditioner, a heat pump, an emergency heater or a fan.")). *Shamoon's* "microcontroller 300 [] sends a signal to the fan control, air conditioning control and heat control of the thermostat 260," and thus, the microcontroller has circuitry that is a control output for issuing control signals to the space conditioning equipment of *Shamoon*. EX1004, ¶[0071]. A POSITA would have understood that circuitry

within the microcontroller that generates these signals for control qualifies as the claimed control output for this element. A POSITA would have further understood or it is at least obvious that control output is “coupled to the space conditioning equipment for providing control signals thereto.” In the absence of such a coupling and such control signals, the thermostat could not control the space conditioning equipment. As discussed above in the prior section, this element also would have been well known to POSITA. *Supra*, §VII.C(2)(g)(a). Inventor Rosen also admits that the ’555 Patent’s control output for space conditioning equipment is not inventive. EX1012, 287:22-24, 289:33-13.

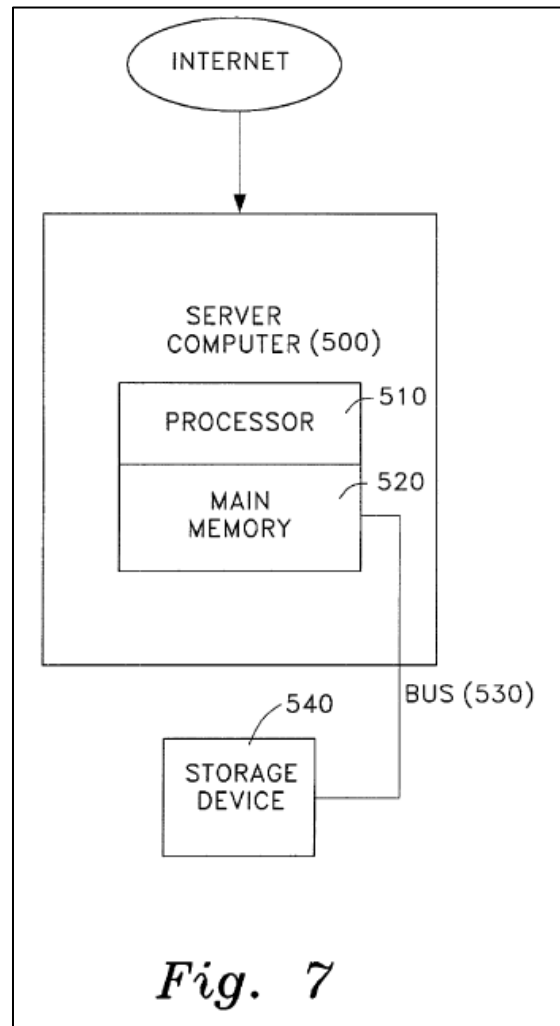
(c) 18[c][4][c]: c) a communications interface adapted to establish bi-directional communications between said processor and a first remote correspondent which is a source of current information; and

137. The *Shamoon-Rainer* combination discloses element 18[c][4][c].

138. *Shamoon*’s input/output unit includes a communications interface that is adapted to establish bi-directional communications between said processor and a first remote correspondent.

139. *Shamoon* discloses a “web-based thermostat” and that microprocessor 300 may be connected via bus 530 to the Internet and a separate server. EX1004, ¶[0083] (“With reference now to the mainly diagrammatic view of Fig. 7, the microprocessor 300 (see Fig. 5 or 6) of apparatus 10 can be connected via bus 530

to the Internet, and a separate server computer 500 with processor 510 and main memory 520 . . .”), Fig. 7.



Shamoon also discloses that “microcontroller 300 is also directly linked to a USB port 170 and a RS-232 port 180.” *Id.*, ¶[0062]. Thus, there is circuitry within microcontroller 300 that is used to establish bidirectional communications when the thermostat is connected to the Internet.

140. A POSITA would have understood that connection via a bus or port to the Internet is a “communications interface that is adapted to establish bi-directional communications.” As the ’555 Patent admits, the “communications interface” may be a “conventional serial port.” EX1001, 3:29-30. It would have been well known to a POSITA that an Internet connection is adapted to establish bi-directional communications. For example, it would have been well known to a POSITA that that an Internet connection would have involved sending information to an Internet server and receiving information for that server, for example to interact with websites on the Internet.

141. *Rainer* also discloses a thermostat connected to the Internet via a communications link to obtain outside information. EX1005, 5:28-31, 4:31-34, Fig. 1 (link 32). As illustrated in *Rainer*’s Fig. 1, the communications link (link 32) connects directly to the control module or processor. *Id.*, Fig. 1, 6:14-19, 7:15-19. *Rainer* discloses obtaining “current utility price information” and weather information using the Internet communications link. *Id.*, 4:31-34, 5:37-41. A POSITA would have understood based on *Rainer*’s disclosure that *Rainer*’s thermostat connects to a remote correspondent (web server) which is a source of current information (current utility price/weather information), using the disclosed communications interface in a bidirectional manner, thus disclosing element 18[c][4][c]. See, e.g., EX1015, 685-686.

142. To the extent that Patent Owner contends this element is missing, it would have been obvious to a POSITA. As discussed above in Section VI, it would have been well known to a POSITA that a thermostat could have been connected to the Internet as an Internet Appliance. *Supra* §VI.A. It would have been obvious to a POSITA that connecting the thermostat to the Internet would have involved a communications interface adapted to establish bidirectional communications. For example, it would have been obvious to have a processor interface to a communication interface such as a peripheral chip (USB, UART, etc.), obvious for the communication interface to interface to a modem, or obvious for the modem to connect to the Internet and/or ISP thereby facilitating a connection to a remote correspondent via the Internet using protocols like TCP and HTTP. *See, e.g.*, EX1005, 5:38-31; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 11:7-57; EX1012, 2, 27; EX1014, 39-40, 44-54, 59-62, 64-69; EX1015, 681-691, 720-723; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51. For example, it would have been well known to a POSITA that an Internet connection would have involved interactions with Internet web sites. Inventor Rosen admits that the '555 Patent's communications interface is not inventive. EX1012, 290:19-291:14.

(d) Obvious to implement in one chip.

143. Implementing *Shamoon's* input/output unit with a sensor input, a control output, and a communications interface on a single chip would have been

obvious to a POSITA at the time of the alleged invention. For example, it would have been well known to have a single chip control multiple functions that could be handled by different chips. EX1043, 91-92. Providing this functionality in a single chip would have been nothing more than a simple design choice. A POSITA would have had a reasonable expectation of success in such an implementation. Such an implementation would have been one of a finite number of implementations for this functionality. It was common knowledge that the thermostat systems would have included a sensor input and control output, as acknowledged by the '555 Patent. EX1001, 1:28-55. Additionally, as the '555 Patent admits, the claimed input/output unit, which is part of a processor, is a conventional, off-the-shelf component implemented in a conventional way. EX1001, 3:54-60. It accordingly would have been obvious for a POSITA to include a single input/output unit with each of these three components. Inventor Rosen admits this as well. EX1012, 101:6-16, 323:14-324:24.

h) 18[d]: D) means coupling said communications interface and said first remote correspondent; and

144. The *Shamoon-Rainer* combination discloses 18[d]. As discussed above, the “means coupling” recited in this claim element is governed by 35 U.S.C. § 112, ¶6. *Supra*, §V.F. Under Patent Owner’s interpretation, the function is

“coupling the communications interface and the remote correspondent,” and the structure is “a serial link and/or data link and any equivalents.”

(e) Function

145. *Shamoon-Rainer* discloses the claimed function of “coupling the communications interface with the remote correspondent.” As discussed above, *Shamoon* discloses microcontroller connected to the Internet and interfacing with server 500. EX1004, ¶[0083], Fig. 7. *Shamoon* also discloses that “microcontroller 300 is also directly linked to a USB port 170 and a RS-232 port 180.” *Id.*, ¶[0062], Fig. 6. A POSITA would have understood that there is a reason for connecting *Shamoon*’s thermostat to the Internet. A connection to the Internet is only useful to interact with “remote correspondents.” Thus, a POSITA would have understood that the communications interface in *Shamoon* is necessarily connected to remote correspondents when *Shamoon*’s thermostat is interacting with the Internet. The server 500 is one such remote correspondent. Without a coupling, no data exchange could occur.

146. *Rainer* also discloses a communications link connecting the thermostat to the Internet. EX1005, 5:28-31, Fig. 1 (link 32). A POSITA would have understood that it was obvious and common knowledge to couple such buses and ports to an Internet server through a variety of means, including through a data link or an Ethernet cable. See, e.g., EX1005, 5:38-31; EX1014, 39-40, 44-54, 59-62, 64-

69; EX1015, 681-691; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51, 54. *Rainer* further discloses that the communications link is used to obtain utility price information and weather information. EX1005, 5:38-41, 5:31-34. In order to receive such information, it necessarily would require coupling the communications interface to a remote correspondent (the source of current information). Because information is being obtained using the communications link, a POSITA would have understood that this information is being obtained from a remote correspondent. Thus, *Rainer* discloses coupling the communications interface with one or more remote correspondents.

(f) Structure

147. *Shamoon-Rainer* discloses the corresponding structure of “a serial link and/or data link and any equivalents.”

148. As discussed above with respect to the function, *Shamoon* discloses bus 52 connecting to the Internet, as well as USB ports and RS-232 ports. EX1004, ¶¶[0062], [0084], Fig. 7. A POSITA would have understood that it was obvious and common knowledge that such buses and ports would have been coupled to an Internet server through a variety of means, such as a modem or Ethernet cable. *See, e.g.*, EX1005, 5:38-41, 5:31-34; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-

27, 5:34-38; EX1037, 50-51, 54; *see generally* EX1014, EX1015. To accomplish a connection to the Internet, a device such as a modem or ethernet connection described in the cited references must be used and then those devices must be connected to equipment operated by an Internet Service Provider. EX1001, 6:1-11; *see, e.g.*, EX1005, 5:38-41, 5:31-34; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51, 54; *see generally* EX1014, EX1015. A POSITA would have understood that these ports and buses of *Shamoon* connect to a modem or some other device that communicates with the server 500 (or other Internet web servers). Collectively, the buses, ports, and other equipment between the communications interface of *Shamoon*, and the equipment operated by the Internet Service provider, together with the Internet itself collectively form a data link that couples the communications interface to the remote correspondent. *See, e.g.*, EX1015, 685-686. The '555 Patent seems to agree that this is common knowledge of a POSITA because it refers to a connection using a modem connecting to an Internet service provider and using the Internet to be completed “in the well-known manner.” EX1001, 6:1-11. Any one of the devices between the communications interface and the remote correspondent are data links because they serve to transmit data from one point to another. At the very least, it would have been obvious to have *Shamoon's* processor interface to a communication interface such as a peripheral

chip (USB, UART, etc.), for the communication interface to interface to a modem or other device used for Internet access, and obvious for the modem to connect to the Internet and/or ISP thereby facilitating a connection to a remote correspondent via the Internet using protocols like TCP and HTTP. *See, e.g.*, EX1005, 5:38-31; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 11:7-57; EX1012, 2, 27; EX1014, 39-40, 44-54, 59-62, 64-69; EX1015, 681-691; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51.

149. Additionally, *Rainer* discloses communications link 32 connecting to the Internet to “connect[] to outside data sources.” EX1005, 5:28-31, Fig. 1 (link 32). A POSITA would have understood that *Rainer*’s link 32 connected to outside data sources through the Internet comprises a “data link.” A POSITA further would have understood that connecting to the Internet necessarily would have involved connecting the communications link (some type of communications interface within the controller of *Rainer*) to the Internet via some type of device such as a modem or ethernet connection. *See, e.g.*, EX1005, 5:38-41, 5:31-34; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51, 54; *see generally* EX1014, EX1015. To accomplish a connection to the Internet, a device such as a modem or ethernet connection described in the cited references must be used and then those devices must be connected to equipment operated by an Internet Service Provider,

which then connects to web servers through the Internet. EX1001, 6:1-11; *see, e.g.*, EX1005, 5:38-41, 5:31-34; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51, 54; *see generally* EX1014, EX1015. *Rainer* further discloses that the communications link can be used to obtain utility price information and weather information. EX1005, 5:38-41, 5:31-34. Because information is being obtained using the communications link, a POSITA would have understood that this information is being obtained from a remote correspondent. Collectively, the equipment between the communications link in the controller of *Rainer*, and the equipment operated by the Internet Service provider, together with the Internet itself collectively form a data link that couples the communications interface to the remote correspondent (the source of weather information and/or utility price information). Any one of the devices between the communications interface and the remote correspondent are data links because they serve to transmit data from one point to another. At the very least, it would have been obvious to have *Rainer's* processor interface to a communication interface such as a peripheral chip (USB, UART, etc.), for the communication interface to interface to a modem or other device used for Internet access, and obvious for the modem to connect to the Internet and/or ISP thereby facilitating a connection to a remote correspondent via the Internet using protocols like TCP and HTTP. *See, e.g.*, EX1005, 5:38-31; EX1019,

1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 11:7-57; EX1012, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *see generally* EX1014, EX1015.

150. Moreover, such a data link would have been well known to a POSITA. For example, it was well known to a POSITA that a thermostat connected to the Internet would have been connected through a wireless device or cable modem. EX1026, Abstract, 2:31-44, 2:38-41, 4:38-52, 6:57-7:5; *see also, e.g.*, EX1001, 6:1-11, EX1005, 5:28-31, EX1019, 1:19-30, 5:26-30; EX1023, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *supra*, §VI.A.

151. A POSITA would have understood that to connect to the Internet, there necessarily must be some connection between the communications interface and the Internet. The '555 Patent teaches that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner,” thus acknowledging this element is obvious as common knowledge. EX1001, 6:1-11; EX1026, Abstract, 2:31-44, 2:38-41, 4:38-52, 6:57-7:5. It is common knowledge that a modem can be used to connect to an Internet service provider that then completes a connection to the Internet and, thus, the “first remote correspondent.” *See, e.g.*, EX1001, 6:1-11; EX1005, 5:28-31; EX1019, 1:19-30, 5:26-30; EX1023, 2, 27; EX1026, 2:26-44, 4:38-52, 5:15-27, 5:34-38, 6:56-7:5; EX1037, 50-51; *supra*,

§VI.A-B. The combination of structures between the communications interface and the web server, which includes the Internet, forms a data link between them.

152. To the extent Patent Owner contends that any of the structures disclosed by the references discussed above do not disclose an identical structure to the “data link” that Patent Owner contends is corresponding structure, they at least disclose structures that are an “insubstantial difference.” All of the structures discussed in the references in the ground, as well as in the references cited for the obviousness of this element, are known structures to achieve data communications between a first device and a second device over a computer network such as the Internet. The patent indicates that such connections are “well known.” EX1001, 6:1-11. The patent does not describe any new “means coupling” structure or use a data link for something other than its ordinary purpose. Because there is nothing special about the “data link” disclosed in the ’555 Patent and it must simply accomplish the communication of data between the communications interface and remote correspondent, all of the above structures are an insubstantial difference for that purpose because they are all known to be interchangeable for that purpose. They are simply design options to communicate over wide area networks such as the Internet that a POSITA can choose to use.

i) 18[e]: a program stored in said memory for displaying messages received from said first remote correspondent,

which received messages do not pertain to the operation of said thermostat system, on said liquid crystal display.

153. The *Shamoon-Rainer* combination discloses element 18[e].

154. The *Shamoon-Rainer* combination discloses a program stored in said memory for displaying messages received from the first remote correspondent (server 500). As discussed above with respect to element 18[c][3], *Shamoon* discloses a memory for storing program information. See *supra*, §VII.C(2)(f). *Shamoon* discloses a “web-based thermostat” (EX1004, ¶[0083]) and that “[a] principal thrust of the invention is to eliminate the need for a PC for the many and myriad applications” (EX1004, ¶[0039]). Based on *Shamoon*’s disclosure, it would have been obvious to a POSITA to modify *Shamoon*’s smart thermostat to include a program that displays information (*e.g.*, in the form of messages) received from the remote correspondent (*e.g.*, the web server).

155. *Shamoon* also discloses that messages are displayed on said liquid crystal display. *Shamoon* discloses a liquid crystal display that displays messages as detailed above with respect to element 18[b]. See *supra*, §VII.C(2)(c). *Shamoon* also discloses “[a] display screen 120 is provided to display . . . messaging.” EX1004, ¶[0048]; see also *id.*, ¶[0040] (“The wall thermostat controller of the invention uses the same operating system as the handheld controller, has similar hardware, and performs pretty much the same.”). *Shamoon* also discloses display

icons for each function, and programming and messaging. EX1004, ¶[0048]. Accordingly, a POSITA would have understood that the messages received from the remote correspondent (web server) in the *Shamoon-Rainer* combination would have been displayed on *Shamoon's* liquid crystal display. A POSITA further would have understood that *Shamoon's* smart thermostat and remote control apparatus, including the display, would have included a program stored in said memory for displaying messages. At the very least, it would have been obvious for software to cause display of the messages because the most common way to control information content on a display is by the use of software.

156. Moreover, *Rainer's* thermostat also includes an LCD. EX1005, 5:42-51, Fig. 1. *Rainer* discloses that the “current utility price information” obtained via the Internet communication link is displayed on the thermostat’s user interface. EX1005, 5:28-31, 5:37-41. A POSITA would have understood that computer software stored in the memory of *Rainer* causes that information to be displayed. The information displayed on an LCD is almost always under control of computer software, making the use of software for display at least obvious, if not the only alternative.

157. A POSITA would have understood that “current utility price information” does not pertain to the operation of the thermostat. The price information is just being displayed to the consumer. It is not providing a message

about the mode the thermostat is currently being controlled to function in like the Proffitt prior art distinguished during prosecution. *Supra*, §V.B. Whatever the “does not pertain to the operation of the thermostat” limitation means, it would seem to include any information that is not indicating how the thermostat is currently being controlled and this information would qualify.

158. As just stated, the ’555 Patent does not specifically address what is meant by not pertaining to the operation of the thermostat, but it provides the example embodiment of obtaining local weather information from a weather website. EX1001, 4:10-15, 4:45-48. Applicant reiterated this as well in distinguishing prior art during prosecution. EX1003, 73 (“More broadly, the application is directed to receiving data, *e.g.*, as to weather conditions, and displaying that data on a local display, *i.e.*, at a local thermostat.”). Patent Owner alleges in its infringement contentions that weather information meets this limitation. EX1017, Ex. A, 17-18. And Inventor Rosen agrees that weather information does not pertain to the operation of the thermostat. EX1012, 294:4-19; *see also id.*, 294:4-296:24.

159. The context of these statements is important. During prosecution, the Patent Owner took the position that the display of data such as weather information was what the invention was directed towards. However, the ’555 Patent expressly teaches that the weather information can be used for control purposes and impacts

thermostat operation. EX1001, 6:19-45. Yet, displaying the weather information on the screen still meets the limitations of the claim according to Patent Owner's clear position during prosecution. As noted above, Patent Owner distinguished the Proffitt reference because the message displayed in that reference concerned a message about an active control function of the thermostat. *Supra*, §V.B. Whatever the meaning of "does not pertain" limitation, the Patent Owner seems to have taken the position that if weather forecast information is displayed on the screen, even though it may be used for control, that meets the claim limitation. Otherwise, the Patent Owner's representations during prosecution would be inconsistent with the specification.

160. *Rainer* also discloses obtaining weather information from "weather services" using the Internet communications link for "display purposes." EX1005, 5:28-31, 4:31-34. For example, a POSITA would have understood that while *Rainer* discloses obtaining weather information for "control and display purposes," it does not require use of weather for both purposes and a POSITA would have understood that it could just be used for display. But as I discuss above, displaying it along with control also discloses the claim limitation consistent with the specification and prosecution history. Moreover, as discussed in the state of the art section, it is common knowledge that many different types of information could be displayed on a thermostat, including weather, without that information pertaining to the operation

of the thermostat. *Supra*, §VI.A-B. For example, one reference teaches that the screen of a thermostat could be used for adjusting the thermostat and then for web surfing. EX1022, 55:54-56. Consistent with the '555 Patent's express embodiments, the prosecution history, Patent Owner's infringement allegations, and Inventor Rosen's testimony, a POSITA would also have understood that the *Shamoon-Rainer* combination's disclosure of obtaining weather information over the Internet discloses this element. But even if it does not, this element is common knowledge of a POSITA.

161. Moreover, *Shamoon* discloses receiving various other forms of information that do not pertain to the operation of the thermostat. For example, *Shamoon* discloses health surveillance equipment that can “be polled to monitor a user's breathing, blood pressure, pulse or breathing and respiration rate.” EX1004, ¶[0077]. *Shamoon* also discloses that “[t]he thermostat and remote control apparatus 10 can be tied into household security . . . to determine status, also to open and close windows, lock and unlock doors, open and close drapes and vents, and turn lights on and off on a fixed or random schedule,” all of which are sources of current information regarding the status of the various household entry points that do not pertain to the operation of the thermostat. EX1004, ¶[0079]. *Shamoon* further discloses that “[t]he thermostat and remote control apparatus 10 is capable of logging into other computers” and to “TV and radio audiovisual communication,” which are

also remote correspondents that are sources of current information, including information that does not pertain to the operation of the thermostat. EX1004, ¶[0080]. Additionally, *Shamoon* discloses monitoring air and water for contaminants, which also is current information regarding the pollutants. *Id.*, ¶[0081]. In view of *Shamoon*'s disclosure, it would have been obvious to modify *Shamoon*'s web-based thermostat to receive messages regarding any of the above topics of health, environmental contaminants, household security, or the myriad of information available on computers, the TV, and radio, which do not pertain to the operation of the thermostat.

162. Finally, and as evidenced by *Shamoon*'s disclosure, it would have been well known to a POSITA that thermostats would display many different types of information. Accordingly it would have been obvious to a POSITA that various diverse types of current information would be displayed, including information that does not pertain to the operation of the thermostat. This would have been obvious at least due to the desire to integrate disparate control systems in the home, *e.g.*, HVAC, lighting, security, and/or home entertainment.

3. Claim 20: The thermostat system of claim 18 in which communications between said first remote correspondent and said communications interface is carried out via the Internet.

163. The *Shamoon-Rainer* combination discloses Claim 20.

164. The *Shamoon-Rainer* combination discloses the thermostat system of claim 18 in which communications between said first remote correspondent and said communications interface are carried out via the Internet. *Shamoon* discloses a “web-based thermostat” and that microprocessor 300 is connected to the Internet. EX1004, ¶[0083], Fig. 7. *Rainer* also disclosed a thermostat connected to the Internet. EX1005, 5:28-31, Fig. 1. As already detailed above in limitations 18[d]-[e], the *Shamoon-Rainer* combination discloses the communications between said first remote correspondent (web server) and said communications interface are carried out via the Internet. *See supra*, §VII.C(2)(h)-(i).

D. Ground 2: Claims 18 and 20 are obvious over Inoue in view of Peters and weather.com.

165. To the extent that Patent Owner attempts to swear behind *Shamoon*, the challenged claims are also rendered obvious by the *Inoue-Peters-weather.com*. *Inoue* and *Peters* describe temperature monitoring and control in late 1990s/early 2000 laptops as a thermostat system.

166. In my opinion, Claims 18 and 20 would have been obvious over *Inoue* in view of *Peters* and *weather.com*. The hardware elements in the challenged claims were well known and used in thermostat systems for many years before the ’555 Patent, as I have discussed above. *Supra*, §VI.C. Indeed, the admissions in the specification of the ’555 Patent demonstrate that most of these elements would have

been well known to a POSITA before the priority date. To the extent Patent Owner contends any of these elements are missing from the *Inoue-Peters-weather.com* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat.

167. Based on the following analysis, I conclude that a POSITA at the relevant time would have understood the limitations of Claims 18 and 20 were expressly disclosed, taught, or suggested by *Inoue* in combination with *Peters* and *weather.com*, and it would have been obvious to a POSITA to combine them to arrive at the challenged claims.

1. A POSITA Would Have and Could Have Combined *Inoue* with *Peters*

168. A POSITA would have been motivated to combine *Inoue* with *Peters* to arrive at the challenged claims of the '555 Patent. *Inoue* and *Peters* are analogous art in the same field of endeavor of computing and address similar problems of temperature control and conditioning in laptop computers. EX1006, ¶¶[0001]-[0016], Fig. 1; EX1007, Abstract, 1:15-22, 3:41-4:6.

169. A POSITA would have been motivated to modify *Inoue*'s laptop computer to incorporate *Peters*'s exterior temperature sensor to monitor the

temperature outside of the CPU. *Inoue* discloses a thermal sensor that “measure the temperature within the enclosure of the electronic apparatus” and when there is an increase in temperature of a certain threshold, *Inoue*’s cooling fan generates air to cool the temperature in the device. EX1006, ¶¶[0002], [0013], [0015], [0029], [0038]. *Peters* discloses a temperature sensor that measures the temperature outside of the CPU (in *Inoue*, the temperature of main enclosure 11). See, e.g., EX1007, Abstract, 4:7-31, 5:32-53, 6:12-21; EX1006, ¶[0020], Fig. 1. In light of *Inoue*’s teachings of monitoring and cooling the temperature inside of the laptop’s main enclosure, a POSITA would have been motivated to look to *Peters* for implementation details regarding the location, coupling, and thermal control logic related to *Peters*’ second temperature sensor that measures the temperature outside of the CPU.

170. A POSITA would have recognized and been motivated by the express benefits of such a combination in order to control not only the temperature of the CPU itself but also the main enclosure of *Inoue*’s laptop computer, which a POSITA would have recognized contains not only the CPU but other components also in need of temperature control. *Id.* For example, *Inoue* teaches that when the temperature inside of the laptop’s enclosure becomes excessive, “the CPU and other electronic components in the vicinity of the CPU may suffer from a defect or failure of operation.” EX1006, ¶[0002]. A POSITA would have recognized, in light of

Inoue's express disclosures, the benefits of modifying *Inoue* to incorporate *Peters*'s second temperature sensor to monitor the temperature outside of the CPU. While *Inoue* discloses the limitations of the claim, *Peters* is included to illustrate another option for temperature control inside of a laptop computer. This demonstrates that controlling the temperature in the conditioned space of a laptop is common knowledge of a POSITA.

171. *Peters* also teaches the benefits of its system for “reduc[ing] or minmiz[ing] the annoyance caused by a fan turning on and off often in a relatively short period of time” and conserving power. EX1007, 3:41-47. A POSITA would have recognized that conserving battery power and minimizing fan annoyances improve the consumer experience, and would have been motivated by design and market forces to modify *Inoue* in view of *Peters* to achieve these benefits. A POSITA also would have been motivated to not have the laptop computer fail due to excessive heat, and would have been motivated by design and market forces to modify *Inoue* in view of *Peters*, for example to minimize laptop computers getting too hot in consumers' laps.

172. A POSITA would have had a reasonable expectation of success with combining *Inoue* with *Peters*. *Inoue* and *Peters* are complimentary laptop cooling systems using a combination of sensors, thermal control logic, and fans to monitor and control temperature in the laptop computer. EX1006, ¶¶[0001]-[0002], [0013],

[0015], [0020], [0029], [0038], Fig. 1; EX1007, Abstract, 2:65-3:8, 3:50-4:31, 5:20-52, 6:12-21, 7:5-10, 13:24-48, 16:52-65, Fig. 1. In light of *Inoue*'s express teachings of a thermal sensor that "measure[s] the temperature within the enclosure of the electronic apparatus," a POSITA would have recognized that *Peters*'s temperature sensor measuring temperature exterior to the CPU would have been readily incorporated into *Inoue*'s laptop computer without substantial modification or undue experimentation. A POSITA also would have recognized that *Inoue*'s laptop therefore already includes the hardware and/or circuitry needed to implement *Peters*'s teachings. Such a combination would have involved combining prior art elements (sensors) according to known methods (measuring temperature in a space) to yield predictable results (environmental control of a substantially enclosed space).

173. A POSITA also would have been motivated to modify *Inoue*'s memory and display to incorporate *Peters*'s graphical controller rendering data structures from memory for display. EX1007, 8:39-65. *Inoue* discloses an LCD display for display of "[p]rocessing and/or results of the execution of application software." EX1006, ¶¶[0020]-[0021], Fig. 1. In light of *Inoue*'s teachings, a POSITA would have been motivated to look to *Peters* for implementation details regarding the display of "[p]rocessing and/or results of execution of application software." *Peters* discloses a graphics controller 123 that renders data structures from main memory for. EX1007, 8:39-49.

174. A POSITA would have had a reasonable expectation of success with combining *Inoue* with *Peters*. *Inoue* and *Peters* are complimentary laptop systems both with memories for storing programs or applications and data, as well as LCD displays. EX1006, ¶¶[0020]-[0021], [0025], Fig. 1; EX1007, 8:24-38 (disclosing an LCD display and main memory 124 that functions as “the working memory for CPU 102 and the rest of the compute system 100 and generally includes a conventional memory device or array of memory devices in which application programs and data are stored”). A POSITA would have recognized that *Peters*’s graphics controller would have been readily incorporated into *Inoue*’s laptop computer for display of data stored in memory without substantial modification or undue experimentation. A POSITA further would have recognized *Inoue*’s laptop already includes the hardware, software, and/or circuitry to readily incorporate such a modification. *Id.*; EX1006, ¶¶[0020]-[0021], [0025], Fig. 1. Such a combination would have involved combining prior art elements (graphics controllers, memory, and LCD displays) according to known methods (rendering data from memory for display) to yield predictable results (display of data).

2. A POSITA Would Have and Could Have Combined *Inoue* and *Peters* with *weather.com*.

175. A POSITA would have been motivated to combine *Inoue-Peters* with *weather.com* and the knowledge of a POSITA to arrive at the challenged claims of

the '555 Patent. *Inoue-Peters* and *weather.com* are analogous art in the same field of endeavor of computing and data networks such as the Internet. See EX1006, ¶[0001].

176. A POSITA would have been motivated to combine *Inoue-Peters* with *weather.com* to obtain current information (weather) from a remote correspondent (weather.com web server) to display on *Inoue-Peters*'s display. It would have been well known and a matter of common sense to a POSITA to use a laptop connected to the Internet (such as *Inoue-Peters*'s laptop) to obtain current information (e.g., weather) from a weather website. It would have been obvious to do so because users of devices connected to the Internet often desire to know about the weather in their particular area. A POSITA would have recognized that this is the purpose and benefit of a weather website such as *weather.com*. Moreover, accessing *weather.com* on a laptop computer is a well-known and conventional method for retrieving current weather information. Accessing a website such as *weather.com* using the laptop of *Inoue-Peters* would be doing something that is common.

177. A POSITA would have been motivated to combine *Inoue-Peters* with *weather.com* in order to obtain the current weather and display it on a display screen on *Inoue-Peters*'s laptop computer. It would have been well known to a POSITA to make weather and other types of information accessible to devices, including *Inoue-Peters*'s laptop computer connected to the Internet, by transmitting the information

over the Internet through a modem. It would have been well known and common practice to use a web browser on a laptop to access websites (such as *weather.com*) obtain information of interest (such as current weather) and then display it on the screen of the laptop. See, e.g., EX1015, 682-685; EX1022, 3:58-60; EX1023, 2; EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5; EX1040, 4; EX1041, 82, 93; EX1012, 60:9-15.

178. A POSITA would have had a reasonable expectation of success in combining *Inoue-Peters* with *weather.com*. *Inoue-Peters* and *weather.com* are complimentary systems. As noted, the ‘555 Patent admits that weather information sources are widely accessed on the Internet. A POSITA would have understood that a laptop is a common way of doing so. *Inoue* relates to an electronic device such as a “notebook type personal computer” or laptop computer connected to the Internet. EX1006, ¶¶[0020], [0028]. *Inoue*’s laptop computer executes software, and it would have been common knowledge to a POSITA that such software would have included web browsers. EX1006, ¶¶ [0021], [0025], [0027]; EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5; EX1037, 50; EX1012, 60:9-15. Similarly, *Peters* relates to a computer system such as a laptop computer, on which applications may run. EX1007, 2:40-44, 8:29-33. For example, a POSITA would have understood that one such application would have been a web browser. *Weather.com* is a website accessible on the Internet, such as through a web browser. Executing a browser on

Inoue-Peters's laptop computer to use *weather.com* would have involved combining well known prior art elements (websites and computers) according to known methods (accessing the Internet) to yield predictable results (retrieving the local weather).

179. Moreover, a POSITA would have understood that *Inoue-Peters* already includes the hardware and software needed to implement *weather.com's* teachings. *Inoue* includes a modem, a display, a CPU for executing application software. EX1006, ¶¶[0020]-[0021], [0027]-[0028] (referencing the CPU executing application software). Similarly, *Peters* includes a CPU, memory on which application programs are stored, and display. EX1007, 6:11-20, 8:29-65, Figs. 1-2. It would have been well known to a POSITA that such application software implemented on *Inoue's* CPU would have included web browser software, and that such software could be used to access websites such as *weather.com*. Moreover, a user of a laptop computer would have been motivated to go to *weather.com* to check the weather, i.e., do exactly what *weather.com* was designed to allow users on a laptop computer to do.

3. Claim 18

- a. **18[Pre]: A thermostat system for controlling space conditioning equipment comprising:**

180. If the preamble is limiting, the *Inoue-Peters-weather.com* combination discloses it.

181. The *Inoue-Peters-weather.com* combination discloses a thermostat system controlling space conditioning equipment. *Inoue* discloses a laptop that controls the temperature inside the laptop. See, e.g., EX1006, ¶[0011] (using “temperature information signal, identifying the temperature, so as to commence an interruption processing for controlling the temperature”) ; see also *id.*, ¶[0001] (“The present invention relates to a method of controlling temperature in an electronic apparatus such as a computer device”), ¶[0008] (“An embodiment of the present invention may provide a temperature controller circuit capable of managing the interior temperature of an electronic apparatus”), ¶[0009] (“According to the present invention, there is provided a temperature controller circuit for an electronic apparatus, comprising: a central processing unit (CPU)”), ¶[0010] (“Employment of the above-described temperature controller circuit may serve to implement a method of controlling temperature in an electronic apparatus according to the present invention.”). Thus, *Inoue*’s laptop is a thermostat system.

182. *Inoue* also discloses controlling space conditioning equipment. *Inoue*’s CPU controls the temperature. See, e.g., EX1006, Abstract, ¶¶[0001]-[0002], [0008]-[0010]. *Inoue* discloses “[t]he present invention relates to a method of **controlling temperature** in an electronic apparatus such as a computer device”

EX1006, ¶[0001] (emphasis added). Temperature is controlled because, for example, “an increase in temperature within the enclosure can be suppressed.”

EX1006, ¶[0016]. For example, *Inoue* discloses use of a cooling fan controls the temperature:

A cooling device such as cooling fan 32 is incorporated within the main enclosure 11 for generating air stream. The generated air stream is expected to escape out of the main enclosure 11 after absorbing heat within the main enclosure 11. The cooling fan is expected to suppress an increase in the interior temperature of the main enclosure 11. A fan controller unit or circuit 33 serves to control the operation or rotation of the cooling fan 32.

EX1006, ¶[0029]; *see also id.*, ¶[0002] (similar); ¶[0015] (“The cooling device may include a cooling fan designed to generate air stream for taking out heat from the CPU, for example.”); ¶[0038] (“A temperature rise results in the confined space of the main enclosure 11. Rotation of the cooling fan 32 serves to generate air circulation between the interior and exterior of the main enclosure 11. The interior temperature of the main enclosure 11 is thus avoided from increasing too far.”). *Inoue* accordingly controls space conditioning equipment in response to monitoring temperature, just like a thermostat does, and therefore discloses a “thermostat system.” A fan conditions space by convection, *i.e.*, forcibly removing hotter air from the conditioned space and ingesting cooler air from outside the condition space. Inventor Rosen agrees that a fan is space conditioning equipment. EX1012, 96:5-8, 322:10-12.

183. *Peters* also discloses a thermostat system for controlling space conditioning equipment. *Peters* discloses “[a] computer system having thermal control logic that efficiently cools the computer system,” where “the thermal control logic couples to a CPU module and a fan.” EX1007, Abstract, 3:50-4:6, 5:20-31, Fig. 1. The fan (or fan 180) is “space conditioning equipment” that conditions the temperature of the computer by cooling the computer. *Id.*, 7:5-10 13:24-48, 16:52-65. The thermal control logic controls space conditioning equipment (fan) in response to monitored temperature, just as a thermostat does, and therefore discloses

a “thermostat system.” *See, e.g., id.*, 2:65-3:8 (“Conventional laptop computers typically monitor the computer’s temperature and turn the fan on or off”), 6:30-49 (“[T]he thermal control logic 108 independently controls the . . . speed of fan 180 in response to one or both of the temperature readings provided by the temperature sensor 106.”), 7:40-59.

b. 18[a]: A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated;

184. The *Inoue-Peters-weather.com* combination discloses element 18[a].

185. The *Inoue-Peters-weather.com* combination discloses a temperature sensor. *Inoue* discloses “[a] temperature detector or thermal sensor may be connected to the interrupt request so as to measure the actual temperature within the enclosure of the electronic apparatus.” EX1006, ¶[0013]. This “thermal sensor may be designed to directly measure the temperature of the CPU.” *Id.*; *see also id.* ¶[0039] (“During the operation of the CPU 17, the temperature detector 18 keeps monitoring the actual temperature of the CPU 17.”). *Inoue* similarly describes the temperature sensor and detection as follows:

A temperature detector or thermal sensor 18 is embedded within a silicon body of the CPU 17 for detecting a temperature of the CPU 17. The temperature detector 18 is designed to generate a temperature information signal identifying the temperature of the CPU 17.

EX1006, ¶[0023].

186. The temperature sensor provides an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. *Inoue* discloses that temperature sensor 18 “is designed to generate a temperature information signal identifying the temperature of the CPU 17.” EX1006, ¶[0023].

187. *Peters* also discloses a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. *Peters* discloses two temperature sensors, one of which measures the temperature of the CPU core and one that measures the temperature inside the laptop’s enclosure. *See, e.g.*, EX1007, Abstract, 4:7-31, 6:12-21. The latter sensor is able to measure the temperature of “a region away from the die 105, such as an exterior region 109 of the CPU 102.” *Id.*, 5:32-52. The temperature of the exterior region 109 of the CPU is the temperature of the “conditioned space in which the temperature sensor is situated. If the temperature of that space becomes excessive, the thermal control logic adjusts the fan speed. *Id.*, 7:40-59.

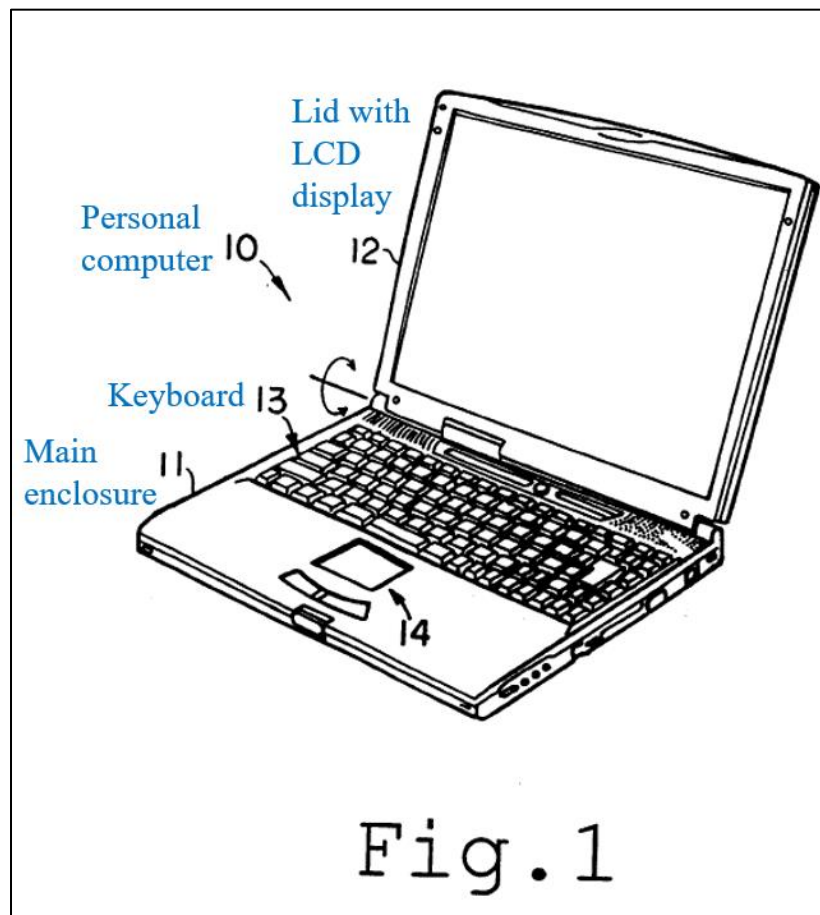
188. Additionally, *Peters* discloses that the temperature sensor provides temperature data, for example to a keyboard controller if polled by the keyboard controller. EX1007, 11:1-14. The temperature sensor also would provide temperature data to the thermal control logic in order for it to adjust the fan speed, as disclosed in *Peters* and detailed above in limitation 1[p]. *Id.*, 7:40-59; *supra*,

§VII.D(3)(a). A POSITA would have understood that this temperature data is provided in the form of an electrical signal.

c. 18[b]: B) a liquid crystal display for selectively displaying an alphanumeric message;

189. The *Inoue-Peters-weather.com* combination discloses element 18[b].

190. The *Inoue-Peters-weather.com* combination discloses a liquid crystal display. *Inoue* specifically discloses that the laptop includes an LCD display. EX1006, ¶[0020] (“A liquid crystal display (LCD) and the like is incorporated in the lid 12.”). This is further illustrated in Figure 1, below:



EX1006, Fig. 1 (annotated). As *Inoue* describes, “[p]rocessing and/or results of execution of the application software may be displayed on the screen of the LCD incorporated in the lid 12.” EX1006, ¶[0021]. A POSITA accordingly would have understood that *Inoue*’s LCD screen would display alphanumeric messages, as would have been well known on laptop displays.

191. *Peters* also discloses a display as part of its computer system, such as display 125 on which “text and images” are rendered. EX1007, 8:3-4, 8:39-58, Fig. 1. Display 125 “comprises any suitable electronic display device upon which an image or text can be represented,” including “a liquid crystal display (‘LCD’).” *Id.*, 8:59-65. *Peters*’ display is therefore a liquid crystal display that displays an alphanumeric message. *Peters*’ display does so “selectively” because the display of alphanumeric messages is controlled by a graphics controller coupled to the north bridge of *Peters*’ computer system. *Id.*, 8:39-58. For example, as *Peters* discloses, data structures on display “can be effectively shifted into and out of main memory 124 via the expansion bus and North bridge 120.” *See id.*

192. A POSITA would have understood that messages are displayed “selectively” based upon weather information the software determines should be displayed on the screen. This is standard operation of a laptop computer. For example, when used with weather.com, both *Inoue* and *Peters* would have displayed

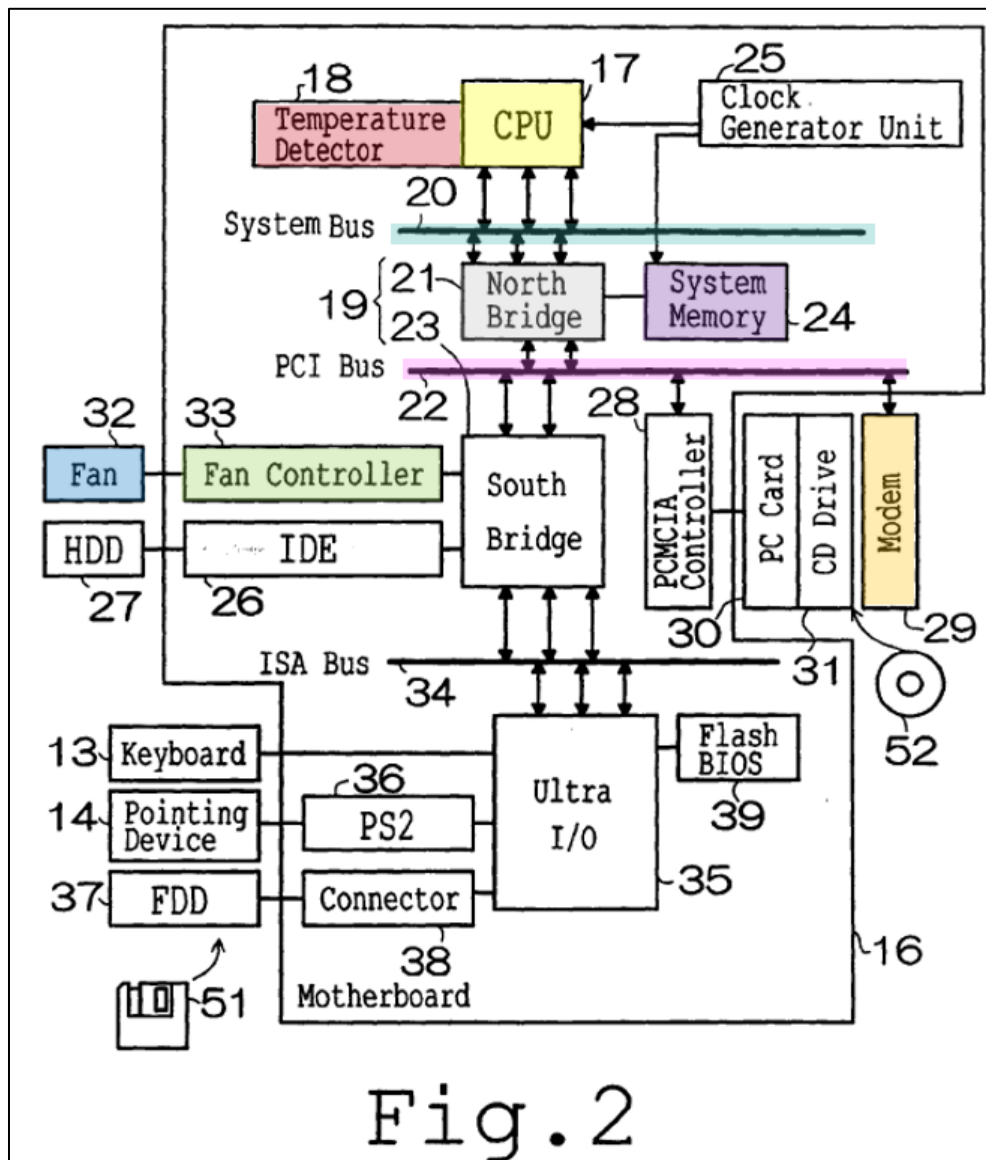
a screen to obtain a zip code and then would have selectively displayed the weather once the website returned the data.

193. To the extent Patent Owner contends that the alphanumeric messages displayed must be received from the remote correspondent, the *Inoue-Peters-weather.com* combination discloses this as addressed in 18[e]. See *infra*, §VII.D(3)(i).

d. 18[c][1]: C) a processor, said processing including: 1) a central processing unit;

194. The *Inoue-Peters-weather.com* combination discloses element 18[c][1].

195. The *Inoue-Peters-weather.com* combination discloses a processor that includes a central processing unit. *Inoue* discloses a “notebook type personal computer 10 as an electronic apparatus,” which includes “a central processing unit (CPU) and other electronic components are incorporated.” EX1006, ¶[0020]. *Inoue* discloses a motherboard, illustrated below, that includes a CPU 17:



EX1006, Fig. 2 (annotated). *Inoue's* CPU executes application software. EX1006, ¶¶[0025], [0027] (referencing the CPU executing application software). A POSITA would have understood that the CPU is a part of a processor, the remaining elements

of which I discuss below. I incorporate my discussion of the processor components below by reference.

196. *Peters* also discloses a processor that includes a CPU. *Peters* discloses a computer system with a “microprocessor or central processing unit (‘CPU’)” such as CPU 102. *See, e.g.*, EX1007, 1:25-26; *see also, e.g., id.*, Abstract, 2:15-33, 2:53-54, 2:65-3:28, 3:53-55, 4:7-31, 5:8-13, 5:20-6:21, 7:25-39, 7:65-8:8, 8:18-23, 9:41-52, Figs. 1-2. A POSITA would have understood this is a processor containing a CPU. Again, I discuss the remaining parts of the processor below.

e. 18[c][2]: 2) a real time clock;

197. While neither *Inoue* nor *Peters* discuss a real time clock, that may be because it is so obvious to include one. It is common knowledge of a POSITA to use a real time clock in a portable computer. EX1028, 6:8-17; EX1027, 16:4-30, 132:32-54; EX1031, 2:12-26, 3:24-30, Fig. 1; EX1032, 11:23-28, 12:41-61, Fig. 1; EX1033, 4:55-60, 5:1-6, 6:36-40, Fig. 1; EX1034, 2:32-34, Figs. 88, 94, 97-99; EX1043, 96; EX1012, 121:11-121:22; *supra*, §VI. One would be hard pressed to find a portable computer built in the 1990s or later that did not include a real time clock. Many laptops used the popular Microsoft Windows operating system. This operating system puts a time stamp on files that indicates the last time the file was saved. EX1042, 249. A real time clock is necessary to create those time stamps. While a real time clock is useful for many purposes in a portable computer, one must

be included for creating time stamps of when files were saved. Multiple prior art references establish the common knowledge that real time clocks were used in portable computers. EX1028, 6:8-17; EX1027, 16:4-30, 132:32-54; EX1031, 2:12-26, 3:24-30, Fig. 1; EX1032, 11:23-28, 12:41-61, Fig. 1; EX1033, 4:55-60, 5:1-6, 6:36-40, Fig. 1; EX1034, 2:32-34, Figs. 88, 94, 97-99; EX1043, 96; EX1012, 121:11-121:22. Thus, this element is obvious based upon the common knowledge of a POSITA. Inventor Rosen admits that the '555 Patent's real-time clock is not inventive. EX1012, 287:22-24, 288:8-15.

198. Inventor Rosen admits that the '555 Patent's real-time clock is not inventive. EX1012, 287:22-24, 288:8-15. Not only is the claimed real-time clock not novel, there also is nothing novel about its arrangement or usage.

f. 18[c][3]: 3) a memory coupled to said central processing unit for storing program and data information; and

199. The *Inoue-Peters-weather.com* combination discloses element 18[c][3].

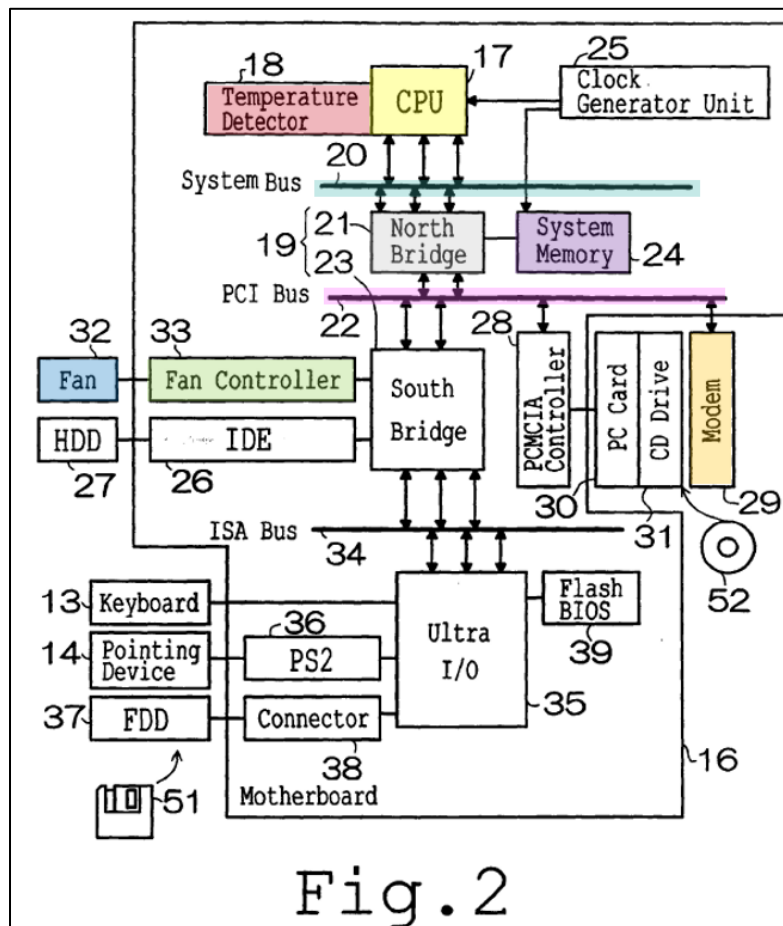
200. *Inoue's* processor includes a memory for storing program and data information. *Inoue* discloses memory such as "system memory unit 24" and "flash memory 39." With respect to system memory 24, *Inoue* describes:

A system memory unit 24 is connected to the north bridge 21. The north bridge 21 serves to allow the CPU 17 to fetch programs of the OS

and/or application software temporarily stored in the system memory unit 24. Memory modules such as a synchronous dynamic random access memory (SDRAM) can be employed as the system memory unit 24. The memory modules may be received within corresponding DIMM (dual in-line memory module) connectors fixedly mounted on the motherboard 16, for example.

EX1006, ¶[0025]. *Inoue* further discloses that “[w]hen the CPU 17 executes an application software, for example, the south bridge 23 serves to transfer programs and/or data, read out of the HDD 27, to the system memory unit 24.” EX1006, ¶[0027]. A POSITA accordingly would have understood that “programs and/or data” are stored in *Inoue*’s memory. Inventor Rosen admits that the ’555 Patent’s memory is not inventive. EX1012, 288:5-11.

201. The memory of *Inoue*’s processor is coupled to the central processing unit. *Inoue* discloses that system memory 24 is coupled to CPU 17, as illustrated in Figure 2 below:



EX1006, Fig. 2 (annotated); see also EX1006, ¶¶[0024]-[0025].

202. *Peters* also discloses a processor including a memory coupled to said central processing unit for storing program and data information. As illustrated in Figure 2 above, the memory is coupled to the CPU. *Peters* discloses “memory coupled to the CPU” such as main memory 124 that stores control tables which “specify whether the CPU clock frequency should be adjusted in response to the thermal event or whether the fan speed should be adjusted.” EX1007, 4:7-31; see also *id.*, 18:27-31, 19:1-4. For example, *Peters* discloses that “[t]he CPU core 104

accesses main memory 124 and uses the current CPU temperatures to retrieve the low and high temperature ranges from each of the control tables associated with the current temperature.” *Id.*, 13:49-61; *see also id.*, 14:63-15:21. A POSITA would have understood this as memory for storing data information. *Peters* also discloses that “main memory 124 functions as the working memory for the CPU 102 and the rest of the computer system 100 and generally includes a conventional memory device or array of memory devices in which application programs and data are stored.” EX1007, 8:24-38. A POSITA would have understood this as memory for storing program information.

203. A sensor input and control output would have been well known to a POSITA, as acknowledged by the ’555 Patent. EX1001, 1:28-55 (noting that processor accurately measures temperature of a sensor and sends control signals to equipment). To the extent Patent Owner contends this element is missing from the *Inoue-Peters-weather.com* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the ’555 Patent’s admissions to supply a missing claim element. Inventor Rosen also admits that the ’555 Patent’s sensor input and input/output unit are not inventive. *Id.*, 287:22-24, 289:18-21, 290:8-11. These admissions demonstrate this element was well known to POSITA and it would have been obvious to use in the *Inoue-Peters-weather.com* combination. At the very least this element would have been obvious because, as Inventor Rosen admits, a

POSITA would have understood that different functions can be combined into a single chip or separated among multiple chips in a microprocessor system. EX1012, 101:6-16, 323:14-324:24.

g. 18[c][4] 4) an input/output unit including:

204. The *Inoue-Peters-weather.com* combination discloses 18[c][4] as detailed below. *Infra*, §VII.D(3)(g)(a)-(d).

(a) 18[c][4][a] a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;

205. The *Inoue-Peters-weather.com* combination discloses element 18[c][4][a].

206. *Inoue-Peters's* processor includes an input/output unit that includes a sensor input coupled to a temperature sensor. *Inoue* discloses south bridge 23, which connects to a temperature detector or thermal sensor 18.

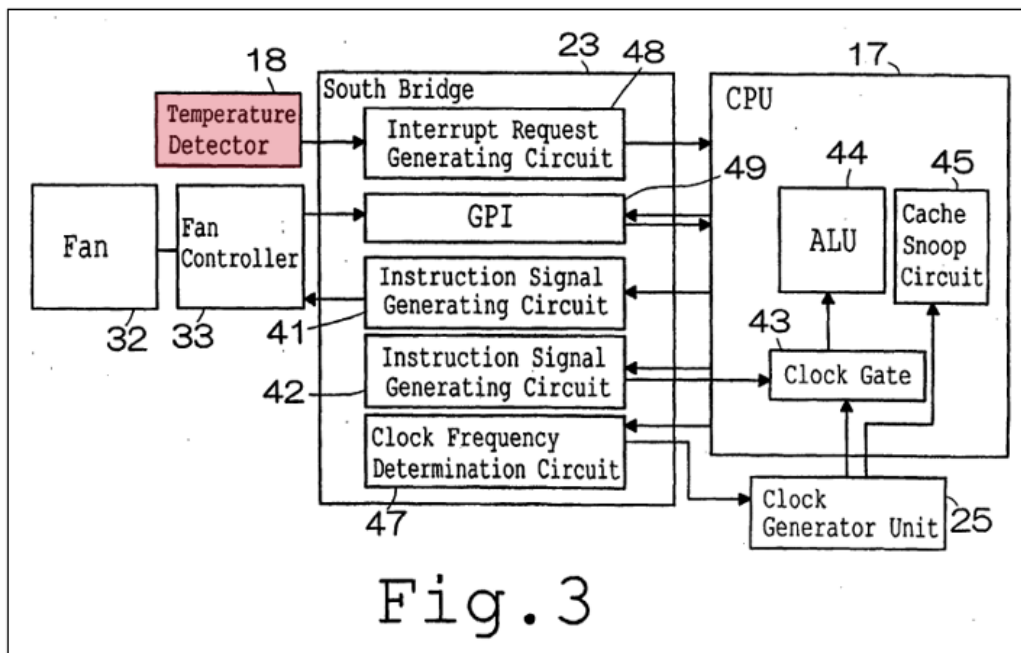


Fig. 3

EX1006, Fig. 3 (annotated), ¶[0019]. A POSITA accordingly would have understood that south bridge 23 interfaces to a temperature detector 18 thus coupling to a temperature sensor. A temperature detector detects the temperature and is thus a temperature sensor.

207. The sensor input receives the electrical signal from the temperature sensor. *Inoue* discloses that temperature detector or thermal sensor 18 “is designed to generate a temperature information signal identifying the temperature of the CPU 17.” *Id.*, ¶[0023] (emphasis added). A POSITA would have understood that this temperature information signal is an electrical signal from the temperature sensor that is received by the sensor input of *Inoue*’s south bridge. A POSITA would have recognized South Bridge and North Bridge as components of a standard Intel-based

computer architecture at the time. More specifically, the North Bridge and South Bridge chips were chips comprising communication interfaces. EX1043, 95.

208. As addressed above in 18[a], *Peters* also discloses a temperature sensor (116) and a thermal control logic that controls a fan based on the monitored temperature in the space outside of the CPU. *Supra*, §VII.D(3)(b); EX1007, 5:52-6:11, 7:40-59. A POSITA would have understood that *Peters*'s express disclosure of the thermal control logic monitoring the temperature of sensor 116 would have involved a sensor input coupled to temperature sensor 116 for receiving the electrical signal therefrom.

209. A sensor input and control output were well known to a POSITA, as acknowledged by the '555 Patent. EX1001, 1:28-55 (noting that processor accurately measures temperature of a sensor and sends control signals to equipment). To the extent Patent Owner contends this element is missing from the *Inoue-Peters-weather.com* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. Inventor Rosen also admits that the '555 Patent's sensor input and input/output unit are not inventive. *Id.*, 287:22-24, 289:18-21, 290:8-11. These admissions demonstrate this element was well known to POSITA and it would have been obvious to use in the *Inoue-Peters-weather.com* combination. At the very least this element would have been obvious because, as Inventor Rosen admits, a POSITA

would have understood that different functions can be combined into a single chip or separated among multiple chips in a microprocessor system. EX1012, 101:6-16, 323:14-324:24.

(b) 18[c][4][b]: b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and

210. The *Inoue-Peters-weather.com* combination discloses element 18[c][4][b].

211. The input/output unit includes a control output coupled to the space conditioning equipment. As illustrated in Figures 2 and 3, south bridge 23 connects to a fan controller 33 controls the operation of cooling fan 32. EX1006, Figs. 2-3; ¶[0032]. A POSITA accordingly would have understood that south bridge 23 includes a control output coupled to the space conditioning equipment.

212. The control output issues control signals to the space conditioning equipment. South bridge 23 issues a control signal generated by generating circuit 41 to the fan controller 33, which then “control[s] the operation or rotation of the cooling fan 32 in accordance with the instruction and the number identified *in the fan instruction signal*.” EX1006, ¶[0032] (“As shown in Fig. 3, the south bridge 23 comprises an instruction signal generating circuit 41 designed to generate *a fan instruction signal* in accordance with instructions issued from the CPU 17. The fan instruction signal may include a trigger information signal for identifying an

instruction to start or terminate a rotation of the cooling fan 32, a numerical information signal for identifying the rotation speed to be set at the cooling fan 32, and the like.”) (emphasis added); *see also id.*, ¶ [0029] (disclosing the fan controller 33 “serves to control the operation or rotation of the cooling fan 32.”).

213. *Peters* discloses “[a] computer system having thermal control logic that efficiently cools the computer system,” where “the thermal control logic couples to a CPU module and a fan.” EX1007, Abstract, 3:50-4:6, 5:20-31, Fig. 1. Thermal control logic controls the fan (or fan 180), which conditions the temperature of the laptop by cooling it. *Id.*, 2:53-64, 6:30-49, 7:5-10, 7:40-59, 13:24-48, 16:52-65. A POSITA would have understood that the thermal control logic coupled to and controlling the fan (space conditioning equipment) would have involved a control output for issuing control signals.

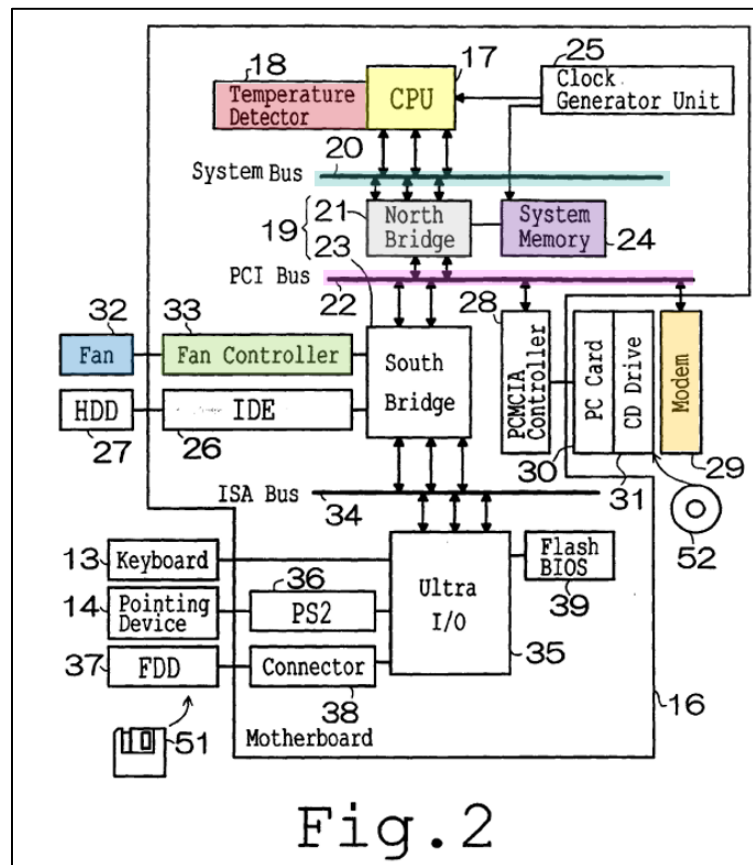
214. As discussed above in the prior section, this element also would have been well known to POSITA. *Supra*, §VII.D(g)(b). Inventor Rosen also admits that the ’555 Patent’s control output for space conditioning equipment is not inventive. EX1012, 287:22-24, 289:3-13.

(c) **18[c][4][c]: c) a communications interface adapted to establish bi-directional communications between said processor and a first remote correspondent which is a source of current information; and**

215. The *Inoue-Peters-weather.com* combination discloses element 18[c][4][c].

216. The input/output unit includes a communications interface adapted to establish bi-directional communications between said processor and a first remote correspondent, such as weather.com. Weather.com is a source of current information—the weather. As discussed above, it would be obvious to access weather.com using the laptop computers disclosed in *Inoue-Peters*.

217. *Inoue* discloses a modem 29 that “serves to connect CPU 17 to a network such as the Internet, an extranet, or the like.” EX1006, ¶[0028]. Modem 29 is illustrated in Figure 2, below:



EX1006, Fig. 2 (annotated). It would have been well known to a POSITA that a modem such as *Inoue's* modem 29 connected to the Internet establishes bidirectional communication between *Inoue's* CPU and an Internet server such as *weather.com's* server (remote correspondent).

218. *Inoue*'s modem 29 connects to its south bridge via a bus (PCI bus 22), as illustrated in Fig. 2 above. EX1006, Fig. 2; *see also id.*, ¶[0024] (south bridge 23 is connected to PCI bus 22), ¶[0028] (modem 29 is connected to PCI bus 22). While *Inoue* is not clear regarding which circuitry serves as an interface between the processor and the modem, a POSITA would have understood such circuitry existed.

To communicate with a “first remote correspondent,” the modem needs to receive instructions from the processor through a communications interface. A POSITA would have understood that circuitry in either the North Bridge or South Bridge circuits serves as a communications interface between the processor and the modem when establishing bidirectional communications between the processor and the first remote correspondent. *See, e.g.*, EX1043, 95. The North Bridge or South Bridge circuit then communicates with the modem through the PCI bus, as was common knowledge to a POSITA. A PCI bus was a standard bus interface used by multiple computer manufacturers at the time. Alternatively, the south bridge or north bridge in combination with the PCI bus and modem qualify as the communications interface. The input/output unit of Inoue thus consists of the southbridge or northbridge, PCI Bus 22, and Modem 29.

219. The first remote correspondent (*weather.com*’s server) is a source of current information. A POSITA would have understood that *weather.com* is a source of current weather information.

(d) Obvious to implement in one chip

220. Implementing *Inoue* in view of *Peters*’ input/output unit with a sensor input, a control output, and a communications interface on a single chip would have been obvious to a POSITA at the time of the alleged invention. For example, it would have been well known to have a single chip control multiple functions that

could be handled by different chips. EX1043, 91-92. Providing this functionality in a single chip would have been nothing more than a simple design choice. A POSITA would have had a reasonable expectation of success in such an implementation. Such an implementation would have been one of a finite number of implementations for this functionality. Additionally, as the '555 Patent admits, the claimed input/output unit, which is part of a processor, is a conventional, off-the-shelf component implemented in a conventional way. It accordingly would have been obvious for a POSITA to include a single input/output unit with each of these three components. Inventor Rosen admits this as well. EX1012, 101:6-16, 323:14-324:24.

h. 18[d]: D) means coupling said communications interface and said first remote correspondent; and

221. The *Inoue-Peters-weather.com* combination discloses element 18[d]. As discussed above, the “means coupling” recited in this claim element is governed by 35 U.S.C. § 112, ¶6. *Supra*, §V.F. Under Patent Owner’s interpretation, the function is “coupling the communications interface and the remote correspondent,” and the structure is “a serial link and/or data link and any equivalents.”

(a) Function

222. The *Inoue-Peters-weather.com* combination discloses the claimed function of “coupling the communications interface with the remote correspondent.”

As detailed above with respect to element 18[c][4][c], *Inoue* discloses a modem that connects the communications interface of the North Bridge or South Bridge to a modem. That connection to a modem facilitates coupling of the communications interface to the server of the weather.com website (remote correspondent) via the Internet. *Supra*, §VII.D(g). Thus, the communications interface is coupled to both the modem and the weather.com server through the Internet.

(b) Structure

223. The *Inoue-Peters-weather.com* combination also discloses the corresponding structure of “a serial link and/or data link and any equivalents.” A POSITA would have understood that the modem (which is connected to the communications interface via the PCI bus) serves to couple the communication interface to the Internet to allow the computer to access the web server. *See* EX1001, 6:1-11 (’555 Patent teaching that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner”); EX1015, 685-686; *supra*, §§VI.C, VII.C(2)(h). Thus there is a data link between the communications interface and the web server (remote correspondent). The data link that connects the communications interface to the web server comprises the modem connected to the Internet.

224. A POSITA would have understood that to connect to the Internet, there necessarily must be some connection between the communications interface and the

Internet. The '555 Patent teaches that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner,” thus admitting this element is obvious as common knowledge. EX1001, 6:1-11; EX1026, Abstract, 2:31-44, 2:38-41, 4:38-52, 6:57-7:5. It is common knowledge that a modem can be used to connect to an Internet service provider that then completes a connection to the Internet and, thus, the “first remote correspondent.” *See, e.g.*, EX1001, 6:1-11; EX1005, 5:28-31; EX1019, 1:19-30, 5:26-30; EX1023, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *supra*, §VI. The combination of structures between the communications interface and the web server, which includes the Internet, forms a data link between them. To accomplish a connection to the Internet, a device such as a modem or ethernet connection described in the cited references must be used and then those devices must be connected to equipment operated by an Internet Service Provider, which then connects to web servers through the Internet. EX1001, 6:1-11; *see, e.g.*, EX1005, 5:38-41, 5:31-34; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 7:56-67, 11:7-57; EX1012, 2, 11-12, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51, 54; *see generally* EX1014, EX1015. Collectively, the equipment between the communications link in *Inoue*, and the equipment operated by the Internet Service provider, together with the Internet itself collectively form a data link that couples the communications interface to the remote correspondent (weather.com). Any one of the devices between the

communications interface and the remote correspondent are data links because they serve to transmit data from one point to another. At the very least, it would have been obvious to have *Inoue*'s processor interface to a communication interface such as a peripheral chip (USB, UART, etc.), for the communication interface to interface to the modem, and obvious for the modem to connect to the Internet and/or ISP thereby facilitating a connection to weather.com via the Internet using protocols like TCP and HTTP. *See, e.g.*, EX1005, 5:38-31; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 11:7-57; EX1012, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *see generally* EX1014, EX1015.

225. To the extent Patent Owner contends that any of the structures disclosed by the references discussed above do not disclose an identical structure to the “data link” that Patent Owner contends is corresponding structure, they at least disclose structures that are an “insubstantial difference.” All of the structures discussed in the references in the ground, as well as in the references cited for the obviousness of this element, are known structures to achieve data communications between a first device and a second device over a computer network such as the Internet. The patent indicates that such connections are “well known.” EX1001, 6:1-11. The patent does not describe any new “means coupling” structure or use a data link for something other than its ordinary purpose. Because there is nothing special about the “data link” disclosed in the ’555 Patent and it must simply accomplish the communication

of data between the communications interface and remote correspondent, all of the above structures are an insubstantial difference for that purpose because they are all known to be interchangeable for that purpose. They are simply design options to communicate over wide area networks such as the Internet that a POSITA can choose to use.

- i. **18[e]: a program stored in said memory for displaying messages received from said first remote correspondent, which received messages do not pertain to the operation of said thermostat system, on said liquid crystal display.**

226. The *Inoue-Peters-weather.com* combination discloses element 18[e].

227. The *Inoue-Peters-weather.com* combination discloses a program stored in said memory for displaying messages from said first remote correspondent are displayed on said liquid crystal display. As detailed in limitation 18[b], *Inoue* and *Peters* disclose a liquid crystal display. *Supra*, §VII.D(3)(c). The *Inoue-Peters-weather.com* combination discloses displaying messages (*e.g.*, weather information) from said first remote correspondent (weather.com server) on *Inoue-Peters's* LCD. EX1008, 6, 9; EX1013, 5. When a user accesses weather.com on a laptop computer, such as *Inoue-Peters's* laptop computer, weather.com sends data packets (messages) containing weather information, and that weather information is displayed on the screen of the laptop. EX1008, 6, 9; EX1013, 5.

228. *Inoue* also discloses that “[w]hen the CPU 17 executes an application software . . . the south bridge 23 serves to transfer programs and/or data, read out of the HDD 21, to the system memory unit 24.” EX1006, ¶[0027]. A well-known application software would have included a web browser to access the Internet, including weather.com. EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5; EX1037, 50; EX1012, 60:9-15, 61:12-19. A POSITA would have understood that in order to display such messages, *Inoue* would have included a program stored in memory for displaying messages. Display of the information received from weather.com would have involved a program stored in memory. *See, e.g.*, EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5.

229. *Peters* also discloses a program stored in said memory for displaying messages from said first remote correspondent are displayed on said liquid crystal display. As detailed in limitation 18[b], *Peters* discloses a liquid crystal display for displaying textual information. *Supra*, §VII.D(3)(c). As also detailed above in limitation 18[c][3], *Peters* discloses memory such as main memory 124. *Supra*, §VII.D(3)(f). *Peters* discloses that data structures for display on display 125 are “effectively shifted into and out of main memory 124 via the expansion bus and North bridge 120.” EX1007, 8:39-58. It would have been well known to a POSITA that shifting data structures into and out of memory for display would have involved a program stored in memory for displaying messages.

230. The received messages do not pertain to the operation of said thermostat system. *See supra*, §VII.C(2)(i). As discussed above, the display of weather information on the thermostat satisfies this claim limitation. *Supra*, §VII.C(2)(i).

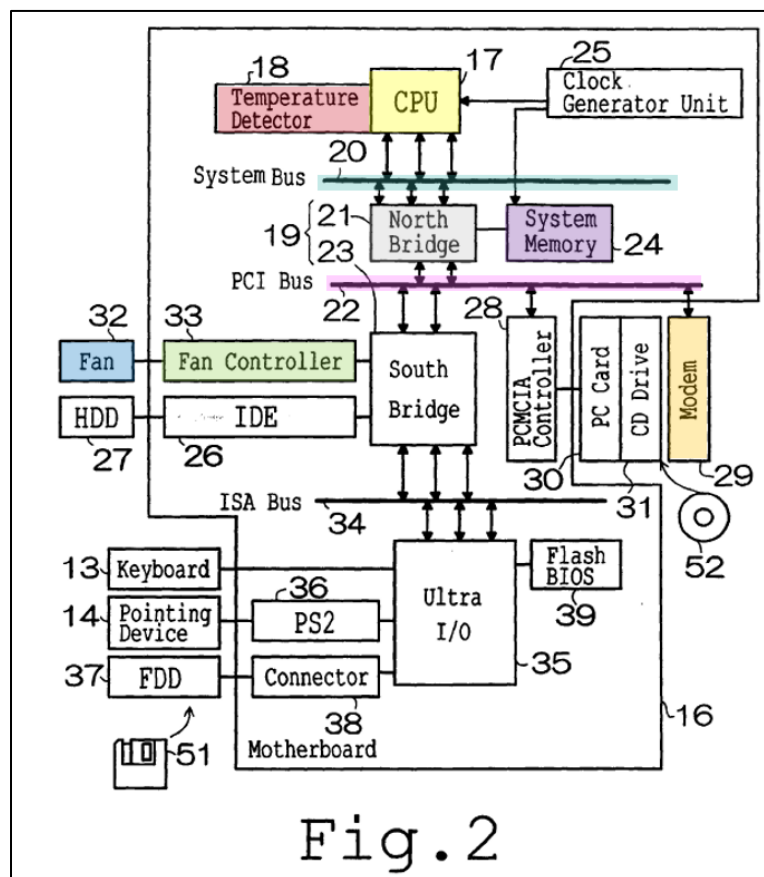
231. Consistent with the '555 Patent's express embodiments, the prosecution history, Patent Owner's infringement allegations, and Inventor Rosen's testimony, a POSITA would also have understood that obtaining weather information from weather.com over the Internet discloses this element. Moreover, it would have been obvious to a POSITA to receive messages from other well-known websites beyond weather.com to obtain current information, such as news or promotions, that also do not pertain to the operation of said thermostat system.

232. To the extent Patent Owner disagrees this element is disclosed by the combination, it would have been obvious based upon the common knowledge of a POSITA. It was common knowledge of a POSITA that web browsers were used in laptop computers to access websites such as weather.com and display messages received from web servers on the liquid crystal display of the laptop. *See* EX1035, Abstract, 3:8-49, Figs. 1-2; EX1036, 4:4-5:5; EX1037, 50; EX1041, 82, 93; EX1012, 60:9-15. The messages received from web servers contain information that does not pertain to the operation of the thermostat. At the very least, it would have been obvious for software to cause display of the messages because the most common way to control information content on a display is by the use of software.

4. **Claim 20: The thermostat system of claim 18 in which communications between said first remote correspondent and said communications interface is carried out via the Internet.**

233. The *Inoue-Peters-weather.com* combination discloses Claim 20.

234. *Inoue* discloses a modem 29 that “serves to connect CPU 17 to a network such as the Internet, an extranet, or the like.” EX1006, ¶[0028]. Modem 29 is illustrated in Figure 2, below:



EX1006, Fig. 2 (annotated). In light of *Inoue*’s disclosure, it would have been well known to a POSITA that the communications between weather.com web server and the communications interface of *Inoue*’s processor would have been carried out via

the Internet and *Inoue*'s modem. Weather.com is accessible via the Internet so that is how it would have been accessed by *Inoue*, which is connected to the Internet.

E. Ground 3: Claims 18 and 20 are obvious over Glorioso and Shah.

235. To the extent Patent Owner contends that the *Inoue-Peters-weather.com* combination does not disclose a thermostat system and attempts to swear behind *Shamoon*, the challenged claims are nonetheless rendered obvious by the *Glorioso-Shah* combination.

236. In my opinion, Claims 18 and 20 would have been obvious over *Glorioso* in view of *Shah*. The hardware elements in the challenged claims were well known and used in thermostat systems for many years before the '555 Patent, as I have discussed above. *Supra*, §VI(C). Indeed, the admissions in the specification of the '555 Patent demonstrate that most of these elements would have been well known to a POSITA before the priority date. To the extent Patent Owner contends any of these elements are missing from the *Glorioso-Shah* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the '555 Patent's admissions to supply a missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat.

237. Based on the following analysis, I conclude that a POSITA at the relevant time would have understood the limitations of Claims 18 and 20 were

expressly disclosed, taught, or suggested by *Glorioso* in combination with *Shah*, and it would have been obvious to a POSITA to combine them to arrive at the challenged claims.

1. A POSITA Would Have and Could Have Combined *Glorioso* with *Shah*

238. A POSITA would have been motivated to combine *Glorioso* with *Shah*. *Glorioso* and *Shah* are analogous art in the same field of endeavor of thermostat systems connected to communication networks. EX1009, 2:54-3:8, 3:8-39, 4:1-4, Fig. 1; EX1010, Abstract, 3:44-65, Fig. 1

239. *Glorioso* does not indicate what type of display it uses, but a POSITA would have been motivated to modify *Glorioso*'s display to include *Shah*'s LCD display. Liquid crystal displays were well known and widely used in electronic devices at the time of the alleged invention, including in thermostats. EX1001, 1:54-55 (discussing LCD as part of "modern thermostats"); EX1029, 1-2, 4; EX1024, 1, 31-32, 41-42, 46; EX1018, 9:33-59, Fig. 3; EX1004, ¶¶[0070]-[0071]; EX1038, 4:56-5:7; EX1039, 1:40-48, 2:25-28. LCDs were known to be desirable due to their low cost, low power consumption, and compact design. Thus, the desirability of using a liquid crystal display was known to persons of ordinary skill in the art, and a POSITA would have been motivated to incorporate *Shah*'s LCD display to obtain these benefits. Moreover, use of an LCD was an obvious design choice. Because of

their widespread use in thermostats as a conventional choice for a display, it would have been obvious for a POSITA to use an LCD in any thermostat.

240. The liquid crystal display claimed in the '555 Patent is directed to no more than a conventional type of display used in a conventional way to achieve the claimed purpose and functionality, all with predictable results and well within the skill of a POSITA. EX1001, 1:54-55 (discussing LCD as part of “many modern thermostats”) Indeed, liquid crystal displays were a very common screen used in thermostat systems at the time of the purported invention. *See, e.g.*, EX1018, 9:33-59, Fig. 3; EX1004, ¶¶[0070]-[0071]; EX1038, 4:56-5:7; EX1029, 1-2, 4; EX1024, 1, 31-32, 41-42, 46; EX1039, 1:40-48, 2:25-28. Using conventional structures would have been obvious to achieve any of the advantages known to a person of ordinary skill, including the versatility and low-power consumption of LCDs adapted for touchscreen functionality.

241. Moreover, liquid crystal displays were well-known to provide advantages, such as low-power consumption, versatility, and displaying more information in a more efficient manner. A POSITA would have readily understood the benefits provided by an LCD display in a thermostat system and including an LCD display in a thermostat would have been nothing more than a simple design choice. Moreover, a POSITA would have understood the prevalence of liquid crystal displays in prior art systems, and would have been motivated to include a

liquid crystal display as the display in a thermostat system due to the benefits offered and ordinary market pressures of low price due to wide availability. Thus, one of ordinary skill would have been motivated to include such functionality and combine a thermostat with a liquid crystal display because of the known and predictable benefits.

242. A POSITA would have had a reasonable expectation of success in doing so. Using an LCD as a display in a thermostat would have involved combining well known prior art elements (LCDs) according to known methods to yield predictable results (displaying information on an LCD). Doing so would have involved minimal, if any, modification to *Glorioso*'s thermostat which has a display (and might even be an LCD).

243. *Glorioso* is silent on whether it includes a real time clock but a POSITA would have been motivated to include *Shah*'s real time clock. Inclusion of a real time clock in a thermostat's processor was well known and common knowledge to a POSITA as admitted by the '555 Patent. EX1001 1:34-41; EX1018, Fig. 5; EX1021, 3:13-22. A real time clock was often implemented with an off the shelf component as well. EX1021, 3:13-22 ("The microprocessor also receives real time information from a real time clock 38 via a clock data line 40. This real time information is made available to the microprocessor when the real time clock 38 is enabled via an enabling line 42. The real time clock is preferably a DS 130258

Semiconductor Chip available from Dallas Semiconductor Company. It is to be appreciated that real time clocks are well known in the art and the above reference to a particular product from a particular company is by way of example only.”). *Shah*’s processor includes a real time clock. EX1010, 3:1-20, Fig. 2. A POSITA would have understood that in order for the thermostat to display the time and to implement algorithms adjusting the temperature based on the time as *Shah* discloses, *Shah*’s processor includes a real-time clock.

244. In addition, a POSITA desiring to design a thermostat system would have recognized that a real time clock would offer a variety of well-known benefits. For example, a POSITA would have recognized that including a real time clock would allow a user to be automate adjustment of the thermostat like is taught by *Shah*. This feature is common knowledge. EX1001 1:43-47. Also, a POSITA would have recognized that including a real time clock in a thermostat would allow a user to be able to set different temperature settings depending on the time of day—another common feature of thermostats and convenience for a user. EX1001 1:43-47. A POSITA would have recognized that such configurability options would have been desirable to users of thermostats. A POSITA therefore would have been motivated by common sense, design incentives, and other market forces to include a real time clock in a thermostat. A POSITA therefore would have been motivated

by these benefits and the fact that many thermostats have clocks to include one in any thermostat.

245. A POSITA would have had a reasonable expectation of success in modifying *Glorioso*'s thermostat to include a real time clock. Doing so would have involved combining well known prior art elements (thermostats and real time clocks) according to known methods (coupling) to yield predictable results (a thermostat with a real time clock). As discussed, above, this modification could be made using off the shelf components. Doing so would have been well within the skill set of a POSITA and would not have involved substantial modification or undue experimentation.

246. A POSITA would have been motivated to modify *Glorioso* to connect to the Internet, as disclosed in *Shah*. The ability for a thermostat to connect to the Internet, for example, to interface with external sources of information, was well-known and prevalent in prior art thermostat systems and disclosures. *Supra*, §VI.A-B. Adding internet connectivity to thermostats was an obvious improvement on existing thermostat systems because it was a common, ordinary, and well-known way to provide more information and control to homeowners with respect to their thermostat and environmental systems. *See e.g.*, EX1023, 9 n.10 ("A very different segment of the media coverage of 'Internet appliances' concerns the notion of connecting traditional household appliances . . . to the Internet. . . . Some of these

concepts make sense (*e.g.* connecting thermostats so you can program them through a Web site, not to have to reset time when power blinks, perform remote diagnostics on large appliances, etc.) . . .”).

247. It was within the general knowledge of those of ordinary skill and well-known and understood in the art that electronic devices and systems, including thermostat systems, could be connected to the Internet to utilize information available via the Internet. As stated in U.S. Patent No, 6,161,133, (“*Kikinis*”), “[e]xamples [of such systems and devices] are WEB phones, WEB TV’s, Palm-top computers, Internet capable cell phones, Laptop computers, and so on, even including sophisticated desktop and larger computers, or other, non-information appliances such as a refrigerator, air conditioning thermostat, toy etc., which may be connected to and utilize information from the Internet.” EX1026, 4:46-52.

248. It was thus far from novel or new to include Internet connectivity in thermostats, for example, to obtain current weather and other information. In fact, the ’555 Patent admits that weather information sources were “widely available and are routinely accessed by, for example, using the Internet,” at the time of the inventions. *See, e.g.*, EX1001, 4:14-15.

249. Here, the claimed receiving of messages via the Internet does nothing more than to propose implementing existing processes (*e.g.*, providing access to sources of information via the Internet) using well-known and commonplace Internet

technology. I understand that when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.

250. One of ordinary skill in the art would have been motivated to provide Internet connectivity to a thermostat to, for example, provide additional information to thermostat users. For example, *Gazdzinski* discloses a thermostat system with a “network (*e.g.*, Internet) interface [] configured to provide rapid access to a variety of web sites or URLs of interest, such as those providing local weather, directions from the elevator to local points of interest, stock market quotations, breaking news headlines, etc.” See EX1020, 3:22-25. In addition, the use of the Internet was a well-known technique for enabling device users to obtain weather information. A person of ordinary skill in the art (“POSITA”) would have also been motivated to include Internet connectivity in thermostats to provide the ability to quickly obtain accurate and up-to-date weather information, as taught by *Gazdzinski*. EX1020, 3:19-26 (“***the network (e.g., Internet) interface is configured to provide rapid access to a variety of web sites or URLs of interest, such as those providing local weather, directions from the elevator to local points of interest, Stock market quotations, breaking news headlines, etc.***”) (emphasis added).

251. A POSITA at the time of the alleged invention of the asserted patents thus would have been familiar with the well-understood practice of connecting thermostat systems to the Internet to provide additional features attractive to consumers, including, displaying weather data and other information of interest to the user. Those of ordinary skill in the art therefore would have been motivated to include Internet connectivity to obtain known advantages.

252. Moreover, it was well-known that thermostat systems could include Internet connectivity functionality to offer various features that appeal to consumers. Thus, one of ordinary skill would have been motivated to include such features because of the known and predictable benefits to the consumer as well as ordinary market forces. At the time of the invention, connecting a thermostat system to the Internet (*e.g.*, to rapidly obtain current information) was well-known and it would have been obvious to provide this feature as part of an integrated system.

253. A POSITA would have had a reasonable expectation of success in modifying *Glorioso's* thermostat to connect to the Internet, as various thermostats had been connected to the Internet before, as detailed above. *Supra*, §VI.A. This would have involved combining well known prior art elements (thermostats and communications interfaces to the Internet) according to known methods (Internet connection) to yield predictable results (thermostat connected to the Internet). As acknowledged by the '555 Patent, implementing such a communications interface

with means coupling the interface to a remote correspondent required nothing more than “typical coupling” and “conventional[] interfaces with an Internet Service Provider [] which completes the communications link to the remote correspondent in the well-known manner.” EX1001, 5:65-6:10. A POSITA would have understood that *Glorioso* already includes the hardware, software, and/or circuitry to readily incorporate such a modification. Accordingly, connecting *Glorioso*’s thermostat to the Internet would have involved minimal, if any, modification to *Glorioso*’s thermostat which is connected to a communications network such as a WAN.

2. Claim 18

254. The hardware elements in Claim 18 were well known and used in thermostat systems for many years before the ’555 Patent. Indeed, the admissions in the specification of the ’555 Patent demonstrate that most of these elements would have been well known to a POSITA before the priority date. It was also well known to connect appliances—such as thermostat systems—to the Internet to obtain current information, as I have discussed above. *Supra*, §VI.A-B.

255. It was well known to a POSITA that thermostat systems would have included a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space, as acknowledged by the ’555 Patent. EX1001, 1:28-47, 3:31-53. Moreover, Inventor Rosen admits that the ’555 Patent’s sensor is not inventive. EX1012, 289:14-24.

256. It was well known to a POSITA that thermostat systems would have included the ability to display alphanumeric messages on an LCD display, as acknowledged by the '555 Patent. EX1001, 1:48-55.

257. It was well known to a POSITA that thermostat systems would have included a processor, as acknowledged by the '555 Patent. EX1001, 1:28-47. Moreover, Inventor Rosen admits that the '555 Patent's CPU or microprocessor is not inventive. EX1012, 287:22-24, 288:16-19.

258. It was well known to a POSITA that thermostat systems would have included a real time clock, as acknowledged by the '555 Patent. EX1001, 1:28-47. Moreover, Inventor Rosen admits that the '555 Patent's real-time clock is not inventive. EX1012, 287:22-24, 288:8-11.

259. It was well known to a POSITA that thermostat systems include a memory storing a program and that is programmable so that the thermostat set points may vary with the day of the week (thus necessitating the storage of data), as acknowledged by the '555 Patent. EX1001, 1:28-55. Moreover, Inventor Rosen admits that the '555 Patent's memory is not inventive. EX1012, 287:22-288:7.

260. It was common knowledge of a POSITA that thermostat systems would have included a sensor input and control output, as acknowledged by the '555 Patent. EX1001, 1:28-55 (noting that processor accurately measures temperature of a sensor and sends control signals to equipment). The '555 Patent admits "all the processor

components” are available off the shelf. EX1001, 3:54-60. Inventor Rosen also admits that the ’555 Patent’s sensor input and input/output unit are not inventive. *Id.*, 287:22-24, 289:18-21, 290:8-11. Inventor Rosen also admits that the ’555 Patent’s control output for space conditioning equipment is not inventive. EX1012, 287:22-24, 289:33-13.

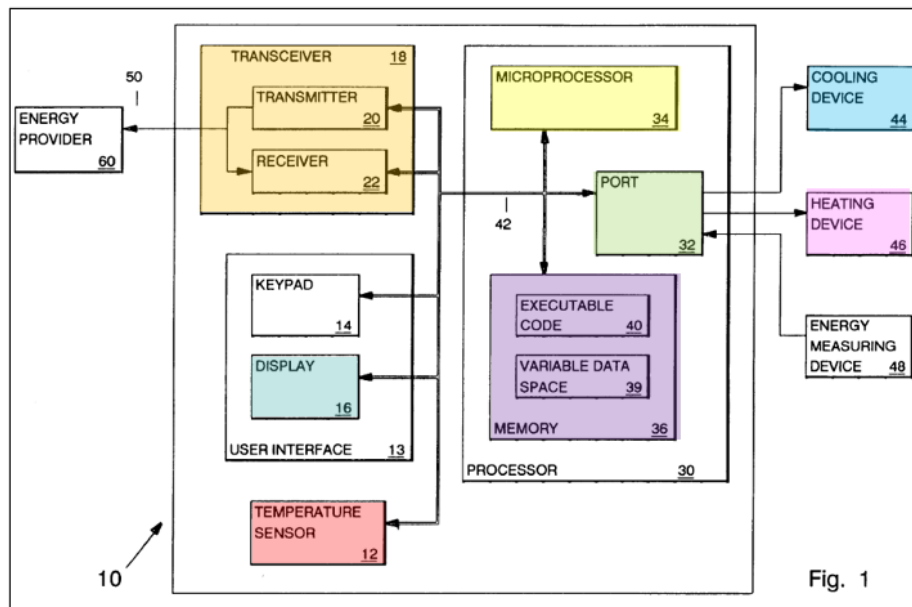
261. It was well known to a POSITA that a thermostat could have been connected to the Internet as an Internet Appliance. *Supra*, §VI.A. The ’555 Patent discloses that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner,” thus admitting this element is obvious as common knowledge. EX1001, 6:1-11. It was common knowledge that a modem can be used to connect to an Internet service provider that then completes a connection to the Internet and, thus, the “first remote correspondent.” *See, e.g.*, EX1001, 6:1-11; EX1005, 5:28-31; EX1019, 1:19-30, 5:26-30; EX1023, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *supra*, §VI. Inventor Rosen admits that the ’555 Patent’s communications interface is not inventive. EX1012, 290:19-291:14.

262. To the extent Patent Owner contends any of these elements are missing from the *Shamoon-Rainer* combination or not obvious, I understand from counsel for Petitioner that it is proper to rely upon the ’555 Patent’s admissions to supply a

missing claim element. These admissions demonstrate this element was well known to a POSITA and would have been obvious to use in a thermostat.

a. 18[Pre]: A thermostat system for controlling space conditioning equipment comprising:

263. If the preamble is limiting, the *Glorioso-Shah* combination discloses it. *Glorioso* discloses a thermostat system. *Glorioso* discloses a “smart thermostat,” illustrated below in Figure 1.



EX1009, Fig. 1 (annotated), 2:54-3:8.

264. *Glorioso*’s smart thermostat is for controlling space conditioning equipment. *Glorioso*’s smart thermostat controls a cooling device 44 (such as an air conditioner) and/or a heating device 46 (such as a furnace). EX1009, 2:54-3:8, 4:1-17.

b. 18[a]: A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated;

265. The *Glorioso-Shah* combination discloses element 18[a].

266. *Glorioso* discloses a temperature sensor. *Glorioso* discloses that “smart thermostat 10 includes a temperature sensor 12,” as also illustrated in Figure 1 above. EX1009, Fig. 1, 2:54-3:8.

267. *Glorioso*’s temperature sensor provides an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. The temperature sensor is situated in the conditioned space and measures the temperature of that space. EX1009, 2:54-3:8 (“The temperature sensor 12 is included within the space cooled or heated by the cooling device 44 or heating device 46, respectively.”); *id.*, Abstract, 1:55-59 (“The smart thermostat includes a temperature sensor for measuring a temperature”), 2:24-25 (“In a step 202 the temperature sensor 12 measures a temperature.”). A POSITA would have understood that *Glorioso*’s temperature sensor would provide that measured temperature in the form of an electrical signal, as was well known.

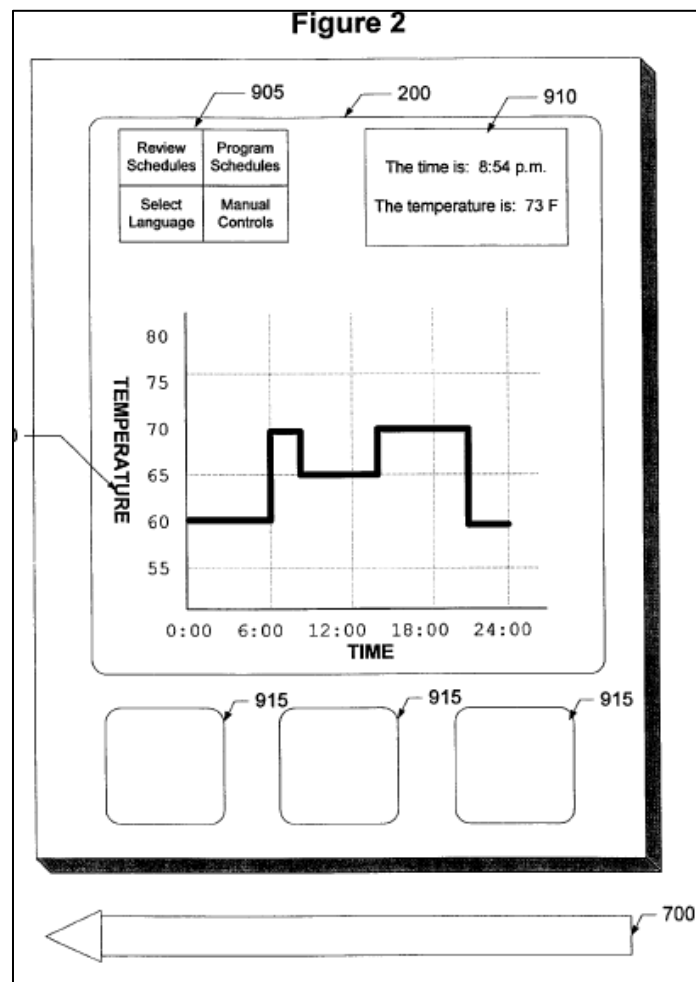
268. This element is also well known to a POSITA as discussed in Ground 1. *Supra*, §VII.C(2)(b).

c. 18[b]: B) a liquid crystal display for selectively displaying an alphanumeric message;

269. The *Glorioso-Shah* combination discloses element 18[b].

270. *Glorioso* discloses a display but does not indicate what kind. *Shah* discloses a liquid crystal display. *Shah* discloses a “thermal comfort controller” or thermostat that includes a touch-sensitive LCD display. EX1010, 2:63-67 (“Of course the graphical user interface system could also be manufactured to be integrated with a thermostat itself. In such an embodiment, a touch-sensitive LCD display is coupled with the thermostat’s existing central processing unit and RAM.”). Thus, the messages are “selectively” displayed because the software is programmed to display the message in the language the user requests.

271. *Shah*’s LCD display selectively displays an alphanumeric message. For example, *Shah* discloses that display of the user interface (display unit 200), which can be an LCD display, “has a touch-sensitive screen which allows the user to input data without the need for a keyboard or mouse.” *Id.*, 2:41-55. For example, the user can select a preferred language on the display, such as when the thermostat is first powered up after installation. *Id.*, Abstract, Fig. 2. An example of this screen is illustrated as Figure 2.



Id., Fig. 2. As *Shah* discloses, “[o]f course, other data could also be displayed, such as a current date, day of the week, indoor and/or outdoor relative humidity, etc.” *Id.*, 3:9-20. A POSITA accordingly would have understood that *Shah*’s LCD display selectively displays an alphanumeric message. The messages are “selectively” displayed because the software is programmed to display the message in the language the user requests.

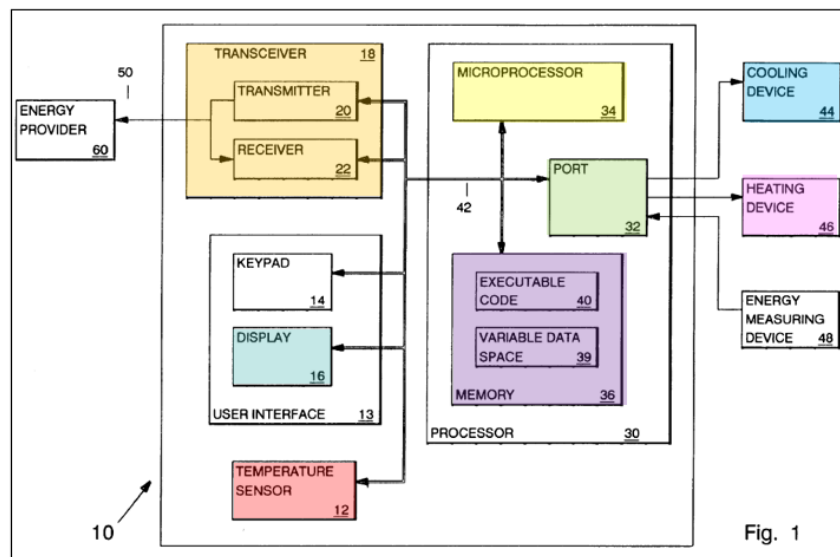
272. To the extent Patent Owner contends that the alphanumeric messages displayed must be received from the remote correspondent, the *Glorioso-Shah* combination discloses this as addressed in 18[e]. *See infra*, §VII.E(2)(i).

273. This element is also well known to POSITA as discussed in Ground 1. *Supra*, §VII.C(2)(c).

d. 18[c][1]: C) a processor, said processor including: 1) a central processing unit

274. The *Glorioso-Shah* combination discloses element 18[c][1].

275. *Glorioso* discloses a processor including a central processing unit. *Glorioso* discloses that its smart thermostat includes processor 30 (a processor) which includes microprocessor 34 (a CPU), as also illustrated below in yellow:



EX1009, Fig. 1, 2:54-3:8 (“The smart thermostat 10 includes . . . a processor. The processor 30 includes . . . a microprocessor 34”). Inventor Rosen agrees that the

processor may be a microprocessor. EX1012, 92:24-93:5, 288:16-23.

e. 18[c][2]: 2) a real time clock;

276. The *Glorioso-Shah* combination discloses element 18[c][2].

277. *Glorioso* is silent on the presence of a real time clock but it would be obvious to include *Shah*'s real time clock or a real time clock based on the common knowledge of a POSITA as set forth in Section VI above, which is incorporated by reference here. *Shah*'s processor includes a real time clock. For example, *Shah* discloses control algorithms 500 that include "a set-point schedule containing a list of times associated to a list of temperatures," in which the "thermal controller sets-up or sets-back the temperature according to such a set-point schedule." EX1010, 3:1-5. As an example, "a set-point schedule could be configured to adjust the temperature to 60 degrees at 6:00 a.m., then to 67 degrees at 6:30 a.m., and up to 73 degrees at 8:00 a.m., etc." *Id.*, 3:5-8. These control algorithms are stored in memory in the central processing unit of the thermostat. *Id.*, 5:44-50. Moreover, *Shah* discloses displaying the time on the display. *Id.*, 3:9-20 ("other data 910 is also displayed, including the time and temperature"), Fig. 2. A POSITA would have understood that in order for the thermostat to display the time and to implement algorithms adjusting the temperature based on the time as *Shah* discloses, *Shah*'s processor includes a real-time clock.

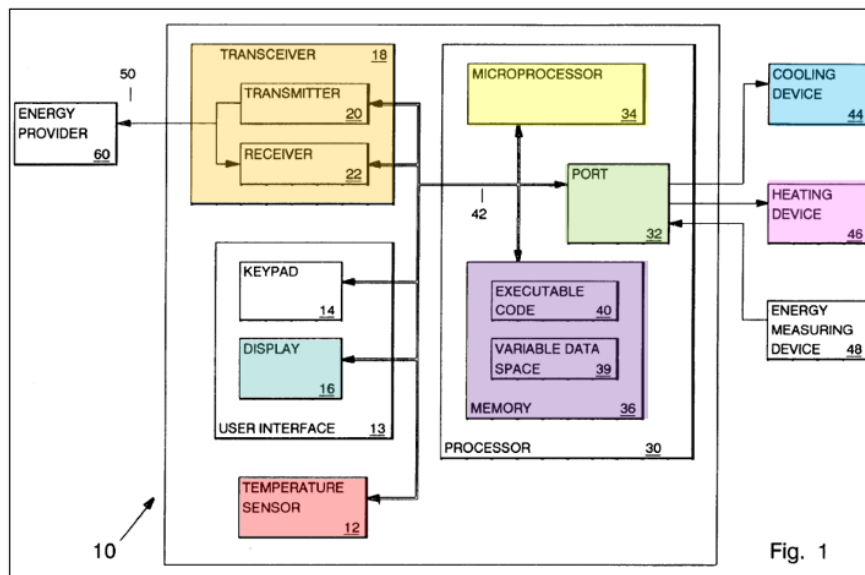
278. This element is also well known to a POSITA as discussed in Ground

1. *Supra*, §VII.C(2)(e).

f. 18[c][3]: 3) a memory coupled to said central processing unit for storing program and data information; and

279. The *Glorioso-Shah* combination discloses element 18[c][3].

280. *Glorioso*'s processor (processor 30) includes a memory (memory 36), as also illustrated below in purple:



EX1009, Fig. 1, 2:54-3:8 (“The processor 30 includes . . . a memory 36”). As illustrated in Figure 1, the memory of *Glorioso*'s processor (memory 36) is coupled to the central processing unit (microprocessor 34). Moreover, *Glorioso* discloses the memory 36 having instructions for microprocessor 34, which a POSITA would have understood involved coupling *Glorioso*'s memory 36 to microprocessor 34. *Id.*, 2:59-63.

281. The memory of *Glorioso*'s processor is for storing program and data information. Memory 36 includes "variable data space 39 and an executable code 40 having instructions for the microprocessor 34 for directing the actions of the processor 30." EX1009, 2:54-3:8. *Glorioso* discloses that "[t]he microprocessor 34 operates over a bus 42 for reading from the executable code 40 and the variable data space 39, writing to the variable data space 39, and receiving information and issuing commands to the elements of the smart thermostat 10." *Id.* A POSITA would have understood that such executable code is program information, and data space 39 contains data information. Moreover, *Glorioso* also discloses the smart thermostat maintaining various temperature setpoints (data), which a POSITA would have understood would have been stored in memory. EX1009, 4:4-18.

282. This element is also well known to a POSITA as discussed in Ground 1. *Supra*, §VII.C(2)(f).

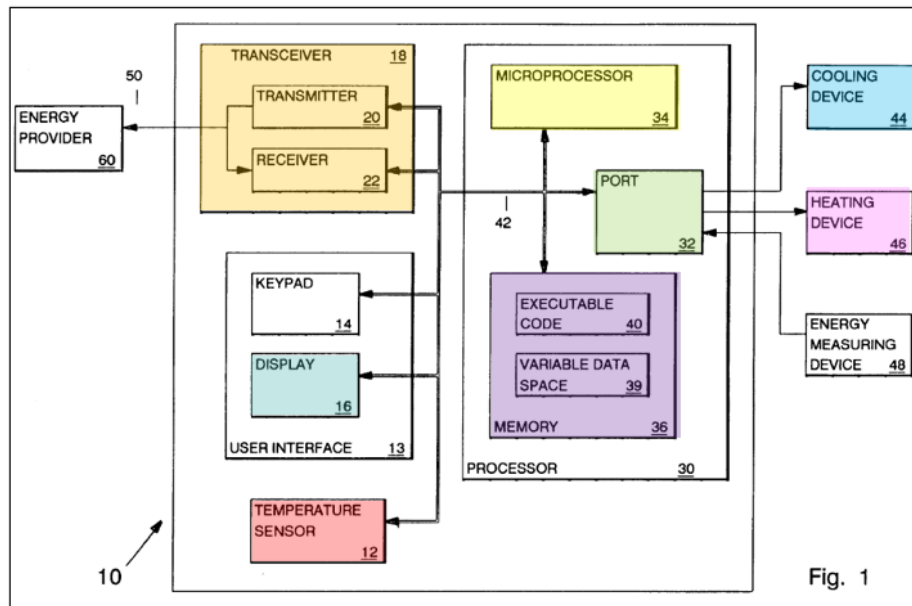
g. 18[c][4]: 4) an input/output unit including:

283. The *Glorioso-Shah* combination discloses 18[c][4] as detailed below. *Infra*, §VII.E(2)(g)(a)-(d). *Glorioso*'s input/output unit is a combination of transceiver (including transmitter 20 and receiver 22), and port 32. EX1009, 2:54-3:8, Fig. 1. I discuss the components of the input/output unit below.

(a) 18[c][4][a]: a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;

284. The *Glorioso-Shah* combination discloses element 18[c][4][a].

285. *Glorioso*'s processor includes an input/output unit. *Glorioso*'s input/output unit is a combination of transceiver 18 (including transmitter 20 and receiver 22) (peach), and port 32 (green). EX1009, 2:54-3:8, Fig. 1 (annotated).



Glorioso discloses that “[t]he receiver 22 receives an input signal and the transmitter 20 transmits an output signal.” *Id.*, 3:8-11. A POSITA would have understood that the combination of the transceiver and port are an input/output unit. The three components of the input/output unit recited by Claim 18 are discussed in this section and the following two sections.

286. *Glorioso*'s input/output unit includes a sensor input coupled to the temperature sensor for receiving said electrical signal therefrom. As detailed above in element 18[a], *Glorioso* discloses a temperature sensor for providing an electrical

signal as temperature sensor 12. *See supra*, §VII.E(2)(b). As illustrated in Figure 1 above, the temperature sensor is coupled to port 32 of the input/output unit. EX1009, Fig. 1. While *Glorioso* is not clear as to where electrical signals from the temperature sensor are received, a POSITA would understand that it is obvious that the port 32 could receive such signals. The schematic indicates that Port 32 can provide output and receive input based upon the arrows going in and out of the port. Thus, it would be obvious for the port 32, which is shown as connected to the temperature sensor, to receive an electrical signal therefrom. In order for the thermostat to function properly, the temperature sensor would need to be connected to some sensor input so that the processor receives the proper temperature to function. To the extent that sensor input is not in the Port 32, any alternate circuitry receiving the signal would be part of the input/output unit.

287. This element is also well known to a POSITA as discussed in Ground 1. *Supra*, §VII.C(2)(g).

(b) 18[c][4][b]: b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and

288. The *Glorioso-Shah* combination discloses element 18[c][4][b].

289. *Glorioso*'s input/output unit includes a control output (port 32) coupled to space conditioning equipment (cooling device 44 and/or heating device 46). *Glorioso* discloses "port 32 is connected to a cooling device 44 such as an air

conditioner, a refrigerator, or a freezer and/or a heating device 46 such as a furnace, boiler, or an oven.” EX1009, 2:54-3:8.

290. *Glorioso*’s port 32 issues control signals to the space conditioning equipment. *Glorioso* discloses “[t]he processor 30 issues a control signal through the port 32 for operating the cooling device 44 and/or heating device 46 when the temperature is different than the temperature setpoint associated with the acceptable energy cost level.” EX1009, 4:4-18. This control signal includes control information to the space conditioning equipment. *Id.*, 6:19-27 (“the control signal includes control information to operate the cooling device 44 when the temperature is greater than the selected temperature setpoint”). As *Glorioso* further discloses “the control signal would issue control information for operating the heating device 46 when the temperature fell to 60F or below. For the cooling device 44, the control signal would issue control information for operating the cooling device 4 when the temperature rose to or above 82F.” *Id.*, 4:1-36.

291. This element is also common knowledge of a POSITA as discussed in Ground 1. *Supra*, §VII.C(2)(g).

(c) **18[c][4][c]: c) a communications interface adapted to establish bi-directional communications between said processor and a first remote correspondent which is a source of current information; and**

292. The *Glorioso-Shah* combination discloses element 18[c][4][c].

293. *Glorioso's* input/output unit includes a communications interface. *Glorioso* discloses transmitter 20/receiver 22 of transceiver 18 communicating through communication network 50. EX1009, 3:8-11, 4:1-4, 6:4-6, 6:48-51, 6:63-65; *see also id.*, 3:40-67. A POSITA accordingly would have understood that the transceiver comprising the receiver 22 and transmitter 20 is a communications interface. The transceiver is connected to a communications network for bidirectional communication. *Id.*, 3:9-12 (“The receiver 22 receives an input signal and the transmitter 20 transmits an output signal through a communication network 50 for two-way communication with at least one energy provider 60.”).

294. *Glorioso's* communications interface is adapted to establish bi-directional communications between said processor and a first remote correspondent. *Glorioso* discloses a first remote correspondent as energy provider 60 including computer system 62 and receiver 64 and transmitter 66 in bi-directional communication with the processor of the thermostat. EX1009, 4:37-51 (“The energy provider 60 includes a computer system 62 . . . and a receiver 64 and a transmitter 66 coupled through the communication network 50 for *two-way communication* with the smart thermostat 10.”) (emphasis added); Fig. 2. *Glorioso* discloses that the transceiver (comprising transmitter 18 and receiver 22) of *Glorioso's* input/output unit is in communication with energy provider 60 (and accordingly, as a POSITA would have understood, computer system 62 and transmitter 66). *See, e.g.*, EX1009,

3:8-12 (“The receiver 22 receives an input signal and the transmitter 20 transmits an output signal through a communication network 50 for two-way communication with at least one energy provider 60.”), 4:1-4 (“In operation, the receiver 22 receives the input signal including a current price level for energy issued by the energy provider 60.”).

295. *Glorioso*’s first remote correspondent is a source of current information. For example, *Glorioso* discloses that computer system 62 is a source of information regarding “outages, announcements, promotions, or the like.” EX1009, 5:16-22 (“[T]he computer system 62 receives information for outages, announcements, promotions, or the like and passes the information to the transmitter 55 for transmission to the smart thermostat 10”). *Glorioso* also discloses that computer system 62 is a source of information for “the current price level for energy” and billing *Id.*, 4:2-3, 6:4-30; *see also id.*, 4:52-5:15.

(d) Obvious to implement in one chip.

296. It is not clear if Claim 18 requires the components of the input/output unit to be in a single chip. Whether *Glorioso*’s unit is one chip or multiple chips is irrelevant for the same reasons that I discuss above with Ground 1. Implementing *Glorioso*’s input/output unit with a sensor input, a control output, and a communications interface on a single chip would have been obvious to a POSITA at the time of the alleged invention. For example, it would have been well known to

have a single chip control multiple functions that could be handled by different chips. EX1043, 91-92. Providing this functionality in a single chip would have been nothing more than a simple design choice. A POSITA would have had a reasonable expectation of success in such an implementation. Such an implementation would have been one of a finite number of implementations for this functionality. Additionally, as the '555 Patent admits, the claimed input/output unit, which is part of a processor, is a conventional, off-the-shelf component implemented in a conventional way. It accordingly would have been obvious for a POSITA to include a single input/output unit with each of these three components. Inventor Rosen admits this as well. EX1012, 101:6-16, 323:14-324:24.

h. 18[d]: D) means coupling said communications interface and said first remote correspondent; and

297. The *Glorioso-Shah* combination discloses element 18[d].

298. *Glorioso* discloses a means coupling said communications interface and said first remote correspondent. As discussed above, the “means coupling” recited in this claim element is governed by 35 U.S.C. § 112, ¶6. *Supra*, §V.F. Under Patent Owner’s interpretation, the function is “coupling the communications interface and the remote correspondent,” and the structure is “a serial link and/or data link and any equivalents.”

(a) Function

299. *Glorioso* discloses the claimed function of “coupling the communications interface with the remote correspondent.” As described above in element 18[e], *Glorioso* discloses that the transceiver of its smart thermostat is coupled to computer system 62 of energy provider 60, for example, to communicate current information. *Supra*, §VII.E(2)(i). The computer system 62 of energy provider 60 is a remote correspondent. Due to the coupling between the communications interface (the transceiver) and the remote correspondent, (the computer system of energy provider 60), current information is sent from the energy provider to the thermostat. *See, e.g.*, EX1009, 3:8-10 (“The receiver 22 receives an input signal and the transmitter 20 transmits an output signal through a communication network 50 for two-way communication with at least one energy provider 60.”), 4:1-4 (“In operation, the receiver 22 receives the input signal including a current price level for energy issued by the energy provider 60.”).

(b) Structure

300. *Glorioso* discloses the structure of “a serial link and/or data link and any equivalents.” *Glorioso* discloses that communications network 50 includes the following:

Preferably the communication network 50 includes local base stations for concentrating user status information targeted for the energy provider 60 (FIG. 2) received in the output signal with other information received from other remote devices and passing the

concentrated information through a wide area network (WAN) to the targeted energy provider 60 (FIG. 2); and for receiving concentrated information from the energy provider 60 (FIG. 2) through the WAN, sorting the concentrated information, and transmitting the input signal to the targeted smart thermostat 10. The input signals, output signal, and the signals issued by the base stations and the energy provider 60 (FIG. 2) include digital switching bits for targeting the signals to the intended receiver. Such targeting and switching bits are conventional and well known in the art. The WAN may be wired or wireless and is commercially available from several sources including landline telephone companies Such as Pacific Telesis Company, known as Pacific Bell of San Francisco, Calif., hybrid fiber optic and coax cable television companies, cellular telephone providers, cellular telephone providers having CDPD protocol for piggy backing digital data on an analog cellular telephone, providers of specialized wireless services such as Metricom of Los Gatos, Calif.

EX1009, 3:17-39. *Glorioso* also discloses that “the transceiver 18 communicates in signal bursts within a carrier frequency range of 902 to 928 MHz. The communications are originated by the smart thermostat 10 to the base station.” *Id.*, 3:40-44. A POSITA would have understood that a wired or wireless connection to a WAN to transmit bits, including the commercially available sources listed above, to communicate with a remote device (the energy company computer) over the WAN comprises a data link. See EX1030, ¶¶[0012], [0017], [0023], [0041], [0044]-

[0048], Fig. 4; *see also* EX1001, 6:1-11 ('555 Patent teaching that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner”); *supra*, §VII.C(2)(h). For example to couple to a remote correspondent via a WAN it is obvious to connect the communications interface to a modem (wired or wireless) for communication to an Internet service provider which connects to the Internet and allows connection to any server connected to the Internet. Such a data link thereby allows a coupling of the communication interface to the remote correspondent via the data link.

301. A POSITA would understand that to connect to the Internet, there necessarily must be some connection between the communications interface and the Internet. The '555 Patent teaches that a modem is used to connect to an Internet service provider that completes the connection in the “usual manner,” thus admitting this element is obvious as common knowledge. EX1001, 6:1-11, EX1026, Abstract, 2:31-44, 2:38-41, 4:38-52, 6:57-7:5. It is common knowledge that a modem can be used to connect to an Internet service provider that then completes a connection to the Internet and, thus, the “first remote correspondent.” *See, e.g.*, EX1001, 6:1-11; EX1005, 5:28-31; EX1019, 1:19-30, 5:26-30; EX1023, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *supra*, §VI. The combination of structures between the communications interface and the web server, which includes the Internet, forms a data link between them. At the very least, it would have been

obvious to have *Glorioso*'s communications interface (the transceiver) to connect to a modem, and obvious for the modem to connect to a wide area network such as the Internet and/or to an ISP thereby facilitating a connection to the remote correspondent (the energy company computer) via the Internet using protocols like TCP and HTTP. *See, e.g.*, EX1005, 5:38-31; EX1019, 1:19-30, 4:36-40, 5:26-30, 13:10-19; EX1020, 5:60-63, 11:7-57; EX1012, 2, 27; EX1026, 2:26-44, 5:15-27, 5:34-38; EX1037, 50-51; *see generally* EX1014, EX1015.

302. To the extent Patent Owner contends that any of the structures disclosed by the references discussed above do not disclose an identical structure to the “data link” that Patent Owner contends is corresponding structure, they at least disclose structures that are an “insubstantial difference.” All of the structures discussed in the references in the ground, as well as in the references cited for the obviousness of this element, are known structures to achieve data communications between a first device and a second device over a computer network such as the Internet. The patent indicates that such connections are “well known.” EX1001, 6:1-11. The patent does not describe any new “means coupling” structure or use a data link for something other than its ordinary purpose. Because there is nothing special about the “data link” disclosed in the ’555 Patent and it must simply accomplish the communication of data between the communications interface and remote correspondent, all of the above structures are an insubstantial difference for that purpose because they are all

known to be interchangeable for that purpose. They are simply design options to communicate over wide area networks such as the Internet that a POSITA can choose to use.

- i. **18[e]: a program stored in said memory for displaying messages received from said first remote correspondent, which received messages do not pertain to the operation of said thermostat system, on said liquid crystal display.**

303. The *Glorioso-Shah* combination discloses element 18[e].

304. *Glorioso's* messages received from the first remote correspondent do not pertain to the operation of said thermostat system. As detailed above in element 18[c], *Glorioso's* thermostat receives information or messages regarding “outages, announcements, promotions, or the like” from the remote correspondent (computer system 62). *Supra*, §VII.E(2). The messages may also include “the current price level for energy” and billing information. EX1009, 2:7-11, 4:1-4, 4:28-29, 4:52-5:3, 5:9-12, 6:4-6, 6:51-53. A POSITA would have understood that each of these types of information do not pertain to the operation of the thermostat. As discussed above, the “does not pertain” limitation was added during prosecution to distinguish Proffitt, which caused a message to be displayed indicating that the thermostat was in an overridable power conservation mode. *Supra*, §V.B. The above categories of “announcements,” “promotions” “current price level” and billing information would not involve a message concerning the current mode in which the thermostat would

operating or the thermostat's operational status. Thus, these types of information would seem to meet the claim limitation, whatever its definition. If they do not, then it would have been common knowledge of a POSITA that such information could be displayed once the thermostat is connected to the Internet as discussed above. *Supra*, §VII.C(2)(i).

305. *Glorioso* discloses a program stored in said memory for the displaying messages received from said first remote correspondent. Those messages would be displayed on *Shah*'s LCD, as would have been obvious to use for the display for the reasons that I discuss above. *Supra*, §VII.E(1). *Glorioso* discloses a user interface that "displays the request information, announcements, and/or promotions to the user." EX1009, 5:54-6:3; *see also id.*, 2:7-9 (displays bills). And as detailed above in element 18[c][3], *Glorioso*'s thermostat includes "a memory 36 including variable data space 39 and an executable code 50 having instructions for the microprocessor 34 for directing actions of processor 30." *Id.*, 2:59-63. A POSITA would have understood based on *Glorioso*'s disclosure that displaying such messages on a user interface would have involved a program stored in *Glorioso*'s memory for displaying the messages or information. At the very least, it would have been obvious for software to cause display of the messages because the most common way to control information content on a display is by the use of software.

306. *Glorioso* as modified by *Shah* discloses that the messages are displayed on said liquid crystal display. As detailed above in element 18[b], *Shah* discloses a liquid crystal display on which messages are displayed. *Supra*, §VII.E(2)(c). It would have been obvious to modify *Glorioso*'s user interface to include a liquid crystal display of *Shah* to display the messages received from the first remote correspondent.

3. **Claim 20: The thermostat system of claim 18 in which communications between said first remote correspondent and said communications interface is carried out via the Internet.**

307. The *Glorioso-Shah* combination discloses Claim 20. As detailed above in elements 18[c][4][c] and [d], *Glorioso* discloses its smart thermostat communicating over a communication network such as a WAN using commercially available phone line or fiber optic components to communicate with and couple to the first remote correspondent. *Supra*, §VII.E(2)(g)-(h). *Glorioso* specifically discloses that such a WAN “may be wired or wireless” and may include “CDPD protocol for piggy backing digital data on an analog cellular telephone.” EX1009, 3:31-39. A POSITA would have understood that such a CDPD protocol would have supported TCP/IP transmission and thus included communicating over the Internet. *See, e.g.*, EX1019, 4:35-40, 5:26-30.

308. It additionally would have been obvious to modify *Glorioso* in view of *Shah* to carry out the claimed communications over the Internet. First, the Internet is a type of WAN. Second, *Shah* discloses a “comfort controller” or thermostat with a “network interface for connecting to the Internet or other network”, such as “network interface 950.” EX1010, 3:44-65, Abstract. It would have been obvious to modify *Glorioso*’s transmitter²⁰/receiver 22 connected to a WAN including a phone line to incorporate *Shah*’s network interface 950 connected to the Internet (including with a modem connected to a phone line) to communicate over the Internet. EX1010, 3:44-65.

309. Moreover, communications being carried out over the Internet between a remote correspondent and a first communications interface in a thermostat is a matter of common knowledge of a POSITA. As explained above, connecting a thermostat to the Internet was a matter of common knowledge. *Supra*, §VI.A.

VIII. SECONDARY CONSIDERATIONS

310. During prosecution of the ’555 Patent, the applicant did not identify any evidence of secondary considerations of non-obviousness tied to the claimed invention of the ’555 Patent. I understand from counsel for Petitioner that Patent Owner in the co-pending district court litigation has not yet identified any evidence with respect to secondary considerations of non-obviousness. And although I

understand from counsel for Petitioner that Patent Owner has the burden to demonstrate secondary considerations of nonobviousness, I nonetheless have considered whether there are any secondary considerations of non-obvious, and I have identified none.

311. Accordingly, currently there appears to be no objective evidence of non-obviousness that might warrant a finding that Claims 118 and 20 are patentable. To the extent the Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to address it.

IX. CONCLUSION

312. For at least the above-described reasons, in my opinion Claims 18 and 20 of the '555 Patent would have been obvious to a POSITA based on the prior art references that I have cited and analyzed above. The '555 Patent implements techniques that were both readily known in both the personal computer field and the thermostat field. There is nothing novel about the arrangement of elements in Claims 18 and 20.

313. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within

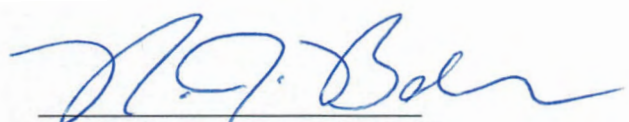
the United States. If cross-examination is required of me, subject to reasonable notice to allow me to manage my professional schedule in a way that honors commitments to federal courts, the ITC, and the Board, I will appear for cross-examination within the United States during the time allotted for cross-examination.

314. I reserve the right to supplement my opinions in the future to respond to any arguments raised by Patent Owner and to consider any new information that becomes available to me.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 28th day of March 2023, in LAS VEGAS, NV

Respectfully submitted,


R. Jacob Baker, Ph.D., P.E.

APPENDIX A

R. JACOB (JAKE) BAKER, PH.D., P.E.

Professor Pristinus of Electrical and Computer Engineering
Independent Consultant

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Las Vegas, NV 89120

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PROFESSIONAL SUMMARY

Russel Jacob (Jake) Baker, Ph.D., P.E. (IEEE Student Member 1983, Member 1988, Senior Member 1997, and Fellow 2013) was born in Ogden, Utah, on October 5, 1964. He received the B.S. and M.S. degrees in electrical engineering from the University of Nevada, Las Vegas, in 1986 and 1988. He received the Ph.D. degree in electrical engineering from the University of Nevada, Reno in 1993. His Google Scholar profile is [here](#) and his ResearchGate profile is [here](#).

From 1981 to 1987 he served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division). From 1985 to 1993 he worked for E. G. & G. Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapons tests at the Nevada Test Site. During this time, he designed, and oversaw the fabrication and manufacture of, over 30 electronic and electro-optic instruments including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame- and bit-syncs, data converters, streak-camera sweep circuits, Pockels cell drivers, micro-channel plate gating circuits, and analog oscilloscope electronics. From 1991-1992 he was an adjunct faculty member in the department of electrical engineering at the University of Nevada, Las Vegas (UNLV). From 1993 to 2000 he served on the faculty in the department of electrical engineering at the University of Idaho (UI), first as an untenured Assistant Professor and then from 1998 as a tenured Associate Professor. In 2000 he joined a new electrical and computer engineering (ECE) program at Boise State University (BSU) where he was promoted to Full Professor in 2002. He then served as the ECE department chair at BSU from 2004 to 2007. At BSU he helped establish graduate programs in ECE including, in 2006, the university's second PhD degree. In 2012 he re-joined the faculty at UNLV as a tenured Full Professor of ECE. During his service at the UI, BSU, and UNLV he has been the major professor to more than [100 graduate students](#). In addition to this industry and academic experience, he has done consulting, both technical and expert witness, for over [200 companies](#).

Over the last 35+ years his [research/development interests](#) and [publications](#) have been, or currently are, focused on: analog-to-digital/digital-to-analog data conversion and transmission, optoelectronics (imagers, displays, LIDARs, APDs, SiPMs, and associated electronics), analog and digital integrated circuit design and fabrication, design of diagnostic electrical and electro-optic instrumentation for scientific research, integrated electrical/biological circuits and systems, array (memory, imagers, and displays) fabrication and design, CAD tool development and online tutorials, low-power interconnect and packaging (electrical and optical) techniques, design of wired/wireless communication and interface circuits, circuit design for the use and storage of renewable energy, power electronics and power supply design, and the delivery of [online engineering education](#).

Dr. Baker is the named inventor on over [150 US patents](#). He is a member of the honor societies Eta Kappa Nu and Tau Beta Pi, a licensed Professional Engineer, a popular lecturer that has delivered over [50 invited talks](#) around the world, an IEEE Fellow, and the author of the books CMOS Circuit Design, Layout, and Simulation, CMOS Mixed-Signal Circuit Design, and a coauthor of DRAM Circuit Design: Fundamental and High-Speed Topics. He received the 2000 Best Paper Award from the IEEE Power Electronics Society, the 2007 Frederick Emmons Terman Award,

the 2011 IEEE Circuits and Systems Education Award and the 2021 Wiley-IEEE Press Textbook Award for the 4th Edition of his book CMOS Circuit Design, Layout, and Simulation.

His service activities include the IEEE Press Editorial Board (1999-2004), editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015), the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), Distinguished Lecturer for the SSCS (2012-2015), Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the IEEE Solid-State Circuits Magazine, IEEE Kirchhoff Award Committee (2020-2023), and advisor for the student branch of the IEEE at UNLV (2013-2023).

INDUSTRY EXPERIENCE

2008 - present: Expert witness in intellectual property disputes in electrical, electro-optic, and computer engineering matters for: 1) district court and ITC patent disputes, 2) inter partes reviews at the PTAB, and 3) arbitrations and mediations.

2013 - 2022: Worked with Freedom Photonics, Santa Barbara, CA, on the integration, fabrication and design, of optoelectronics with CMOS integrated circuits. Work includes the design of compact optical transceivers for range finding applications, high-efficiency integrated silicon avalanche photodetectors for quantum key receivers, Geiger mode SiGe receivers for long-range communications, cryptography, and the fabrication of near-infrared focal plane arrays. Packaging and testing of numerous chips fabricated in both CMOS and SiGe technologies using LEDs, ILDs, PIN, APDs, and ROICs.

2017 - 2019: Worked with Vorpil Research Systems, Las Vegas, NV on the design of integrated circuit electronics and optoelectronics for optical transceivers used in LIDARs/LADARs.

2016 - 2019: Worked with Attollo Engineering on the design of transient digitizers for the capture of high-speed signals for range finders using LEDs and lasers in compact optical transceivers.

2013 - 2018: Working with Mission Support and Test Services, LLC (MSTS, formerly National Security Technologies, LLC, [NSTec]) on the Design and Fabrication of Integrated electrical/photonics application specific integrated circuit (ASIC) design for use in the implementation of diagnostic instrumentation.

2013 - 2015: Consultant for OmniVision. Working on integrating CMOS image sensors (CIS) with memory for very high-speed consumer imager products. Design specialty DRAM, high-speed interfaces between CIS and DRAM, packaging techniques to pair the CIS with DRAM.

2010 - 2013: Worked with Arete' Associates on the design of high-speed compressive transimpedance amplifiers for LADAR projects and the design of ROIC unit cells. Work funded by the U. S. Air Force.

2013: Cirque, Inc. Consulting on the design of analog-to-digital interfaces for capacitive touch displays and pads.

2012: Consultant at Lockheed-Martin Santa Barbara Focal Plane Array. CMOS circuit design and fabrication for the development and manufacture of infrared components and imaging systems with an emphasis on highest sensitivity Indium Antimonide (InSb) focal plane arrays (FPAs) in linear through large staring formats. Product groups include FPAs, integrated dewar assemblies (IDCAs), camera heads, high-speed interfaces between image processors and imaging systems, and infrared imaging systems.

2010 - 2012: Working with Aerius Photonics (and then FLIR Inc. when Aerius was purchase by FLIR) on the design of Focal Plane Arrays funded (SBIRs and STTRs) by the U.S. Air Force, Navy, and Army. Experience with readout integrated circuits (ROICs) and the design/layout of photodetectors in standard CMOS.

2009 - 2010: Sun Microsystems, Inc. (and then Oracle) VLSI research group. Provided consulting on memory circuit design/fabrication and proximity connection (PxC) interfaces to DRAMs and SRAMs for lower power, 3D packaging, for memory modules and controllers implemented with FPGAs and custom ASICs.

2009 - 2010: Contour Semiconductor, Inc. Design of NMOS voltage and current references as well as the design of a charge pump for an NMOS memory chip.

1994 - 2008: Affiliate faculty (Senior Designer), Micron Technology. Designed CMOS circuits for DRAMs including DLLs, PLLs for embedded graphics chips, voltage references and regulators, data converters, field-emitting display drivers, sensing for MRAM (using delta-sigma data conversion topologies), SRAMs, RFIDs, CMOS active pixel imagers and sensors, power supply design (linear and switching), input buffers, etc. Worked on a joint research

project between Micron and HP labs in magnetic memory fabrication and design using the MTJ memory cell. Worked on numerous technologies ranging from LED lighting to medical imaging using CMOS image sensors (too many to list) resulting in numerous US patents (see following list). Considerable experience working with product engineering to ensure high-yield from the production line from fabrication to test. Co-authored a book on DRAM circuit design through the support of Micron. Gained knowledge in the entire memory design process from fabrication to packaging. Developed, designed, and tested circuit design techniques for multi-level cell (MLC) Flash memory using signal processing.

January 2008: Consultant for Nascentric located in Austin, TX. Provide directions on circuit operation (DRAM, memory, and mixed-signal) for fast SPICE circuit simulations.

May 1997 - May 1999: Consultant for Tower Semiconductor, Haifa, Israel. Designed CMOS integrated circuit cells for various modem chips, interfaces, and serial buses including USB circuits, charging circuits based upon power up/down circuits using an MOS or bandgap reference, pre-amplifiers, comparators, etc.

Summer 1998: Consultant for Amkor Wafer Fabrication Services, Micron Technology, and Rendition, Inc., Design PLLs and DLLs for custom ASICs and a graphics controller chip.

Summers 1994 - 1995: Micron Display Inc. Designing phase locked loop for generating a pixel clock for field emitting displays and a NTSC to RGB circuit on chip in NMOS. These displays are miniature color displays for camcorder and wrist watch size color television. Worked on the fabrication and design of video peripheral circuits for these displays.

September - October 1993: Lawrence Berkeley Laboratory. Designed and constructed a 40 A, 2 kV power MOSFET pulse generator with a 3 ns rise-time and 8 ns fall-time for driving Helmholtz coils.

Summer 1993: Lawrence Livermore National Laboratory, Nova Laser Program. Researched picosecond instrumentation, including time-domain design for impulse radar and imaging.

December 1985 - June 1993: (from July 1992 to June 1993 employed as a consultant while finishing up my Ph.D.), E.G.&G. Energy Measurements Inc., Nevada, Senior Electronics Design Engineer. Responsible for the design and manufacturing of instrumentation used in support of Lawrence Livermore National Laboratory's Nuclear Test Program. Responsible for designing and fabricating over 30 electronic and electro-optic instruments including: CCD camera design, communication networks, fiber optic transmitters employing high speed laser drive electronics, receivers employing envelop tracking for DC voltage restoration and regeneration of received information, receiver low noise amplifier design, frame synchronizers for re-assembling transmitted images, high-speed SRAM memory system design with battery back-up, calibration equipment design such as a tunnel diode pulse generator for testing compensation of oscilloscopes and DAC design for calibrating CCD readout electronics, power supply and battery charger designs, sweep circuits for streak cameras, Pockel's cell drive electronics, vertical amplifier design using HBTs for analog oscilloscopes used at the Nevada Test Site, and 10 kV ramp designs using a planar triode to name some of the designs.

This position provided considerable fundamental grounding in EE with a broad exposure ranging from the design of PC boards to, for example, the design of cable equalizers. Summarizing, gained experience in circuit design technologies including: bipolar, vacuum tubes (planar triodes for high voltages), hybrid integrated circuit fabrication and design, GaAs (high speed logic and HBTs), Mach-Zehnder interferometers, Pockels cells, krytrons, power MOSFETs, microwave techniques, power supplies, fiber optic transmitters/receivers, etc.

Summer 1985: Reynolds Electrical Engineering Company, Las Vegas, Nevada. Gained hands on experience in primary and secondary power system design, installation and trouble-shooting electric motors on mining equipment.

ACADEMIC EXPERIENCE

January 1991 – present: Professor of Electrical and Computer Engineering at the **University of Nevada, Las Vegas** from August 2012 to present. From January 2000 to July 2012 held various positions at **Boise State University** including: Professor (2003 – 2012), Department Chair (2004 - 2007), and tenured Associate Professor (2000 - 2003). From August 1993 to January 2000 was a tenured/tenure track faculty member at the **University of Idaho:** Assistant Professor (1993 - 1998) and then tenured Associate Professor (1998 - 2000). Lastly, from January 1991 to May 1993 held adjunct faculty positions in the departments of Electrical Engineering at the University of Nevada, Las Vegas and Reno. Additional details:

- Research is focused on analog and mixed-signal integrated circuit fabrication and design. Worked with multi-disciplinary teams (civil engineering, biology, materials science, etc.) on projects that have been funded by EPA, DARPA, NASA, Army, DMEA, Navy, and the AFRL.
- Current and past research and development interests are:
 - Design and packaging of electrical/optical systems (e.g., LiDARs/LADARs) using LEDs, semiconductor lasers, lens for focusing and directing light, integrated circuits, and associated control and communication systems/circuits.
 - Capacitive sensing techniques using delta-sigma modulation and interfacing to sensors
 - Design of high-voltage and energy switching circuits
 - Circuit design and fabrication for the control, use, and storage of renewable energy using thermoelectric generators
 - Design of electrical/biological/optical circuits and systems using electrowetting on dielectric for automating and controlling biological experiments
 - Design of readout integrated circuits (ROICs) for use with focal plane arrays (FPAs)
 - Heterogeneous integration of III-V photonic devices (e.g., FPAs and VCSELs) with CMOS
 - Methods (e.g., 3D packaging and capacitive interconnects) to reduce power consumption in semiconductor memories, memory modules, and digital systems using custom and non-custom (e.g., FPGAs) implementations
 - Analog and mixed-signal circuit fabrication and design for communication systems, synchronization, energy storage, data conversion, and interfaces
 - The design of writing and sensing circuitry for emerging nonvolatile memory technologies, focal planes, and displays (arrays) in nascent nanotechnologies (e.g., magnetic, chalcogenide)
 - Reconfigurable electronics design and fabrication using nascent memory technologies such as the memristor to implement FPGAs
 - Finding an electronic, that is, no mechanical component, replacement for the hard disk drive using nascent fabrication technologies
 - Power electronics circuit design for consumers and consumer electronics including power management and adaptive control to reduce power consumption
 - Design of bandpass delta-sigma modulators for IQ demodulation in wireless communication systems in OFDM, WiFi, 802.11, Bluetooth, 3G, 4G, etc.
 - University prototyping, fabricating, and packaging of integrated circuits
- Led, as chair, the department in graduate curriculum (MS and PhD), program development, and ABET accreditation visits.
- Worked with established and start-up companies to provide technical expertise and identify employment opportunities for students.
- Held various leadership and service positions including: ECE chair, graduate coordinator, college curriculum committee (chair), promotion and tenure committee, scholarly activities committee, faculty search committee, university level search committees, etc. Collaborate with College of Engineering faculty on joint research projects.
- Taught courses in circuits, analog IC design, digital VLSI design and fabrication, fiber optics, and mixed-signal integrated circuit design to both on- and, via the Internet, off-campus students. Research emphasis in integrated circuit design using nascent technologies.

EDUCATION

- Ph.D. in Electrical Engineering; December 1993; University of Nevada, Reno, GPA 4.0/4.0. Dissertation Title: *Applying power MOSFETs to the design of electronic and electro-optic instrumentation.*
- M.S. and B.S. in Electrical Engineering; May 1986 and May 1988; University of Nevada, Las Vegas. Thesis Title: *Three-dimensional simulation of a MOSFET including the effects of gate oxide charge.*

MEMBERSHIPS IN PROFESSIONAL AND SCHOLARLY ORGANIZATIONS

IEEE (student, 1983; member, 1988; senior member, 1997; Fellow, 2013)
Member of the honor societies Eta Kappa Nu and Tau Beta Pi
Licensed Professional Engineer

HONORS AND AWARDS

- Consolidated Students of the University of Nevada, Las Vegas (CSUN) Faculty Award, 2017
- Tau Beta Pi UNLV Outstanding Professor of the Year in 2013, 2014, 2015 and 2016
- UNLV ECE Department Distinguished Professor of the Year in 2015
- IEEE Fellow for contributions to the design of memory circuits - 2013
- Distinguished Lecturer for the IEEE Solid-State Circuits Society, 2012 - 2015
- IEEE Circuits and Systems (CAS) Education Award - 2011
- Twice elected to the Administrative Committee of the Solid-State Circuits Society, 2011 - 2016
- Frederick Emmons Terman Award from the American Society of Engineering Education - 2007
- President's Research and Scholarship Award, Boise State University - 2005
- Honored Faculty Member - Boise State University Top Ten Scholar/Alumni Association 2003
- Outstanding Department of Electrical Engineering faculty, Boise State 2001
- Recipient of the IEEE Power Electronics Society's Best Paper Award in 2000
- University of Idaho, Department of Electrical Engineering outstanding researcher award, 1998-99
- University of Idaho, College of Engineering Outstanding Young Faculty award, 1996-97

SERVICE

Reviewer for IEEE transactions on solid-state circuits, circuits and devices magazine, education, instrumentation, nanotechnology, VLSI, etc. Reviewer for several American Institute of Physics journals as well (Review of Scientific Instruments, Applied Physics letters, etc.) Board member of the IEEE press (reviewed dozens of books and book proposals). Reviewer for the National Institutes of Health. Technology editor and then Editor-in-Chief for the Solid-State Circuits Magazine.

Led the Department on ABET visits, curriculum and policy development, and new program development including the PhD in electrical and computer engineering. Provided significant University and College service in infrastructure development, Dean searches, VP searches, and growth of academic programs. Provided university/industry interactions including starting the ECE department's advisory board. Held positions as the ECE department Master's graduate coordinator and coordinator for the Sophomore Outcomes Assessment Test (SOAT).

Also currently serves, or has served, on the IEEE Press Editorial Board (1999-2004), as a member of the first Academic Committee of the State Key Laboratory of Analog and Mixed-Signal VLSI at the University of Macau, as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), as an Advisory Professor to the School of Electronic and Information Engineering at Beijing Jiaotong University, as a Distinguished Lecturer for the SSCS (2012-2015), as the Technical Program Chair for the IEEE 58th 2015 International Midwest Symposium on Circuits and Systems, MWSCAS 2015, as advisor for the student branch of the IEEE at UNLV (2013-2023), and as the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the *IEEE Solid-State Circuits Magazine*, and IEEE Kirchhoff Award Committee (2020-2023).

ARMED FORCES

From 1981 to 1987 served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division), Honorable Discharge. Military Occupational Specialty (MOS) was Machine Gunner (MOS 0331)

TEXTBOOKS AUTHORED

Baker, R. J., "CMOS Circuit Design, Layout and Simulation, Fourth Edition" *Wiley-IEEE Press*, 1234 pages. ISBN 9781119481515 (2019) **Over 50,000 copies of this book in print.** (Third Edition published in 2010, Revised Second Edition published in 2008, and Second Edition Published in 2005)

Baker, R. J., "CMOS Mixed-Signal Circuit Design," *Wiley-IEEE*, 329 pages. ISBN 978-0470290262 (second edition, 2009) and ISBN 9780471227540 (First Edition published in 2002)

Keeth, B., Baker, R. J., Johnson, B., and Lin, F., "DRAM Circuit Design: Fundamental and High-Speed Topics", *Wiley-IEEE*, 2008, 201 pages. ISBN: 9780470184752

Keeth, B. and Baker, R. J., "DRAM Circuit Design: A Tutorial", *Wiley-IEEE*, 2001, 201 pages. ISBN 0780360141

Baker, R. J., Li, H.W., and Boyce, D.E. "CMOS Circuit Design, Layout and Simulation," *Wiley-IEEE*, 1998, 904 pages. ISBN 9780780334168

BOOKS, OTHER (edited, chapters, etc.)

Saxena, V. and Baker, R. J., "Analog and Digital VLSI," chapter in the CRC Handbook on Industrial Electronics, edited by J. D. Irwin and B. D. Wilamowski, *CRC Press*, 2009 second edition.

Baker, R. J., "CMOS Analog Circuit Design," (A self-study course with study guide, videos, and tests.) IEEE Education Activity Department, 2000. ISBN 0-7803-4822-2 (with textbook) and ISBN 0-7803-4823-0 (without textbook)

Baker, R. J., "CMOS Digital Circuit Design," (A self-study course with study guide, videos, and tests.) *IEEE Education Activity Department*, 2000. ISBN 0-7803-4812-5 (with textbook) and ISBN 0-7803-4813-3 (without textbook)

Li, H.W., Baker, R. J., and Thelen, D., "CMOS Amplifier Design," chapter 19 in the CRC VLSI Handbook, edited by Wai-kai Chen, *CRC Press*, 1999 (ISBN 0-8493-8593-8) and the second edition in 2007 (ISBN 978-0-8493-4199-1)

INVITED TALKS AND SEMINARS

Have given over 50 invited talks and seminars at the following locations: AMD (Fort Collins), AMI semiconductor, Arizona State University, Beijing Jiaotong University, Boise State University, Carleton University, Carnegie Mellon, Columbia University, Dublin City University (Ireland), E.G.&G. Energy Measurements, Foveon, the Franklin Institute, Georgia Tech, Gonzaga University, Hong Kong University of Science and Technology, ICSEng Keynote, ICySSS keynote, IEEE Computing and Communication Workshop (CCWC), IEEE Electron Devices Conference (NVMETS), IEEE Workshop on Microelectronics and Electron Devices (WMED), Indian Institute of Science (Bangalore, India), Instituto de Informatica (Brazil), Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM, Mexico), Iowa State University, Lawrence Livermore National Laboratory, Lehigh University, Lockheed-Martin, Micron Technology, Nascentric, National Semiconductor, Princeton University, Rendition, Saintgits College (Kerala, India), Southern Methodist University, Sun Microsystems, Stanford University, ST Microelectronics (Delhi, India), Temple University, Texas A&M University, Tower Semiconductor (Israel), University of Alabama (Tuscaloosa), University of Arkansas, University of Buenos Aires (Argentina), University of Houston, University of Idaho, University of Illinois (Urbana-Champaign), Université Laval (Québec City, Québec), University of Macau, University of Maryland, Université de Montréal (École Polytechnique de Montréal), Xilinx (Ireland), University of Nevada (Las Vegas), University of Nevada (Reno), University of Toronto, University of Utah, Utah State University, and Yonsei University (Seoul, South Korea).

RESEARCH FUNDING (LAST 5 YEARS AS A PROFESSOR)

Recent funding listed below. In-kind, equipment, and other non-contract/grant funding [e.g., MOSIS support, money for travel for invited talks, etc.] not listed.

- Baker, R. Jacob, (2017-2023) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit," NASA, \$29,999 (Phase I), \$225,238 (Phase II), and \$79,697 (Phase IIE)
- Goldman, J., Menezes, J., and Baker, R. J., (2021-2022) "Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling," UNLV Sports Research & Innovation Initiative. Proof of Concept Grant Program, \$50,000
- Baker, R. Jacob, (2019-2021) "Dual-Mode, Extended Near-Infrared, Focal Plane Arrays Fabricated with CMOS Compatible GeSiSn Alloy Materials," DARPA, \$149,998
- Baker, R. Jacob, (2018-2020) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$99,996
- Baker, R. Jacob, (2019) "Improved Quantum Efficiency Photo-Detector," Navy, \$29,999

- Baker, R. Jacob, (2018-2019) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit – Phase I," NASA, \$29,999
- Baker, R. Jacob, (2017-2019) "Quantum Cryptography Detector Chip," Defense MicroElectronics Activity (DMEA), \$266,029
- Baker, R. Jacob, (2017-2019) "Advanced Printed Circuit Board Design Methods for Compact Optical Transceiver," U.S. Army/DOD, \$299,605
- Baker, R. Jacob, (2016-2018) "High-Sensitivity Monolithic Silicon APD and ROIC," U.S. Air Force/DOD, \$299,665
- Baker, R. Jacob, (2017-2018) "Transimpedance Amplifier Integrated Circuit Collaboration," Department of Energy, National Security Technologies, LLC, \$100,436
- Baker, R. Jacob, (2017) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$30,000
- Baker, R. Jacob, (2016-2017) "Testing and development of BiCMOS photodetectors and diagnostic instrumentation," Department of Energy, National Security Technologies, LLC, \$181,605
- Baker, R. Jacob, (2016-2017) "Dual-Mode, Extended Near Infrared, Focal Plane Arrays fabricated with a Commercial SiGe BiCMOS Process," DARPA, \$41,892

DOCTORAL STUDENT SUPERVISION

11. Mario Valles Montenegro (underway)
10. Sachin Namboodiri – A Multi-channel MCP-PMT based Readout Integrated Circuit for LiDAR Applications (2020)
9. Wenlan Wu – High-Speed Radhard Mega-Pixel CIS Camera for High-Energy Physics (2019)
8. Kostas Moutafis – A Highly-Sensitive Global-Shutter CMOS Image Sensor with On-Chip Memory for Hundreds of kilo-frames per second Scientific Experiments (2019)
7. Yiyan Li – Portable High Throughput Digital Microfluidics and On-Chip Bacteria Cultures (2016)
6. Yacouba Moumouni – Designing, Building, and Testing a Solar Thermoelectric Generation, STEG, for Energy Delivery to Remote Residential Areas in Developing Regions (2015)
5. Qawi IbnZayd Harvard – Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design (2011)
4. Vishal Saxena – K-Delta-1-Sigma Modulators for Wideband Analog-to-Digital Conversion (2010)
3. Robert Russell Hay – Digitally-Tunable Surface Acoustic Wave Resonator (2009)
2. Xiangli Li (the first Boise State University College of Engineering PhD graduate) – MOSFET Modulated Dual Conversion Gain CMOS Image Sensors (2008)
1. Feng Lin, Research and Design of Low Jitter, Wide Locking-Range Phase-Locked and Delay-Locked Loops (2000)

MASTERS STUDENT SUPERVISION

93. Abraham Lopez (underway)
92. David Santiago (underway)
91. Khulan Tsogt (underway)
90. Jazmin Bolor (underway)
89. Chris Barr (underway)
88. Minsung Cho – Studies of Forward Projection Algorithms and Implementation on PC and FPGA (2023)
87. Armani Alvarez – A Control Integrated Circuit for a Hysteretic Flyback Power Converter (2022)
86. Francisco Mata-carlos – A Wearable Electronic Monitoring Device for Low Pressure Garment Applications and Temperature Analysis for Prevention of Ulceration and Infection (2022)
85. Daniel Senda – Designs and Outcomes of Transcranial Magnetic Stimulation (TMS) and Repetitive Transcranial Magnetic Stimulation (rTMS) Circuits (2021)
84. James Skelly – Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling (2021)
83. Gonzalo Arteaga – Current-mode photon-counting circuit with SiGe BiCMOS input stage (2020)
82. Jason Silic – Design and Fabrication of a 6-bit Current-Mode ADC for Lidar and High-Speed Applications (2020)
81. Brandon Wade (2020)
80. Mario Valles Montenegro – Front-End CMOS Transimpedance Amplifiers on a Silicon Photomultiplier Resistant to Fast Neutron Fluence (2020)
79. Jonathan DeBoy (2018)
78. Dane Gentry – Design, Layout, and Testing of SiGe APDs Fabricated in a BiCMOS Process (2018)

77. James Mellot – Variable Transition Time Inverters in a Digital Delay Line with Analog Storage for Processing Fast Signals and Pulses (2018)
76. Eric Monahan – High Speed Fast Transient Digitizer Design and Simulation (2018)
75. Shada Sharif – Design and Analysis of First and Second Order K-Delta-1-Sigma Modulators in Multiple Fabrication Processes (2018)
74. Vikas Vinayaka – Analysis and Design of Analog Front-End Circuitry for Avalanche Photodiodes (APD) and Silicon Photo-Multipliers (SiPM) in Time-of-Flight Applications (2018)
73. Claire Tsagkari – Design, Fabrication and Testing of a Capacitive Sensor Using Delta-Sigma Modulation (2017)
72. Kevin Buck – Fast Transient Digitizer and PCB Interface (2015)
71. Marzieh Sharbat Maleki (2015)
70. Angsuman Roy – Design, Fabrication and Testing of Monolithic Low-Power Passive Sigma-Delta Analog-to-Digital Converters (2015)
69. Daniel Anderson – Design and Implementation of an Instruction Set Architecture and Instruction Execution Unit for the RZ9 Coprocessor System (2014)
68. Jared Gordon – Design and Fabrication of an Infrared Optical Pyrometer ASIC (2013)
67. Justin Butterfield (2012)
66. Adam Johnson – Methods and Considerations for Testing Resistive Memories (2012)
65. Ben Millemon – CMOS Characterization, Modeling, and Circuit Design in the Presence of Random Local Variation (2012)
64. Justin Wood (2012)
63. Chamunda Ndinawe Chamunda (2011)
62. Gary VanAckern – Design Guide for CMOS Process On-Chip 3D Inductors using Thru-Wafer Vias (2011)
61. Lucien Jan Bissey – High-Voltage Programmable Delta-Sigma Modulation Voltage-Control Circuit (2010)
60. Kaijun Li (2010)
59. Yingting Li (co-supervised with Maria Mitkova) (2010)
58. Lael Matthews (co-supervised with Said Ahmed-Zaid) (2010)
57. Priyanka Mukeshbhai Parikh (2010)
56. Todd Plum (co-supervised with Jeff Jessing) – Design and Fabrication of a Chemicapacitive Sensor for the Detection of Volatile Organic Compounds (2010)
55. Rahul Srikonda (2010)
54. Avani Falgun Trivedi (2010)
53. Kuang Ming Yap – Gain and Offset Error Correction for CMOS Image Sensors using Delta-Sigma Modulation (2010)
52. Mahesh Balasubramanian – Phase Change Memory - Array Development and Sensing Circuits using Delta-Sigma Modulation (2009)
51. Lincoln Bollschweiler (2009)
50. Shantanu Gupta (2009)
49. Qawi Harvard – Wide I/O DRAM Architecture Utilizing Proximity Communication (2009)
48. Avinash Rajagiri (2009)
47. Ramya Ramarapu (2009)
46. Harikrishna Rapole (2009)
45. Aruna Vadla (2009)
44. Hemanth Ande (2008)
43. Curtis Cahoon – Low-Voltage CMOS Temperature Sensor Design using Schottky Diode-Based References (2008)
42. Prashanth Busa (2008)
41. John McCoy III (2008)
40. Dennis Montierth – Using Delta-Sigma-Modulation for Sensing in a CMOS Imager (2008)
39. Rudi Rashwand (2008)
38. Barsha Shrestha (co-supervised with Zhu Han) – Wireless Access in Vehicular Environments using Bit Torrent and Bargaining (2008)
37. Eric Becker – Design of an Integrated Half-Cycle Delay Line Duty Cycle Corrector Delay Locked Loop (2007)

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INVITED TALKS (PARTIAL LISTING)

- Harvard, Q. I. and Baker, R. J., "Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design," a presentation covering semiconductor packaging, DRAM architectures, and I/O circuits. The goal of this work is to investigate replacing the currently used dual in-line memory modules (DIMMs) with a smaller and a lower power memory module, a "Nano-Module."
- Baker, R. J., and Campbell, K. A., "Reconfigurable Analog Electronics using the Memristor."
- Baker, R. J., and Saxena, V., "A K-Delta 1-Sigma Modulator for Wideband Analog-to-Digital Conversion."
- Li, K., Saxena, V., and Baker, R. J., "The Baker ADC: An Overview,"
- Saxena, V., and Baker, R. J., "High-Speed Op-Amp Design: Compensation and Topologies for Two and Three Stage Designs,"
- Baker, R. J., "Circuit Design for MLC Flash: Towards a Semiconductor Replacement for the Hard Disk Drive."

- Baker, R. J., Terman Award Acceptance Speech, given at the Frontiers in Education Conference (FIE 2007), Milwaukee, WI, October 11, 2007.
- Baker, R. J., "The One-Transistor, One-Capacitor (1T1C) Dynamic Random Access Memory (DRAM), and its Impact on Society," presented at the Franklin Institute, in the symposium honoring Dr. Robert H. Dennard and his receipt of the 2007 Benjamin Franklin Medal in Electrical Engineering, April 25, 2007.
- Baker, R. J. and Saxena, V., "Design of Bandpass Delta-Sigma Modulators: Avoiding Common Mistakes."
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- Baker, R. J., "Design of High-Speed CMOS Op-Amps for Signal Processing," IEEE/EDS Workshop on Microelectronics and Electron Devices (WMED), April, 2005
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EXPERT WITNESS EXPERIENCE (LAST 4 YEARS)

The law firms and clients (underlined) whom I have provided expert witness services in electrical and computer engineering are listed below. I have been deposed 94 times, given expert testimony at 12 trials (7 USITC, 2 D. Del., 1 Arbitr., 1 S.D. Cal., and 1 E.D. Tex.), and participated in 1 mediation.

Bracewell LLP (New York, NY and Seattle, WA)

Case – Kioxia America, Inc. and Kioxia Corporation v. BitMICRO LLC

Case Numbers – IPR2023-00741, IPR2023-00742, and IPR2023-00743. Petitions filed on March 23, 2023.

Case Subject Matter – Solid-state storage devices utilizing multi-profile memory controllers. Optimizing memory operations in a memory system suitable for use in an electronic storage device. Supplying energy to a cache memory using a supercapacitor.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Bookoff McAndrews, PLLC (Washington, DC)

Case – Lenovo Inc. and Motorola Mobility LLC v. Theta IP, LLC

Case Numbers – IPR2023-00694, IPR2023-00697, and IPR2023-00698. Petitions filed on March 7, 2023.

Case Subject Matter – Power in wireless communication circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

McDermott Will & Emery LLP (Chicago, IL and Austin, TX)

Case – Xilinx, Inc. v. Polaris Innovations Limited

Case Numbers – IPR2023-00513 and IPR2023-00514. Petitions filed on February 6, 2023.

Case Subject Matter – Methods for terminating a memory chip with various termination resistances and output drivers for integrated circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Norton Rose Fulbright LLP (Austin, TX and Dallas, TX)

Case – Current Lighting Solutions, LLC d/b/a GE Current v. Jiaxing Super Lighting Electric Appliance Co., Ltd.

Case Number – IPR2023-00270. Petition filed on December 19, 2022.

Case Number – IPR2023-00271. Petition filed on December 14, 2022.

Case Subject Matter – LED lighting, lamps, tube lamps, assembly, and associated circuits and electronics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes review.

Paul Hastings LLP (Washington, DC)

Case – Ex Parte Reexaminations

Case Numbers – 90/015155 and 90/015156. Requests filed on November 7, 2022.

Case Number – 90/015134. Request filed on October 14, 2022.

Case Number – 90/015130. Request filed on September 30, 2022.

Case Subject Matter – Packaging and fabrication of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declaration.

Sheppard, Mullin, Richter & Hampton LLP (Menlo Park, CA)

Case – Bell Semiconductor, LLC v. NXP, SMC, Micron, Nvidia, Advanced Micro Devices (AMD), Acer, Infineon, Qualcomm, Motorola Mobility, and Western Digital

Case Number – ITC Investigation No. 337-TA-1340. Complaint filed October 6, 2022.

Case Subject Matter – Electronic devices, semiconductor devices, and components.

Work Performed – Provided expert consulting services.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Daedalus Prime LLC v. Samsung Electronics and TSMC

Case Number – ITC Investigation No. 337-TA-1335. Complaint filed September 12, 2022.

Case Subject Matter – Semiconductor devices, mobile devices, and components.

Work Performed – Provided expert consulting services.

DLA Piper (Chicago, IL and Washington, DC)

Case – Ampt, LLC v. SolarEdge Technologies, Inc.

Case Number – ITC Investigation No. 337-TA-1327. Complaint filed July 28, 2022.

Case Subject Matter – Solar power optimizers, inverters, and components.

Work Performed – Provided expert consulting services including writing declarations for claim construction, expert reports, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Scramoge Technology Ltd.

Case Numbers – IPR2022-01052, IPR2022-01053, and IPR2022-01058. Petitions filed on May 26, 2022.

Case Numbers – IPR2022-01054, IPR2022-01055, IPR2022-01056, and IPR2022-01057. Petitions filed on May 24, 2022.

Case Number – IPR2022-00939. Petition filed on April 29, 2022.

Case Subject Matter – An antenna that supports wireless charging.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Ex Parte Reexaminations

Case Number – 90/015020. Request filed on May 2, 2022.

Case Number – 90/014906. Request filed on November 12, 2021.

Case Number – 90/014899. Request filed on November 10, 2021.

Case Number – 90/014888. Request filed on October 21, 2021.

Case Numbers – 90/014886 and 90/014887. Requests filed on October 20, 2021.

Case Number – 90/014885. Request filed on October 19, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging.

Work Performed – Provided expert consulting services and wrote declarations.

DLA Piper (Chicago, IL, Austin, TX, and Washington, DC)

Case – SolarEdge Technologies, Inc. v. Fronius International GMBH

Case Number – IPR2022-00849. Petition filed on April 14, 2022.

Case Subject Matter – Mechanical assembly and enclosure whereby an upper housing part is detached from a lower housing part using a “rotate-and-lift” feature.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Kirkland & Ellis LLP (New York, NY)

Case – Samsung Electronics Co. v. Sonrai Memory Ltd.

Case Numbers – IPR2022-00305 and IPR2022-00306. Petitions filed on December 10, 2021.

Case Subject Matter – USB devices and circuits for saving power.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews.

Haynes and Boone, LLP (Washington, DC)

Case – Unified Patents, LLC v. Arigna Technology Limited

Case Number – IPR2022-00285. Petition filed on December 9, 2021.

Case Subject Matter – High voltage driver circuit for driving power devices such as insulated gate bipolar transistors (IGBTs).

Work Performed – Provided expert consulting services, wrote declaration for inter partes review and was deposed.

Paul Hastings LLP (Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.

Case Numbers – IPR2022-00149 and IPR2022-00150. Petitions filed on November 12, 2021

Case Numbers – IPR2022-00100 and IPR2022-00101. Petitions filed on October 28, 2021.

Case Numbers – IPR2022-00051, IPR2022-00052, and IPR2022-00098. Petitions filed on October 27, 2021.

Case Numbers – IPR2021-01575 and IPR2021-01576. Petitions filed on October 1, 2021.

Case Numbers – IPR2021-01299, IPR2021-01300, IPR2021-01345, IPR2021-01346, and IPR2021-01347. Petitions filed on September 7, 2021.

Case Subject Matter – Circuit design, including switching power supply design, rectifiers, power factor correction, etc. for lighting and displays using light emitting diodes (LEDs).

Work Performed – Provided expert consulting services, wrote declarations, and was deposed ten times.

Haynes and Boone, LLP (Plano, TX)

Case – Pure Storage, Inc. v. Digital Cache, LLC

Case Number – IPR2022-00121. Petition filed on October 29, 2021.

Case Subject Matter – Non-volatile memory (NVM) devices capable of retaining stored data in case of a power failure.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Banner Witcoff (Washington, DC)

Case – SolarEdge Technologies Ltd. v. Koolbridge Solar, Inc.

Case Numbers – IPR2022-00007, IPR2022-00008, IPR2022-00009, IPR2022-00010, IPR2022-00011, and IPR2022-00012. Petitions filed on October 11, 2021.

Case Numbers – IPR2022-00013, IPR2022-00014, and IPR2022-00015. Petitions filed on October 8, 2021.

Case Subject Matter – DC-to-AC converters using full-bridges, multi-level conversion for power systems, and other electronics for harvesting solar energy.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. LED Wafer Solutions LLC

Case Number – IPR2021-01554. Petition filed on September 20, 2021.

Case Number – IPR2021-01526. Petition filed on September 10, 2021.

Case Number – IPR2021-01506. Petition filed on September 7, 2021.

Case Number – IPR2021-01491. Petition filed on September 3, 2021.

Case Subject Matter – Packaging of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declarations.

Paul Hastings, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/014,846. Request filed on August 30, 2021.

Case Subject Matter – Wireless power transmission and ways to wirelessly charge and/or discharge a battery.

Work Performed – Provided expert consulting services and wrote declaration.

Jones Day (San Diego, CA and Pittsburgh, PA)

Case – SOLiD, Inc. v. CommScope Technologies LLC

Case Numbers – IPR2021-01390, IPR2021-01391, IPR2021-01392, IPR2021-01393, and IPR2021-01394. Petitions filed on August 12, 2021.

Case Subject Matter – Digital antenna system that enables extension of radio frequency (RF) analog signals from base stations to areas (e.g., inside of buildings) where access to such signals is inhibited.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declaration.

Unified Patents, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/019,015. Request filed on July 20, 2021.

Case Subject Matter – Voltage-controlled oscillator (VCO) temperature compensation.

Work Performed – Provided expert consulting services and wrote declaration.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – *Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC v. Unification Technologies LLC*

Case Numbers – IPR2021-00940, IPR2021-00941, and IPR2021-00942. Petitions filed on June 4, 2021.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Kaijet Technology v. *Sanho Corporation*

Case Number – IPR2021-00886. Petition filed on April 30, 2021.

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services for inter partes review, wrote declaration, was deposed.

O'Melveny & Myers LLP (Los Angeles, CA and New York, NY)

Case – Solas OLED LTD. v. *Samsung Electronics Co. LTD.*

Case Number – Texas, ED (Marshall) 2:21-cv-00105. Complaint filed March 22, 2021.

Case Subject Matter – Touch-sensors for gesture recognition and signal processing for capacitive touch displays.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

O'Melveny & Myers LLP (San Francisco, CA)

Case – Super Interconnect Technologies LLC v. *Google LLC*

Case Number – Texas, ED (Marshall) 2:18-cv-00463 (complaint filed November 2, 2018) and Texas, WD (Waco) 6:21-cv-00259 (complaint filed March 15, 2021).

Case Subject Matter – Transmission of data and clock signals. Serial signals such as transition minimized differential signaling. Communications between processors and non-volatile storage such as Universal Flash Storage (UFS) and embedded MultiMedia Controller (eMMC).

Work Performed – Provided expert consulting services and wrote expert reports.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, and Irvine, CA)

Case – Fundamental Innovation Systems International LLC v. *Anker Innovations and Fantasia Trading LLC d/b/a Ankerdirect*

Case Number – Delaware, 1:21-cv-00339. Complaint filed on March 5, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – *TCT Mobile Inc. and TCL Communication, Inc.* v. Fundamental Innovation Systems International LLC

Case Numbers – IPR2021-00597, IPR2021-00598, and IPR2021-00599. Petitions filed on February 26, 2021.

Case Number – IPR2021-00428. Petition filed on January 13, 2021.

Case Number – IPR2021-00410. Petition filed on January 11, 2021.

Case Number – IPR2021-00395. Petition filed on December 31, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews. Was deposed twice.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. Pictos Technologies, Inc.

Case Number – IPR2021-00557. Petition filed on February 18, 2021.

Case Number – IPR2021-00436. Petition filed on January 19, 2021.

Case Numbers – IPR2021-00437 and IPR2021-00438. Petitions filed on January 15, 2021.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

O'Melveny & Myers LLP (San Francisco, CA) and DLA Piper (New York, NY)

Case – Solas OLED Ltd. v. BOE Technology Group Co. Ltd. and Samsung Electronics

Case Number – ITC Investigation No. 337-TA-1243. Complaint filed January 5, 2021.

Case Subject Matter – Active matrix OLED display devices and components

Work Performed – Provided expert consulting services, wrote expert reports, was deposed, and testified at trial.

Paul Hastings LLP (Washington, DC)

Case – Samsung, Inc. v. Garrity Power Services LLC

Case Number – IPR2021-00389. Petition filed on December 31, 2020.

Case Subject Matter – Power electronics including full-bridge PWM modules for wireless power transmission using magnetic coupling via antennas and transformers. Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declaration for inter partes reviews.

Morgan, Lewis & Bockius LLP (Palo Alto, CA and Shanghai, CN)

Case – Monolithic Power Systems, Inc. v. Meraki Integrated Circuit Technology, Inc. and Promate Electronic Company, LTD.

Case Number – Texas, WD (Waco) 6:20-cv-00876. Complaint filed on December 24, 2020.

Case Subject Matter – Design of switching power supplies including synchronous rectification.

Work Performed – Provided expert consulting services including declaration for claim construction, trade secret analysis and declaration, and Markman tutorial.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC; Dell Technologies Inc.; Dell Inc.; and HP Inc. v. Unification Technologies LLC

Case Numbers – IPR2021-00343, IPR2021-00344, and IPR2021-00345. Petitions filed on December 22, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews, wrote declarations, and was deposed.

Jones Day (Chicago, IL and Dallas, TX)

Case – WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Xilinx, Inc.

Case Numbers – Delaware, 1:20-cv-01231 and Delaware, 1:20-cv-01233. Complaints filed on November 23, 2020 and September 16, 2020.

Case Subject Matter – Controlling power cycles in communication devices and transferring multiple asynchronous clock signals.

Work Performed – Provided expert consulting services, wrote claim construction declaration, wrote expert reports, and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Cosemi Technologies, Inc. v. EverPro Technologies, Fibbr Technologies, Logitech, Inc., and Facebook Technologies

Case Number – ITC Investigation No. 337-TA-1233. Complaint filed October 28, 2020.

Case Subject Matter – Data cables, including HDMI, Display Port, and USB Type A, USB Type C and USB Type A/C data cables.

Work Performed – Provided expert consulting services.

Kirkland & Ellis LLP (Boston, MA and New York, NY)

Case – Pictos Technologies, Inc. v. Samsung Electronics Co., LTD. and Samsung Semiconductor, Inc.

Case Number – ITC Investigation No. 337-TA-1231. Complaint filed September 25, 2020.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, correction of bad pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote expert report.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. TCT Mobile Inc. and TCL Communication, Inc.

Case Number – Delaware, 1:20-cv-00552. Complaint filed on September 11, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations, expert report on invalidity, and was deposed.

Walters Wilson LLP (Redwood City, CA)

Case – Western Digital Corporation and SanDisk, LLC v. Martin Kuster

Case Numbers – IPR2020-01410 and IPR2020-01411. Petitions filed on August 3, 2020.

Case Subject Matter – Computer connectors such as universal serial bus (USB) that connect to peripheral devices such as mice, keyboards, displays, printers, external storage, etc.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Advanced Micro Devices, Inc. v. Monterey Research, LLC

Case Number – IPR2020-01315. Petition filed on July 16, 2020.

Case Number – IPR2020-00985. Petition filed on May 26, 2020.

Case Subject Matter – Reading and writing to semiconductor memory such as SRAM and double data rate (DDR) DRAM. Buffer circuits with variable current supplies for controlling the rise and fall times of output signals.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed twice.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Unification Technologies LLC v. Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC

Case Number – Texas, WD (Waco) 6:20-cv-00500. Complaint filed June 5, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and was deposed.

Ari Law, P.C. (Palo Alto, CA) and Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Sanho Corporation v. Kaijet Technology, Magic Control Technology, and Star View Global

Case Numbers – Georgia, ND (Atlanta) 1:18-cv-05385 (third amended complaint filed November 14, 2019) and Georgia, ND (Atlanta) 1:20-cv-02150 (filed May 19, 2020).

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and expert reports. Was deposed.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. Coolpad Group Limited, Coolpad Technologies, Inc., and Yulong Computer Telecommunication Scientific Co. Ltd.

Case Number – Texas, ED (Marshall) 2:20-cv-00117. Complaint filed on April 23, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

Pillsbury Winthrop Shaw Pittman LLP (San Francisco, CA and Shanghai, China)

Case – SMIC, Americas v. Innovative Foundry Technologies LLC

Case Numbers – IPR2020-00837 and IPR2020-00839. Petitions filed on April 14, 2020.

Case Subject Matter – Methods of manufacturing a semiconductor component, such as a short-channel MOS device, including forming graded-junctions using spacers along the sidewalls of a transistor's gate.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Russ August & Kabat (Los Angeles, CA)

Case – Oyster Optics, LLC v. Ciena Corporation

Case Number – California, ND (Oakland) 3:20-cv-02354. Complaint filed on April 7, 2020.

Case Subject Matter – Fiber optic telecommunication systems.

Work Performed – Provided expert consulting services, wrote claim construction declaration, and was deposed.

Russ August & Kabat (Los Angeles, CA)

Case – Seoul Semiconductor Co., Ltd. v. Document Security Systems, Inc.

Case Number – IPR2020-00938. Petition filed on May 18, 2020.

Case – Nichia Corporation v. Document Security Systems, Inc.

Case Number – IPR2020-00908. Petition filed on May 18, 2020.

Case – Cree, Inc. v. Document Security Systems, Inc.

Case Number – IPR2020-00557. Petition filed on February 11, 2020.

Case Subject Matter – Light emitting diodes (LEDs) as a light source, extraction of light.

Work Performed – Provided expert consulting services, wrote declaration for inter partes reviews, and was deposed three times.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Flex Logix Technologies, Inc. v. Konda Technologies Inc.

Case Numbers – IPR2020-00260, IPR2020-00261, and IPR2020-00260. Petitions filed on December 16, 2019.

Case Numbers – PGR2019-00037, PGR2019-00040, and PGR2019-00042. Petitions filed on March 18, 2019.

Case Subject Matter – FPGA layout routing for integrated circuits and networks, electrical and computer engineering.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews.

DLA Piper (Chicago, IL, Houston, TX, and Washington, DC) and White & Case LLP (New York, NY and Washington, DC)

Case – M-Red Inc. v. Panasonic Corporation

Case Number – Texas, ED (Marshall) 2:19-cv-00251. Complaint filed on July 16, 2019.

Case Subject Matter – Integrated circuit electronics adjustment, such as ring oscillators, using auto calibration. Evaluating a known good die using both wire and flip-chip interconnects.

Work Performed – Provided expert consulting services and wrote declaration for claim construction.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. NuCurrent, Inc.

Case Number – IPR2019-01217. Petition filed on June 19, 2019.

Case Numbers – PGR2019-00049 and PGR2019-00050. Petitions filed on May 28, 2019.

Case Numbers – IPR2019-00858, IPR2019-00859, IPR2019-00860, IPR2019-00861, IPR2019-00862, and IPR2019-00863. Petitions filed on March 22, 2019.

Case Subject Matter – Wireless power transmission using magnetic coupling via antennas and transformers. Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews. Was deposed five times.

DLA Piper (East Palo Alto, CA)

Case – Invensas Corporation and Tessera Advanced Technologies, Inc. v. NVIDIA Corporation

Case Number – Delaware, 1:19-cv-00861. Complaint filed on May 8, 2019.

Case Subject Matter – Reference voltage circuits (programmable bandgaps) having a substantially zero temperature coefficient using bipolar and MOS transistors.

Work Performed – Provided expert consulting services.

Irell & Manella LLP (Los Angeles, CA)

Case – VLSI Technology LLC v. Intel Corporation

Case Number – Texas, WD (Waco) 6:19-cv-00256. Complaint filed on April 11, 2019.

Case Subject Matter – Static Random Access Memory (SRAM) having a variable power supply using charge-sharing capacitors, methods for designing digital systems, and hardware managed interrupt control.

Work Performed – Provided expert consulting services, wrote expert reports, declaration, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. ProMOS Technologies, Inc.

Case Numbers – IPR2019-00779, IPR2019-00780, IPR2019-00781, IPR2019-00784, and IPR2019-00785. Petitions filed on March 5, 2019.

Case Subject Matter – Programmable latches that include non-volatile programmable elements, digital delay elements, and decoders for memory chips.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed four times.