

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

Apple Inc.
“Apple”
Petitioner

v.

Advanced Coding Technologies, LLC
“ACT”
Patent Owner

INTER PARTES REVIEW OF U.S. PATENT NO. 7,804,891

DECLARATION OF MR. DAVID B. LETT

I declare that all statements made in this declaration on 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.

Date: 6/30/2025

By: David B. Lett

David B. Lett

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I, David B. Lett, do hereby declare:

I. Introduction

1. My name is David Lett, and I have been retained by counsel for Apple Inc. (“Apple”) as an expert witness to assist in analyzing issues related to the patentability of claims 1-9 of U.S. Patent No. 7,804,891, “the ’891 Patent.” I understand that Apple intends to submit this declaration in support of a petition for *inter partes* review (“IPR”) of the ’891 Patent before the Patent Trial and Appeal Board (“PTAB”) of the United States Patent and Trademark Office (“USPTO”).

2. I am being compensated for my work in this matter at my standard hourly rate. My compensation in no way depends on the outcome of this proceeding or the content of my testimony.

3. My analysis here is based on my years of education, research and experience, as well as my investigation and study of relevant materials, including those cited herein. I may rely upon these materials, my knowledge and experience, and/or additional materials to further explain and corroborate my analysis, and to respond to any critiques of my analysis that may be raised during the course of the IPR proceeding in which this declaration is submitted.

II. Materials Considered

4. I have reviewed the IPR Petition that Apple is submitting to the PTAB to challenge claims 1-9 of the ’891 Patent. In fact, in preparing this declaration, I

collaborated with counsel in developing the obviousness grounds set forth in the Petition. Based on my review, the Petition accurately portrays my opinions regarding the unpatentability of claims 1-9 of the '891 Patent. I fully endorse the obviousness grounds, including the proposed prior art combinations and mapping of those prior art combinations to the elements of claims 1-9 as described in the Petition.

5. In addition to the Petition, I reviewed the following materials in the course of preparing this declaration on the '891 Patent:

- EX1001 U.S. Patent No. 7,804,891 to Majima (“the '891 Patent”)
- EX1002 Excerpts from the Prosecution History of the '891 Patent (“the Prosecution History”)
- EX1004 JP Publication No. JPH05260021A and Certified English Translation (“Yamane”)
- EX1005 U.S. Patent No. 6,512,748 (“Mizuki”)
- EX1006 U.S. Patent No. 5,425,053 (“Matsumoto”)
- EX1007 U.S. Patent No. 5,502,713 (“Lagerqvist”)
- EX1008 U.S. Patent No. 6,456,831 (“Tada”)
- EX1009 U.S. Patent No. 6,232,906 (“Tada-906”)
- EX1010 Design of a Robust Baseband LPC Coder for Speech Transmission over 9.6 Kbit/s Noisy Channels (1982), *available at <https://ieeexplore.ieee.org/document/1095525>*

- EX1011 Stefanovic, *Vocoder Model based Variable Rate Narrowband and Wideband Speech Coding below 9kbps* (1999), available at <https://www.proquest.com/docview/1814373345?%20Theses&fromopenview=true&pq-origsite=gscholar&sourcetype=Dissertations%20>
- EX1012 U.S. Patent No. 5,432,778 (“Minde”)
- EX1013 U.S. Patent No. 6,519,740 (“Martensson”)
- EX1014 Complaint, *Advanced Coding Technologies LLC v. Apple Inc.*, 2-24-cv-00687, E.D. Tex., filed Aug. 20, 2024
- EX1015 Patent Owner’s Infringement Chart for the ’891 Patent, *Advanced Coding Technologies LLC v. Apple Inc.*, 2-24-cv-00687, E.D. Tex., filed Aug. 20, 2024
- EX1016 U.S. Patent Application Publication No. 2004/0203941 (“Kaplan”)
- EX1017 Newaskar, *A/D Precision Requirements for an Ultra-Wideband Radio Receiver* (1999), available at https://web.archive.org/web/20170810194425id_/http://www-mtl.mit.edu/researchgroups/icsystems/uwb/docs/SIPS_2002_A_DC_resolution.pdf
- EX1018 U.S. Patent No. 6,184,829 (“Stilp”)
- EX1019 Landau, *Sampling, Data Transmission, and the Nyquist Rate*, Proceedings of the IEEE, Vol. 55, No. 10 (Oct. 1967)

III. Qualifications

A. Summary

6. I am a technical consultant and product development industry veteran with expertise in electronics, software, hardware, video, audio, and data communications (including wireless cellular and Bluetooth), having led product development organizations in cable, satellite, consumer electronics, asset tracking, remote tank logistics, and alarm industries. My current *curriculum vitae* is attached as Appendix A and some highlights follow.

7. I earned my B.S. in Electrical Engineering (1982) with high honors from the University of Tennessee in Knoxville, Tennessee. I also attended the Georgia Institute of Technology from 1986 to 1987, completing 40% of the required degree hours for the M.S. Electrical Engineering program.

8. From 1982 to 1985, I worked at Scientific Atlanta as an Electrical Engineer designing video, audio, and data communications equipment for the cable television industry. I designed software and hardware including addressable data transmitters, video sync suppression scramblers, transaction format converters, and data channel monitors for addressable Cable Television systems and Set Top Boxes.

9. From 1983 to 1985, while working at Scientific Atlanta, I also worked as an Assistant Professor at DeVry Institute of Technology, teaching courses in electronics and microprocessor hardware/software.

10. From 1985 to 1990, I worked at Wegener Communications as a Senior Electrical engineer, designing satellite communications equipment including forward error correction (FEC) coding systems, PSK modems, and analog control systems for RF modulators and PSK demodulators. I was promoted to the Hardware Engineering Manager, where I managed product development of video, audio, and data satellite receivers, modulators, graphics display systems, DSP-based companders, FSK and PSK satellite modems, multiplexers, forward error correction (FEC) codecs, RF upconverters and downconverters, and baseband analog and digital processing components.

11. In 1990, I returned to Scientific Atlanta, which was acquired by Cisco in 2006. I worked as Engineering Manager running the set top box engineering group where I was promoted to Director and Vice President during my tenure until 2011. I led the design of many cable set top boxes and systems through the evolution of analog video, addressability, downloadable software, electronic program guides, digital video, software applications, high-definition TV, DVR, DOCSIS, full spectrum tuners, and multiroom DVR. These systems implemented various technologies including DOCSIS 1/2/3 and hybrid gateways, 802.11, IPTV, DVR, cable modems, ADSL, VDSL, DVB-T/C/S, bootloaders, factory diagnostics, application frameworks, Nagra, DRMs, conditional access, secure microprocessors, device management, Android, Adobe Flash, Linux, DVD play/record, MPEG-4,

MPEG-2, H.264, NTSC, PAL, DAVIC, MoCA, high-performance CPUs, cablecards, network processors, HDMI, multiple video/audio display interfaces, 2D/3D graphics, and multiple RF tuners.

12. From 2011 to 2016, I worked for EchoStar Technologies, which served as the product development organization for sister company DISH Network. I served as Vice President of Engineering and was the Head of the Atlanta research and development center. I led the development of satellite set top boxes, consumer electronic equipment, and a home automation and security system. Technologies used included video/audio, IoT, H.265, HEVC, 3D, Satellite, wireless Zigbee, Z-Wave, Wi-Fi, Bluetooth, MoCA, transcoding, embedded C Linux applications, mobile applications (IOS and Android), SaaS, web applications (Javascript, HTML), BSS/OSS, AWS cloud storage, 2-way video/audio streaming, authentication, and VoIP.

13. In 2016, I started an independent consulting business in technology and intellectual property projects. I have consulted in various technology areas and industries including consumer electronics, cable, satellite, television, video/audio/image processing, multimedia content, networking, security, camera, online advertising, and Internet of Things (IoT).

14. From 2019 to 2022, I worked as Chief Technology Officer for Telular, an Ametek company. I was responsible for the development of Industrial IoT (IIoT)

recurring revenue solutions, combining wireless technologies (cellular, Bluetooth, sub-GHz, GPS, and satellite), purpose-built hardware, and SaaS in the commercial telematics, security and home automation markets and sold under the SkyBitz and Telguard Brands.

15. My record of professional service includes awards on products I designed and developed from several organizations in my field of expertise, including Best of Show, Technology Emmy, and Best of Innovations.

16. I am a named inventor on at least 119 issued patents and published patent applications corresponding to the areas of my professional work. The patents and published applications involving telecommunications, video, and audio technologies include:

- U.S. Patent No. 9,615,139 titled “Determining Device That Performs Processing of Output Pictures”
- U.S. Patent No. 9,495,860 titled “False Alarm Identification”
- U.S. Patent No. 9,882,736 titled “Remote Sound Generation for a Home Automation System”
- European Patent No. 1,552,698 and Canada Patent No. 2,501,112 titled “Video transmission systems and methods for a home network”

- U.S. Patent Nos. 8,120,924, 7,240,217, 6,785,817, 6,564,324, 6,212,278 and 5,440,632 titled “Reprogrammable subscriber terminal”
- U.S. Patent Application No. US2015/0160635 titled “Multi-Tiered Feedback-Controlled Home Automation Notifications”
- U.S. Patent No. 9,495,860 titled “False alarm identification”
- U.S. Patent No. 8,549,567 titled “Media Content Sharing Over a Home Network”
- U.S. Patent Nos. 9,247,409 and 9,691,261 titled “Home Automation Communications”
- U.S. Patent No. 5,657,414 and European Patent No. 0,672,323 titled “Auxiliary device control for a subscriber terminal”
- Canada Patent No. 2,478,838 titled “Exporting data from a digital home communication terminal to a client device”
- U.S. Patent No. 5,592,551 titled “Method and apparatus for providing interactive electronic programming guide”
- U.S. Patent No. 8,161,388 and Canada Patent No. 2,554,208 titled “Interactive discovery of display device characteristics”
- U.S. Patent No. 7,908,625 titled “Networked Multimedia System”

- U.S. Patent Nos. 7,861,272 and 7,849,486 titled “Networked subscriber television distribution”
- U.S. Patent Nos. 7,774,820 and 7,069,578 titled “Settop cable television control device and method including bootloader software and code version table for maintaining and updating settop receiver operating system software”
- U.S. Patent No. 5,715,515 titled “Method and apparatus for downloading on-screen graphics and captions to a television terminal”
- U.S. Patent No. 5,539,822 titled “System and Method for Subscriber Interactivity in a Television System”
- U.S. Patent No. 5,771,064 titled “Home communications terminal having an applications module”
- U.S. Patent Application Publication No. 2004/0133911 and PCT Patent Application Publication No. 2004/4047457 titled “Subscriber Network in a Satellite System”
- U.S. Patent No. 5,367,571 titled “Subscriber terminal with plug in expansion card”
- U.S. Patent No. 5,357,276 titled “Method of Providing Video On Demand with VCR Like Functions”

- U.S. Patent No. 9,941,623 titled “Flat ethernet cables and associated systems, devices, and methods”
- U.S. Patent No. 4,817,148 titled “Signal scrambling transmission system”

IV. Legal Standards

17. I have been asked to provide my opinions as to whether claims 1-9 of the '891 Patent would have been obvious to a person of ordinary skill in the art as of the earliest claimed priority date of the '891 patent (Mar. 31, 2004) (“Critical Date”).

18. I am an engineer by training and profession. The opinions I express in this declaration involve the application of my technical knowledge and experience to the evaluation of certain prior art with respect to the '891 Patent. In addition, I understand that the following legal principles apply.

19. It is my understanding that, in determining whether claims of the '891 patent are obvious in this proceeding, the claim terms are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the relevant art. A person of ordinary skill in the art would read the claim terms in the context of the entire patent specification in which they appear, as well as the prosecution history of the patent.

20. It is my understanding that a claim is unpatentable under 35 U.S.C. § 103 if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention. I also understand that an obviousness analysis takes into account the scope and content of the prior art, the differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art at the time of the invention.

21. In determining the scope and content of the prior art, it is my understanding that a reference is considered relevant prior art if it falls within the field of the inventor's endeavor. In addition, a reference is prior art if it is reasonably pertinent to the particular problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have commended itself to an inventor's attention in considering his problem. If a reference relates to the same problem as the claimed invention, that supports use of the reference as prior art in an obviousness analysis.

22. To assess the differences between prior art and the claimed subject matter, it is my understanding that 35 U.S.C. § 103 requires the claimed invention to be considered as a whole. This "as a whole" assessment involves showing that one of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would

have selected the elements from the prior art and combined them in the claimed manner.

23. It is my further understanding that several rationales may be applied for combining references or modifying a reference to show obviousness of claimed subject matter. These rationales include: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify a prior art reference or to combine prior art teachings to arrive at the claimed invention.

V. Overview of the '891 Patent

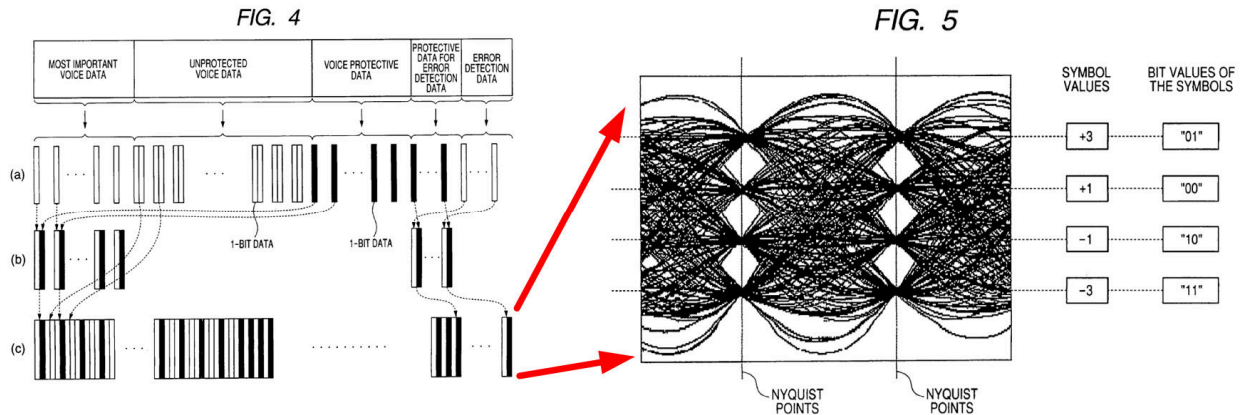
A. Brief Description

24. The '891 Patent describes techniques for encoding voice data and modulating the encoded signals for transmission to a receiver. EX1001, 1:14-2:44, 2:48-4:29, 5:38-7:40, FIGS. 1-4. In an embodiment, the transmitter separates the voice data into groups including “most important” bits that are afforded a higher level of protection against transmission errors and “unprotected” bits that are

afforded a lower level of protection. EX1001, 6:4-55, 8:27-55, 10:21-54, FIGS. 3-4. To prepare the voice data for transmission, the transmitter interleaves the most important bits of the voice data with “protective” bits that have a predetermined value (e.g., “1”) to create interleaved pairs consisting of a most important bit from the coded voice data and a protective bit of a predetermined value (e.g., “1”). EX1001, 5:59-6:15, 6:46-50, 6:66-7:31, FIGS. 3-4. The interleaver likewise creates bit pairs consisting of two unprotected voice data bits. *Id.*

25. Each 2-bit pair corresponds to a different symbol in a four-value modulation scheme (e.g., frequency-shift keying (FSK)) that is used to transmit the voice data to a receiver over a noisy communication channel. EX1001, 7:17-40, FIG. 4. Noticeably, because a predetermined protective bit is paired with each most-important voice data bit, only two of the four transmission symbols can be used to represent a most-important voice data bit, while the unprotected voice data bits can be represented by all four symbols. EX1001, 7:41-8:3, FIG. 5. This makes the most-important bits more resilient to noise than unprotected bits because the most-important bits map to symbols that are more readily discriminated in the modulated signal than symbols representing the unprotected bits. For example, as shown below in FIG. 5, the pairing of a most-important bit with a predetermined protective bit (e.g., “1”) means that the most-important bit can only be mapped to a +3 or -3 symbol depending on whether the value of the most-important bit is “1” or “0.” *Id.*

These symbols provide maximum frequency separation in the disclosed 4-value FSK scheme. By contrast, the pairs of unprotected bits can be mapped to any of the four symbols, leaving less frequency separation between them. EX1001, 5:1-37, 7:41-8:47, FIG. 5.



EX1001, FIGS. 4-5 (annotated).

26. The transmitter then sends the modulated signal to a receiver. EX1001, 4:54-5:37, 8:56-9:12, FIG. 6. In addition to demodulating and decoding the signal, the receiver is also configured to judge a communication quality of the channel based on how many of the protective bits were decoded to the predetermined value (e.g., "1") as expected versus how many of the protective bits were decoded to an incorrect value (e.g., "0") that does not match the expected/predetermined value. EX1001, 9:13-67, FIG. 6. For example, channel noise may have corrupted the modulated signal during transmission and caused the symbol for a most-important data bit—protective bit pair that was transmitted as a +3 symbol ("01") to be

incorrectly judged as a +1 symbol (“00”) at the receiver. The “0” value of the most-important data bit is still correctly portrayed by the +1 symbol, but the change in of the protective bit from 1 to 0 indicates a degradation in channel quality.

27. Based on comparing the values of the protective bits as received with an expected result, the receiver judges a communication quality of the transmission channel. EX1001, 9:13-25, 10:5-12:28, FIG. 6. If the channel quality is sufficiently degraded, the receiver can determine to take one or more actions to change the voice data. EX1001, 9:13-25, 10:5-12:28, FIG. 6. These actions can include making a “predetermined change” to the data, replacing the data, “substantially destroying” the data, or attenuating the data. EX1001, 3:10-40, 9:13-25, 11:7-12:28, FIG. 6.

28. For reference, I provide the following listing of challenged claim elements from the ’891 Patent:

Claim 1	
[1pre]	A communication quality judging device comprising:
[1a]	a symbol judging means for obtaining a baseband signal representative of a sequence of multilevel symbols and judging the symbol represented by the baseband signal;
[1b]	a communication quality judging means for judging communication quality of a transmission channel over which the baseband signal has been transmitted, based on content of the symbol judged by the symbol judging means; and

[1c]	a data changing means for, if the communication quality judged by the communication quality judging means does not satisfy a predetermined condition, making a predetermined change to the data to be transmitted represented by the symbol used in the judgment,
[1d]	wherein at least a portion of a bit string is distinguished as a protected portion, the bit string constituting data to be transmitted represented by the sequence of symbols, and at least a portion of the symbol that belongs to the sequence of symbols contains a bit belonging to the protected portion and a redundant bit having a predetermined value, and
[1e]	wherein the communication quality judging means identifies the number of redundant bits having the predetermined value or the number of redundant bits missing the predetermined value among the redundant bits contained in the symbol that contains a bit belonging to the protected portion, and judges the communication quality of the transmission channel based on the identified result.
Claim 2	
[2]	The communication quality judging device according to claim 1, wherein the data changing means comprises means for externally obtaining a parameter that defines at least a portion of the condition.
Claim 3	
[3]	The communication quality judging device according to claim 1 or 2, wherein the predetermined change includes a process of substantially destroying the data to be transmitted represented by the symbol used to judge that the communication quality does not satisfy a predetermined condition.
Claim 4	

[4]	The communication quality judging device according to claim 1 or 2, wherein the predetermined change includes a process of replacing the data to be transmitted represented by the symbol used to judge that the communication quality does not satisfy a predetermined condition, with previous data represented by a symbol previously obtained by the symbol judging means.
Claim 5	
[5]	The communication quality judging device according to claim 4, wherein the predetermined change further includes a process of substantially destroying the data to be transmitted that follows last replaced data and that is represented by the symbol used to judge that the communication quality does not satisfy a predetermined condition, when more than a predetermined number of replaced data continues.
Claim 6	
[6]	The communication quality judging device according to claim 1 or 2, wherein the data to be transmitted is composed of data representative of strength of a variable, and the predetermined change includes an attenuating process of changing the data to be transmitted represented by the symbol used to judge that the communication quality does not satisfy a predetermined condition, to a data equivalent in which the variable represented by the data is attenuated.

Claim 7	
[7]	The communication quality judging device according to claim 6, wherein, when first data, which is transmitted immediately before second data to be subjected to the attenuating process, has been subjected to the attenuating process, the attenuating process provided to the second data consists of a process of changing the second data to a data equivalent in which the variable represented by the second data is attenuated at an attenuation ratio larger than that for the variable represented by the first data.
Claim 8	
[8pre]	A communication quality judging method, the method comprising the steps of:
[8a]	obtaining a baseband signal representative of a sequence of multilevel symbols and judging the symbol represented by the baseband signal;
[8b]	judging communication quality of a transmission channel over which the baseband signal has been transmitted, based on content of the symbol judged in the symbol judging step; and
[8c]	changing data if the communication quality judged in the communication quality judging step does not satisfy a predetermined condition, to make a predetermined change to the data to be transmitted represented by the symbol used in the judgment,
[8d]	wherein at least a portion of a bit string is distinguished as a protected portion, the bit string constituting data to be transmitted represented by the sequence of symbols, and at least a portion of the symbol that belongs to the sequence of symbols contains a bit belonging to the protected portion and a redundant bit having a predetermined value, and

[8e]	wherein, in the communication quality judging step, the number of redundant bits having the predetermined value or the number of redundant bits missing the predetermined value is identified among the redundant bits contained in the symbol that contains a bit belonging to the protected portion, and the communication quality of the transmission channel is judged based on the identified result.
Claim 9	
[9pre]	A computer program causing a computer to execute the steps of:
[9a]	obtaining a baseband signal representative of a sequence of multilevel symbols and judging the symbol represented by the baseband signal;
[9b]	judging communication quality of a transmission channel over which the baseband signal has been transmitted, based on content of the symbol judged in the symbol judging step; and
[9c]	changing data if the communication quality judged in the communication quality judging step does not satisfy a predetermined condition, to make a predetermined change to the data to be transmitted represented by the symbol used in the judgment,
[9d]	wherein at least a portion of a bit string is distinguished as a protected portion, the bit string constituting data to be transmitted represented by the sequence of symbols, and at least a portion of the symbol that belongs to the sequence of symbols contains a bit belonging to the protected portion and a redundant bit having a predetermined value, and
[9e]	wherein, in the communication quality judging step, the number of redundant bits having the predetermined value or the number of redundant bits missing the predetermined value is identified among the redundant bits contained in the symbol that contains a bit belonging to the protected portion, and the communication quality of the transmission channel is judged based on the identified result.

B. Prosecution History

29. The Examiner issued just one Office Action during original examination of the '891 Patent. EX1002, 192-202. In this Office Action, the independent claims were rejected as obvious over Minde (EX1012) in view of Martensson (EX1013). EX1002, 192-202. The applicant responded by amending independent claim 1 to require “data changing means” that can make a “predetermined change to the data” when the judged communication quality “does not satisfy a predetermined condition.” EX1002, 212-220. This feature was originally recited in a dependent claim that the Examiner deemed allowable in the first Office Action. Independent claims 9 and 10 were amended to recite similar features. EX1002, 212-220. Following these amendments, the Examiner allowed the application and the '891 Patent was granted. EX1002, 224-227.

VI. Person of Ordinary Skill in the Art

30. It is my understanding that the patentability of the claims of the '891 Patent must be assessed from the perspective of a person of ordinary skill in the art at the time of the alleged invention (“POSITA”). For purposes of my analysis in this declaration, I have taken the earliest claimed priority date of the '891 Patent (Mar. 31, 2004) as the date of the alleged invention (“Critical Date”). I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the

types of problems encountered in the field; the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a POSITA is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a POSITA would also have knowledge from the teachings of the prior art, including the art cited below.

31. Taking these factors into consideration, it is my opinion that a person of ordinary skill in the art for the '891 Patent by the Critical Date ("POSITA") would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, or equivalent, and two years of industry experience in telecommunications and audio coding. Additional education might compensate for less experience, and vice versa.

32. I have possessed the qualifications of a POSITA since the Critical Date of the '891 Patent, and long before.

VII. Claim Construction

33. Other than the claim terms identified below, I have not been asked to opine on the special meanings of claim terms within the '891 patent. I have been informed that the claim terms should be afforded their ordinary meaning in view of the specification and file history. By addressing the relevance of the prior art to the various terms and limitations in claims 1-9, I have not intended to formally construe

any claim terms beyond those identified below. I have not formed an opinion as to whether the claims are definite or adequately supported by the specification of the '891 Patent.

A. “data to be transmitted” (all claims)

34. Independent claims 1, 8, and 9 each include limitations that refer to “data to be transmitted.” In the context of the claims and specification of the '891 Patent, a POSITA would have understood the term “data to be transmitted” in the claims to encompass data that was to be transmitted by a transmitter and that has been received by a receiver. This interpretation is consistent with the logical structure of the claim and the specification of the '891 Patent.

35. For example, claim 1 recites the following components of a “communication quality judging device” in Elements [1a]-[1c]:

[1a] a symbol judging means for *obtaining a baseband signal representative of a sequence of multilevel symbols* and judging *the symbol represented by the baseband signal*;

[1b] a communication quality judging means for judging communication quality of a transmission channel over which *the baseband signal has been transmitted*, based on content of the symbol judged by the symbol judging means; and

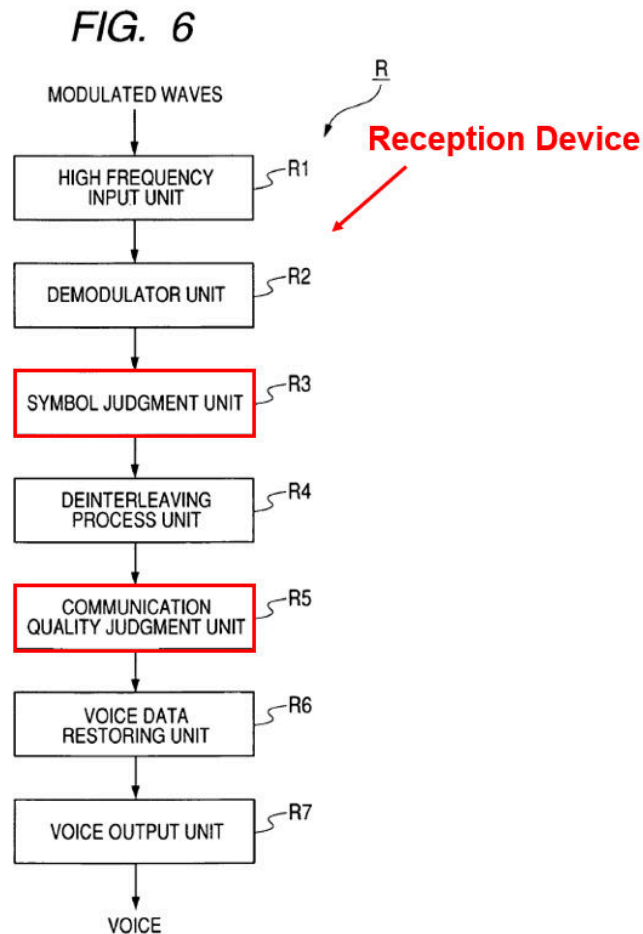
[1c] a data changing means for, if the communication quality judged by the communication quality judging means does not satisfy a predetermined condition, ***making a predetermined change to the data to be transmitted represented by the symbol*** used in the judgment,

EX1001, 15:35-63.

36. As shown above, in claim 1, the “data to be transmitted” is represented by a judged “symbol” and the judged symbol is in turn represented by a “baseband signal [that] ***has been transmitted.***” *Id.* In other words, the “data to be transmitted” refers to data represented by a symbol in a baseband signal that has been transmitted by the time the communication quality judging device performs the functions recited in claim 1. This is logical because the communication quality judging means is an element of the receiver that judges the communication quality of the transmission channel by evaluating bits in a ***transmitted*** signal. *Id.* Notably, the ’891 Patent describes no means of judging the quality of a transmission channel based on data that has not yet been transmitted.

37. The specification of the ’891 Patent is consistent with this understanding. For instance, the ’891 Patent explicitly discloses the functions of judging symbols, judging communication quality, and changing data as functions performed by a “symbol judgment unit R3” and “communication quality judgment unit 5” of a “***reception device R.***” EX1001, 8:56-9:25, 9:36-10:9, 10:45-12:10, FIG.

5. Even in the preferred embodiments of the '891 Patent, “obtaining a baseband signal,” “judging communication quality of a transmission channel,” and “making a predetermined change to the data to be transmitted” are each performed by a reception device (i.e., a receiver), using data that has already been transmitted from a transmission device. While the specification uses the term “data to be transmitted,” its use is in the context of operations performed by the transmitter rather than the receiver as recited in claim 1. *See, e.g.*, EX1001 13:15-21, FIG. 2.



EX1001, FIG. 6 (annotated).

38. Independent claims 8 and 9 refer to “data to be transmitted” similarly to claim 1. Consequently, the claim term “data to be transmitted” should be interpreted to at least encompass data that was to be transmitted by a transmitter and that has been received by a receiver.

B. Means-Plus-Function Elements (claim 1)

39. Elements [1a]-[1c] and [2] respectively recite “means for” performing functions without further recitation of structure.¹ EX1001, 15:35-63. As such, I have been informed by counsel that these claim elements “shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” 35 U.S.C. §112(6); 37 C.F.R. §42.104(b)(3).

40. The specification of the '891 Patent explains that corresponding components of the reception device R, including the symbol judgement unit R3, communication quality judgement unit R5, and data restoring unit R6, are each “composed of a processor, a memory that stores a program executed by the processor, and the like.” EX1001, 9:13-25, 14:44-15:25. Because these components can be implemented with a general-purpose processor that executes “a program” stored in memory, the scope of Elements [1a]-[1c] encompass a processor

¹ Element [1e] further describes the function performed by the “communication quality judging means” of Element [1b].

configured to perform algorithm steps for carrying out the respective function(s) recited by each claim element and equivalents. The corresponding structure also encompasses “special purpose electronics” in lieu of a processor. EX1001, 13:1-4 (“any portion composed of a processor ... may be composed of a special purpose electronics instead of the processor”).

1. “symbol judging means” (Element [1a])

41. The recited function for the “symbol judging means” is “obtaining a baseband signal representative of a sequence of multilevel symbols and judging the symbol represented by the baseband signal.” The ’891 Patent discloses a “symbol judgment unit R3” of reception device R and its operation, for example, at col. 9:5-10:4 and FIG. 6. *See* EX1001, 9:5-10:4, FIG. 6. The specification explains that the symbol judgment unit R3 obtains the baseband signal from demodulator unit R2. EX1001, 9:5-12. The ’891 Patent also discloses that when an instantaneous value of the baseband signal is greater than a first threshold ($Th+$), symbol judgment unit R3 determines that the symbol is “01,” when the instantaneous value is not less than a second threshold ($Th0$) and less than $Th+$, unit R3 determines that the symbol is “00,” when the instantaneous value is not less than a third threshold ($Th-$) and less than $Th0$, unit R3 determines that the symbol is “10,” and when the instantaneous value is less than ($Th-$), unit R3 determines that the symbol is “11.” EX1001, 9:36-10:4, FIG. 6.

42. Based on this disclosure, the corresponding structure/algorithm for the “symbol judging means” encompasses special-purpose electronics or a general-purpose processor that performs the recited function by obtaining from a demodulator a baseband signal representative of a sequence of multilevel symbols and judging the symbol by comparing the symbol level to a set of thresholds, and equivalents thereof. EX1001, 9:13-25.

2. “communication quality judging means” (Elements [1b], [1e])

43. The recited function for the “communication quality judging means” is “judging communication quality of a transmission channel over which the baseband signal has been transmitted, based on content of the symbol judged by the symbol judging means...[by] identif[ying] the number of redundant bits having the predetermined value or the number of redundant bits missing the predetermined value among the redundant bits contained in the symbol that contains a bit belonging to the protected portion.” The ’891 Patent discloses a “communication quality judgement unit R5” of reception device R and its operation, for example, at col. 10:45-12:10, 15:39-43, 15:56-63, and FIG. 6; *see also id.*, 6:46-50. The specification attributes several functions to the communication quality judgment unit R5, but claim 1 focuses specifically on the function of judging communication quality of a transmission channel based on content of the symbol judged by the symbol judging

means by identifying the number of redundant bits having the predetermined value or the number of redundant bits missing the predetermined value and judging the communication quality of the transmission channel based on the identified result. EX1001, 15:39-43, 15:56-63. Regarding this function, the specification discloses the following:

[T]he communication quality judgment unit R5 identifies how many bits have a value of “0” (incorrectly though it would normally have a value of “1”) in the protective data in the vocoder output data received in step S1, and determines whether or not the identified number x satisfies the relationship ($n < x < m$) with respect to a predetermined lower limit n and a predetermined upper limit m (where n is an integer not less than 0, and m is an integer greater than n) (step S3). ... It is considered that the number x of erroneous bits in the protective data is indicative of the poorness of communication quality of the transmission channel L.

EX1001, 10:63-11:6, 11:46-48; *see also id.*, 6:46-50; 10:63-11:6.

44. Based on this disclosure, the corresponding structure/algorithm for the recited “communication quality judging means” encompasses special-purpose electronics or a processor configured to perform the recited function by evaluating the number of redundant bits x that do or do not have the predetermined value with

respect to a predetermined lower limit n and a predetermined upper limit m (where n is an integer not less than 0, and m is an integer greater than n), and equivalents thereof.

3. “data changing means” (Element [1c])

45. The recited function for the “data changing means” is “if the communication quality judged by the communication quality judging means does not satisfy a predetermined condition, making a predetermined change to the data to be transmitted represented by the symbol used in the judgment.” The ’891 Patent discloses that the communication quality judgement unit R5 of the reception device R makes a predetermined change to the data if the communication quality judged by the communication quality judging means does not satisfy a predetermined condition. EX1001, 11:7-34, 11:46-12:19, FIG. 6.

46. The ’891 Patent describes several types of “predetermined change[s]” that can be made to the data under different conditions.² For example, the data in a current frame can be “replaced” by data from one or more prior frames, the data in

² The language of Element [1c] refers to just one “predetermined condition” and one “predetermined change.” Any one of the different types of predetermined changes to the data described in the specification of the ’891 Patent is therefore within the scope of Element [1c].

the current frame can be “attenuated,” or the data can be “destroyed” altogether depending on the judged quality of the communication channel and the history of changes made in prior frames. *See, e.g.*, EX1001, 11:26-12:10, 13:23-14:2, FIG. 8.

47. Based on the '891 Patent's disclosure, the corresponding structure/algorithm for the recited “data changing means” encompasses special-purpose electronics or a processor configured to perform the recited function by replacing, attenuating, or destroying data to be transmitted if the communication quality is judged not to satisfy a predetermined condition, and equivalents thereof.

4. “means for externally obtaining a parameter that defines at least a portion of the condition” (Claim [2])

48. Claim 2 depends from claim 1 and adds that “the data changing means comprises means for externally obtaining a parameter that defines at least a portion of the condition.” EX1001, 15:63-67. The recited function for the additional “means for” limitation recited in claim 2 is “externally obtaining a parameter that defines at least a portion of the condition.” The specification discloses that “the communication quality judgment unit R5 may externally obtain parameters that define conditions for use in performing a bad frame masking process (for example, the upper limit *m* as described above) depending on user operation and the like. By externally obtaining the upper limit *m* depending on user operation, the reception device R may provide a function similar to squelch. When the parameters are

externally obtained, the communication quality judgment unit R5 may be provided with, for example, a switch, a keyboard, and other input devices for inputting the parameters. Alternatively, the unit may be provided with a serial interface circuit or recording media drive device to externally obtain serially-transmitted parameters or to read parameters recorded on the recording media.” EX1001, 14:3-16.

49. Based on the '891 Patent's disclosure, the corresponding structure/algorithm for the recited “means” encompasses a switch, a keyboard, a serial interface, other input device, or a recording media drive device to externally obtain serially-transmitted parameters or to read parameters record on the recording media, and equivalents thereof. EX1001, 14:3-16.

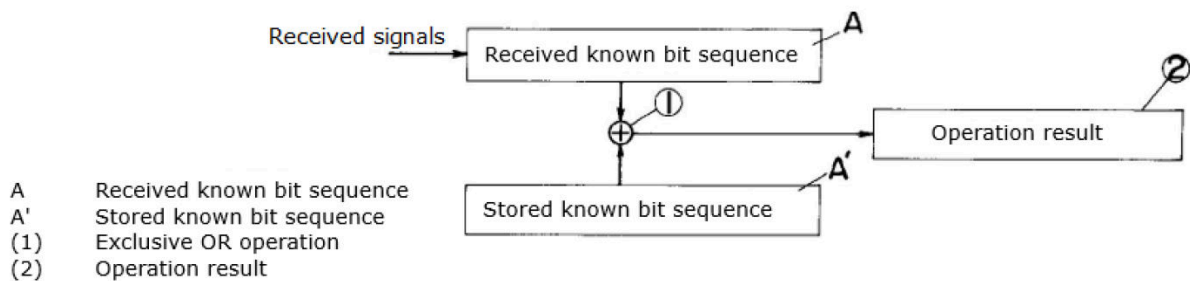
VIII. Ground 1A – Obviousness based on Yamane-Mizuki-Matsumoto

A. Overview of Yamane

50. Yamane describes a receiver that receives an information signal including a sequence of bits over a communication channel. EX1004, Abstract, [0002], [0005]-[0008], Cl. 1-3. The sequence of bits is appended with “known” bits that each have a predetermined value, much the same as embodiments of the '891 Patent insert predetermined protective bits into the most important data. EX1004, Abstract, [0002], [0007]-[0014], Cl. 1-3. The appended bits are referred to by Yamane as a “received known bit sequence A.” EX1004, Abstract, [0009], [0011], [0012]. The receiver compares the received known bit sequence with a

“stored known bit sequence A” to determine a quality of the communication channel over which the information signal is transmitted. EX1004, Abstract, [0009], [0011]-[0013], FIG. 1.

[FIG. 1]

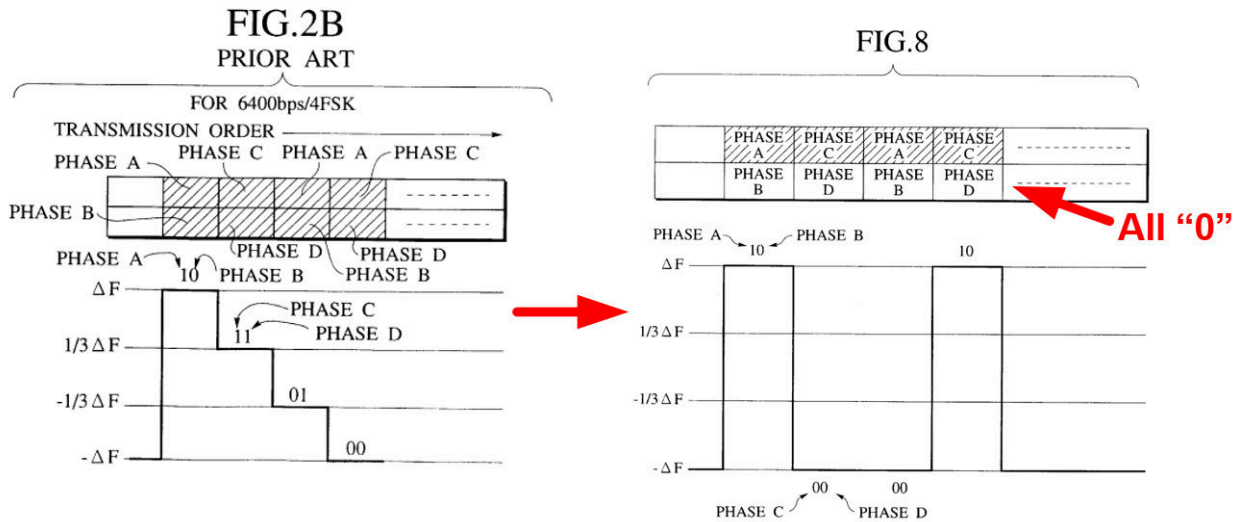


EX1004, FIG. 1.

51. Yamane’s receiver determines a number of “error bits” in the received known bit sequence, each error bit representing a mismatch between the received known bit sequence and the stored known bit sequence. EX1004, [0009], [0011]-[0013]. The receiver then selects an error control method based on the number of error bits. EX1004, [0009], [0011]-[0013], [0015]-[0020]. The error control methods can include “error detection” or “error correction” when the number of error bits is less than a threshold (indicating that the quality of the communication channel is relatively good), and “information signal rejection” when the number of error bits meets or exceeds the threshold (indicating that the quality of the communication channel is relatively bad). EX1004, [0016]-[0019].

B. Overview of Mizuki

52. Mizuki discloses a conventional radio paging scheme involving an FSK-modulated signal comprising a sequence of two-bit symbols, each symbol representing one bit from a first logical channel (also referred to as a “phase”) and another bit multiplexed from a second logical channel. EX1005, 1:22-2:27, FIG. 2B. The FSK scheme of Mizuki is nearly identical to the FSK scheme of the ’891 Patent’s preferred embodiment. EX1005, 1:22-2:27, FIG. 2B; *cf.* EX1001, 7:41-8:8, FIG. 5. For example, Mizuki explains that a frequency shift of $+\Delta F$ corresponds to the symbol “10,” a frequency shift of $+\left(\frac{1}{3}\right)\Delta F$ corresponds to the symbol “11,” a frequency shift of $-\left(\frac{1}{3}\right)\Delta F$ corresponds to the symbol “01,” and a frequency shift of $-\Delta F$ corresponds to the symbol “00,” much like the four states of the two-bit symbols (i.e., +3, +1, -1, -3) of the FSK scheme disclosed in the ’891 Patent. EX1005, 1:22-2:27, 6:36-55, FIG. 2B; EX1001, FIG. 5.



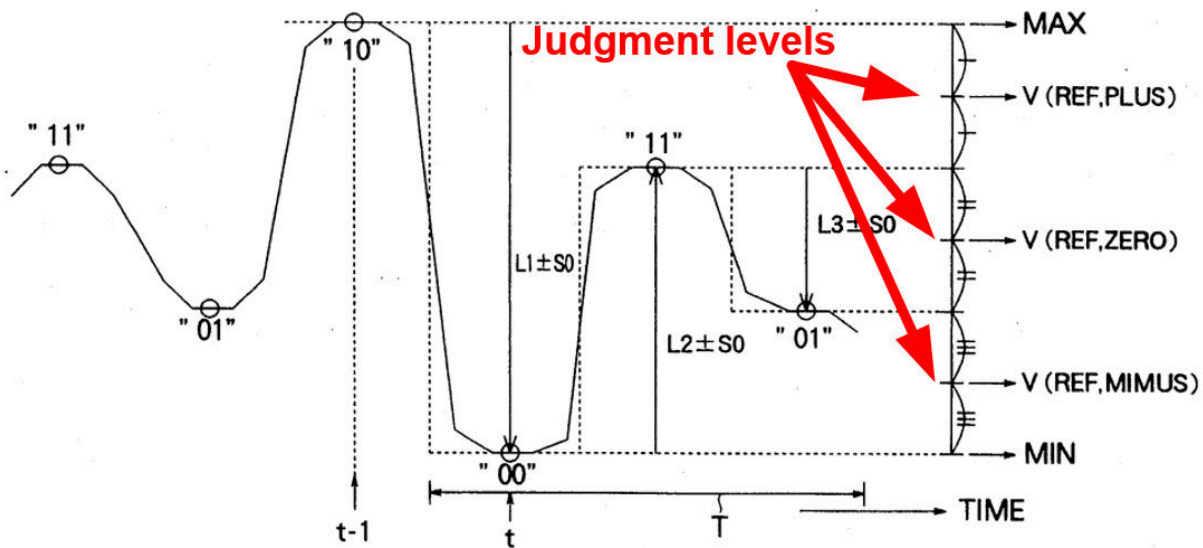
EX1005, FIG. 2B, FIG. 8 (annotated).

53. Mizuki teaches that, in certain conditions, rather than multiplexing two data bits from different logical channels (phases) to form two-bit symbols, the two-bit symbols can be formed by pairing a single data bit from one logical channel with a redundant bit having a predetermined value. EX1005, 6:36-55, FIG. 8. When the predetermined value of the redundant bit is set to "0," the two-bit symbols can assume just two values (i.e., "10" or "00") that depend solely on the value of the single data bit and that correspond to maximally separated frequency shifts in the FSK-modulated signal of $(+\Delta F)$ or $(-\Delta F)$, while effectively eliminating the intermediate frequency shifts $(+\frac{1}{3}\Delta F, -\frac{1}{3}\Delta F)$. EX1005, 6:36-55, FIG. 8. In Mizuki, therefore, consecutive symbols are "separated by the maximum signal-to-signal distance," therefore leading to a situation where "errors due to influences such as thermal noises are less likely to occur." EX1005, 1:63-

2:37, 6:36-55, FIG. 2B, FIG. 8. Mizuki explains that a receiver can “receive, demodulate and decode the subsequent bit sequences according to a combination of transmission rate and modulation scheme indicated by that frame information.” EX1005, 1:22-37.

C. Overview of Matsumoto

54. Matsumoto discloses a “radio paging receiver” that receives a “multilevel modulated signal.” EX1006, 1:8-2:22, 2:41-3:15, FIGS. 1-2. For example, Matsumoto’s receiver includes an analog demodulator, an analog to digital (A/D) converter 13, and a multilevel-to-binary converter 14 to convert a modulated radio signal into a digital bit stream. EX1006, 2:41-3:25. Specifically, the A/D converter 13 “converts the time sequence of multilevel symbols into a time sequence of multilevel symbols having digital symbol levels” and the multilevel-to-binary converter “converts the time sequence of multilevel symbols into a binary (or digital) signal of binary (or digital) values by judging the symbol levels on the basis of judgement levels.” EX1006, 2:41-54, 3:16-25. This symbol judging is done by comparing measured symbol levels to threshold “judgment levels.” EX1006, 1:8-40, 3:16-25, 4:9-40, FIG. 2, *cf.* EX1001, 9:36-67.



EX1006, FIG. 2.

D. Combination of Yamane, Mizuki, and Matsumoto

Obviousness of Integrating Mizuki's Teachings

55. As discussed above, Yamane discloses a receiver that (1) judges a quality of a communication channel by comparing a received bit sequence including predetermined redundant bits with a stored "known" bit sequence to count the number of "error bits" in the received sequence that do not match the known sequence and (2) selects an "error control method" based on the number of error bits. EX1004, [0002]-[0004], [0007], [0009]-[0020] *supra*, §VIII.A. Although Yamane mentions frame synchronization, Yamane is otherwise silent regarding any modulation and coding scheme that would be used to generate and transmit frames comprised of the known bit sequence and encoded information

signals. A POSITA therefore would have turned to references like Mizuki that describe details of conventional techniques for transmitting information signals along with redundant bits having known values. *Supra*, §VIII.B. For example, based on Mizuki, it would have been obvious to a POSITA to assign a single/fixed value to each bit in Yamane's known bit sequence (e.g., "0"), and to pair the known bit having the predetermined value (e.g., "0") with data bits from at least a portion of Yamane's BCH-encoded information signal B to form two-bit multilevel symbols that map to just two of four possible values (e.g., "10", "00") corresponding to maximally separated frequency shifts in an FSK modulation scheme.³ *Id.*; EX1005, 1:22-2:28, 6:37-50. Multiple reasons would have prompted a POSITA to integrate Mizuki's teachings in Yamane as described.

56. **First**, a POSITA would have sought to implement Yamane according to Mizuki's modulation scheme to enable the system to flexibly, and with low overhead, increase or decrease transmission rates depending on transmission needs by either assigning a known redundant bit to each two-bit symbol or assigning a second data bit to each two-bit symbol. EX1005, 7:19-29, 8:22-32, 3:1-28.

³ Yamane's BCH encoding is an example of well-known error correction coding as described by the '891 Patent. EX1001, 13:7-14.

57. **Second**, when the system employs a higher-data rate that uses all four symbol levels, the frequency shift levels for the symbols are set to $+\Delta F$, $+\left(\frac{1}{3}\right)\Delta F$, $-\left(\frac{1}{3}\right)\Delta F$, and $-\Delta F$, as taught by Mizuki. EX1005, 1:63-2:9, 6:36-50, FIG. 2B, FIG. 8. With a constant difference between neighboring levels of $\left(\frac{2}{3}\right)\Delta F$, a POSITA would have understood this to be beneficial for minimizing symbol judgement error. EX1005, 1:63-2:9, 6:36-50, FIG. 2B, FIG. 8. For example, because no two neighboring levels are closer to each other than any other pair of neighboring levels, no neighboring symbol is more likely to be misjudged as compared with other neighboring symbols.

58. **Third**, a POSITA would have recognized that creating a modulated signal where each symbol includes an information bit and a redundant bit having the same predetermined value, as taught by Mizuki, would ensure that every information bit protected with a redundant bit is separated by a maximum signal-to-signal distance in a 4-valued FSK modulation scheme, and therefore decrease a symbol judgement error rate. EX1005, 2:9-16, 6:36-50, FIG. 2B, FIG. 8. For example, Mizuki teaches that when the least-significant bit in every symbol is set to the predetermined value of “0,” this ensures that every symbol is the maximum phase $+\Delta F$ or the minimum phase $-\Delta F$ while eliminating the intermediate phases $\left(+\left(\frac{1}{3}\right)\Delta F, -\left(\frac{1}{3}\right)\Delta F\right)$, thus increasing a phase separation between differing

consecutive symbols. EX1005, 8:36-50 (“the modulated signals take only two states ... that are separated by the maximum signal-to-signal distance”), 8:22-32 (“improve the reception characteristic of the receiver”), 2:10-17 (“errors due to influences such as thermal noises are less likely to occur”); FIGS. 7-8.

59. **Fourth**, a POSITA would have combined Yamane’s system for determining a quality of a transmission channel by counting a number of incorrect predetermined bits according with Mizuki’s suggestion to pair predetermined bits with protected information bits, because doing so would provide a convenient way to measure an error rate of the information channel. Because Mizuki explains that each information bit can be paired with a redundant bit having the value of “0,” and this redundant bit is the second bit of each symbol, the receiver understands that every symbol should have a “0” value as the least significant bit. This means that the receiver can readily determine channel quality simply by counting the number of symbols that were judged to have a “1” as the least significant bit, representing an error.

60. **Fifth**, a POSITA would have found it obvious to combine the teachings of Yamane with Mizuki because the combination merely involves the application of a known technique to a known system to achieve predictable results. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (a supposed invention that “simply arranges old elements with each performing the same function it had been known

to perform” is obvious). “It’s enough... to show that there was a known problem... in the art, that [another known teaching] ... helped address that issue, and that combining the teachings of ... wasn’t beyond the skill of an ordinary artisan. Nothing more is required to show a motivation to combine under *KSR*.” *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380-81, (Fed. Cir. 2023). Here, Mizuki recognized a problem with existing modulation schemes and described a straightforward technique to address it. In this context, combining the teachings of Yamane and Mizuki would have been obvious and a POSITA would have reasonably expected success, especially since the combination involves well-known FSK modulation and standard radio hardware/software that was well known before the Critical Date. *KSR* at 401.

Obviousness of Integrating Matsumoto’s Teachings

61. As described above, it would have been obvious based on Mizuki to form two-bit multilevel symbols in Yamane’s system for modulation by frequency shift keying. Mizuki explains that “[t]he receiver can receive, demodulate and decode” received bit sequences, but neither Yamane nor Mizuki describe in detail the hardware or operations involved in de-modulating such multilevel symbols. A POSITA therefore would have turned to Matsumoto for specific guidance on implementing this aspect of the receiver. For example, Matsumoto describes how to judge multilevel symbols by comparing measured symbol values to threshold

judgement levels and selecting one of four different bit pair values based on this comparison. EX1006, 3:16-25, 4:9-64, FIG. 2 *supra*, §VIII.C. A POSITA would have further combined the teachings of Yamane-Mizuki with Matsumoto in this manner for multiple reasons.

62. **First**, a POSITA would have implemented the combination because comparing symbol measurements to judgement levels, as taught by Matsumoto, beneficially enables more accurate judgments of received symbols in a multilevel modulated signal. For example, Matsumoto explains that each symbol judgment corresponds to a range of judgement values (i.e., between $V(\text{ref}, \text{zero})$ and $V(\text{ref}, \text{plus})$ for the symbol “11”), meaning that the receiver could still correctly judge a symbol even when the symbol level deviates within a defined range from the nominal or expected symbol level. EX1006, 2:41-4:36.

63. **Second**, Matsumoto discloses an analog demodulator 12 that demodulates an analog multilevel modulated signal 10 and an analog-to-digital (A/D) converter 13 that converts the demodulated multilevel symbols into digital values. EX1006, 2:41-54. A POSITA would have been motivated to implement Yamane’s techniques for judging communication quality based on digital bit values and Mizuki’s techniques for transmitting an analog radio signal including a sequence of multilevel symbols with Matsumoto’s receiver, because doing so

would beneficially provide this analog-to-digital converter 13 for converting the analog radio signal into digital values for further processing.

64. **Third**, because Mizuki describes sequence symbols that each include two bits modulated according to a 4-valued FSK modulation mode, and Matsumoto describes techniques for converting an analog radio signal including multilevel modulated symbols into digital bit values, a POSITA would have recognized Matsumoto's symbol judging technique to be an effective manner of resolving bits represented in a multi-level symbol. EX1005, 1:22-2:28, 6:37-7:14; EX1006, 2:41-4:36. More, a POSITA would have understood frequency shift keying to be an effective solution for transmitting binary values, and Mizuki's method of FSK modulation is specifically the type of modulated signal that Matsumoto's symbol judging technique was equipped to address. EX1006, 2:44-47.

65. **Fourth**, a POSITA would have implemented the combination because Matsumoto's symbol judging technique would beneficially allow the resulting "radio communication apparatus ... [to] quickly recover from a misjudgment state." EX1006, 1:43-45; *see also id.*, 1:8-40 (describing problems perceived with other conventional approaches to symbol judgment).

66. **Fifth**, a POSITA would have found it obvious to further combine the teachings of Yamane with Matsumoto because the combination merely involves the application of a known technique to a known system to achieve predictable

results. *KSR*, 550 U.S. at 417 (a supposed invention that “simply arranges old elements with each performing the same function it had been known to perform” is obvious). “It’s enough... to show that there was a known problem... in the art, that [another known teaching] ... helped address that issue, and that combining the teachings of ... wasn’t beyond the skill of an ordinary artisan. Nothing more is required to show a motivation to combine under *KSR*.” *Intel*, 61 F.4th at 1380-81. Here, Matsumoto recognized a problem with existing symbol judging techniques and described a straightforward method to address it. In this context, combining the teachings of Yamane-Mizuki with Matsumoto would have been obvious, and a POSITA would have reasonably expected success considering that the combination merely involves techniques that were established long before the Critical Date of the ’891 Patent. *KSR* at 401.

E. Analysis

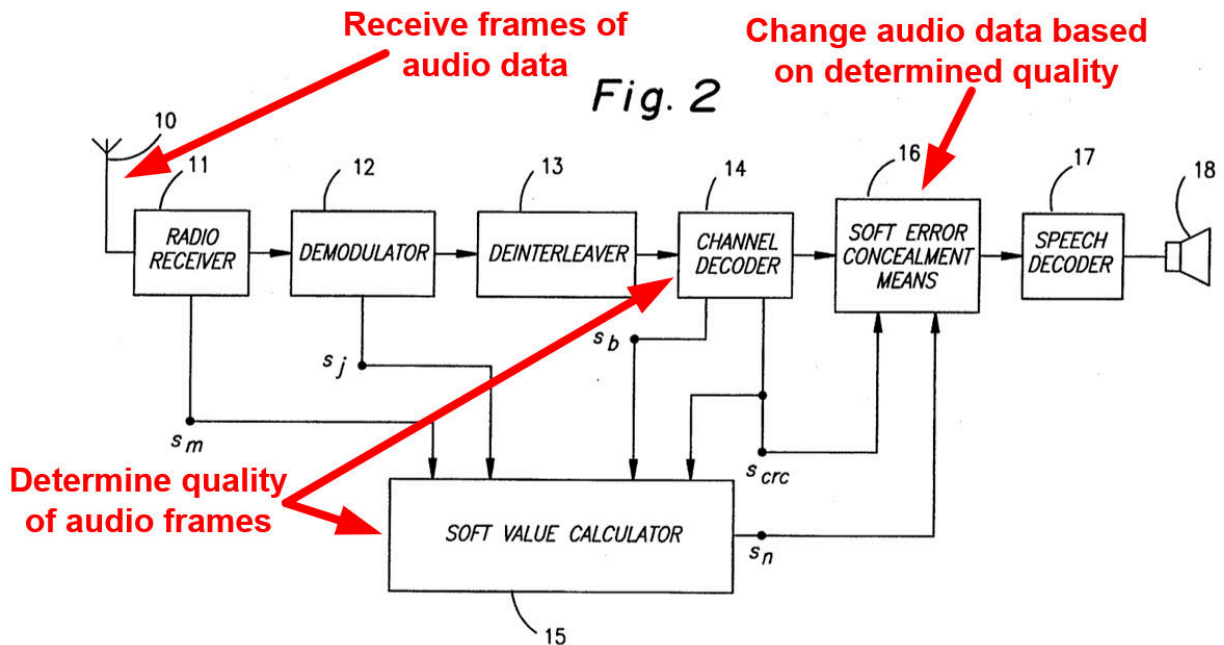
67. As noted above, in preparing this declaration, I reviewed the IPR Petition that Apple is submitting to the PTAB to challenge claims 1-9 of the ’891 Patent. I collaborated with counsel in developing the grounds set forth in the Petition, and as such, the Petition itself reflects my analysis and opinions regarding the patentability of claims 1-9 of the ’891 Patent. Based on my review, the Petition correctly describes why the proposed prior art combinations would have been

obvious to a POSITA and how the prior art combinations render each element of claims 1-9 obvious.

IX. Ground 1B – Obviousness based on Yamane-Mizuki-Matsumoto-Lagerqvist

A. Overview of Lagerqvist

68. Lagerqvist discloses a receiver in a digital voice coding system that receives coded voice signals and decodes them to produce an audio output. EX1007, 1:12-48, 3:64-4:59, FIG. 2. Like the '891 Patent, coded voice data in Lagerqvist's system is broken into frames for transmission, each frame encoding 20 ms of audio and carrying coded data bits of varying importance. EX1007, 1:21-36, 2:61-3:3, 3:21-62. Lagerqvist explains that a channel decoder 14 of the receiver processes each received frame to determine a quality associated with the frame, for example classifying the frame as being of "good" quality or "bad" quality. EX1007, 4:30-50 ("[t]he channel decoder 14 also provides a measurement as to how bad, or erroneous, a full speech frame is, so-called bad frame indicator BFI"), 4:60-67 ("[a] so-called neural net or some other soft value calculator 15 may also be arranged on the receiver side of the mobile station...with the purpose of obtaining a better and more accurate estimation of the quality of the received speech frames").



EX1007, FIG. 2 (annotated).

69. Lagerqvist explains that soft error concealment means 16 includes a “state machine” that changes audio frames judged to be “bad” by the receiver. EX1007, 4:51-59, FIG. 2. For example, Lagerqvist describes one embodiment including a “state machine with eight states,” where the state machine advances for each consecutive frame that is judged to be “bad” by the receiver. EX1007, 7:38-8:13, FIG. 4. At each state of the state machine, one or more actions are taken with respect to the received frame. EX1007, 7:38-8:13, FIG. 4. These actions result in audio frames being attenuated gradually through consecutive bad frames until “no speech signal is heard.” EX1007, 7:38-8:13, FIG. 4.

B. Combination of Yamane, Mizuki, Matsumoto, and Lagerqvist

70. Yamane describes a data changing means for making a predetermined change to data if the communication quality does not satisfy a predetermined condition, the predetermined change representing a complete rejection of a received data block, for example. EX1004, [0016], [0018]; *supra*, §VIII.A. While Yamane describes several error control methods that can be applied based on the measure of communication quality indicated by the number of errors detected in the known bit sequence, a POSITA would have appreciated that other methods of error control were commonly known for different applications. Lagerqvist describes additional error control methods that likewise involve changing data, but in the context of a voice decoder system. *Supra*, §IX.A. To the extent that Yamane does not expressly describe a predetermined change where data is replaced with previous data, substantially destroying data following replaced data, or attenuating the data, Lagerqvist demonstrates that these features were not new or innovative before the Critical Date of the '891 Patent. EX1007, 3:64-4:67, 7:38-8:10, FIG. 2, FIG. 4. Multiple reasons would have prompted a POSITA to implement the Yamane-Mizuki-Matsumoto combination in accordance with Lagerqvist's data changing techniques.

71. *First*, a POSITA would have understood that Lagerqvist's teachings would have beneficially expanded the capabilities of the Yamane-Mizuki-

Matsumoto combination by allowing it to perform error concealment not only in a generic communication system but also specifically in a voice decoding system. A POSITA would have been drawn to implement voice error concealment in the combination because “the speech quality will be improved.” EX1007, 2:48-29; *see also id.*, 1:12-2:57.

72. **Second**, a POSITA would have understood that implementing the receiver of the Yamane-Mizuki-Matsumoto combination to perform voice error concealment like that taught in Lagerqvist by gradually attenuating poor quality audio data would result in a receiver that smoothly conceals low-quality audio instead of abruptly removing poor quality audio. When bad audio frames are abruptly removed, this leaves gaps of silence in the audio data that can sound jarring to the listener, especially when several gaps occur in succession. Attenuating bad data as taught by Lagerqvist would beneficially produce a more aesthetic listening experience.

73. **Third**, because Lagerqvist’s frames of audio data are separated into multiple different classes of data, with more important bits receiving additional error protection and less important bits receiving less error protection, a POSITA would have been motivated to implement the receiver of the Yamane-Mizuki-Matsumoto combination according to Lagerqvist’s teachings to provide additional error protection to bits that are most important to decoding the voice signal in a

transmitted frame. EX1007, 3:20-63, FIG. 1. For example, just as the receiver of the '891 Patent pairs redundant bits with “most important voice data” to provide extra protection while “unprotected voice data” bits are paired together without redundant bits, a POSITA would have been motivated to implement Mizuki’s teachings for pairing information bits with redundant bits with Lagerqvist’s teachings for separating data into categories by importance (e.g., selectively pairing most sensitive information bits with redundant bits for additional error resilience while not pairing less sensitive information with redundant bits to increase transmission efficiency).

74. *Fourth*, a POSITA would have understood that Lagerqvist’s technique for demodulating a baseband modulated signal, deinterleaving the demodulated signal, and judging communication quality based on the deinterleaved and demodulated signal is well suited to produce a system that uses Yamane’s techniques for judging communication quality and makes changes when protected bits are paired in symbols with redundant bits. For example, Yamane discloses techniques for counting a number of erroneous redundant bits, which means that it would be beneficial to deinterleave the redundant bits and the protected bits that are paired together in symbols as taught by Mizuki, so that the redundant bits can be evaluated together in one block.

75. ***Fifth***, a POSITA would have found it obvious to condition use of Lagerqvist's proposed error concealment and data changing operations at least in part on Yamane's measure of communication quality as indicated by the number of error bits detected in the known bit sequence of a received frame. Both Yamane and Lagerqvist recognized that error control methods based solely on hard decision criteria such as parity bits or bad frame indicators (BFI) were deficient insofar as they did not fully account for the probability that degraded channel quality may produce errors across different parameters. EX1004, [0001]-[0009]; EX1007, 2:11-3:3, 5:1-5. The application of Lagerqvist's techniques in combination with Yamane would have been obvious to further the stated objectives of both references and ensure that error concealment is performed according to a "method that is most suitable for the characteristics of the communication channel." EX1001, 1.

76. ***Sixth***, a POSITA would have found it obvious to combine the teachings of Yamane-Mizuki-Matsumoto with Lagerqvist because the combination merely involves the application of a known technique to a conventional system to achieve predictable results. A POSITA would have reasonably expected success making the combination, especially as it merely involves known techniques that could be implemented on conventional software/hardware that was widely available before the Critical Date of the '891 Patent.

C. Analysis

77. Based on my review, the Yamane-Mizuki-Matsumoto-Lagerqvist combination would have rendered claims 1 and 3-9 of the '891 Patent obvious for each of the reasons described in the Petition.

X. Ground 1C – Obviousness based on Yamane-Mizuki-Matsumoto-Kaplan

A. Overview of Kaplan

78. Kaplan discloses how a user can “interface[] with the circuitry and microprocessor of [a mobile telephone] device through a keypad, or touchpad, located on the front outer surface of the housing.” EX1016, [0004]. Kaplan also teaches that mobile phones can be “configured, or ‘provisioned’, for various modes of operation” that “determine[] how basic functions of the mobile will operate, such as setting or resetting wireless voice and data exchange protocol parameters, parameters used to enable or disable communication features, and local network services available to the mobile” including “enhance vocoder” features. *Id.*, [0004]; *see also id.*, [0001]-[0014], [0023].

B. Combination of Yamane, Mizuki, Matsumoto, and Kaplan

79. Yamane discloses a radio receiver configured to operate in a wireless environment and to judge the quality of a wireless communication channel. EX1004, [0005]-[0011]. Yamane discloses little detail about the hardware of the receiver device or the manner in which the receiver is configured or provisioned,

however. A POSITA therefore would have looked to other references such as Kaplan for specific guidance on how to implement the receiver and ensure it is configured with suitable software and operational parameters. Kaplan, for example, teaches that devices can be configured or provisioned by externally obtaining parameters over the air (OTA), from user input, or from other devices “via RF signals, or cable connections.” EX1016, [0004]-[0008]. It would have been obvious to a POSITA to apply Kaplan’s teachings to the receiver device in the Yamane-Mizuki-Matsumoto combination of Ground 1a to achieve known and predictable benefits, including the ability to flexibly configure/provision the device with new or updated software and operational parameters even after the device’s initial production and to expand the capabilities of the device through new software received through an external interface (e.g., a wireless connection, cable connection, keyboard or the like). *Id.*, [0004]-[0010]; *KSR*, 550 U.S. at 417; *Intel*, 61 F.4th at 1380-81; *supra*, §V.A.4. A POSITA would have reasonably expected success implementing the combination as confirmed by Kaplan’s teaching that such interfaces for receiving external configuration parameters were well known before the Critical Date.

C. Analysis

80. Based on my review, the Yamane-Mizuki-Matsumoto-Kaplan combination would have rendered claim 2 of the '891 Patent obvious for each of the reasons described in the Petition.

XI. Additional Remarks

81. I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

APPENDIX A

Expert Witness, CTO

Technology industry veteran with electronics/software/hardware/video/audio/data expertise.

IoT | Consumer Electronics | Telecommunications | Cable | Satellite | Broadband | Wireless

- Expert witness testimony (PTAB, ITC), technical consulting, and expert reports for renowned patent law firms such as Fish & Richardson and Banner Witcoff.
- 117 Patents and Patent publications. Served on corporate patent boards and as 30(b)(6) witness.
- Uniquely broad hardware/software/systems technical understanding.
- Award winning design and development including Best of Show, Technology Emmy, and Best of Innovations of over 100 million shipped products, responsible for \$1.3B annual revenue.
- Industries: Consumer Electronics, Cable, Satellite, Internet of Things (IoT), Telematics, Smart Truck Logistics, Transportation, Alarm Systems, Smart Tank monitoring & fulfillment, Smart Home, Television, Telecommunications, Video, Audio, Wireless, Broadband, OTT Video, IPTV, Payments
- Technical: hardware design, software design, systems design, mechanical design, embedded systems, cloud computing, AWS, Azure, Oracle Cloud Infrastructure (OCI), SaaS, edge computing, high speed digital, C, Java, Python, Linux, mobile applications (iOS, Android, cross-platform), web applications (Java, JavaScript, HTML), firmware, RTOS, user interfaces, UI/UX, video, audio, data, RF, DSP, communications, cybersecurity, encryption, error correction coding, real-time systems, cable, CATV, DOCSIS, broadband, satellite, satcom, IPTV, OTT video, video streaming, image processing, wireless, cellular, 3G, 4G, LTE, LTE-M, 5G, NB-IoT, Cat-M1, WiFi, ZigBee, Z-Wave, Bluetooth, BLE, LoRa, Internet of Things (IoT), IIoT, sensors, Machine-to-Machine (M2M), Telematics, AI, ML, networks, payments, consumer electronics, and telecommunications.

EXPERIENCE

Nov. 2016-present, **Expert Witness/CTO**, Independent Consultant

Technology, product development, organizational, & intellectual property consulting

- Expert Witness Reports and Testimony - Declarations, Opinions, PTAB Inter Partes Review (IPR) Petitions and Defense, Depositions
- Intellectual Property/Patent assistance, prosecution/defense strategy, search
- Technical Consulting

Jul. 2019 – June 2022, **Chief Technology Officer (CTO)**, **Telular**, an Ametek Company, Greater Atlanta Area

- Responsible for global engineering, corporate technical strategy, and technical representation.
- Developed SaaS, mobile, and hardware products for Industrial IoT (IIoT) businesses including transportation, tank monitoring, petroleum logistics, and facility alarm monitoring with 1.4M+ subscribers, sold under the SkyBitz and Telguard brands.
- Led the development of an IoT Toolkit (scalable platform and APIs) to extend the Telular IoT platform for all 60+ (and growing) AMETEK companies, enabling development of high- value IIoT recurring revenue web and mobile applications.
- SaaS, Cellular, 3G, 4G, LTE, LTE-M, 5G, NB-IoT, Cat-M1, BLE, Satellite, cloud, distributed systems, Azure, Oracle Cloud, IoT, telematics, AI, ML, M2M, hardware, GPS, solar, low-power design, broadband, firmware, software, systems, architecture, video, image processing, mobile apps, web apps.

Aug. 2011 – Oct. 2016, **Vice President of Engineering, Head of the Atlanta R & D Center, EchoStar Technologies**, Greater Atlanta Area (\$3B revenue, Engineering for Dish Network with a common controlling stockholder)

- Developed products for Dish Network and international customers including highest volume set-top boxes, H.265, HEVC, 3D, Satellite, MoCA, transcoding, Embedded C Linux applications, mobile applications (iOS and Android), SaaS, and web applications (Javascript, HTML). Provided product lifecycle support of contract manufacturers, test methodologies, customer service, QA, marketing, and sales.

- Led the architecture and global development of a huge end-to-end secure IoT cloud/fog/edge Platform for the consumer security & smart home market and other adjacent markets. Established the unique TV and mobile UI and MyLocal911 patented self-monitored security paradigm. System architecture consisted of 32 cloud systems and 24 CPE products. Systems included BSS/OSS, AWS cloud storage, 2-way video/audio streaming, authentication, provisioning, software download, command and control, customer service, online storefront, 911 emergency VoIP, logistics, CPE, and mobile applications. Represented the platform at trade shows.
- Functioned as a general manager in roles and responsibilities including vision, operations, business results, product management, program management, complex projects and services, hardware/software/systems product development of video, Internet of Things (IoT), and mobile application products.
- **Winner of the prestigious Best of Show award at the 2013 CES for the Hopper** because of the Hopper Transfers functionality and mobile applications.
- **Won 2015 CSI award “Best smart home product, technology or service”.**

Aug. 1990 – July 2011, **Vice President of Engineering, Cisco / Scientific Atlanta**, Greater Atlanta Area (\$35B / \$1.9B revenue companies respectively. Cisco acquired Scientific Atlanta Feb. 2006)

- Intellectual property – served on the corporate patent board, provided patent assistance, and testified in patent litigation cases including as a 30(b)(6) witness representing the corporation.
- Responsible for the hardware/firmware/software/mechanical/systems/architecture/ASIC requirements design and development of several generations of high volume set top boxes and other products with extensive data communications and multimedia capabilities and advanced features including DOCSIS 1/2/3 and hybrid gateways, 802.11, IPTV, DVR, cable modems, ADSL, VDSL, DVB-T/C/S, bootloaders, factory diagnostics, application frameworks, Nagra, DRMs, conditional access, secure microprocessors, device management, Android, Adobe Flash, Linux, DVD play/record, MPEG-4, MPEG-2, H.264, NTSC, PAL, DAVIC, MoCA, high-performance CPUs, cablecards, network processors, HDMI, multiple video/audio display interfaces, 2D/3D graphics, multiple RF tuners, and full spectrum tuners.
- Products developed supported worldwide video, audio, power supply, and regulatory standards.
- Developed products manufactured in company factories, contract manufacturers (CMs), Original Design Manufacturers (ODMs), and Joint Design Manufacturers (JDMs).
- Developed processes and practices to ensure success in high quality, high volume, low cost, and fast time-to-market product development.
- Architected Video-On-Demand (VOD) systems.
- Architected robust software download system to ensure network disaster recovery to avoid truck rolls. Received some of the **industries’ first downloadable software patents and an electronic program guide patent**. Developed the downloadable software system, enabling the applications software development business which evolved into a major corporate strategic business objective.
- Responsible for the total value proposition strategy internally in the organization through process design and externally facing customers to propose innovative solutions that add value and differentiate our offering.
- Established and managed department capex and opex budgets and manpower planning.
- Achieved unprecedented 3%/qtr product cost reductions for all products during the product lifecycle.
- Highly reliable products never had a field recall, which would have been disastrous to the business due to truck roll costs.
- Established software development department and software development practices including software processes, code reviews, networked version control and defect tracking, unit test teams, coding standards, and release processes.
- Reduced product development time to market for set top boxes from 14 months to 6 months through continuous process improvement
- Scaled organization from supporting \$10M to \$1.3B in sales
- Accounted for more than **70% of the revenues for Cisco’s Service Provider Video Technology Group and for Scientific Atlanta Corporation**.
- Award winning design and development of over 100 million shipped products
- **Winner of Technology Emmy in 2012 for Pioneering Development of Multi-Room DVR.**

- **Winner of 2006 CES "Best of Innovations" award for DVR/DVD Recorder/Player.**
- **Winner of Motorola/EE Times Excellence in Innovation Award** in 1994.

Nov. 1985 - July 1990, **Hardware Engineering Manager / Senior Engineer, Wegener Communications, Inc.,** Greater Atlanta Area

- Managed product development of video, audio, and data satellite receivers, modulators, graphics display systems, DSP-based companders, FSK and PSK satellite modems, multiplexers, forward error correction (FEC) codecs, RF upconverters and downconverters, and baseband analog and digital processing components. Disciplines managed included hardware, ASICs, FPGAs, RF, digital, microprocessors, analog, mechanical, and embedded software.
- Architected and designed forward error correction (FEC) coding systems, PSK modems, and analog control systems for RF modulators and PSK demodulators.

Mar. 1983 - June 1985 (while working at Scientific Atlanta), Assistant Professor, **DeVry Institute of Technology,** Greater Atlanta Area

- Taught evening school courses in microprocessor hardware/software and Electronics

June 1982 – Oct. 1985, **Scientific-Atlanta, Engineer II/Engineer I,** Greater Atlanta Area

- Designed software and hardware including addressable data transmitters, video sync suppression scramblers, transaction format converters, and data channel monitors for addressable Cable Television systems and Set Top Boxes.

EDUCATION

- MSEE course work in Electrical Engineering, Georgia Institute of Technology, Atlanta, Georgia
- BSEE, University of Tennessee, Knoxville, Tennessee, with High Honors. Specialization in Computer Engineering. GPA: 3.53/4.00.
- Georgia Institute of Technology Scrum Leadership Certificate, Certified Scrum Master (CSM), Certified Scrum Product Owner (CSPO), Certified Large Scale Scrum (LeSS) Practitioner
- Many short courses in business and engineering.