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Curriculum Vitae

Harry G. Direen Jr, Ph.D, PE

Areas of Expertise:

- Electrical / Electronic Engineering including digital, analog and RF circuits
- Software Engineering and Systems
- Control Systems including Embedded Control Systems
- Signal Processing and Sensors
- UAVs (Unmanned Aerial Vehicles) / Drone autonomous control
- Intellectual Property litigation; patent infringement analysis
- Product software and hardware reverse engineering
- Over 35 years of experience in the electronics and software engineering field

Education:

- Ph.D. Electronics Engineering / Control Systems
  University of Colorado, 1996
  Thesis: *Optimization of Wavelet Basis Controllers for Nonlinear Systems with Applications to Learning Control Systems*
- BSEE University of California at Irvine, 1982

Litigation Support Experience:

- Over 16 cases involving Intellectual Property, patent infringement, patent invalidity/validity, IPR, CBM, deposition and trial support
- Over 58 product reverse engineering cases involving patent infringement
- Appendix A contains case details

Professional Experience

DireenTech Inc.

Consultant, Expert Witness, COO, 1999-Present

DireenTech has a three year research contract with the US Air Force Academy (started March 2015) in area of image processing, GPS designed navigation technology, and over-all autonomous control of unmanned aerial vehicles (UAVs). I am involved in all aspects of this research.

Developing wheelchair control systems which allow a person with quadriplegia to drive and control the chair with head movements. Working with a neurosurgeon and therapists to better understand issues and capabilities of people with spinal cord injuries. Goals of moving beyond wheelchair control to provide a range of support systems.

An expert witness in multiple patent litigation cases involving encryption/decryption methods associated with databases; vehicle surveillance systems; garage door openers; security products; and other cases. Carried out product analysis and product reverse engineering of the associated products. Generated claim charts and expert reports for the analysis. Analyzed patent invalidity/validity arguments and generated rebuttal reports. Testified in depositions and trails. Involved in the generation of demonstratives for trials. A list of significant cases is attached as Appendix A.

An expert witness in multiple CBMs and IPR cases.

Product reverse engineering and forensics of hardware and software products. Products reversed engineered include database systems; media players; audio signal processing and compression; modems; modem compression algorithms; Coriolis mass flow meters; and a variety of other products. I have successfully discovered and analyzed complex digital signal processing algorithms and pertinent operations within these products. A list of significant forensics investigations and litigation cases is attached as Appendix A.

Worked with a pump manufacture on the development of a 2 horse-power, three-phase, sensorless, permanent magnet motor driver to be used with a novel water pump system.

Designed and developed a 400 watt, switch-mode power supply technology, microprocessor controlled, neon light ballast for a start-up company. The ballast uses SEPIC converter coupled with a push-pull forward convertor, taking AC-line input to 10-KV output. The neon ballast has a number of unique features for which a patent was pursued. Responsible for all the electronic hardware design and development along with the embedded firmware design and development. Digital signal processing algorithms were designed and implemented within the firmware.

Designed and developed an automated software test system which uses a Laser-Micrometer to measure characteristics of high-precision, milling tools. The system contains motor controller for accurately placing and controlling tool position; measures tool parameters; performs significant digital signal processing including filtering, multi-dimensional curve-fitting and other complex analysis of the data, and displays the results.

Designed and developed embedded software for an in-car camera system. The camera system captures continuous running videos of both in car and front of car locations. Video movies from before, during,

and after an event are stored to a flash drive when triggered by an event such as a collision, panic button press, or door opening. The camera system contained an accelerometer, GPS, Wi-Fi, USB, and other subsystems. I developed digital signal processing algorithms for sensor processing with in the camera.

Solved stiction issues in the motor control of a high precision optics system. I provided additional motor control algorithms and analysis for the optics company.

Other contracts he has been involved with include:

- Microwave Power Amplifier for a satellite system
- FPGA design of an SPI command filter
- Automated test software development for a focal plane array
- Embedded software development for high power RF amplifier

Valdez International Co, Colorado Springs, CO

Researcher, 2011 - 2014 for the Academy Center for UAS Research, Department of Electrical and Computer Engineering

Dr. Direen was responsible for the design and development of embedded mission control system software for unmanned aerial systems. This software controls un-manned, autonomous, cooperative, aircraft for missions involved in target search, acquisition and tracking. The control system captured images of potential ground targets; handled image processing; sensor fusion; communications with aircraft avionics; communications with ground stations and other aircraft and un-manned assets; and handled all command and control decisions and processes to carry out the aircraft's mission.

US Air Force Academy

Instructor of Electrical Engineering, Spring semester of 2011

- Taught ECE315, an electronic engineering course for non-engineering majors. The course covered DC electronics through radar systems.

Xpriori LLC

Chief Architect, 2003-2009

Chief architect for the Xpriori XMS native XML database, instrumental in all aspects of the architecting, design, development and coding of the database technology.

- Provided direct customer interface and support on both military classified projects and commercial projects.
- Worked with a partner company in writing and submitting an SBIR proposal for the use of the XML database product for a distributed, peer-to-peer, information management system.

NeoCore Inc.

Principal/Consulting Engineer, 1999-2003

Instrumental in the design, development and coding of NeoCore's XML database. This included development of the entire index structure and encapsulation of NeoCore's patented Digital Pattern Processing (DPP) into the database.

- Designed and coded a BLAST (Basic Local Alignment Search Tool) plug-in module for the XML database, to search for DNA and protein sequences.
- Design and development of network interface HW & SW. Designed and coded SW kernel and low level drivers for a firewall style network interface. HW based on QED RM7000, 64 bit RISK processor, and Intel NICs. Design of a dual 25-watt switch mode power supply for above.

Performed finite field and statistical analysis of NeoCore's Digital Pattern Processing (DPP) technology.

Internal White Papers:

a. Finite Fields and Properties of the NeoCore Icon Generator, Associative Processing Unit, and Associative Memory Controller used in Digital Pattern Processing
b. Couplet Hierarchy Vectors
c. NeoPacket Slider with Pre-Parser and Proximity Search Engine
d. Duplicate Tree Structures in DPP Virtual Associative Memories
e. DPP™ Memory Management (co-author)

Center for Computational Biology (CCB http://www.cudenver.edu/ccb/)

a. Established NeoCore's connection with the UC Denver's CCB
b. Worked with the CCB on an application for NSF grant (02-058): Self-evolving Metadata Schema for Knowledge Building in Biological Databases
c. Support of the Center of Computational Pharmacology use of NeoCore's database technology
d. Developed and gave presentations on NeoCore's XML dB technology at the CCBs company showcase, CU Denver computer science dept., and UCCS biology dept.

Recognitions

- BioIT World Champion (http://www.bio-itworld.com/champions/harry_g._direen,.html)

Advisory Boards

2001-2004

- Member of Advisory Board for the Center of Computational Biology (http://www.cudenver.edu/ccb/)
- Member of UCCS Advisory Board for developing undergraduate courses in the emerging area of computational biology

University of Colorado, Colorado Springs

Honorarium Instructor at UCCS, 1999-2000

- Taught: Engineering Probability and Statistics (Under graduate level)

- Taught: Nonlinear Adaptive Control Systems (Graduate level)

ETO/ASTeX

Engineering Manager, 1997-1999

Established new engineering dept./group. Technical lead and project manager on new RF amplifier for high field MRI systems. Established product specifications, schedules, budgets. Hired engineers and technicians. Primary technical interface for all U.S. and international customers

Senior / Principal Engineer 1985-1997

Principal design engineer for all embedded control for the full line of the company's RF amplifiers and RF generators. These products are used in MRI systems, semiconductor processing equipment, Laser equipment and other industrial and medical applications. Responsibilities included hardware design of: microprocessor controls using single and multiprocessor designs, DSPs, FPGAs, A/D converters, DACs; analog signal processing, analog filters, analog feedback loops, and linear power supplies.

Responsible for all of the embedded software design, coding, and verification. Code development in assembly and C. The embedded software was responsible for: sequencing the systems on and off; user interface including parallel and serial RS-232; fault monitoring; adaptive digital feedback control loops; generator/amplifier safe operating area protection; and display interfaces.

- Developed a power level monitoring system using digital signal processing to monitor peak and total average power delivered to a patient in an MRI system.
- Developed complex adaptive control schemes using digital signal processing to control high power RF generators used in semiconductor processing systems. The control scheme prevented overshoot of RF power and maintain constant power delivered to a plasma etch system. The control scheme simultaneously maintained power output levels and controlled tuning parameters of the RF generator to maintain an optimal matched impedance into the plasma load.
- RF design of: low noise pre-amps; linear amplifiers; and RF signal processing. Familiar with the design of class D and class E RF amplifiers.
- Taught theory of operation and service methods seminars to customers and customer service departments.
- Provided product integration and support at customer sites. Often worked with customers to solve overall system level problems.

EF Johnson

RF/Analog Design Engineer, 1984-1985

High power, linear RF amplifier design (150 MHz). Analog signal processing design. Developed a semi-custom IC design of a tone generator/decoder using switch capacitive filters, analog, and digital processing. This design generated sub-audio tones used for dispatch radios and monitored and detected the sub-audio tones to open the squelch gate on the dispatch radios. Complex digital signal processing was used in the tone decoder process.

College of Southern Idaho

Instructor, 1984

Taught course in basic electronics.

Cubic Corp.

Design Engineer, 1982-1984

Designed a 2 GHz, linear, solid state power amplifiers using single ended and push-pull designs implemented with bipolar and FET transistors. Studied linearization techniques and designed/built pre-distortion circuits. The power amplifiers were designed for use in GPS transponders on ICBMs.

Hardy Scales

Field Service Engineer/Technician, 1974-1981

Provided in-house production test and field service of industrial weighing and batching equipment. Provided service in U.S., Canada, Puerto Rico, and the Virgin Islands.

US Air Force Reserves

Electronic Service Technician, 1973-1979

Tech. School: Electronic Comm. and Crypto Equipment

Professional Engineer

Registered in Colorado, USA # 43218 Professional Engineer

Organizations

Senior Member IEEE
Member Tau Beta Pi
Member Eta Kappa Nu
Treasure of the Pikes Peak Alumni Chapter of Tau Beta Pi (2015)

Patents

1. US Patent No: 7,089,382 Method of Operating a Hierarchical Data Document System having a Duplicate Tree Structure
2. US Patent No: 6,934,730 Method and System for Generating a Transform
3. US Patent No: 6,493,813 Method for Forming a Hashing Code

Testifying Expert at Trials

1. Protegrity Corporation vs Voltage Security., CASE NO.: 3:10-cv-00755-RNC, April 15-17, 2014, Hartford CT.
2. ITC Investigation No. 337-TA-1016, May 1 - 3, 2017, Washington DC
3. Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, July 10-14, 2017, Sherman, TX

Depositions

1. Protegrity Corporation vs Voltage Security., CASE NO.: 3:08-CV-618 (RNC), October 24, 2012 in Denver Colorado.
2. Protegrity Corporation vs Ingrian Networks, Inc. / SafeNet Inc., CASE NO.: 3:10-CV-0755, January 14, 2013 in Denver Colorado.
3. Epicor Software Co. vs Protegrity Corp. CBM2015-00002, July 22, 2015
4. Square Inc. vs Protegrity Corp. CBM2014-00182, July 22, 2015
5. ITC Investigation No. 337-TA-1016, March 7, 2017, Washington DC
6. Mobile Tech. Inc. vs Invue Security Products, IPR Defense, IPR2016-00892, -00895, -00896, -00898, and -00899, March 15, 2017, Atlanta, GA
7. Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, May 17, 2017, Dallas, TX
8. Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, June 19, 2017, Dallas, TX

Publications

- Harry Direen and Mark Jones, *"Knowledge Management in BioInformatics*" Chapter 10 of *"XML and Databases",* Addison-Wesley, March 2003
- H. Direen, C. Brandin, M. Jones, C. Hedgepeth, and D. Shin, "*Knowledge Management through a Fully Extensible, Schema Independent, XML Database*", Proceedings of the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2001.

- Direen, H.G., Jr.; Fosha, C.E.; Frick, P.A. "*Pointwise Conditions for Improving Control on a Known Region of Asymptotic Stability"*, Proceedings of the 1997 American Control Conference, June 1997.

Programming Languages

- C, C++, C#, Python, Java
- Assembly: ARM, MIPS, Intel, TI & Motorola DSPs

Appendix A
List of Forensic and Litigation Cases

1) ITC Investigation No. 337-TA-1016

October 2016 to May 2017
Law Firm: Fish & Richardson, Washington DC
The Chamberlain Group vs Techtronic Industries Co. Ltd. of Hong Kong
US Patent 7,339,336 generally relates to various aspects of a barrier movement operator, such as a garage door or gate opener. Support of plaintiff on patent infringement and patent validity.
Deposition:
ITC Investigation No. 337-TA-1016, March 7, 2017, Washington DC
Trial:
ITC Investigation No. 337-TA-1016, May 1 - 3, 2017, Washington DC

2) Evicam International Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105

June 2016 to July 2017
Law Firm: Munck Wilson Mandala, LLP, Dallas Texas
Support of plaintiff on patent infringement and patent validity. Patents deal with vehicle surveillance systems.
Depositions:
Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, May 17, 2017, Dallas, TX
Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, June 19, 2017, Dallas, TX
Trial:
Evicam International, Inc. vs Enforcement Video, LLC, Civil Action No.: 4:16-CV-105, July 10-14, 2017, Sherman, TX

3) Mobile Tech. Inc. vs Invue Security Products, IPR Defense

May 2016 to present, ongoing.
Law Firm: Meunier Carlin & Curfman LLC, Atlanta GA
IPR2016-00892, -00895, -00896, -00898, -00899, IPR2017-00345
Support of defendant's patents on in-store security devices.
Deposition:
Mobile Tech. Inc. vs Invue Security Products, IPR Defense, IPR2016-00892, -00895, -00896, -00898, and -00899, March 15, 2017, Atlanta, GA

4) Uniloc vs Autodesk Civil Action No. 2:15-cv-01187-JRG-RSP

May 2016 to July 2016

Law Firm: Warren Rhoades LLP, Irving Texas
Support of plaintiff on patent infringement contentions against Autodesk products.

5) Informatica vs Protegrity CBM2015-00021

Project Number: PROT-2015-004, June 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 6,321,201 as a Covered Business Method patent and to invalidate the patent. The '201 patent titled *Data Security System for a Database Having Multiple Encryption Levels Applicable on a Data Element Value Level,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '201.

6) Informatica vs Protegrity CBM2015-00010

Project Number: PROT-2015-004, June 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 8,402,281 as a Covered Business Method patent and to invalidate the patent. The '281 patent titled *Data Security for a Database,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '281.

7) Epicor vs Protegrity CBM2015-00006

Project Number: PROT-2015-003, June 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 8,402,281 as a Covered Business Method patent and to invalidate the patent. The '281 patent titled *Data Security for a Database,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '281.

Deposition: Epicor Software Co. vs Protegrity Corp. CBM2015-00002, July 22, 2015, Stamford CT. Note: the deposition covered both the CBM2015-00002 & CBM2015-00006 cases.

8) Epicor vs Protegrity CBM2015-00002

Project Number: PROT-2015-003, June 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 6,321,201 as a Covered Business Method patent and to invalidate the patent. The '201 patent titled *Data Security System for a Database Having Multiple Encryption Levels Applicable on a Data Element Value Level,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '201.

Deposition: Epicor Software Co. vs Protegrity Corp. CBM2015-00002, July 22, 2015, Stamford CT

9) Square vs Protegrity CBM2014-00182

Project Number: PROT-2014-005, May 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 8,402,281 as a Covered Business Method patent and to invalidate the patent. The '281 patent titled *Data Security for a Database,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '281.

Deposition: Square Inc. vs Protegrity Corp. CBM2014-00182, July 22, 2015, Stamford CT.

10) Square vs Protegrity CBM2015-00014

Project Number: PROT-2014-005, May 2015 – September 2015
Law Firm: GrayRobinson, P.A., Tampa, FL
The case is a petition to the Patent Trials and Appeals Board to review the US patent 6,321,201 as a Covered Business Method patent and to invalidate the patent. The '201 patent titled *Data Security System for a Database Having Multiple Encryption Levels Applicable on a Data Element Value Level,* deals with protection of data in a database typically through encryption. I researched the prior art and the petitioner's reports related to the US patent 6,321,201. I built a defensive case and generated a detailed declaration in support of the validity '201.

Deposition: Square Inc. vs Protegrity Corp. CBM2014-00182, July 22, 2015, Stamford CT. Note: the deposition covered both the CBM2014-00182 & CBM2015-00014 cases.

11) Micro Motion vs Invensys Systems Case No. 12-CV-00799-LED

Company/Project Number: TAEUS 13-MMI001-000103, October 2013 to February 2015
Company/Project Number: TAEUS 13-MMI001-000017, January 2013 to January 2014
Law Firm: FOLEY & LARDNER LLP
I was an expert witness engaged by Foley & Lardner for this case. I reverse engineer an Invensys Systems' Foxboro Coriolis flowmeter, both electronic hardware and digital signal processing software. This was a project carried out in a number of phases starting with reverse engineering the flowmeter and comparing the flowmeter's operation to several different patents. I wrote claim charts and an expert report to support infringement contentions. The primary patent for infringement (US 5,555,190) was deemed invalid by the court so there was no testimony given for this expert report. Additional reverse engineering of digital signal processing with in an FPGA was also carried out to demonstrate infringement against another patent. This case was settled before going to court.

12) Invensys Systems vs Emersion Electric & Micro Motion Case No. 12-CV-00799-LED

Company/Project Number: TAEUS 13-MMI001-000103, February 2014 to February 2015
Law Firm: FOLEY & LARDNER LLP
I was an expert witness engaged by Foley & Lardner for this case. I analyzed and tested several vintage Micro Motion / Emerson Coriolis flowmeters to determine specific operational characteristics of the

flowmeters during transient flow conditions. I wrote declarations showing flowmeter's operation during these conditions to support the litigation case. This case was settled before going to court.

13) MS Surface Tablets Analysis

Project Number: HGLV_2013-001, March 2013
Law Firm: Hogan Lovells, Washington DC
I performed a tear-down and analysis of two separate Microsoft Surface Tablets (RT & Pro) and compare them to several different patents for possible patent infringement.

14) Protegrity vs Voltage Civil Action No. 3:14-cv-00257

Company/Project Number: TAEUS 14-PI001-000024, March 2014
Law Firm: GrayRobinson, P.A., Tampa, FL
I was an expert witness engaged by GrayRobinson through TAEUS for this patent infringement case. I analyzed the Voltage SecureData product through their product documentation. The Protegrity US 8,661,263 patent which deals with format preserving encryption. I wrote an expert report with claim chart demonstrating infringement. The case was settled out of court.

15) SHELLY CONTE vs JAKKS PACIFIC Case No.: 1:12-CV-0006 LJO-GSA

Project Number: WEBO-2013-001, June 2013 – October 2013
Law Firm: Webb & Bordson, APC, San Diego, CA
Patent infringement case against the Jakks Pacific HideNSeek Doll, U.S. Patent No. 6,494,457.
I was engaged by Webb & Bordson as an expert witness for this patent infringement case. I reverse engineered the HideNSeek Doll and produced a claim chart as well as an expert report demonstrating how the HideNSeek Doll used the '457 claimed technology. I provided various support to the law firm for prior-art invalidity contentions and other motions of summary judgements in this case. In the end the judge deemed the patent invalid.

16) CAD Software Analysis for Copyright Infringement

Company/Project Number: TAEUS 13-SPS001-000018, July 2013 – November 2013
A company suspected that a former employee took their high-end CAD software design to another company. That company produced a similar CAD software product. It was believed that the product infringed copyright protection. The software products from both companies were obtained and compared. Executable code from both products was disassembled for comparison. DireenTech developed specialized software analysis tools which allowed the two products to be compared at the disassembly level. The two software products were compared for signs of copyright infringement.

17) Refrigeration Controller Reverse Engineering

Company/Project Number: TAEUS 13-EE001-000068, June 2013 – January 2014
The project involved reverse engineering a microprocessor controlled refrigeration controller. Both electronic hardware and embedded software were reverse engineered to determine if the refrigeration controller infringed a number of different patents. Embedded firmware was extracted from the system, disassembled and analyzed. The embedded firmware was patched to inject software analysis tools we developed to allow monitoring the controller during operation. A simulated refrigeration environment

was designed and built to inject signals into the refrigeration controller so that it could be tested under simulated operating conditions. We discovered strong software obfuscation had been used in the refrigeration controller's firmware, so the project was abandoned by the customer at that point do to the additional costs to try and break the obfuscation.

18) Freescale MMM7210 Transceiver

Company/Project Number: IP Enginuity IPE203071 April 2012
I analyzed a Freescale MMM7210 against the claims of US Patent 6,882,827 and create an evidence of use chart based upon product documentation and review of an IEEE paper.

19) Self-Alarming Buzzer Tag Reverse Engineering

Company/Project Number: TAEUS 12-SC006-000130 October 2012 – November 2012
I reverse engineered clothing tags, used to prevent shop-lifting, to determine if the tags infringed on a competitor's patents. Reverse engineering involved both electronic hardware and embedded firmware analysis.

20) Protegrity vs Ingrian Patent Infringement Case NO.: 3:10-CV-0755

Company/Project Number: TAEUS 12-GR001-000114, August 2012 – October 2013
Law Firm: GrayRobinson, P.A., Tampa, FL
I was engaged as an expert witness by GrayRobinson through TAEUS for this patent infringement case. Ingrian DataSecure products were analyzed via product documentation and source code reverse engineering to demonstrate infringement against several of Protegrity's patents, the primary patent being US 6,321,201. Claim charts and expert reports were generated to demonstrate infringement. The case also involved substantial defense against patent invalidity arguments. The case was settled out of court.

Deposition: Protegrity Corporation vs Ingrian Networks, Inc. / SafeNet Inc., CASE NO.: 3:10-CV-0755, January 14, 2013 in Denver Colorado.

21) Protegrity vs Voltage Patent Infringement Case

Company/Project Number: TAEUS 12-GR001-000114, November 2012 – April 2014
Law Firm: GrayRobinson, P.A., Tampa, FL
I was engaged as an expert witness by GrayRobinson through TAEUS for this patent infringement case. Voltage SecureData products were analyzed via product documentation and source code reverse engineering to demonstrate infringement against several of Protegrity's patents, the primary patent being US 6,321,201. Claim charts and expert reports were generated to demonstrate infringement. The case also involved substantial defense against patent invalidity arguments. The case went to court where I testified on behave of Protegrity. The case settled in Protegrity's favor after approximately three days in court.

Deposition: Protegrity Corporation vs Ingrian Networks, Inc. / SafeNet Inc., CASE NO.: 3:10-CV-0755, January 14, 2013 in Denver Colorado.

Court Testimony: Protegrity Corporation vs Voltage Security., CASE NO.: 3:10-cv-00755-RNC, April 15-17, 2014, Hartford CT.

22) CodeGuard and the Microchip Digital Signal Controllers

Company/Project Number: TAEUS 12-VC001-000042, April 2012
I perform a threat assessment analysis on the Microchip DS-33xx microcontrollers with embedded EEPROM memory to determine the effectiveness of the memory protection features.

23) Samsung Tablet Review / Analysis

Company/Project Number: TAEUS 11-L001-000137, September 2011 – November 2011
I analyzed a Samsung tablet against European patent EP1110182 to determine potential infringement of the patent. I generated claim charts of the tablet vs specific patent claims.

24) Samsung Tablet Review / Analysis

Company/Project Number: TAEUS: 11-L001-000120, October 2011
I analyzed a Samsung tablet against European patent EP1034505 to determine potential infringement of the patent. I generated claim charts of the tablet vs specific patent claims.

25) Samsung Tablet Review / Analysis

Company/Project Number: TAEUS: 11-L001-000126, October 2011
I analyzed a Samsung tablet against European patent EP2073096 to determine potential infringement of the patent. I generated claim charts of the tablet vs specific patent claims.

26) Samsung Tablet Review / Analysis

Company/Project Number: TAEUS: 11-L001-000113, August 2011
I researched the processors used in the Samsung Galaxy and Tab 10.0. The research involved analysis of texture mapping in JPEG and MPEG encoding. I investigated the use of NVIDIA's ULP GeForce GPU in the Samsung Galaxy S2 and whether or not DXTn is used in the Exynos 4210.

27) IBM Clock & Data Recovery vs USPN 6,178,213

Company/Project Number: IP Enginuity IPE 107181 July 2011
The method disclosed in USPN 6,178,213, Claim 8 covers a technology known in the industry as clock and data recovery (CDR), which is used in the receiver portion of many serial data communication systems. This technology is consistent with methods that are required for serial data receivers in IBM products such as the 2-Port 40Gb InfiniBand Expansion Card for IBM BladeCenter. Related IBM products such as the SONET OC-768 receiver were compared to the '213 patent and a claim chart was generated to demonstrate the similarities in the technologies.

28) Nook Touch E-Reader

Company/Project Number: TAEUS: 11-ML005-000086, June – July 2011
I analyzed the Nook e-reader based upon specific questions asked by counsel for this project. The Nook was rooted in order to get access to the lower level operating system. Analysis was performed to determine how accounts and permissions were stored and accessed on the e-reader. The accounts and permissions pertained to how books, magazines, newspapers and other media were kept synchronized with the Barnes & Noble website repositories.

29) Kindle E-Reader

Company/Project Number: TAEUS: 11-ML005-000069, May 2011
For this project I analyzed a Kindle e-reader based on questions specified by counsel. The Kindle underlying operating system is Linux based. Access to the underlying operating system and the file system on the Kindle is not enabled as delivered, so techniques were found to gain access to the underlying operating system. Analysis was performed to determine how accounts and permissions and media are stored and accessed on the e-reader. The accounts and permissions pertained to how books, magazines, newspapers and other media were kept synchronized with remote web-servers.

30) Nook Color E-Reader

Company/Project Number: TAEUS: 11-ML005-000059, April 2011
I analyzed a Nook e-reader and an associated SDK (Software Development Kit) based on questions specified by counsel. The Nook was rooted in order to get access to the lower level operating system on the Nook. Analysis was performed to determine how accounts and permissions are stored and accessed on the e-reader. The accounts and permissions pertained to how books, magazines, newspapers and other media were kept synchronized with the Barnes & Noble website repositories.

31) Panasonic CF-F9 Toughbook Bluetooth Clock

Company/Project Number: IP Enginuity IPE 009201 December 2010
A Panasonic Toughbook computer was investigated in the area of the USB Bluetooth against US Patent 5,870,680. A test report was generated.

32) Xi'an Dongfeng DPT100 Mass Flowmeter vs USPN 6,466,880 & 6,505,131

Company/Project Number: TAEUS: 10-MMI001-000227, 10-MMI01-000131, August 2010 to Feb 2011
The DPT100 is a Coriolis mass flowmeter made by the Chinese company Xi'an Dongfeng. The project required reverse engineering both the electronic hardware and digital-signal-processing firmware for the purpose of comparing the operation of the mass flowmeter with the technology disclosed in the US patent 6,466,880. Analysis of the DPT100 mass flowmeter included disassembly of the electronic components, opening the
meter tube housing, and circuit extraction of select printed circuit boards (PCB). The PCBs that were selected for analysis were the signal processing board, signal conditioning board, and sensor/ driver circuitry board. Circuit analysis revealed that the DPT100 flowmeter used a Texas Instruments TMS320VC5416 DSP (Digital Signal Processor). The code used in the internal TMS320VC5416 DSP was obtained from flash memory within the DPT100, and once extracted it was disassembled and analyzed. The disassembled meter construction, extracted schematics, DSP code, and manuals were evaluated against the USPN 6,466,880 patent. Detailed claim charts were generated revealing the strong similarity of the DPT100 mass flowmeter operation to claims the '880 and '131 patents.

33) Blackberry Curve 8520 Mobile Phone V.42*bis* Discovery

Company/Project Number: TAEUS 10-BT001-000170, September 2010 – December 2010
The 8520 cellphone, uses the Freescale MXC275-30 Mobile eXtreme Convergence architecture. Upgrade firmware for the Blackberry 85200 mobile phone was downloaded from the Blackberry website. The upgrade code was extracted and analysis showed that the rim0x8C000F03.sfi file contained ARM code

with references to the V.42*bis*. The ARM binary code was disassembled and analyzed to discover and reverse engineer the enclosed V.42*bis* algorithm. The code was compiled from an object oriented language making discovery of the V.42*bis* algorithm more difficult than if it had not. Because of this the customer decided not to proceed further; however, we did find references and indications of the V.42*bis* algorithm within the disassembled code.

34) Panasonic DE-A59 Battery Charger

Company/Project Number: IP Enginuity IPE100701 September 2010
A number of Panasonic products were tested and evaluated against the US patent 6,111,389 for possible infringement. The products included: a Panasonic DE-A59 Battery charger, a computer and a KX-TG6533 wireless phone.

35) Pioneer AVIC-HRZ900 TNS Analysis

Company/Project Number: IP Enginuity IPE1005nn_TNS June 2010 – August 2010
Analysis of the Pioneer AVIC-HRZ900 navigation system was performed to determine if the music player of the system decodes .m4a music files and specifically decodes and uses the Temporal Noise Shaping (TNS) option contained in .m4a music files. A music file, OAMsBlues.m4a, with known TNS information was used for the analysis. The TNS information within .m4a music files contains reference indexes to filter coefficients. The OAMsBlues.m4a music file was analyzed to determine all of the locations of the filter indices within the file. A new version of the music file (OAMsBlues_noTNS.m4a) was created with all the filter indices set to zero which causes a music player that decodes and used TNS information to set all the TNS filter coefficients to zero. This in effect disables TNS with in the music file without affecting a music player's normal decoding and playing of the music file. The only effect of the change is to keep the music player from compensating for TNS in rendered music. In rendered music, TNS compensation typically takes place where sounds levels are changing rapidly. The OMAsBlues.m4a and a OMAsBlues_noTNS.m4a music files were copied on to a CD and inserted into the AVIC-HRZ900 navigation system. The music output of the navigation music player was recorded for both music files. The recorded output was then analyzed to determine whether or not the AVIC-HRZ900 navigation system makes use of the TNS information within the OMAsBlues.m4a music file. Analysis was performed to determine if US Patents 5,781,888 and 5,812,971 were being infringed. A report was generated demonstrating the decoding of TNS by the product.

36) SoftBank 922SH Cellphone TNS Analysis

Company/Project Number: IP Enginuity IPE010101 October 2010 – November 2010
Analysis of the Sharp Softbank 922H Cellphone was performed to determine if the music player decoded .m4a music files and specifically decoded and used the Temporal Noise Shaping (TNS) option contained in .m4a music files. Analysis was performed to determine if US Patents 5,781,888 and 5,812,971 were being infringed. A report was generated demonstrating the decoding of TNS by the product.

37) Analyze Kenwood DNX7160 & DPX-U70 TNS Analysis

Company/Project Number: IP Enginuity IPE1005nn_TNS August 2010
Analysis of the Kenwood DNX7160 and DPX-U70 navigation systems was performed to determine if the music player decoded .m4a music files and specifically decoded and uses the Temporal Noise Shaping

(TNS) option contained in .m4a music files. Analysis was performed to determine if US Patents 5,781,888 and 5,812,971 were being infringed. A report was generated demonstrating the decoding of TNS by the product.

38) Search for Evidence of Use of V.42*bis* Compression in Cellphones

Company/Project Number: TAEUS: 10-PR001-000069 March – April 2010
I performed an internet search for firmware upgrades to HTC and Motorola cellphones and download and extract the cellphone's firmware. I searched for evidence of use of the V.42*bis* compression algorithm within the firmware upgrade. This was a first stage process to determine if the associated cellphones infringe US Patent 5,153,591.

39) Avaya 4T+4A+8DS vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW May 2009
I compared the operation of the Avaya G350 Media Gateway to the US patent 5,912,888 technology and generate a claim chart.

40) Mitel SX-200 ICP CX Integrated Communications Platform vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW May 2009
I compared and analyzed the operation of the Mitel SX-200 ICP CX Integrated Communications Platform to the US patent 5,912,888 technology and generate a claim chart.

41) Siemens HiPath RG-2500 Digital Gateway vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW May 2009
I compared the operation of the HiPath RG-2500 Digital Gateway to the US patent 5,912,888 technology and generate a claim chart.

42) Avaya G350 Media Gateway vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW April 2009
I compared and analyzed the operation of the Avaya G350 Media Gateway to the US patent 5,912,888 technology and generate a claim chart.

43) Grandstream GXW4108 vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW April 2009
I compared and analyzed the operation of the Grandstream GXW4108 to the US patent 5,912,888 technology and generate a claim chart.

44) Verilink 8208s Integrated Access Device vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW April 2009
I compared and analyzed the operation of the Verilink 8208s Integrated Access Device to the US patent 5,912,888 technology and generate a claim chart.

45) Lucent CellPipe Integrated Access Device vs USPN 5,912,888

Company/Project Number: VisionaryIP ACA200-GW April 2009
I compared and analyzed the operation of the Lucent CellPipe Integrated Access Device to the US patent 5,912,888 technology and generate a claim chart.

46) DirecTV Set-Top-Box Analysis

Company/Project Number: IP Enginuity IPE901161 January 2009 to March 2009
A DIRECTV Set-Top Box was analyzed to determine the structure of the files on the hard drive, and any other information about the files that could readily be observed. Analysis was done to compare operation to the US Patent 5,864,682. A detailed report was generated.

47) Windows Registry Software Tools Comparison for Copyright Infringement

Company/Project Number: TAEUS 08-FH001-000384, December 2008 – January 2009
A specific manufacture's Windows Registry Software Tools was disassembled and compared in operation to a competitor's software. This was done to find similarities of operation code routines. The work was done to determine if there were grounds for copyright infringement.

48) Sony Ericsson in the GC83 EDGE/GPRS PC Card V.42*bis* Discovery

Company/Project Number: TAEUS 09-BT001-000131, May 2009
I reverse engineered a Sony Ericsson in the GC83 EDGE/GPRS PC Card to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. A firmware upgrade for the GC83 was found and analyzed. The update executable contained firmware code to be run on the GC83 card. The GC83 firmware was disassembled and reverse engineered to compare the operation of the V.42*bis* data compression algorithm with the US Patent 5,153,591. A detailed report showing the operation was produced.

49) Sierra AirCard 775 Wireless Modem V.42*bis* Discovery

Company/Project Number: TAEUS 09-BT001-00087, April – May 2009
I reverse engineered a Sierra Wireless AirCard, model AC775, to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. The Sierra Wireless AirCard, model AC775, uses the Analog Devices AD20msp430 SoftFone™ baseband chipset. Upgrade firmware for the AirCard 775 was downloaded from the Sierra Wireless website. The file downloaded was ac7xxDNLD.exe. The ac77x.bin file was analyzed to determine the nature of the information contained in the file. The majority of the ac77x.bin file was found to contain ARM code. This binary code was disassembled and the resulting assembler-level code evaluated. The disassembled ARM code was further analyzed to determine the method of operation of the V.42*bis* data compression algorithm contained within the AC775 firmware upgrade file (ac77x.bin). The V.42*bis* compression algorithm was reverse engineered to compare its operation with the US Patent 5,153,591. A detailed report showing the operation was produced.

50) Advanced EDR Systems, LLC and Envision Engineering, LLC vs Design Solutions, Inc. and Sean O'Neil, Civil Action No. A07-CA-698 LY,

Direen Technical Consulting, August 2008 – January 2009

Law Firm: Scott, Douglass & McConnico, L.L.P, Austin TX
I was engaged by the Scott, Douglass & McConnico law firm as an expert witness for this case. The law suit dealt with purported failures of DSI (Design Solutions Inc.) to meet contractual and understood design requirements and schedules for the EnvisionCam product. I reviewed the product technology, schedules, design changes and related items in order to offer opinions related to the case. The case was settled before it reached the trial.

51) DirecTV HR21-700, Pace Micro TDC778 Tahoe Analysis

Company/Project Number: IP Enginuity IPE804221 August 2008
An external hard drive that contained programming from a Pace Micro TDC778, Tahoe, Set-Top Box was analyzed to determine the structure of the files on the hard drive, and any other information about the files that could readily be observed. Analysis was done to compare operation to the US Patent 5,864,682. A detailed report was generated.

52) AD1821 Signal Processing CoDecember V.42*bis* Discovery

Company/Project Number: TAEUS 08-BT001-000235, August 2008
I reverse engineered a Sierra Wireless AirCard, model AC775, to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. I disassembled the Windows driver for the AD1821 MODIO™ SoundComm™ Host Signal Processing CoDecember (AD1821) as a first step in the analysis. The V.42*bis* compression algorithm was found in the driver, and I reverse engineered the driver software to show its operation as compared to the US Patent 5,153,591. A detailed report showing the operation was generated.

53) wiseMODEM WVM90 Modem V.42bis Discovery

Company/Project Number: TAEUS 08-BT001-000131, June – July 2008
I reverse engineered a Sierra Wireless AirCard, model AC775, to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. I disassembled the MTLSTRM.SYS Windows driver for the UM9800 56K USB Modem as a first step in the analysis. The V.42*bis* compression algorithm was found in the driver, and I reverse engineered the driver software to show its operation in comparison to the US Patent 5,153,591. A detailed report showing the operation was generated.

54) Sony Ericsson GC83 EDGE/GPRS PC Card V.42*bis* Discovery

Company/Project Number: TAEUS 07-BT001-000118, April – May 2007
I reverse engineered a Sony Ericsson GC83 EDGE/GPRS PC Card (GC83 Card), to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. The GC83 Card is based on the Broadcom BCM2132 EDGE/GPRS/GSM Single-chip Multimedia Baseband processor which uses a ARM926EJ-S processor. Upgrade software for the GC83 card was obtained and the associated firmware for the GC83 card was extracted. This ARM926EJ-S based firmware was disassembled and analyzed. The V.42*bis* compression algorithm was successfully reverse engineered and a detailed report generated to show its operation in comparison to the US Patent 5,153,591.

55) UM9800 56K USB Modem V.42*bis* Discovery

Company/Project Number: TAEUS 07-BT001-11, February 2007
I reverse engineered a UM9800 56K USB Modem to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. The WVM90 contained a M29W800 8-megabit flash for storing all the software executed by the Analog Devices ADSP-2187L DSP. The M29W800 flash was removed from the WVM90 board and read by a Flash Reader. The output of the Flash Reader was a one-megabyte file containing all the firmware code and data tables used by the ADSP-2187L DSP for running the WVM90 modem. The V.42bis compression algorithm was discovered in the firmware after substantial effort. Evaluation of the V.42*bis* compression algorithm revealed that the manufacture took substantial measures to prevent the V.42*bis* routines from being reverse engineered. The V.42*bis* algorithm was hidden in a data-memory table and code obfuscation or code morphing was used. The V.42*bis* compression algorithm was successfully reverse engineered to show its operation as compared to the US Patent 5,153,591. A detailed report showing the operation was generated.

56) USR5699B 56K Fax Modem V.42*bis* Discovery

Company/Project Number: TAEUS A611866, January 2007
I reverse engineered a U.S. Robotics USR5699B 56K* Fax Modem to determine if it supported V.42*bis* compression and whether or not the V.42*bis* compression algorithm used the teachings of the British Telecom US patent 5,153,591. The Windows driver software, 3c1807pd.sys, was disassembled and the resulting code evaluated. The V.42*bis* compression algorithm was successfully reverse engineered and a detailed report generated to show its operation as compared to the US Patent 5,153,591.

57) AC97 SoftV92 Data Fax Modem V.42*bis* Discovery

Company/Project Number: TAEUS A610788, December 2006 – January 2007
A Conexant Systems AC97 SoftV92 Data Fax Modem and supporting Windows XP Driver software was reverse engineered for discovery of a V.42*bis* compression algorithm contained in the fax modem. The driver software, HSF_CNXT.sys, was disassembled and the resulting code evaluated. The V.42*bis* compression algorithm was successfully reverse engineered and a detailed report generated to show its operation as compared to the US Patent 5,153,591.

58) Yokogawa Coriolis Mass Flowmeter

Company/Project Number: TAEUS: A412735, January – June 2006
A Yokogawa Coriolis mass flowmeter was reverse engineered and its operation compared to a number of Micro Motion patents that relate to Coriolis mass flowmeters. This was a continuation of the reverse engineering of the flowmeter to determine the signal processing contained in the meter's NEC 78F4128 microprocessor that comes after the front-end digital signal processing contained in a TI DSP (reference project A409588 done in January – March 2005). Special software had to be designed and written to dump the code contained in the microprocessor's flash memory out the serial port. Code locking mechanisms designed into the NEC 78F4128 microprocessor had to be defeated in order to dump the code. There were no commercial or other disassemblers available for the NEC 78F4218 microprocessor so we wrote our own extension disassembler module for the IDA Pro disassembler tool. Only incomplete

sections of code could be obtained from the NEC 78F4128 microprocessor which ended up preventing successful reverse engineering of the signal processing algorithms in the flowmeter.

59) Windows Media Audio Reverse Engineering

Company/Project Number: TAEUS: A507935, July 2005 – November 2005
Microsoft's Windows Media Audio (WMA) was reverse engineered so that the underlying audio coDecember algorithms could be compared to a number of audio encoder and decoder patents. The WMA encoder wmadmoe.dll and decoder wmadmod.dll were specifically isolated and disassemble for analysis. The wmadmoe.dll and wmadmod.dll files are binary files that contains the machine code (computer processor instructions and data) for encoding and decoding audio. The decompiled code did not contain any of the original code subroutine or variable names, nor did it contain any of the original software engineer's notes or comments. Once the dynamic link libraries (dll) were disassembled into assembly code, the effort of analyzing and annotating the code began. The WMA encoder uses a complex array of variable structures and objects. All of these structures and objects had to be discovered through analysis of the assembly code. The primary encoding and decoding algorithms used by WMA were discovered and analyzed so they could be compared to related audio encoding and decoding patents. Sponsors of the project that I worked with included AT&T, Dolby, Sony, Philips, and Fraunhofer.

60) WMA vs USPN 5,394,473

Company/Project Number: TAEUS: A405951, June – September 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Dolby's US patent 5,394,473: *Adaptive-block-length, adaptive-transform, and adaptive-window transform coder, decoder, and encoder/decoder for high-quality audio.* I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '473 patent.

61) WMA vs USPN 4,914,701

Company/Project Number: TAEUS: A405951, June – September 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Dolby's US patent 4,914,701: *Method and apparatus for encoding speech.* I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '701 patent.

62) WMA vs USPN 4,790,016

Company/Project Number: TAEUS: A405951, June – September 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Dolby's US patent 4,790,016**:** *Adaptive method and apparatus for coding speech.* I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '016 patent.

63) WMA vs USPN 5,592,584

Company/Project Number: TAEUS: A411674, October 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in

AT&T's US patent 5,592,584: *Method and Apparatus for Two-Component Signal Compression*. I wrote a report for AT&T on the relationship between perceptual thresholds and the WMA weighting function. I also wrote a report covering the MDCT (Modified Discrete Cosine Transform) used in WMA. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '584 patent.

64) WMA vs USPN 5,481,614

Company/Project Number: TAEUS: A411674, February 2005 – January 2006
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in AT&T's US patent 5,481,614: *Method and apparatus for coding audio signals based on perceptual model*. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '614 patent.

65) WMA vs USPN 6,466,912

Company/Project Number: TAEUS: A411674, February 2005 – January 2006
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in AT&T's US patent 6,466,912: *Perceptual Coding of Audio Signals Employing Envelope Uncertainty*. I produced a report on the possible WMA Analysis by Synthesis Loop. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '912 patent.

66) WMA vs US Re. 36,559

Company/Project Number: TAEUS: A411697, February 2005 – July 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Sony's US patent Re. 36,559: *Method and Apparatus for Encoding Audio Signals Divided into a Plurality of Frequency Bands*. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '559 patent.

67) WMA vs USPN 5,299,238

Company/Project Number: TAEUS: A411697, February 2005 – July 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Sony's US patent 5,299,238: *Signal Decoding Apparatus*. I produced detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '559 patent.

68) WMA vs USPN 5,661,755

Company/Project Number: TAEUS: A411698, August 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Philips's US patent 5,661,755: *Encoding and decoding of a wideband digital information signal*. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '755 patent.

69) WMA vs USPN 5,579,430

Company/Project Number: TAEUS: A503751, May – September 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in

Fraunhofer's US patent 5,579,430: *Digital Encoding Process*. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '430 patent.

70) WMA vs USPN 5,848,391

Company/Project Number: TAEUS: A503751, May – September 2005
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in Fraunhofer's US patent 5,848,391: *Method subband of coding and decoding audio signals using variable length windows*. I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '391 patent.

71) WMA vs USPN 5,185,800

Company/Project Number: TAEUS: A512252, January - March. 2006
The Windows Media Audio (WMA) was reverse engineered and compared to the technology taught in French Telecom's US patent 5,185,800: *Method of transmitting or storing sound signals in digital form through predictive and adaptive coding and installation therefore*. In order to analyze the US patent 5,185,800 against the WMA (Windows Media Audio) encoder a test signal was generated. The test signal was then encoded with the WMA encoder in a constant Bit-rate mode, 70 kilobits per second format. The test signal generated was comprised of:

1. A low level sinewave at 4.5 kHz
2. A low level sinewave at 5.0 kHz
3. Low level random noise
4. A windowed high level sinewave at 4.8 kHz injected for a short period of time.

The test signal was generated in Wave File format. This signal was encoded by the WMA encoder. The resultant WMA encoded file was then decoded by a WMA compatible decoder. The WMA compatible decoder was instrumented so that internal signals of interest could be captured. WMA uses spectral weighting functions to control the granularity of the spectral coefficient quantization process. Analysis of the spectral weighting functions show that the boundaries of the weighting functions lie on Bark-Band boundaries. Bark-Bands are critical frequency bands representative of the cochlear filer bands.

I generated detailed claim charts demonstrating the similarities in the audio signal processing algorithms used in WMA to those found in the '800 patent.

72) Krohne Optimass Mass Flowmeter

Company/Project Number: TAEUS: A501619 and A501651, March – June 2005
I reverse engineered a Krohne Optimass Flow Meter (Krohne meter) to determine the technical similarity to USPN 6,505,131 (Multi-rate digital signal processor for signals from pick-offs on a vibrating conduit) assigned to Micro Motion, Inc. During an initial project phase, I analyzed portions of the PC boards and was able to extract the code from an EPROM. The code was reverse engineered to reveal digital-signal-processing algorithms that were compared to the claim limitations of USPN 6,505,131. A detail report of the flowmeter's operation was produced along with a claim chart.

73) Biosite Triage Meter

Company/Project Number: TAEUS: A406018, January 2005
I reverse engineered the calibration storage within the Biosite Triage Meter to determine what calibration variables were used.

74) Yokogawa Coriolis Mass Flowmeter

Company/Project Number: TAEUS: A409588, January - March 2005
A Yokogawa Coriolis mass flowmeter was reverse engineered and its operation compared to a number of Micro Motion patents that relate to Coriolis mass flowmeters. The project involved reverse engineering both the electronic hardware and digital signal processing elements of the flowmeter. The flowmeter contained a TI TMS320LF2406 DSP used for the front-end signal processing. The firmware associated with the DSP was extracted, disassembled and analyzed to determine the flowmeter's algorithms used to measure mass flow. These algorithms were compared with a number of Micro Motion patented algorithms to determine if any of the patents were being infringed by the Yokogawa Coriolis mass flowmeter.