

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TRANSCORE, LP

Petitioner,

v.

HAND HELD PRODUCTS, INC.,

Patent Owner

IPR2024-00391

Patent 8,141,784

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,141,784**

DECLARATION OF DANIEL W. ENGELS, PH. D.

I.	Introduction And Qualifications	1
A.	Qualifications and Experience	1
B.	Materials Considered	9
II.	Person Of Ordinary Skill In The Art	10
III.	Statement Of Legal Principles	12
A.	Claim Construction	12
B.	Anticipation	14
C.	Obviousness	15
IV.	Technology Background	16
A.	Software Defined Radios	16
B.	Encoded Reading Devices	19
V.	The '784 Patent	21
VI.	Opinions Regarding the '784 Patent's Invalidity	23
A.	Prosecution History of the '784 patent	25
B.	The Prior Art	25
1.	Tolonen	25
2.	Katz	27
3.	Ishizu	29
VII.	Application of the Prior Art to Asserted Claims	30
VIII.	Ground 1: Claims 1–23 are anticipated over Tolonen.	30
A.	Tolonen Invalidates the Claims	30
1.	Claim 1	35
2.	Claim 2	59
3.	Claim 3	61
4.	Claim 4	65
5.	Claim 5	66

6.	Claim 6	70
7.	Claim 7	72
8.	Claim 8	75
9.	Claim 9	77
10.	Claim 10	77
11.	Claim 11	78
12.	Claim 12	78
13.	Claim 13	78
14.	Claim 14	79
15.	Claim 15	79
16.	Claim 16	79
17.	Claim 17	80
18.	Claim 18	81
19.	Claim 19	84
20.	Claim 20	85
21.	Claim 21	86
22.	Claim 22	87
23.	Claim 23	87
IX.	Ground 2: Obviousness of Claims 1–23 over Tolonen in view of Katz.	88
	A. Motivation to Combine.....	88
	B. Tolonen in view of Katz Invalidates the Claims	95
1.	Claim 1	95
2.	Claim 2	108
3.	Claim 18	110
4.	Claim 19	111
5.	Claim 20	111
6.	Claim 21	114

X.	Ground 3: Anticipation of Claims 1 and 2 over Katz.....	114
A.	Katz discloses claims 1 and 2	114
1.	Claim 1	114
2.	Claim 2	132
XI.	Ground 4: Obviousness of Claims 3–23 over Katz in view of Ishizu.....	132
A.	Motivation to Combine.....	132
B.	Katz in view of Ishizu Invalidates the Claims	136
1.	Claim 3	136
2.	Claim 4	138
3.	Claim 5	140
4.	Claim 6	141
5.	Claim 7	142
6.	Claim 8	143
7.	Claim 9	145
8.	Claim 10	145
9.	Claim 11	145
10.	Claim 12	146
11.	Claim 13	146
12.	Claim 14	146
13.	Claim 15	147
14.	Claim 16	147
15.	Claim 17	148
16.	Claim 18	149
17.	Claim 19	150
18.	Claim 20	150
19.	Claim 21	152
20.	Claim 22	153

21. Claim 23	153
XII. No Secondary Considerations of Non-Obviousness	153
XIII. Conclusion	156

I, Daniel W. Engels, Ph.D., declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I, Daniel W. Engels, submit this declaration to state my opinions on the matters described below.

2. I have been retained as an independent expert in this proceeding before the United States Patent and Trademark Office by TransCore, LP.

3. I understand this proceeding involves U.S. Patent No. 8,141,784 (“the ’784 patent”), and I have been asked to provide my opinions as to the patentability or unpatentability of the claims of the ’784 patent as would have been understood by one of ordinary skill in the art.

4. This declaration sets forth my opinions, which I have formed based on my study of the evidence; my education, training, research, knowledge, and personal and professional experience; and my understanding as an expert in the field.

5. I am being compensated for my time at the rate of \$600 per hour. This compensation is not contingent upon the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding.

A. Qualifications and Experience

6. I believe I am well qualified to serve as a technical expert in this matter based on my educational and work experience. As discussed below, in my career, I have been involved in the research, system development, product development, prototyping, testing, and patenting of object identification and tracking technologies including Software Defined Radio (“SDR”)-based systems.

7. The following is a brief summary of my background and qualifications. I have summarized my education and professional background in this section. I understand that my *curriculum vitae* (CV) is being filed as Exhibit 1003 in this proceeding. Exhibit 1004 is my CV and sets forth the details of my educational history, work history, patents, and other related experience.

8. I received a Bachelor of Science degree in Electrical and Computer Engineering in 1992 from the University at Buffalo, a Master of Science in Electrical Engineering and Computer Science in 1995 from the University of California, and a PhD in Electrical Engineering and Computer Science in 2000 from the Massachusetts Institute of Technology (“MIT”).

9. I was a Research Scientist, Research Technical Supervisor, and Director of Protocols at the Auto-ID Center at MIT. I was the Director of Research at the Auto-ID Labs at MIT, the successor organization to the Auto-ID Center. As the third member of the team that formed the Auto-ID Center, I was responsible for

developing an Automated Identification and Data Capture (“AIDC”) technology agnostic architecture that connects physical objects to the Internet. The basic architecture that we developed in 1998 and 1999 became the EPC System under the Auto-ID Center, and subsequently, the EPC System, or portions thereof, has been adopted for supply chain management and other applications, such as automated toll roads, in a broad range of industries including the Consumer Packaged Goods (“CPG”) industry and the military. The EPC System is usable with any AIDC technology that carries an Electronic Product Code (“EPC”). The EPC is an identification scheme integrated with the Global Trade Item Number (“GTIN”) scheme that may be represented in many forms including alpha-numeric type, bar codes, or binary storage in electronic memory such as in a Radio Frequency Identification (“RFID”) tag. The EPC System encompasses a range of technologies and systems including the EPC identifier, RFID standards, data collection and management systems and servers, the Object Name System (“ONS”), and other standards and component technologies. The fundamental application of the EPC System is the tracking of objects such as individual salable items, cases, pallets, and vehicles to enable their management, such as within and through the supply chain.

10. As the Director of Protocols under the Auto-ID Center, I was responsible for leading the research and development of RFID air interface protocols, protocols for their use, and compliance and compatibility tests for systems developed to those protocols. In addition, I led the development of the Generation 1 Class 1 Passive High Frequency (“HF”) protocol, the Generation 1 Class 1 Passive Ultra-High Frequency (“UHF”) protocol (the “Class 1” protocol), and the initial development of the Generation 2 Class 1 Passive UHF protocol (the “Gen2” protocol). I also led the integration of the Matrics protocol into the Auto-ID Center RFID protocol suite as the Generation 1 Class 0 Passive UHF protocol (the “Class 0” protocol). I continued to be responsible for the development of the Gen2 protocol as the Director of Research for the Auto-ID Labs where I was also a member of the Technical Steering Committee under EPCglobal (part of GS1), the standards organization that licensed the EPC technologies from MIT and continues to manage and develop EPC standards today. I was also a member of the standards group that subsequently revised the Gen2 standard to integrate additional functionality, including security functionality, to create the Gen2 version 2 (“Gen2v2”) standard.

11. As Director of Protocols for the Auto-ID Center, I was also the co-lead for the EPC Field Trial that involved the implementation of the EPC System

across multiple suppliers and a major retailer to prove the operability, usability, and value of the EPC System in practice. The Field Trial utilized early prototypes of the various EPC System components with commercial off-the-shelf passive UHF RFID tags (initially the Intermec Intellitag and later Class 0 tags from Matrics and Class 1 tags from Alien Technologies) encoded with EPC values. The Field Trial included the integration of tags into pallets and cases in their manufacturing facility and reading tagged cases and pallets through warehouses and distribution centers and into the back room of the retail facilities. By tracking these objects as they moved through the supply chains and onto the sales floor, we were able to provide product visibility by tracking and tracing objects within the supply chain, thereby enabling improved product management.

12. As the Director of Research for the Auto-ID Labs at MIT, I was responsible for setting all research directions, which included substantial research into various aspects of RFID technologies in addition to support for the EPC System standards development within EPCglobal. My primary research dealt with the Reader Collision Problem (a problem experienced in dense RFID reader environments that can limit the communication efficiency of wireless systems), UHF tag antenna designs, tools for RFID use and analysis, RFID use in supply chains including the integration of tags into CPG items such as razor blades, and

the regulatory impacts of and on RFID technologies and deployments in addition to broad EPC System related research. The primary system research focused on the application of the EPC System for supply chain management, including the practical communication systems and technologies required to establish and maintain Internet connectivity for at least the reading devices.

13. I founded the MIT Healthcare Research Initiative (“HRI”) to investigate the use of RFID technologies to improve patient safety. The primary research of the HRI focused on the impact of radio frequencies, particularly frequencies used in UHF RFID systems, on humans and pharmaceuticals (particularly biologics) and medical devices, and it focused on the use of the EPC System for supply chain management in both the pharmaceutical supply chain and the medical devices supply chain.

14. As an Associate Professor in the Department of Electrical Engineering at the University of Texas, Arlington and the Director of the Texas Radio Frequency Innovation and Technology Center, I continued to perform fundamental research into RFID technologies, protocols, security and privacy of RFID and other tracking systems, low cost reader designs, and supply chain applications. My research focused on both battery-less RFID systems, including passive UHF RFID systems and Surface Acoustic Wave systems, and battery powered devices

including semi-passive UHF RFID systems and active wireless systems that can provide object track and trace functionality, including WiFi-based tags and Bluetooth-based tags. My application oriented research focused on the use of low-cost wireless technologies for real-time location systems, security and privacy technologies and issues of these systems, and their application in supply chains. In particular, and among others, I am the named inventor on Patent No. 8,102,267, titled Single Antenna, Single Reader System and Method for Locating a Tag, related to real-time location systems.

15. As the Chief Technology Officer for Revere Security, a startup focused on cryptographic protocols and security mechanisms for Internet of Things devices (such as RFID systems), I participated in the GS1 and ISO secure RFID standards development committees for both passive and active RFID systems, and I was an industry advocate for secure, ubiquitous Internet of Things devices including all low-cost wireless communication technologies such as passive UHF RFID and Bluetooth Low Energy (“BLE”).

16. Subsequent to Revere Security, I began developing a secure Internet of Things (IoT) system centered upon the cell phone as a reader and tag communicator for secured QR codes (the machine-readable optical labels that we often scan with our smartphones today), secure NFC tags, and secure BLE tags.

This research and development formed the bases for Vattaca, d/b/a/ VerifyItNow, which I co-founded in October 2013. At Vattaca, some of our target applications included anti-counterfeit, brand management, and supply chain management all based upon the crowdsourced tracking and tracing of objects. In addition, the IoT system we developed also had applications as a real-time locating system for users to track misplaced objects, by providing data analytics based upon community-sourced data.

17. Simultaneous with Vattaca, I was an Associate Professor at Southern Methodist University (“SMU”) where my research focused upon secure Internet of Things devices, networks, and systems including the security of IoT communication protocols such as the BLE communication protocol. Further, my research also concentrated on the security of network communications in order to better provide for secure data transmission when different devices are within the same network. The primary applications of these technologies include Smart City security and management applications and object management based upon the tracking and tracing of objects.

18. I have experience with the U.S. patent system, as both an inventor and a technical expert in the court system and in Patent Office proceedings. I am the named inventor on nine issued U.S. patents, all of which relate to RFID

technology, ad hoc networking, inventory management, unique object identification, authentication, and/or cryptography. I have authored expert reports in multiple patent cases and have testified in depositions and in court as an expert witness in multiple previous patent cases.

B. Materials Considered

19. In preparing this Declaration, I reviewed U.S. Patent No. 8,141,784 (“the ’784 patent”, Ex. 1001), the file history of the ’784 patent (Ex. 1002), the prior art cited herein, as well as all documents identified, listed, and referenced in this Declaration. I also reviewed portions of the Manual of Patent Examining procedure, including Sections 2131, 2141–2145. Those sections explain the legal requirements of anticipation, obviousness, and examining procedures relevant to obviousness.

20. Provided below are the Exhibit numbers for documents cited in this declaration:

Exhibit	Description
1001	U.S. Patent 8,141,784 to Wang, <i>et al.</i> (“the ’784 patent”).
1002	File History for U.S. Patent 8,141,784
1004	Curriculum Vitae of Daniel W. Engels, Ph.D
1005	U.S. Patent Publication 2010/0056200 to Tolonen (“Tolonen”)
1006	David Katz, <i>et al.</i> , “Fast, Versatile Blackfin® Processors Handle Advanced RFID Reader Applications,” ANALOG DIALOGUE 40-09 (Sept. 2006).

Exhibit	Description
1007	Analog Devices, Blackfin Embedded Processor, ADSP-BF531/ADSP-BF532 (Aug. 2006) (“ADSP-BF531 Data Sheet”)
1008	Analog Devices, Blackfin Embedded Symmetric Multiprocessor, ADSP-BF561 (May 2006) (“ADSP-BF561 Data Sheet”)
1009	Analog Devices, “Mixed-Signal Front-End (MxFE) Baseband Transceiver for Broadband Applications,” AD9861 (Nov. 2003) (“AD9861 Data Sheet”)
1010	U.S. Patent Publication 2010/0020763 A1 to Ishizu, <i>et al.</i> (“Ishizu”)
1011	Tuttlebee, Baseband Technology for 3G Handsets and Basestations (Wiley 2004) (“Tuttlebee II”)
1012	Tuttlebee, Enabling Technologies (Wiley 2002) (“Tuttlebee I”)
1013	McGraw-Hill, Dictionary of Scientific and Technical Terms (5 th ed. 1994)
1014	Analog Devices, Blackfin Embedded Processor, ADSP-BF536 (Apr. 2006) (“ADSP-BF536 Data Sheet”)
1015	Atheros, AR5007EG Single-chip IEEE 802.11b/g WLAN solution
1016	Atheros Communications, Press Release: Atheros Launches the World’s Most-Integrated, Single-Chip 802.11g Solution for PCI Express (Dec. 5, 2006)
1017	ISO/IEC 15693-3 First Edition (2001)
1018	EPCglobal, Radio-Frequency Identify Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz–960 MHz version 1.1.0 (2005)

II. PERSON OF ORDINARY SKILL IN THE ART

21. I understand that an assessment of claims of the ’784 patent should be undertaken from the perspective of a person of ordinary skill in the art as of the earliest claimed priority date, which I understand is September 25, 2009. I have also been advised that to determine the appropriate level of a person having ordinary skill in the art, the following factors may be considered: (1) the types of

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

22. The '784 patent states that the inventions relates to “[a]n encoded
information (EIR) terminal ... comprise[d of] a microprocessor electrically
coupled to a system bus, a memory communicatively coupled to the
microprocessor, an encoded information reading (EIR) device, and a wireless
communication interface,” with the EIR device “configured to perform outputting
raw message data containing an encoded message and/or outputting decoded
message data corresponding to an encoded message,” and the microprocessor
“configured to execute a baseband encoder software program and/or a base-band
decoder software program.” Ex. 1001, Abstract. In my opinion, a person of
ordinary skill in the art for the '784 patent as of September 2009 would have
possessed at least a bachelor’s degree in electrical engineering, computer
engineering, physics, or the equivalent, and would have at least two years of
relevant experience working with RFID systems. A person could have qualified as
a person of ordinary skill in the art with some combination of (1) more formal
education (such as a Master’s of Science degree) and less technical experience or

(2) less formal education and more technical or professional experience in the fields listed above.

23. My opinions regarding the level of ordinary skill in the art are based on, among other things, my over 20 years of experience in electrical engineering, computer science and RFID system and technology design, my understanding of the basic qualifications that would be relevant to an engineer or scientist tasked with investigating methods and systems in the relevant area, and my familiarity with the backgrounds of colleagues, co-workers, and employees, both past and present.

24. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '784 patent have been based on the perspective of a person of ordinary skill in the art as of September 2009.

III. STATEMENT OF LEGAL PRINCIPLES

A. Claim Construction

25. I understand that under the legal principles, claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application. I further

understand that the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which a claim term appears, but in the context of the entire patent, including the specification.

26. I am informed by counsel that the patent specification, under the legal principles, has been described as the single best guide to the meaning of a claim term, and is thus highly relevant to the interpretation of claim terms. And I understand for terms that do not have a customary meaning within the art, the specification usually supplies the best context of understanding the meaning of those terms.

27. I am further informed by counsel that other claims of the patent in question, both asserted and unasserted, can be valuable sources of information as to the meaning of a claim term. Because the claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

28. I understand that the prosecution history can further inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be.

Extrinsic evidence may also be consulted in construing the claim terms, such as my expert testimony.

29. I have been informed by counsel that, in *Inter Partes* Review (IPR) proceedings, a claim of a patent shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b) (the “Phillips” claim construction standard), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

30. I have applied the “Phillips” claim construction standard for purposes of interpreting the claims in this proceeding, to the extent they require an explicit construction. The description of the legal principles set forth above thus provides my understanding of the “Phillips” standard as provided to me by counsel.

B. Anticipation

31. I understand that to be granted a patent, the invention must not have been previously disclosed by a reference that is available as prior art. I am not a lawyer, but I have been informed by counsel, that in order to anticipate a patent, the reference must disclose each and every element required by the patent’s claims.

32. As part of anticipation, I have been further informed that a prior art reference may anticipate a reference even if it does not disclose all elements of the claim, if those claim elements are inherent. I have been informed that a prior art reference inherently teaches an element if the inherent characteristic necessarily flows from the teachings of the prior art. I further understand that inherency can be demonstrated using extrinsic evidence that makes clear that the missing descriptive matter is necessarily present in what the reference describes.

C. Obviousness

33. I am not a lawyer, and my opinions are limited to my understanding of the relevant field around the time that the inventor conceived the technology behind the '784 patent. Namely, my knowledge of the art at that time, and what that art would have taught and motivated a POSITA at that time. Nevertheless, I have an understanding of obviousness as explained to me by counsel.

34. I understand that in order to be valid, a patent cannot not have been obvious when it was invented. I understand that a patent is obvious when a person of ordinary skill in the patent's field would have found it obvious to modify one or more existing references in an obvious way to arrive at the patented invention as articulated in the claims. I understand that obviousness is not limited to the explicit teachings of the references but also considers what one skilled in the art would

have understood and considered about the references given their background and experience in the relevant technology. I further understand that where obviousness is based on more than one reference, there must have been a motivation to combine the references.

IV. TECHNOLOGY BACKGROUND

35. The '784 patent relates to an EIR terminal whose structure and operation relates to the fields of Software Defined Radios and encoded information reading devices, such as RFID Readers and Bar Code Scanners.

A. Software Defined Radios

36. Software Defined Radios ("SDR") were in use as early as World War II. At a high level, an SDR is a wireless communication device that relies on software components to perform some functionality historical performed by discrete analog electrical components. *See* Ex. 1011 at 7-8 (John Wiley & Sons Ltd. 2004) (Ex. 1) (Chapter by Mark Cummings).



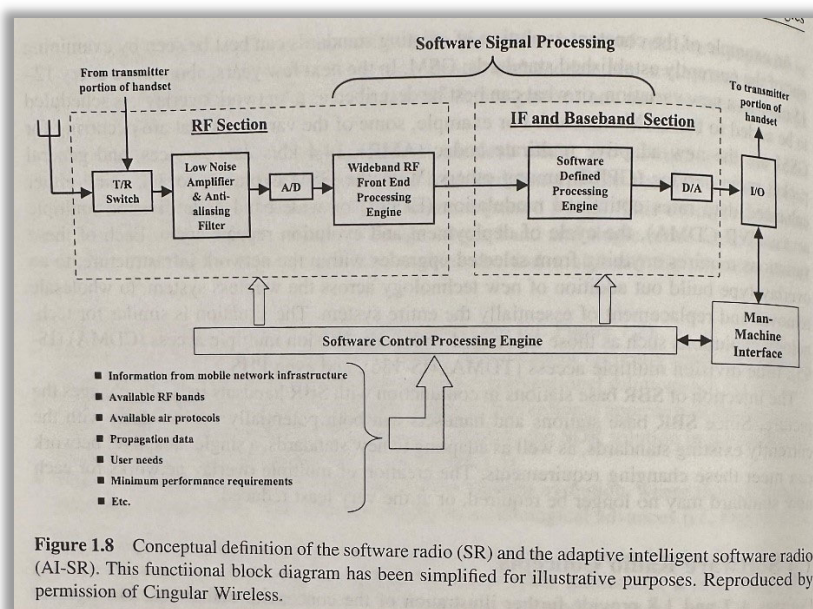
Images from *SCR-300 WW2 Radio Backpack: The “Walkie Talkie” That Shaped the War*, Warfare History Network, Spring 2011, SCR-300 WW2 Radio Backpack: The “Walkie Talkie” That Shaped the War (warfarehistorynetwork.com)

37. All wireless communication systems comprise the same four subsystems: The antenna, the RF Front-End, the Baseband, and the Controller. *See* Ex. 1011 7-8. While early systems relied on discrete analog technology for each of these subsystems, the development of digital technology, first discrete digital components and then microprocessors, have allowed some of these analog technologies to be replaced by modern software executing on microprocessors. *See id.* at 9.

38. By definition, an SDR is “a radio in which the receive digitization is performed at some stage downstream from the antenna, typically after wideband filtering, low noise amplification, and down conversion to a lower frequency in

subsequent stages—with a reverse process occurring for the transmit digitization.”

Ex. 1012 (Wiley 2002) (chapter by Stephen M. Blust). As digital technology continued to evolve, the digitization of signals was able to happen closer to the antenna. Advancements in signal processing technology including analog to digital (“ADC”) converters and digital to analog (“DAC”) converters, faster signal processors, memory chips, etc. have allowed these core technologies to move the digitization of the radio signal from the discrete base band subsystem to the intermediate frequency stage and to the radio frequency (RF) subsystem with the functionality implemented in software. Ex. 1011 at 10. By 2009, when the ’784 patent was filed, as shown in the figure below, Software Defined Radios had advanced to the point that all but the necessarily analog functionality was accomplished in software executing on a processor, necessarily moving the digitization into the RF section, allowing adaptive intelligence that allowed for switching communication parameters to be applied to improve radio performance. *See also, id.* at Ex. 1015 (showing the Atheros AR5007EG chipset).



Ex. 1012 Figure 1.8

B. Encoded Reading Devices

39. Encoded reading devices, such as barcode reading devices and RFID tag reading devices, have existed since well before the filing of the '784 patent in 2009. The first barcode patent was issued on 7 October 1952 as US Patent 2,612,994 covering both linear barcodes and bullseye barcodes. At a high level, a linear barcode encodes information into a sequence of thick and thin lines (which are often called 1D barcodes) such that an appropriate barcode reader can scan the code and recover the encoded information. The most ubiquitous linear barcode is the UPC code that is contained on the individual products purchased at stores in the United States. The first retail checkout UPC barcode scan occurred in 1984.

Linear barcodes have limited, and typically small, information content. To enable higher data content, additional barcode technologies have been developed, such as the now ubiquitous QR codes. Barcodes can be read by a photosensor device (e.g., a camera or laser-based barcode scanner) and decoded to retrieve the stored information.

40. RFID Readers are also a form of encoded information reading device. At a very high level and in general for the most common RFID systems in use such as the ISO/IEC 18000-63 (“Gen2”) protocol, an RFID reader works by sending radio frequency analog signals encoding a packet of digital information such as commands and data to be stored on the tag and receiving analog signals communicated from the tags that encode digital data sent in response to the reader commands. This process requires the reader to at least form a packet for communication to the tag, baseband encode the packet as a sequence of bits, modulate the encoded bits and transmit the modulated bits. Thus, the reader converts digital encoded information into an analog signal that can be outputted as radio waves through an antenna. Similarly, upon reception of a signal, the reader reverses the process to convert analog encoded information into a sequence of bits that can be operated upon by the reader.

41. RFID transponders (i.e., tags) operate similarly to the RFID readers.

The tags receive the radio waves, demodulate the signal, decode the digital command and data, execute the received command, and reverse the receiving process to transmit digital data to the reader over the analog wireless interface.

When the reader issues Read commands to retrieve data from the tag, the signal the tags communicate contains encoded information that is stored in the tag's memory.

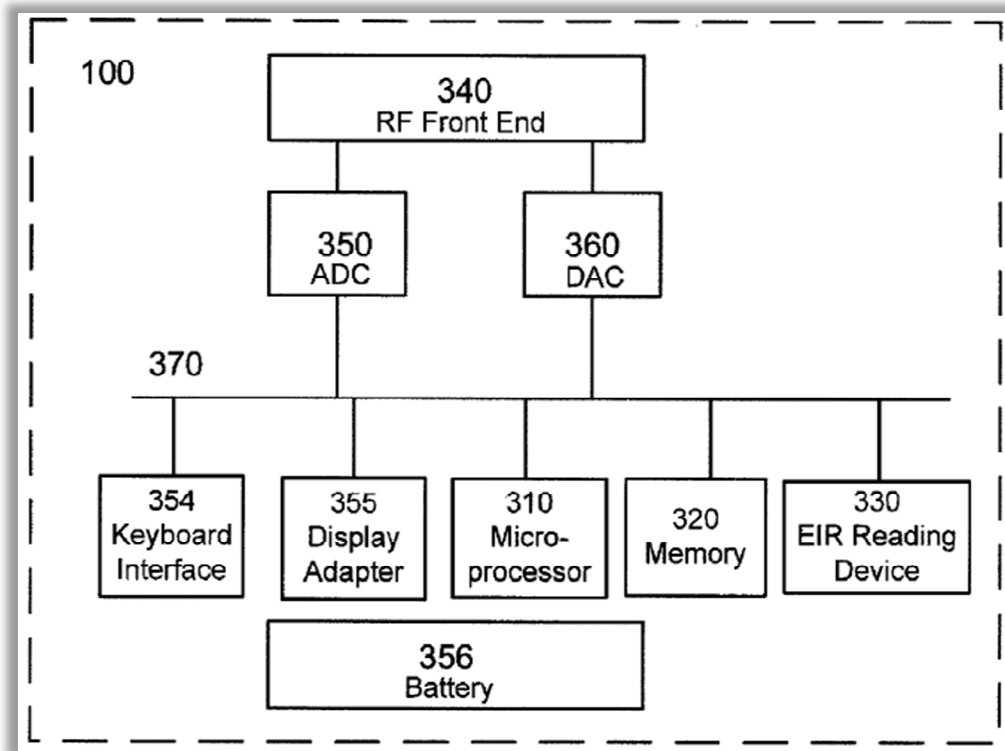
That tag signal is demodulated and decoded by the reader to retrieve the information which then may be communicated to a storage or application system.

V. THE '784 PATENT

42. The '784 patent is directed to “encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface.” '784 patent, 1:7–11. The '784 patent generally expresses the “need for further advances in EIR terminals and systems which would support multiple communication protocols and standards.” '784 patent, 1:24–26.

43. But to accomplish this goal, the EIR terminal employs well-understood and conventional hardware interfaces and software to wireless communicate with other devices via different protocols. As illustrated in Figure 3 below, the EIR terminal connects a microprocessor, a memory, a wireless

communication interface, and an encoded information reading device, such as a barcode reader or an RFID reader, to a system bus. '784 patent, 1:30–35, Fig. 3.



'784 patent, Fig. 3

44. To select between different wireless communication networks, communication protocols, or parameters, the '784 patent describes a “wireless communication protocol selector software program.” '784 patent, 9:38-42. In particular, the '784 patent explains that the “wireless communication protocol selector software program can optimize a value of a user-defined criterion,” which “can be calculated based on one or more of the following parameters: frequency

range, network status, signal strength, service cost, communication channel throughput, and user preferences ... e.g., by network preference, service preference, protocol preference, or frequency preference.” ’784 patent, 9:42-51.

VI. OPINIONS REGARDING THE ’784 PATENT’S INVALIDITY

45. It is my opinion that everything claimed by the ’784 patent was well-known and conventional. For example, long before the ’784 patent was ever filed, RFID readers and barcode readers were commonly available. *See, e.g.*, Katz at 1; Ex. 1005 ¶¶ 55-6, Fig. 3. Additionally, by the time the ’784 patent was filed, it was well-known that conventional SDR technology was capable of implementing various wireless communication protocols in a single wireless device. *See, e.g.*, Ex. 1005 ¶¶ 89-98, Figs. 11, 12; Ex. 1012 at 7 (Chapter 1 by Stephen M. Blust) (introducing SDR and presenting multi-frequency and multi-protocol radios, e.g., Fig. 1.3). It was known, and a desired capability, that a single SDR could communicate according to different communication protocols. *See, e.g., Id.* (introducing SDR and presenting multi-frequency and multi-protocol radios, e.g., Fig. 1.3), Chapter 8 by Friedrich Jondral (explaining that parameterization is an approach to enable an SDR to switch between multiple protocols), Chapter 12 by Klaus Moessner (explaining approaches to implementing multiple protocols in an SDR). By 2009, it was well known that devices, such as smartphones and other

cellular devices, included WiFi chips and could include multiple software defined radios, which “allow a wireless device to change functionality by switching in different software stacks (or software-like objects).” Ex. 1011 at 7 (Chapter 1 by Mark Cummings) (explaining that “all 2G standards required fall back to 1G”).

46. Even the hardware limitations of the '798 patent were conventional. For example, it was well known that “all wireless systems include ... [antenna, RF Front-End, Baseband, and Controller] subsystems,” where the “baseband subsystem sits between the RF front-end and the controller ... [and] is responsible for end-user data encoding/decoding and signal modulation/demodulation.” Ex. 1011 at 7. It was also well known at this time that SDRs had evolved such that the RF front end was capable of digitization—meaning that the ADC was placed in the RF front end. *See, e.g.*, Ex. 1012 at 14.

47. Finally, it was well known that SDRs were capable of switching protocols based on user preferences, for example to achieve a defined Quality of Service or to reduce costs. *See, e.g.*, Ex. 1012 at 7 (introducing SDR and presenting multi-frequency and multi-protocol radios, e.g., Fig. 1.3), Chapter 8 by Friedrich Jondral (explaining that parameterization is an approach to enable an SDR to switch between multiple protocols motivated by “Software defined radio

technology is used to support the service and quality of service (QoS) requirements of the user.” Section 8.1).

A. Prosecution History of the '784 patent

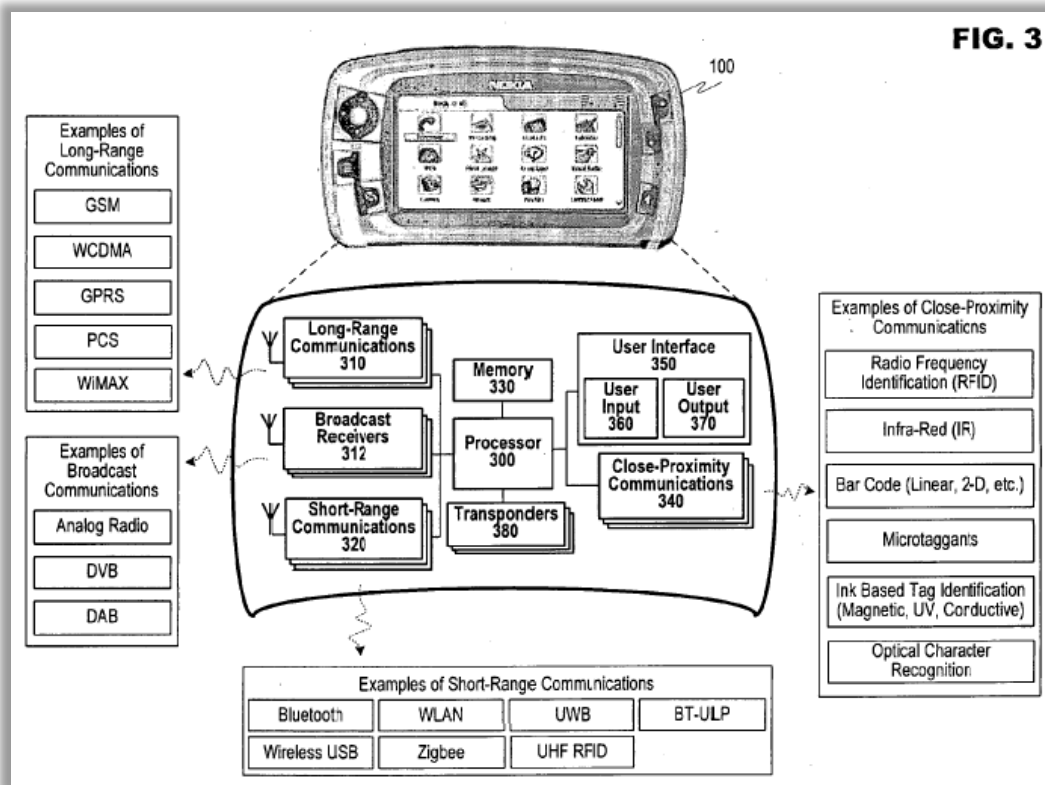
48. In forming my opinion as to the novelty or obviousness of the '784 patent, I reviewed the '784 patent's prosecution history. As I describe in the previous section, the '784 patent describes aspects of RFID technology and SDR technology that was commonplace at the time the '784 patent was filed. As such, it is not surprising the Examiner attempted to reject the '784 patent by taking official notice that what the '784 claimed was previously known. At the same time, I am surprised the Examiner did not find art and/or literature that describes these well-known concepts. To that end, I have searched for and reviewed a small portion of the art in the field.

B. The Prior Art

1. Tolonen

49. Tolonen teaches a wireless communication device (“WCD”) that includes communication modules 310, 312, 320, and 340 for long-range, broadcast, short-range, and close-proximity communications respectively. *See, e.g.,* Tolonen, Fig. 3. As shown in Figure 3, the WCD includes communication

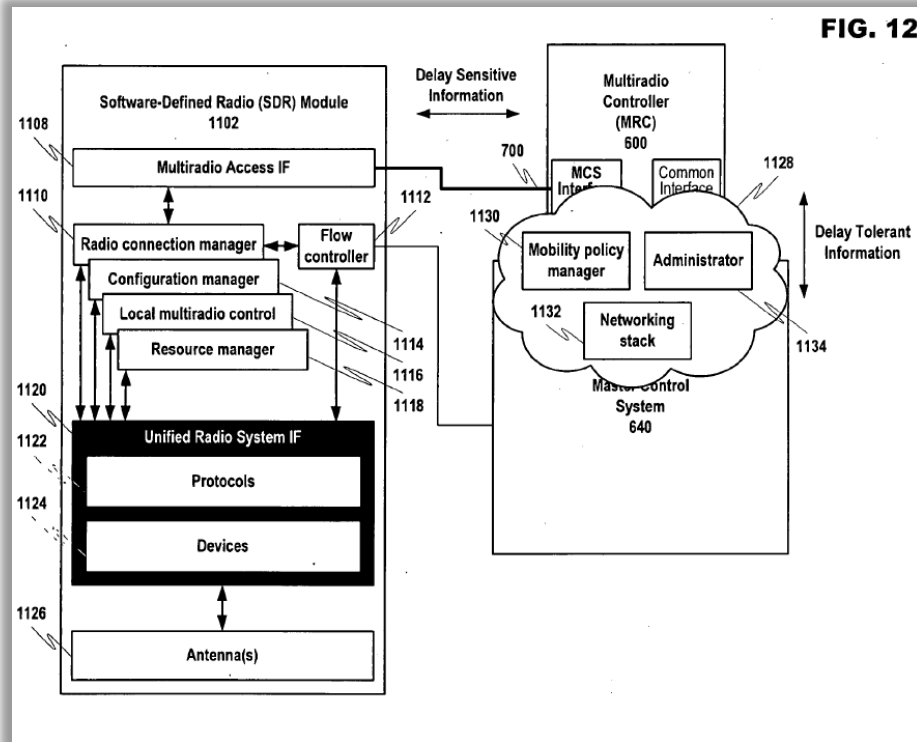
protocols like Bluetooth and WLAN and close-proximity communications such as RFID and/or Bar Code.



Tolonen, Fig. 3

50. Each of Tolonen's communication modules includes the hardware for transmitting and receiving signals, "includ[ing] [the] components (e.g., electronics) that perform functions, such as modulation, demodulation, amplification, and filtering" and are connected by a bus to the processor. Ex. 1005 ¶ 59. Tolonen's processor runs software for "calculat[ing], translat[ing], conver[ting], and/or packetizing ... data" for transmission, among other things. Ex. 1005 ¶¶ 59-60, 62.

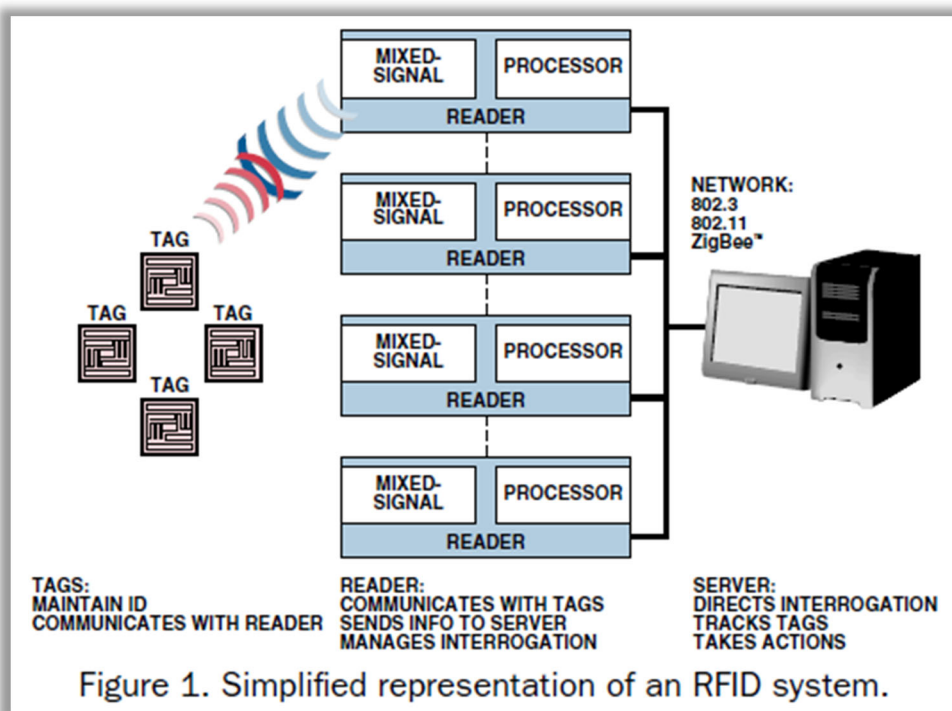
Tolonen's processor also manages the scheduling for the communication modules and defines the particular wireless transport. Ex. 1005 ¶¶ 94-98.



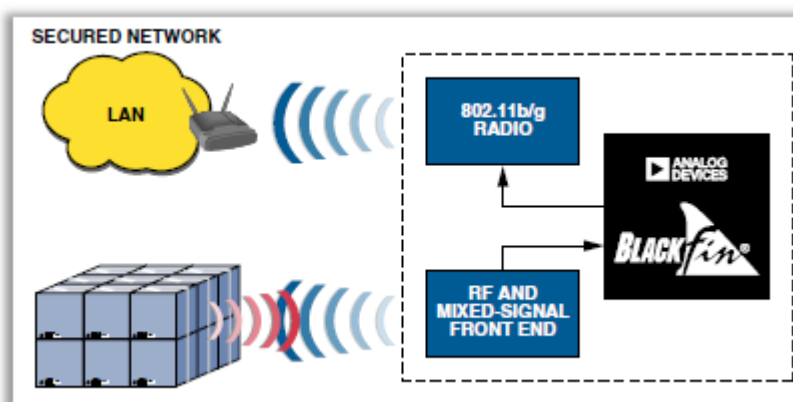
Tolonen, Fig. 12

2. Katz

51. Katz teaches an SDR-based RFID system, for example, a tag reader to interrogate, decode, and process tag information; and a server to house a tag database. Katz, at p. 1. Katz's RFID reader includes a Mixed Signal RF Front End, a Blackfin processor, and, in one implementation, an IEEE 802.11 chipset for communicating with a backend sever. Katz, at pp. 1-2; Figs. 1, 5.



Katz, Fig. 1



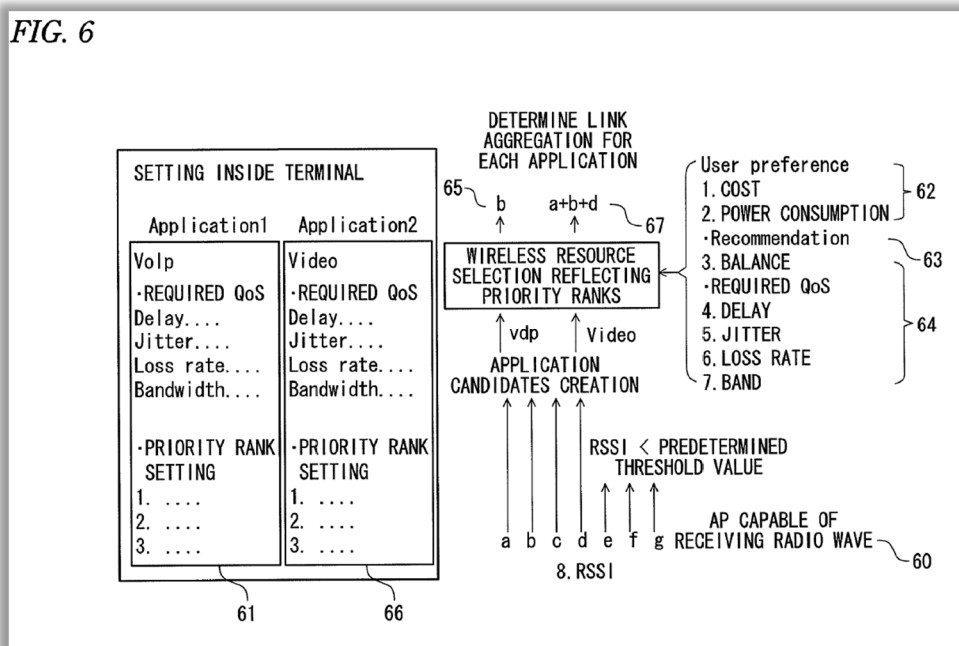
Katz, Fig. 5

52. Katz's Blackfin processor executes software to filter and transform radio signals as well as translate and filter the outputted data. Katz, at pp. 2–3. Katz

also employs ADC/DACs in its radio frequency front end to transform radio signals between the analog and digital domains. Katz, at p. 3, Fig. 2.

3. Ishizu

53. Ishizu teaches a dynamically reconfigurable wireless communication terminal based on user input. Ishizu, ¶¶ 30, 67. Architecturally, Ishizu's terminal includes a data communication aggregation device, comprised of a processor, communication modules, a keyboard for user input, and hard disk with connection policy information. Ishizu, ¶¶ 57, 69, Fig. 2. After evaluating the user input and the connection policy information, Ishizu dynamically reconfigures the terminal to select a wireless network, as shown below in Figure 6. Ishizu, ¶¶ 64–67, Fig. 6.



Ishizu, Fig. 6

VII. APPLICATION OF THE PRIOR ART TO ASSERTED CLAIMS

54. I have reviewed and analyzed the prior art references and materials cited herein. In my opinion the claims of the '784 patent are anticipated and rendered obvious based on the following prior art:

- GROUND 1: Claims 1–23 are anticipated over Tolonen or are obvious over Tolonen in view of the knowledge of a POSITA as detailed below.
- GROUND 2: Claims 1–23 are obvious over Tolonen in view of Katz as detailed below.
- GROUND 3: Claims 1–2 are anticipated over Katz as detailed below.
- GROUND 4: Claims 3–23 are obvious over Katz in view of Ishizu as detailed below.

VIII. GROUND 1: CLAIMS 1–23 ARE ANTICIPATED OVER TOLONEN.

A. Tolonen Invalidates the Claims

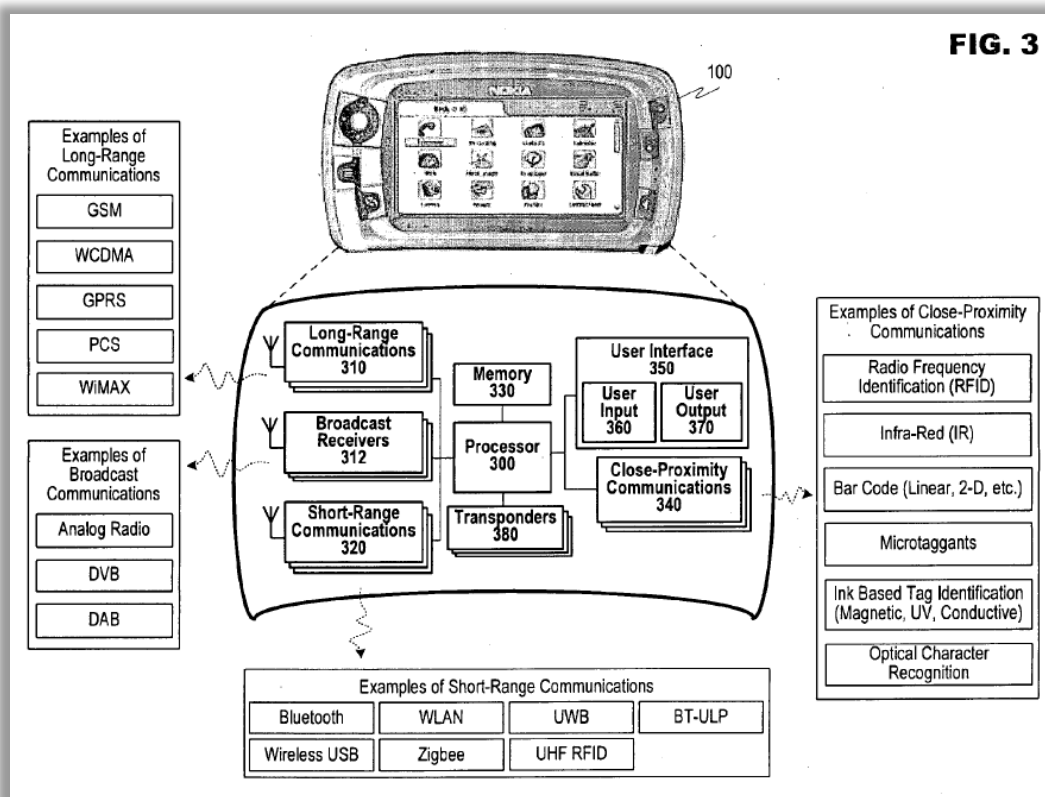
55. It is my opinion that Tolonen anticipates the '784 patent. As shown in Figure 3 below, for example, Tolonen teaches a wireless communication device (WCD) that comprises a processor, a memory, a user interface, and multiple communication modules—including short-range, broadcast, and long-range communication modules (communication elements 320, 312, and 310

respectively), any of which may be implemented by one or more SDRs. Ex. 1005

¶¶ 50, 92. As represented by close-proximity communications 340, Tolonen's

WCD includes an encoded reading device such as an RFID and/or barcode reader.

Ex. 1005 ¶ 56, Fig. 3.



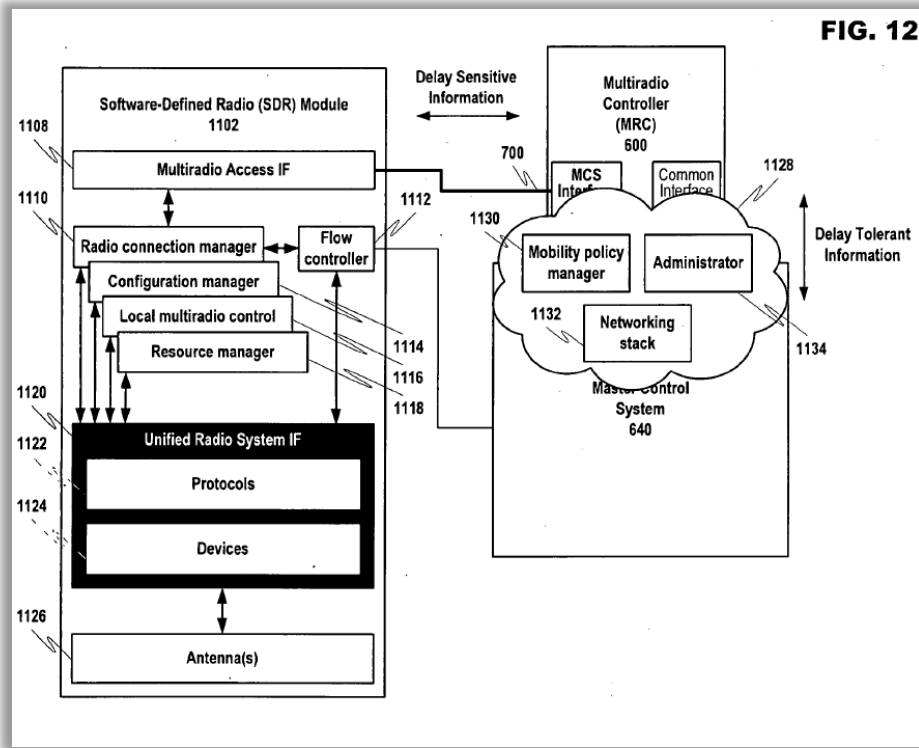
Tolonen, Fig. 3

56. Tolonen's Processor 300 controls the overall device operation through software stored in Memory 330. Tolonen, at ¶¶ 50-51. That software can also "include more specialized software modules configured to manage particular functions such as communication sections 310, 320, and 340." Ex. 1005 ¶ 52. For

example, Tolonen teaches that any one or more of Tolonen's communication modules can be replaced by an SDR. Ex. 1005 ¶ 92. In this particular arrangement, Tolonen's software program, executed by the processor, performs the software-based elements of the SDR. Ex. 1005 ¶ 90. For example, Tolonen teaches that the software, executed by the processor, "may access, manipulate, configure, etc. hardware elements in the apparatus in order to create the desired functionality. *Id.*

57. In addition to controlling the software aspects of the SDR, Tolonen's processor also performs scheduling and dynamic reconfiguration of the SDRs to control the communication protocol and communication characteristics by which the SDR communicates. Ex. 1005 ¶ 90. Tolonen describes the software elements being able to derive information about the environment around the WCD as well as the environment around the device the WCD is attempting to communicate with and adapting to that environment based on user preferences. *See, e.g.*, Ex. 1005 ¶¶ 48, 60, 70, 76, 93, 95, 98. Tolonen teaches that program modules provide information to the SDR that pertains to "instruction information (e.g., rules or preferences regarding which transports to utilized in certain situations)." Ex. 1005 ¶¶ 94–98. Tolonen teaches that "[t]hese preferences and/or rules may be based on various apparatus, application or user-defined characteristics," for example, "the number of messages pending for each transport in [the] networking stack." Ex.

1005 ¶ 98. Tolonen teaches that, with this data, the radio connection manager 1110 configures the SDR “to support the particular wireless transport,” and the SDR’s local multiradio control 1116 implements the configuration. Tolonen at ¶ 95; see also Tolonen at ¶ 70 (teaching that delay tolerant information such as configuration information may be “delivered . . . by master control system 640”), Ex. 1005 ¶¶ 74–75 (teaching that priority controller 740 of MRC 700 may be implemented in software running on processor 300 within master control system 640 to determine priority amongst radio modems, i.e., to dynamically select a wireless communication network). Tolonen’s SDR can then “emulate [the] desired radio function.” Ex. 1005 ¶ 96. For example, by “access[ing] and/or manipulating” protocols 1122 and device information 1124, Tolonen’s SDR is able to “emulate the functionality of a radio module that is configured to operate using a first transport (e.g., Bluetooth ...).” Ex. 1005 ¶ 96.



Tolonen, Fig. 12

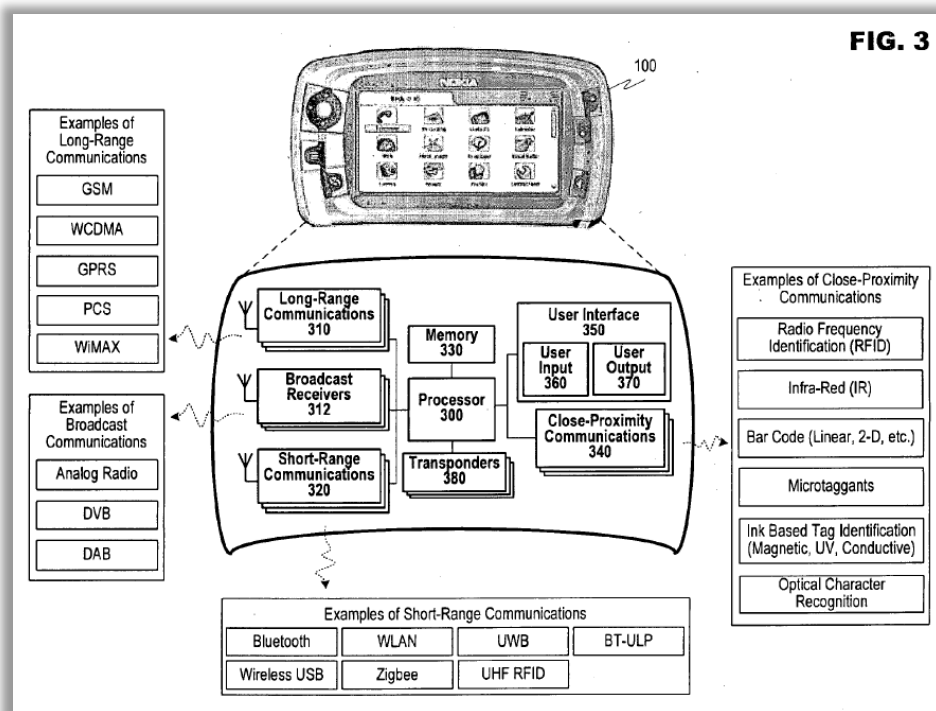
58. Because Tolonen's WCD 100 includes an encoded reading device and communication modules, where one or more may be implemented as an SDR, and because Tolonen's WCD is capable of switching communication protocol and characteristics based on user preferences, it is my opinion that Tolonen anticipates each claim of the '784 patent.

59. In the paragraphs that follow, I describe on a claim-by-claim basis my opinions as to why Tolonen anticipates the '784 patent.

1. Claim 1

a) *[lpre] Tolonen discloses “[a]n encoded information reading (EIR) terminal compris[ing]”*

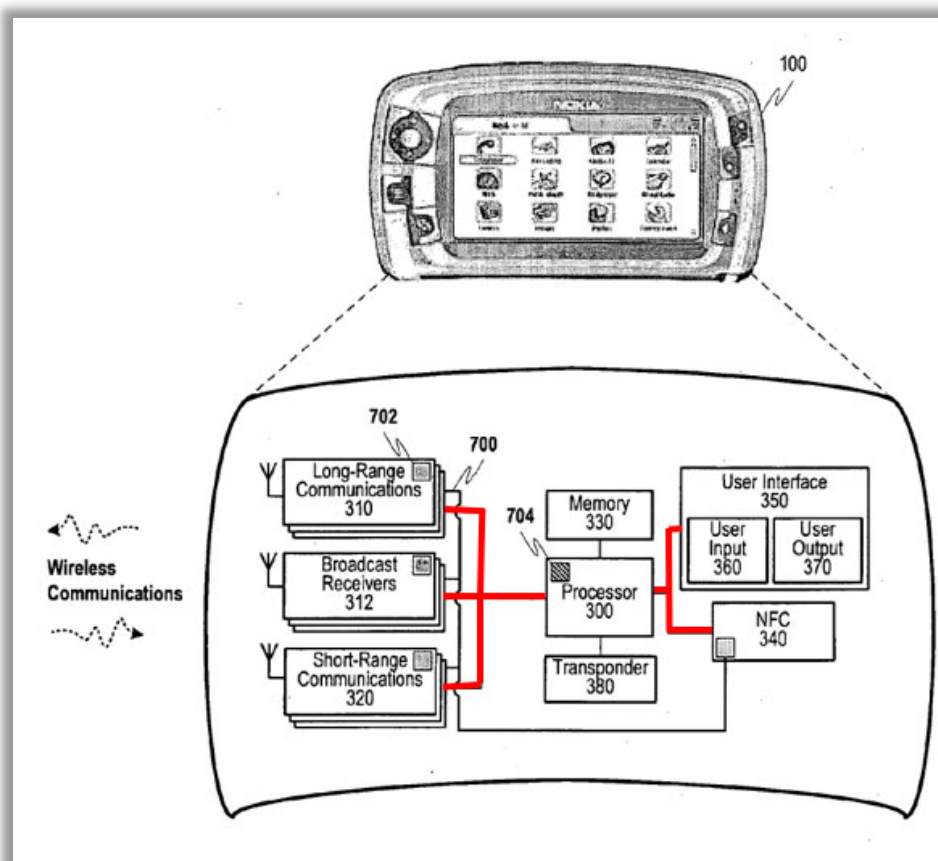
60. It is my opinion that Tolonen’s WCD 100 is an encoded information reading terminal. As shown in Figure 3 below, Tolonen’s WCD comprises, among other things, a processor, a memory, a user interface, and multiple communication methods and devices, including a radio frequency identification (RFID) device and a bar code reading device, to interface with other devices. Ex. 1005 ¶¶ 50-57, Fig. 3.



Tolonen, Fig. 3.

b) [1a] Tolonen's EIR terminal comprises "a microprocessor electrically coupled to a system bus."

61. It is my opinion that Tolonen's EIR terminal comprises a microprocessor electrically coupled to a system bus. Tolonen's WCD 100 includes processor 300, "or [optionally] one or more microprocessors" that are responsible for "control[ling] overall device operation" and "executing software instructions stored in memory 330." Ex. 1005 ¶ 50; *see also* Ex. 1005 ¶ 52. Furthermore, and as illustrated in Figures 3 and 8A, Tolonen's "processor 300 [or microprocessors], communications sections 310, 312, and 320, memory 330, close-proximity communications 340, user interface 350, transponder 380, etc. ... are coupled together via one or more wired and/or wireless bus interfaces." Ex. 1005 ¶ 59; *see also*, Ex. 1005 ¶¶ 71-73, Fig. 8A (describing the use of an I²C bus to connect the processor 300 with communication modules 310, 312, 320, and 340).



Tolonen 8A (annotated to show system bus)

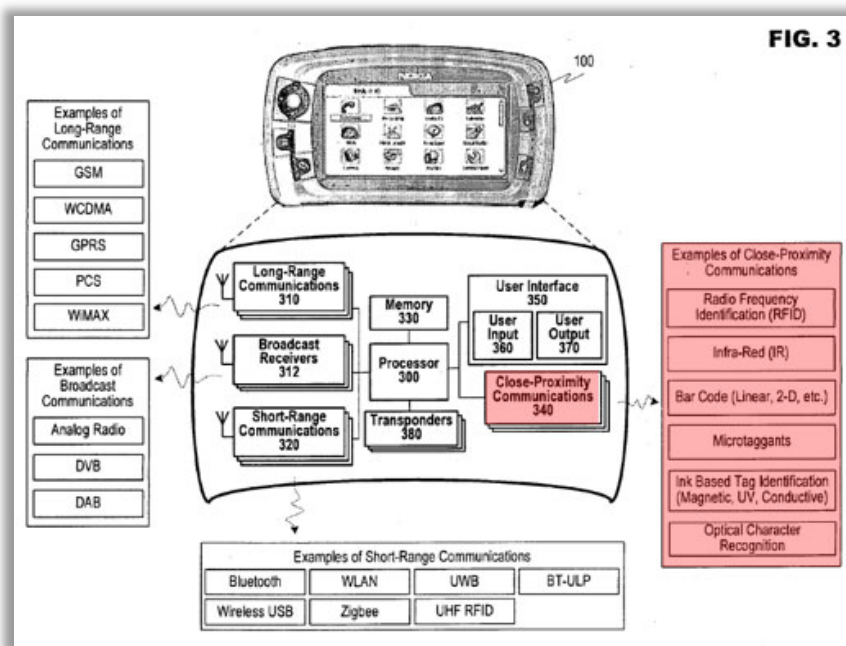
- c) [1b] Tolonen's EIR terminal comprises "a memory communicatively coupled to said microprocessor."

62. It is my opinion that Tolonen's WCD comprises a memory communicatively coupled to said microprocessor. Tolonen's WCD 100 includes a memory connected to one or more microprocessors using a wired or wireless method ("processor 300 ... memory 330 ... are coupled together via one or more wired and/or wireless bus interfaces", Ex. 1005 ¶ 59) where the one or more

microprocessors “are each capable of executing the software instructions stored in memory 330.” *See* Ex. 1005 ¶¶ 50, 59, Fig. 3; *see also supra* Section VIII.A.1.b.

- d) *[1c] Tolonen’s EIR terminal comprises “an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message.”*

63. It is my opinion that Tolonen’s WCD includes an encoded information reading (EIR) device selected from the group consisting of a bar code reading device and an RFID reading device. As shown in Figure 3, below, Tolonen’s WCD 100 includes close-proximity communications 340 (*i.e.*, an EIR device), which “provide[s] functionality related to the short-range scanning of machine-readable data.” Ex. 1005 ¶ 56, Fig. 3. Tolonen contemplates that close-proximity communications 340 may include “Radio Frequency Identification (RFID),” “Bar Code (Linear, 2-D, etc.),” and “Optical Character Recognition,” amongst others. *Id.* Additionally, as shown in figure 3 below, Tolonen discloses that Short Range Communications 320 may communicate via UHF RFID protocols (*i.e.*, that Short Range Communications 320 may be an EIR device). Ex. 1005 ¶ 55, Fig. 3.



64. It is further my opinion that Tolonen's EIR device is configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message. For example, Tolonen's EIR device includes "components (e.g., electronics) that perform functions such as "modulation, demodulation, amplification, and filtering" and includes functionality for "control[ing] the reception of signals from an RFID transponder" or for reading machine-readable data such as linear bar codes (e.g., UPC symbols), 2-D bar codes (e.g., QR codes), and/or optical character recognition, amongst others. Ex. 1005 ¶¶ 41, 56, 58-59. By definition, machine readable data such as bar codes are encoded. In other words, the data is encoded into the bar code image that can be picked up by the optical

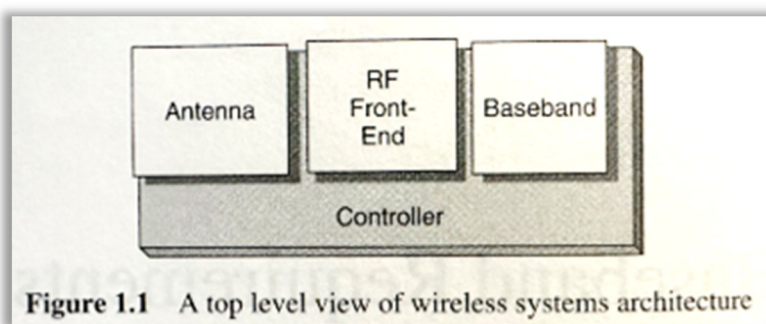
barcode reader. Accordingly, for Tolonen's WCD to be able to read bar codes, as Tolonen teaches, Tolonen's close-proximity communication module (e.g., bar code reader) would need to read the barcode and communicate (i.e., output) the barcode's information to Tolonen's processor in digital form (i.e., as a sequence of bits). Depending on the specifics, this could happen only one of two ways: either Tolonen's bar code reader could output the raw encoded message data (e.g., a raw image of the bar code or a digital representation of the widths for each bar and white space, in the correct order, for the linear bar code) received from the bar code to Tolonen's processor for decoding, or, in the more likely case, Tolonen's bar code reader, itself, decodes the machine readable data encoded in the bar code and outputs the decoded message data to the processor.

65. In my opinion, the latter is more probable. Tolonen's EIR device outputs the decoded message data. For example, Tolonen teaches that the WCD 100 "may ... incorporate components such as optical detectors ... or other sensors known in the art for *interpreting* machine-readable information") (emphasis added). Ex. 1005 ¶ 56. This teaching leads me to conclude that Tolonen's close-proximity communication device includes an optical detector (e.g., camera) that reads and interprets (i.e., decodes) the machine-readable code. *See also* Ex. 1013, McGraw-Hill, Dictionary of Scientific and Technical Terms (5th ed. 1994)

(defining “decode” as “[t]o translate coded characters into a more understandable form”).

- e) *[1d] Tolonen’s EIR terminal comprises “a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus.”*

66. It is my opinion that at least Tolonen’s long-range communication module 310, broadcast receiver module 312, and short-range communication module 320 (collectively the “communication modules”) include wireless communication interfaces that comprise a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal. Every wireless communication system must have an RF Front end. *See, e.g.,* Ex. 1011 pp. 7-8 (“At the highest level, all wireless systems can be decomposed into four subsystems [Antenna, RF Front-End, Baseband, and Controller] (see Figure 1.1). The baseband subsystem sits between the RF front-end and the controller.”).



Ex. 1011 Fig. 1.1

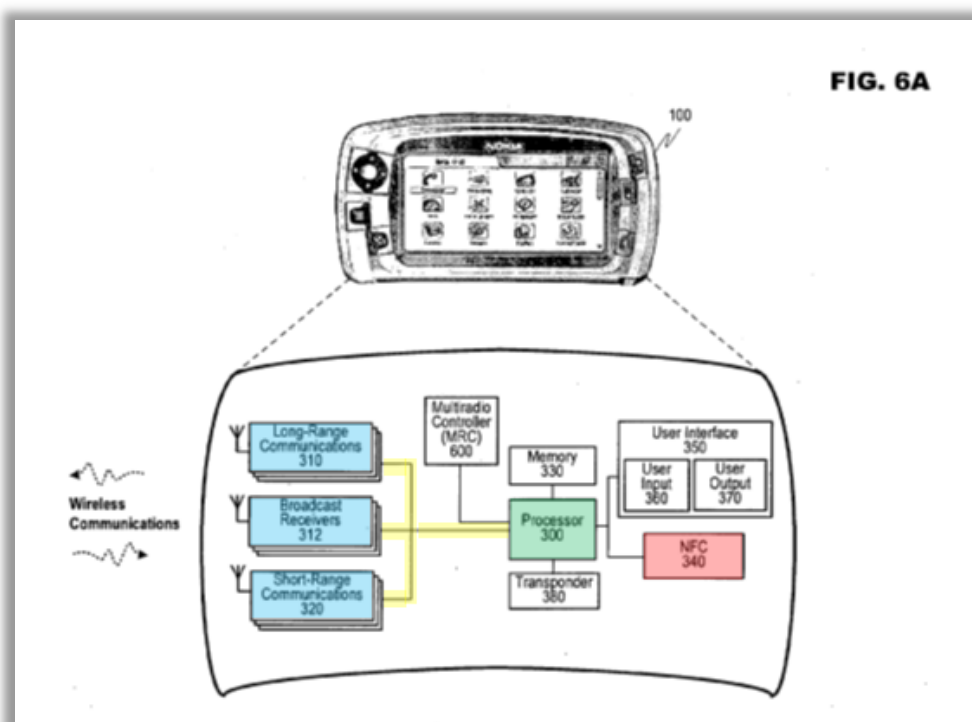
The RF Front end is located between the antenna and the digital system (e.g., baseband component) and includes components such as amplifiers and filters, which are needed to process the modulated analog signals received at the antenna.

Id. See also, Ex. 1012, Chapter 3 by Mark Cummings.

67. For Tolonen's radio modems to transmit packetized digital communications through wireless transmission via analog radio frequency signals, it is a requirement that the communication modules first convert the digital data in the digital system (e.g., Processor 300) to analog signals by passing it through the DAC. Radio transmission, including digital cellular transmissions like GSM and 3G, works by taking digital data from the digital system and converting it into an analog signal that can be communicated via analog radio frequency waves.

68. Tolonen confirms that its communication modules include such an RF front end. For example, Tolonen teaches that the communication modules include

the “[h]ardware ... **for the transmission and reception of signals**, ... include[ing] components (e.g., electronics) that perform functions, such as modulation, demodulation, **amplification**, and **filtering**.” Ex. 1005 ¶ 59 (emphasis added). In this paragraph, Tolonen is describing functionality in an RF front end by enumerating some of its components. Moreover, as Tolonen’s communication modules communicate according to long-range bidirectional, short-range bidirectional, and broadcast (receiver) protocols, and include antennas, the communication modules, must include an RF front end. *See, e.g.*, Tolonen, Fig. 6A; *see also* Ex. 1011 pp. 7-8.



Tolonen Fig. 6A (annotated)

69. It is my opinion that each of Tolonen's communication modules are digital communication modules, which require digitization interfaces in order for the digital logic to work correctly and the antenna to transmit and receive analog signals (i.e., an ADC and DAC are necessary to transform between the analog radio frequency domain and the digital domain of the Processor 300 and other digital components of the WCD). For purposes of showing anticipation of this claim limitation I focus on Tolonen's Long-Range Communication module and, even more specifically, the "GSM" standard example of Tolonen's Long-Range Communication module. *See, e.g.*, Ex. 1005 ¶ 5 (explaining that "GSM is an example of a widely employed 2G digital cellular network"), Fig. 3.

70. GSM is an example digital communication standard where it was known to a POSITA that the standard may be implemented using an SDR. *See, e.g.*, Ex. 1012, Wiley, 2002, Chapter 8 by Friedrich Jondral (explaining how to use parameterization to implement GSM and other cellular standards using an SDR). *See also*, Ex. 1011, Chapter 1 by Mark Cummings (explaining generally how to implement GSM and other cellular standards using an SDR). For a GSM device implemented using an SDR, the SDR processing engine sends digital information to a DAC for conversion into an analog signal which is processed through the intermediate frequency ("IF") stage and then through the RF Front end for

transmission via the antenna as an analog radio signal. When the GSM SDR receives a radio signal, the reverse process is performed. The analog signal is received through the antenna, passed through the RF Front end, passed through the IF processing, and finally passed through the ADC for conversion into a digital signal which can be received and understood by the digital portion (including the software implementing the software defined radio portion) of the wireless device.

71. The below image, taken from Tuttlebee's book on Software Defined Radios identifies the primary functional steps needed to receive and transmit a signal (regardless of whether they are implemented in hardware or software) and further identifies the functional steps that are implemented in software for the Stage 3 evolution of the SDR. Ex. 1011 at 4, Chapter 1 by Mark Cummings.

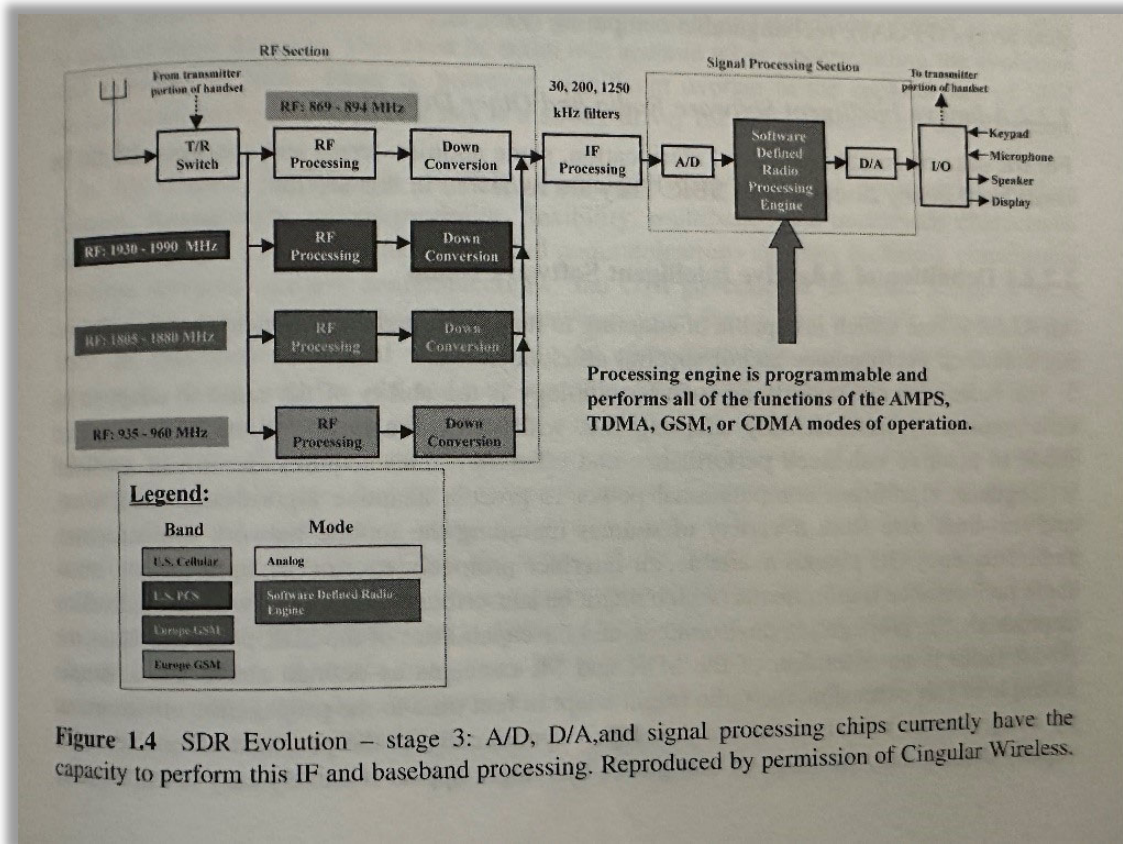


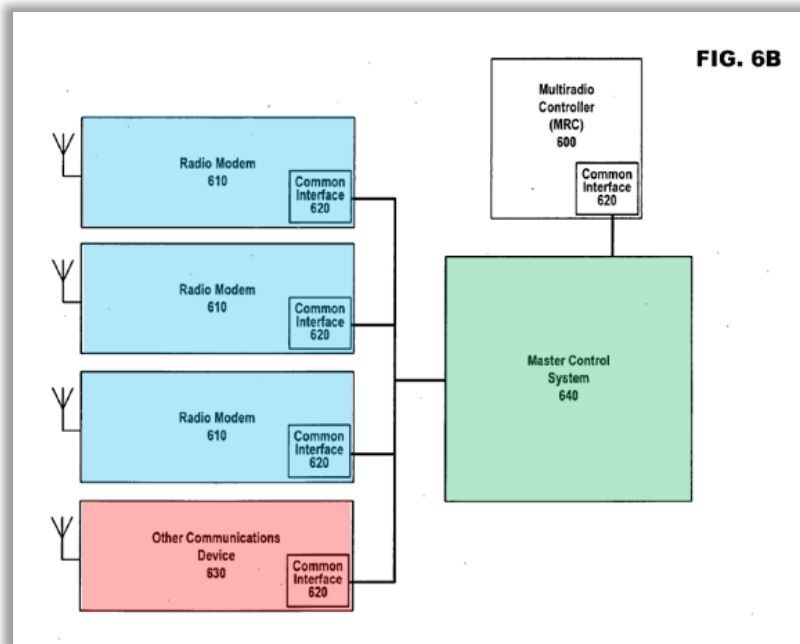
Figure 1.4 SDR Evolution – stage 3: A/D, D/A, and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012 Fig. 1.4

72. As Tolonen's Long-Range Communication Module 310 implements the GSM standard, which according to Tolonen can be implanted through an SDR, it is necessarily the case that Tolonen's Long-Range Communication Module 310, like the example shown in Tuttlebee's figure 1.4, includes an ADC and DAC electrically coupled to the RF front end and further electrically coupled to the processor (Software Defined Radio Processing Engine in Tuttlebee's figure 1.4). See Ex. 1005 ¶¶ 89-98. According to the figure above, the processor is what is

operating the Software Defined Processing Engine. *See* Fig. 1.4 (“Processing Engine is Programmable and Performs all of the AMPS, TDMA, GSM, or CDMA modes of operation”). As Tolonen’s Long-Range Communication Module 310 implements the GSM standard and can be implanted through an SDR, it is necessarily the case that Tolonen’s Long-Range Communication Module 310, like the example shown in Tuttlebee’s figure 1.4, includes an ADC and DAC coupled to the RF front end and to the processor. *See* Ex. 1005 ¶¶ 89-98.

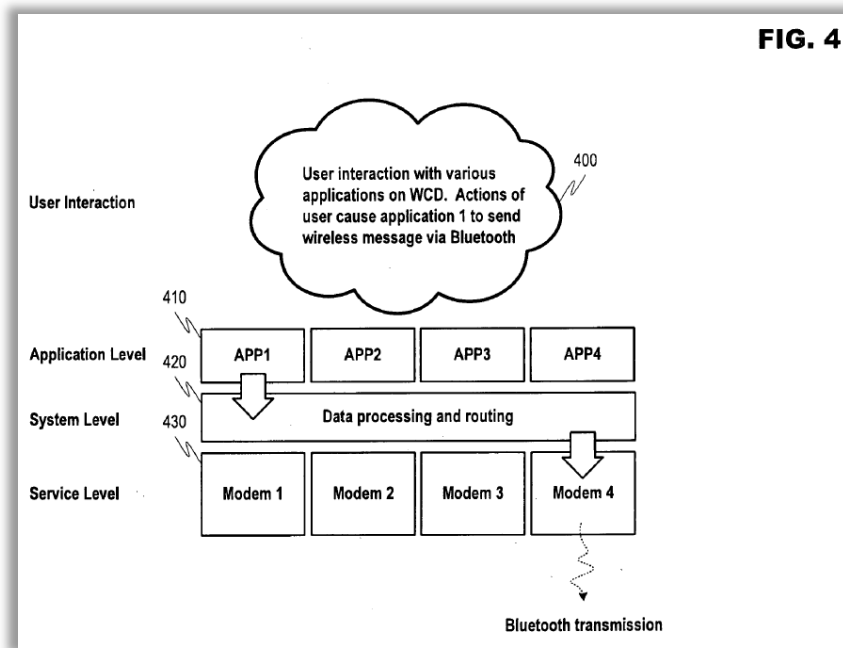
73. As further support for my position that Tolonen’s communication modules include an RF Front end with an ADC and DAC coupled between the RF Front End and the Processor, Tolonen refers to its communication modules in some places as “modems,” which in connection with Figures 6A and 6b, are electrically coupled to Tolonen’s WCD 100’s system bus. In connection with Figure 6A above, Figure 6B below illustrates Tolonen’s communication modules as “radio modems.”



Tolonen Fig. 6B (annotated)

74. Radio modems operate to, among other things, convert data from digital format to analog signals (digital to analog conversion – DAC) for data transmission across an RF front end and to convert data from analog signals to digital format (analog to digital conversion – ADC) after reception by an RF front end. In this way, Tolonen’s Radio Modems, at least inherently, include an analog to digital converter (“ADC”) and digital to analog converter (“DAC”). *See* Ex. 1005 ¶¶ 53-56, 59, 62, 65-66, Fig. 6A, 6B. Indeed, ADCs and DACs are required for digitization, which is a requisite step of any digital communication handset. *See generally* Ex. 1012 at pp. 3-21.

75. Finally, the ADCs and DACs within Tolonen's communication modules are electrically coupled to Tolonen's processor through a system bus. *See, e.g.,* Ex. 1005, Fig. 3. Tolonen teaches that the communication modules are coupled together with the WCD 100's processor (e.g., microprocessor), memory, close-proximity communication 340 (e.g., EIR device), and user interface "via one or more wired and/or wireless bus interfaces." Ex. 1005 ¶ 59. Tolonen teaches that the processor, together with software stored in memory and the user interface, allows the user to perform communications through the communication modules, including by executing "routines that ... provide data processing, routing, transmission, reception, etc." Ex. 1005 ¶¶ 50-51, 59-60. To illustrate further, Figure 4 below, illustrates an example process flow for communication through the short-range (e.g., Bluetooth) communication protocol. Ex. 1005 ¶ 61, Fig. 4.



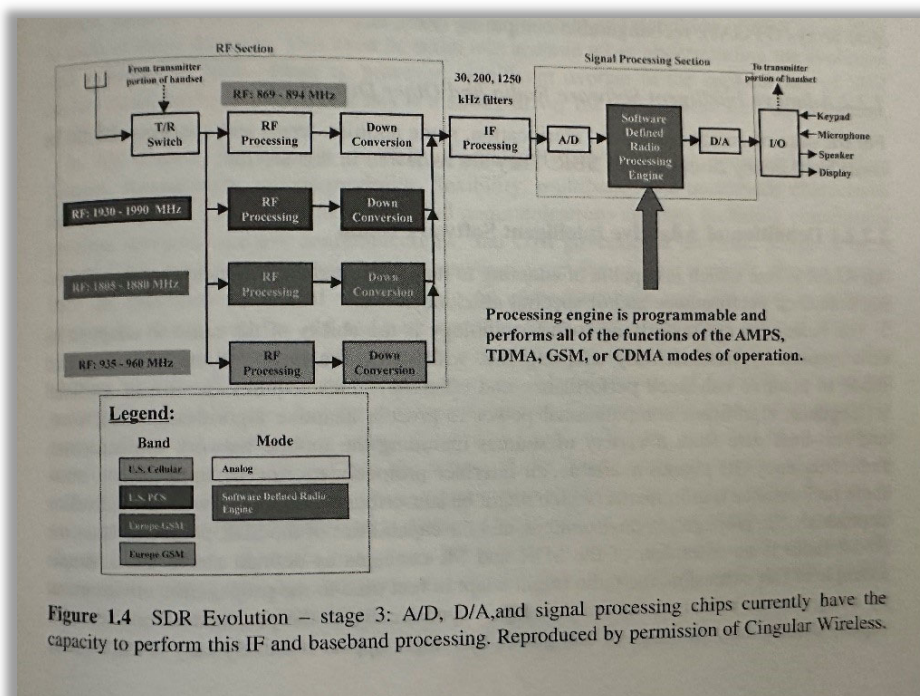
Tolonen Fig. 4

According to figure 4, “the system level 420 may process and route data requests for transmission,” which “may include ... the calculation, translation, conversion and/or packetizing [of] the data.” *Id.* at ¶ 62. Tolonen teaches that “[t]he data may then be routed to an appropriate communication resource in the service level” and that “the packets may be routed to a radio modem for delivery via wireless transmission.” *Id.* In other words, Tolonen’s processor executes data processing and communicates data to the communication modules through the system bus for transmission.

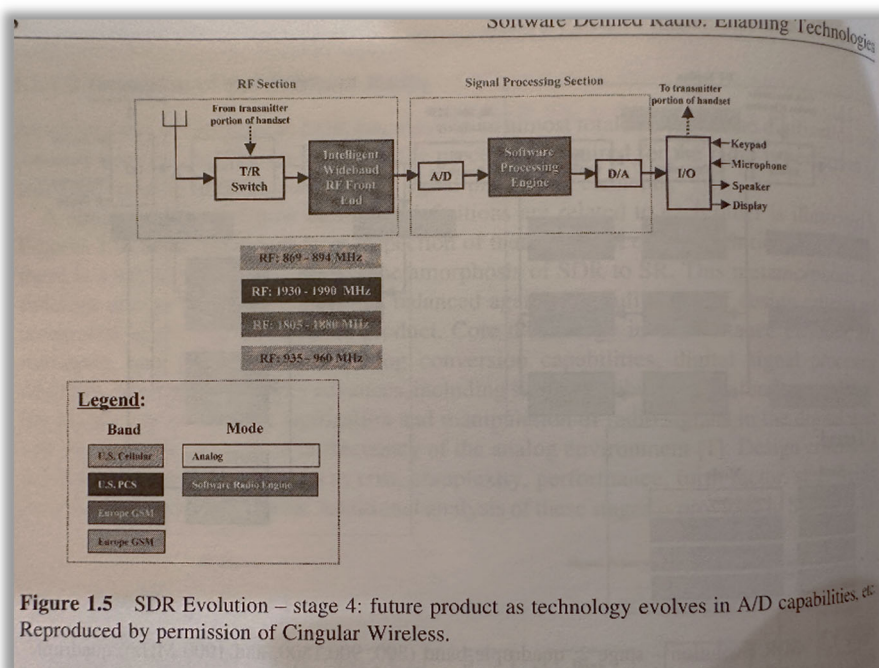
76. As I described in the preceding paragraphs, in order for at least Tolonen’s communication modules, including Bluetooth and long-range communication module, to operate, Tolonen’s communication modules must have

RF front ends electrically connected to an ADC and DAC which are electrically connected to the system bus. Nevertheless, to the extent some other configuration existed at the time the '784 patent was filed, this arrangement would have been obvious, as it was the most common, if not the only such arrangement—indeed at the time of drafting my report I can think of no other wireless communication system that would not include an RF front end electrically coupled to an ADC and DAC which are electrically coupled to a system bus.

77. For example, Tolonen's long-range communication module communicates uses "technologies from ... 3 G" and teaches using SDRs for these communication modules. Ex. 1005 ¶¶ 53, 89, 92. When implemented through SDR, 3 G chipsets included an RF Front end electrically coupled to an ADC and a DAC, which were further coupled through a bus to the processor running the SDR software. *See* Ex. 1011 at 7-8, Figs. 1.4 and 1.5; *see also* Ex. 1005 ¶¶ 89-98.



Ex. 1012 Fig. 1.4



Ex. 1012 Fig. 1.5

78. To the extent GSM was accomplished through an SDR, as suggested by Tolonen, it also would have been obvious to use an SDR GSM chipset such as those taught by Tuttlebee. Tuttlebee's chips from Cingular Wireless are part of a finite group of SDR chipsets for communicating according GSM. As such, a POSITA would have found it obvious to try using the Cingular Wireless chips and would have reasonably expected the combination to yield Tolonen's WDC with a long-range communication module according the SDR (Cingular Wireless chip) described by Tuttlebee.

79. A POSITA implementing Tolonen's invention would have chosen from one of many available off-the-shelf SDRs and SDR chipsets would have chosen Cingular Wireless's SDR as discussed by Tuttlebee because of its availability and efficacy. Tuttlebee teaches that Cingular Wireless's SDR includes a processing engine programmable to "perform[] all of the functions of the AMPS, TDMA, GSM, or CDMA modes of operation," and a POSITA would have determined this chip ideal for implementing the GSM protocols and 3 G. *See* Ex. 1012 at 7. Moreover, as Tolonen describes incorporating SDRs, a POSITA would have expected reasonable success at plugging Cingular Wireless's SDR into the teachings of Tolonen to arrive at a fully functional WDC that communicates through cellular radio according to the Cingular Wireless's SDR.

f) [1e] Tolonen's "microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program."

80. Tolonen's processor 300 performs many of the functions for communicating via radio frequency, such as "modulation, demodulation, amplification, and filtering" as well as the functions for processing data including "calculate[ing], **translat[ing]**, **conver[ting]**, and/or packetizing the data" for transmission, i.e., performing baseband processing. Ex. 1005 ¶¶ 59-60, 62 (emphasis added). Encoding and decoding are processes for **translating**, or **converting**, data from one representation to another representation. *See, e.g.*, Ex. 1013, McGraw-Hill, Dictionary of Scientific and Technical Terms (5th ed. 1994) (defining "decode" as "[t]o translate coded characters into a more understandable form"). And, as Tolonen contemplates that some of the communications "may be encoded so that only certain receiving devices may access the transmission content," Ex. 1005 ¶ 54, the processing also pertains to encoding (e.g., encrypting) and decoding (e.g., decrypting) signals. Accordingly, Tolonen's processor includes a baseband encoder and decoder software program.

- g) *[1f] Tolonen's "base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control."*

81. As described for limitation 1(f), Tolonen's processor (or microprocessors) performs functions in connection with transmitting and/or receiving encoded messages, including "modulation, demodulation, amplification, and filtering," as well as the functions for processing the data including "calculate[ing], **translat[ing]**, **conver[ting]**, and/or packetizing the data" for transmission. Ex. 1005 ¶¶ 59-60, 62; *see supra* VIII.A.1.f. Encoding and decoding are processes for **translating**, or **converting**, data from one representation to another representation. Packetized data is a bit stream that contains encoded data. *See, e.g.*, Ex. 1013, McGraw-Hill, Dictionary of Scientific and Technical Terms (5th ed. 1994) (defining "decode" as "[t]o translate coded characters into a more understandable form"). Tolonen contemplates that some of the communications "may be encoded so that only certain receiving devices may access the transmission content," Ex. 1005 ¶ 54. Encryption is the process of encoding data so that only certain receiving devices may access the transmission content so as to correctly decode the received signal and retrieve the encoded data.

- h) *[1g] Tolonen's "DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream."*

82. Tolonen's communications modules, which communicate encoded messages, include radio modems comprising an ADC and DAC, electrically coupled to the communication modules' RF front end and to Tolonen's system bus which is electrically coupled to Processor 300. *See supra* Section VIII.A.1.e–g. For Tolonen's radio modems to transmit encoded communications, such as those including packetized data, via radio frequency signals, the communication modules must first convert the encoded digital data, such as the digital packet containing the packetized data, to analog signals via the DAC. Indeed, radio transmissions, including cellular transmissions, work by taking digital data and converting it into an analog signal that can be communicated via radio-frequency waves. Again, as I explain above for limitation 1(e), SDR engines sends digital information to a DAC for conversion into an analog signal which is processed through the intermediate frequency ("IF") stage and then through the RF front end for transmission out of the antenna as an analog radio signal. When the SDR receives a radio signal, the reverse process is performed. The analog signal is received through the antenna, passed through the RF Front end, passed through the IF processing, and finally passed through the ADC for conversion into a digital signal which can be received

and understood by the digital portion (including the software implementing the software defined radio portion) of the wireless device.

- i) *[1h] Tolonen's "ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end."*

83. Complementing the DAC functionality, for Tolonen's WCD 100 to receive and process radio frequency communications, including long-range encoded communications, Tolonen's communication modules must include an ADC that converts the received analog signal into a digital signal that can be understood by the software executing on Tolonen's Processor 300. Again, since processors communicate through digital information and RF communications work by communicating analog signals, a digital wireless communication system requires conversion from an analog signal to a digital bit stream upon reception. *See also supra* Section VIII.A.1.e-h. Moreover, as Tolonen contemplates encoded communications, the received analog signal converted by the ADC would necessarily yield an encoded digital bit stream. *See also* Ex. 1005 ¶ 6, 13, 40, 53-54, 79, 96, 106-112, Fig. 14A; *supra* Section VIII.A.1.e-h.

- j) [1i] Tolonen's "base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding."

84. In the same way that Tolonen's WCD 100 comprises a processor and communication modules (including all the requisite hardware and software) for sending encoded, long-range communications, in order to communicate with other devices, Tolonen's WCD 100 also includes the hardware and software functionality to decode and interpret the communications received. *See supra* Section VIII.A.1.f–i. This means that upon receipt and conversion from analog to digital, Tolonen's Processor 300 executes software that decodes the received message (i.e., *the second encoded bit stream*) into a decoded message (i.e., *second bit stream corresponding to said second encoded bit stream*). Again, Tolonen teaches the processor provides the "communication utilities for supporting long-range communications"—including "modulation, demodulation, amplification, and filtering," as well as the functions for processing the data including "calculate[ing], translat[ing], conver[ting], and/or packetizing the data"—and that long range communications can be encoded. Ex. 1005 ¶¶ 54, 59-62. Encoding and decoding are processes for **translating**, or **converting**, data from one representation to another representation. *See, e.g.*, Ex. 1013, McGraw-Hill, Dictionary of Scientific

and Technical Terms (5th ed. 1994) (defining “decode” as “[t]o translate coded characters into a more understandable form”). Receiving packetized data (i.e., channel encoded data) requires channel decoding. Tolonen contemplates that some of the communications “may be encoded so that only certain receiving devices may access the transmission content.” Ex. 1005 ¶ 54. Encryption is the process of encoding data so that only certain receiving devices may access the transmission content, and these certain receiving devices would necessarily decrypt the received encrypted messages. In this way, Tolonen, at least inherently teaches this limitation.

2. Claim 2

a) [2a]Tolonen’s “[t]he EIR terminal of claim 1 ... is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.”

85. It is my opinion that Tolonen discloses claim 1 and at least one embodiment of Tolonen’s WCD is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-

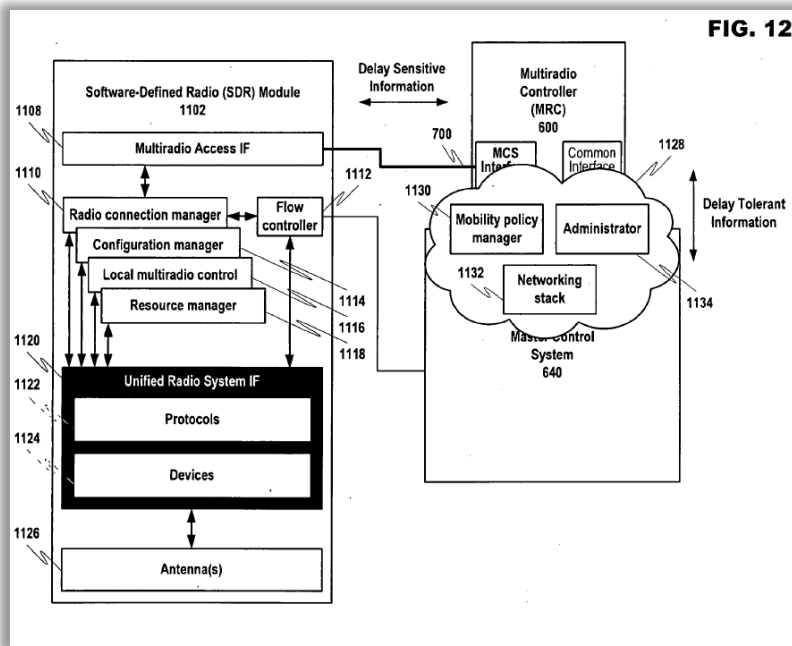
modulation, de-multiplexing, channel decoding, decryption, and source decoding.

See supra Section VIII.A.1. For example, Tolonen teaches that the “components (e.g., electronics) that perform functions, such as modulation, demodulation, amplification, and filtering” “may be replaced by integrated circuits in the form of a programmable logic device ... that may be programmed to replicate the functions of the stand-alone devices.” Ex. 1005 ¶ 59. Additionally, Tolonen contemplates that any hardware-based radio module, such as communication modules 310, 320, 330, and 340, may optionally be replaced with “radio modules that rely more heavily upon a reconfigurable software-based element”—“a software-defined radio.” Ex. 1005 ¶¶ 89-92 (teaching that the “flexibility of SDR module 1104 may provide an option of omitting some communication hardware from WCD 100”, ¶ 92). Finally, Tolonen teaches the processor (e.g., running software) processes the data including “calculat[ing], translat[ing], conver[ting], and/or packetizing the data”—and that communications are encoded for security. Ex. 1005 ¶¶ 59–62. In this way Tolonen’s baseband encoder software is run on software devoid of hardware.

3. Claim 3

- a) [3a] Tolonen's "EIR terminal of claim 1[] further compris[es] a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol."

86. It is my opinion that Tolonen discloses claim 1 and that Tolonen's WCD further comprises a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol. *See supra* Section VIII.A.1. For example, where Tolonen's hardware radio modems are replaced with a software-defined radio ("SDR"), the SDRs receive data instructing on rules and preferences for the communication medium (e.g., the *wireless communication network*, *wireless communication protocol*, and *parameters of the wireless communication protocol*). Ex. 1005 ¶¶ 10-4, 92-6, 98.



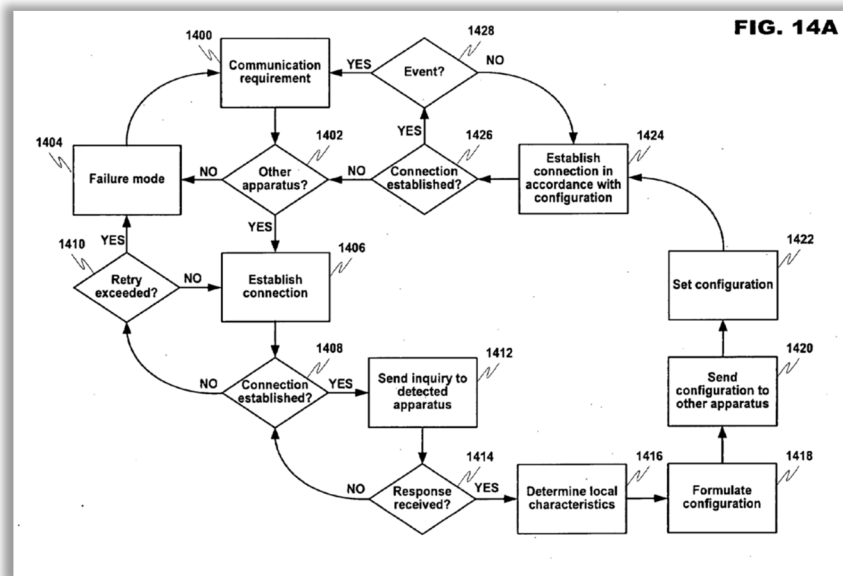
Tolonen Fig. 12

87. With reference to figure 12 above, Tolonen teaches that the SDR includes a radio connection manager 1110 that receives data from program modules 1128, residing within Tolonen’s Multiradio Controller (“MRC”) 600, pertaining to “instruction information (e.g., rules or preferences regarding which transports to utilized in certain situations).” Ex. 1005 ¶¶ 94-98. Tolonen teaches that “[t]hese preferences and/or rules may be based on various apparatus, application or user-defined characteristics,” for example, “the number of messages pending for each transport in [the] networking stack.” Ex. 1005 ¶ 98. Tolonen teaches that, with this data, the radio connection manager 1110 configures the SDR “to support the particular wireless transport,” and the SDR’s local multiradio

control 1116 implements the configuration. *Id.* at ¶ 95; *see also id.* at ¶ 70 (teaching that delay tolerant information such as configuration information may be “delivered ... by master control system 640”), ¶¶ 74-75 (teaching that priority controller 740 of MRC 700 may be implemented in software running on processor 300 within master control system 640 to determine priority amongst radio modems, i.e., *to dynamically select a wireless communication network*). Tolonen’s SDR can then “emulate [the] desired radio function.” Ex. 1005 ¶ 96. For example, by “access[ing] and/or manipulating” protocols 1122 and device information 1124, Tolonen’s SDR is able to “emulate the functionality of a radio module that is configured to operate using a first transport (e.g., Bluetooth ...).” Ex. 1005 ¶ 96.

88. Tolonen teaches that this configuration can happen dynamically. In one way, Tolonen teaches that “mobility policy manager 1130 may work with administrator 1134 to create an appropriate implementation schedule so that communication may continue within the guidelines set forth in the preferences and/or rules.” Ex. 1005 ¶ 98. In another way, Tolonen teaches that “it may be possible for SDR module 1108 to have cognitive features,” such that “[c]haracteristics like apparatus status (e.g., process load, pending messages, power condition, etc.) and the environment proximate to an apparatus may be utilized to configure SDR module 1102.” Ex. 1005 ¶ 97. Tolonen teaches that

“resources in SDR module 1102, another radio module, or elsewhere in WCD 100 may be able to identify signals that could potentially interfere with apparatus communication” and “MRC 600 may schedule communication in a multiradio system” including by providing scheduling information to SDR module 1102.” *Id.* Furthermore, and as illustrated in Figure 14A below, Tolonen teaches that “in various embodiments ... the communication may continue in accordance with the existing configuration until an event occurs that would necessitate a new configuration,”—“fulfillment of the communication requirement, a loss of wireless connection between the apparatuses, sensed interference in proximity to either apparatus, a higher priority communication in one or both of the apparatuses that could conflict with current communication.” Ex. 1005 ¶ 104; *see also* Fig. 14A.



Tolonen, Fig. 14A

4. Claim 4

- a) *[4a] Tolonen's "[t]he EIR terminal of claim 1, further compris[es] a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol."*

89. Claim limitation 4[A] is identical to Claim 3. Accordingly, Tolonen teaches limitation 4[A] for the same reasons. *See supra* Section VIII.A.3.

- b) *[4b] Tolonen discloses "wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput."*

90. It is my opinion that the value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput. For example, to implement a particular radio configuration, Tolonen's SDR 1102 receives data from MCS 700 and/or master control system 640 indicating "rules or preferences regarding which transports to utilize in certain situations." Ex. 1005 ¶¶ 94-5; *see supra* Section VIII.A.3. Tolonen teaches that the "preferences and/or rules may be based on various apparatus, application or *user-*

defined characteristics.” Ex. 1005 ¶ 98 (emphasis added). In addition to user preferences, Tolonen teaches that when two devices are in communication with one another, characteristics with regard to the communicating devices and the communication channel are used to formulate and define the configuration of the SDR, which includes “channel selection for each transport (e.g., hopping patterns), error correction, Quality of Service (QoS) requirements, operational schemes (e.g., power saving, high speed, etc.), radio module priority (for conflict resolution), etc.” Ex. 1005 ¶ 102; *see also id.* at ¶ 104 (teaching that communications continue in accordance with the set, existing configuration until an event occurs that necessitates a new configuration).

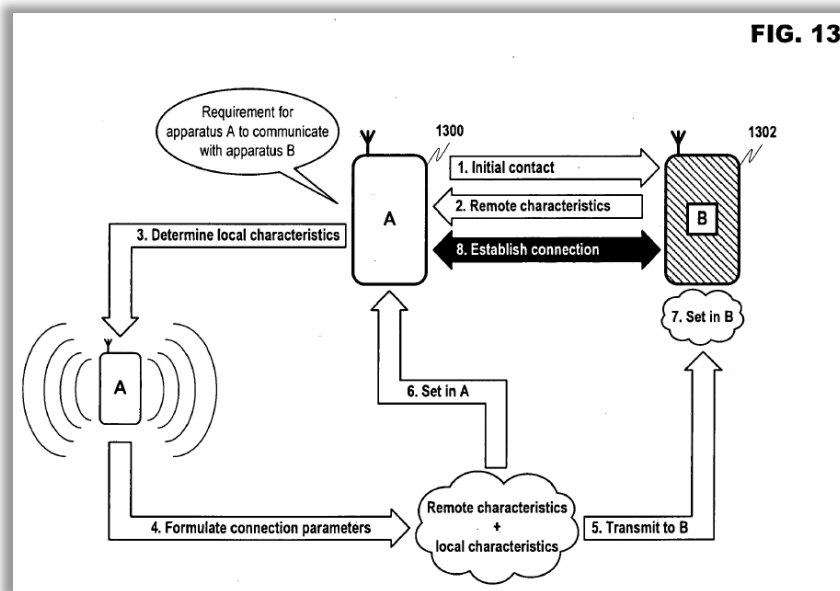
5. Claim 5

- a) [5a] Tolonen’s “[t]he EIR terminal of claim 1, further compris[es] a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”

91. Claim limitation 5[A] is identical to Claim 3. Accordingly, Tolonen teaches limitation 5[A] for the same reasons. *See supra* Section VIII.A.3.

- b) [5b] Tolonen discloses “wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.”

92. It is my opinion that Tolonen’s WCD is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion. First, I adopt the same analysis I set forth for claim 4(b) above, where I describe how Tolonen’s system formulates the connection between devices based on user criteria. But furthermore, as shown in Figure 13 below, Tolonen describes a scenario where a first device establishes a connection with a second device. Ex. 1005 ¶ 100.



Tolonen, Fig. 13

93. For this scenario, Tolonen teaches that “apparatus A 1300 may send a wireless inquiry to apparatus B 1302 ... for example, utilizing a channel (e.g., an initialization channel) that is known to (e.g., predefined or predetermined) each apparatus.” Ex. 1005 ¶ 101. That predefined channel is necessarily over a predefined frequency range. Additionally, in this example, Apparatus B would be searching for Apparatus A’s beacon signal at this frequency, as it searches for an “inquiry” message from Apparatus A, as Apparatus B selects the configuration given to it by A. This communication channel comprises a predefined communication range. From there, the first device determines “remote characteristics”—information relating to the second device’s “status and/or environmental conditions proximate to the second device”—and local characteristics—same as the remote characteristics but pertaining to itself. Ex. 1005 ¶¶ 101-102. Finally, “ha[ving] both the remote and local characteristic information, a configuration for SDR module 1102 may be formulated,” including by “defin[ing] a transport, ... channel selection ..., error correction, Quality of Service (QoS) requirements, operational schemes (e.g., power saving, high speed, etc.), [and] radio module priority.” Ex. 1005 ¶ 102; *see also, id.* ¶¶ 110-2, Fig. 14b.

94. In another example, rather than communicating between two predetermined devices, Tolonen describes finding a device with which to connect.

In this example, Tolonen's first device searches for second devices, or apparatuses, to connect to. Ex. 1005 ¶ 105. Tolonen's "process may begin ... with the realization of a communication requirement in an apparatus." *Id.* "A determination [is] ... made ... as to whether any other apparatuses that can fulfill [the device's] requirement are within communication range of the apparatus." *Id.* Then, "[i]f at least one other apparatus that can fulfill the communication requirement is detected within range of the apparatus, ... a connection request may be sent to the other apparatus ... on a channel known to both apparatuses (e.g., an initialization channel)", and the remote characteristics and local characteristics are used to establish the connection configuration. *Id.* at ¶¶ 106-07; *see also id.* at ¶ 78 (describing scheduling around a "targeted beacon transmission time in WLAN (100 ms)"). In this way, Tolonen is operable to search beacon signals at predefined frequency ranges and select the wireless transport (*i.e.*, wireless communication network and frequency channel) which optimizes said user-defined criterion.

6. Claim 6

- a) *[6a] Tolonen discloses “[t]he EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”*

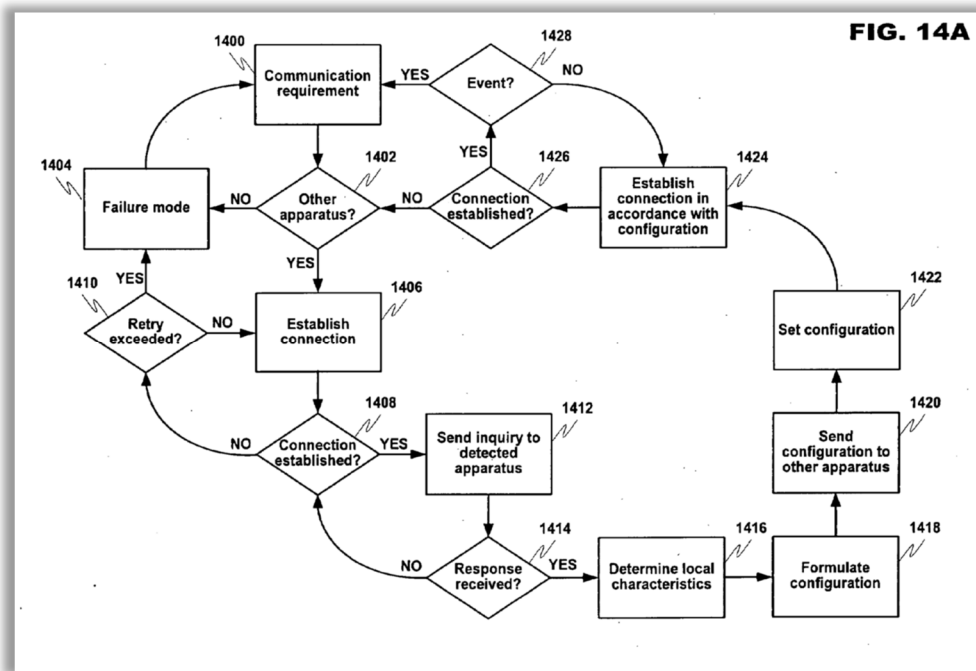
95. Claim limitation 6[A] is identical to Claim 3. Accordingly, Tolonen teaches limitation 6[A] for the same reasons. *See supra* Section VIII.A.3.

- b) *[6b] Tolonen discloses “wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.”*

96. Tolonen recognizes that signal interference issues arise when communicating using multiple communication protocols simultaneously on multiple radio modems. Ex. 1005 ¶¶ 63–64. For example, because Bluetooth, WLAN, and wireless USB all operate on the 2.4 GHz band, substantial communication overlap can occur. Ex. 1005 ¶ 64. This overlap causes interference, which results in the loss of packets and diminishes signal quality and efficiency. Ex. 1005 ¶ 64.

97. To remedy the interference, Tolonen teaches that the “[multiradio controller] may schedule communication in a multiradio system.” Ex. 1005 ¶ 97.

But beyond scheduling communications, Tolonen also contemplates that configurations may need to be switched mid communication. Tolonen teaches that “the communication may continue in accordance with the existing configuration until an event occurs that would necessitate a new configuration. Examples ... include ... sensed interference in proximity to either apparatus, a higher priority communication in one or both of the apparatuses ... a status change in either apparatus (e.g., power depletion), etc.” Ex. 1005 ¶ 104. For example, Tolonen’s Figure 14 illustrates a process by which a communication apparatus may define a new communication configuration whenever an event, (e.g., “fulfillment of the communication requirement, a loss of wireless connection between the apparatuses that could conflict with current communication, a status change in either apparatus (e.g., power deletion)”) necessitates such a change. Ex. 1005 ¶ 104, Fig. 14A.



Tolonen, Fig. 14

98. In redefining the communications, Tolonen performs the steps I described with respect to claims 4(b) and 5(b), which I incorporate by reference herein. Accordingly, the configuration is according to a user preference.

7. Claim 7

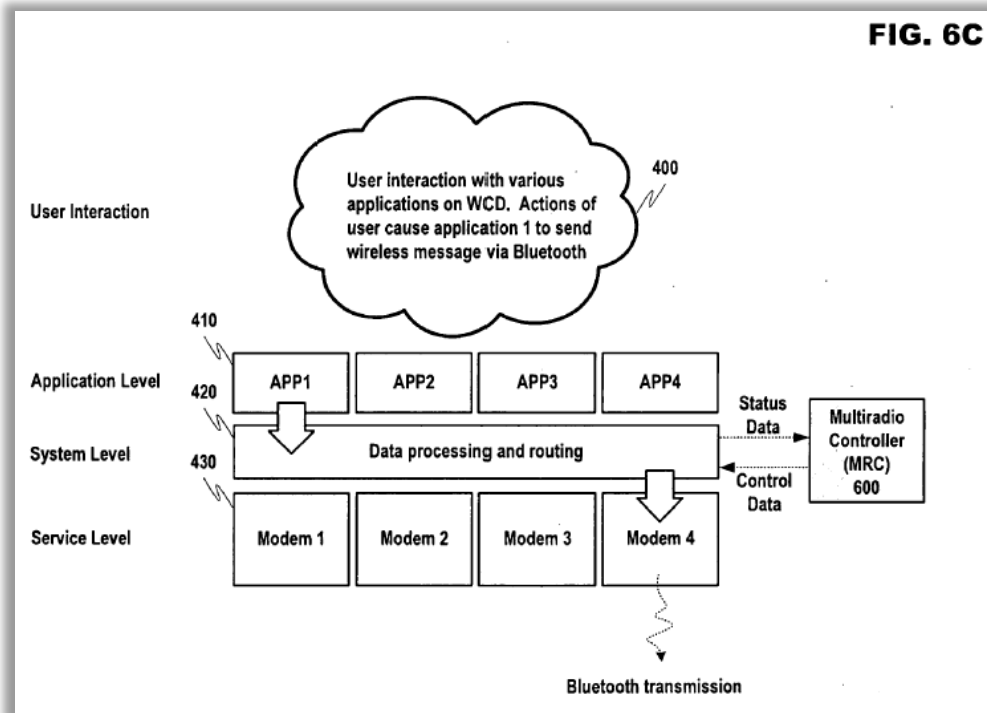
- a) [7a] Tolonen's "EIR terminal of claim 1, [is] further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action."

99. It is my opinion that Tolonen discloses claim 1 and that Tolonen's WCD is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless

communication protocol responsive to a user action. *See supra* Section VIII.A.1. In defining the communications, Tolonen performs the steps I described with respect to claims 4(b) and 5(b), which I incorporate by reference herein. Tolonen further teaches that the dynamic selection may be responsive to a user action. As one example, Tolonen teaches that a “user coming within effective transmission range of a Bluetooth, WLAN, UWB, WUSB, etc. access point” may cause “a network ... [to] automatically be established to transmit information to WCD 100 possessed by user 110.” Ex. 1005 ¶ 42. In this example, the user action is the user moving into communication range of the other device.

100. Additionally, Tolonen teaches that the user’s interaction with the interface determines what communication modules, and, thus, what protocols, are employed. Ex. 1005 ¶¶ 48-49, 67, Fig. 6C; *see also, id.* ¶¶ 101-3 (“a requirement to establish communication may be initiated by ... user interaction with apparatus A 1300”). Tolonen teaches that when a user enters data into the device, through the user interface module 240, the “data ... may be interpreted by control module 210 to affect the behavior of WCD 100.” Ex. 1005 ¶ 48. For example, Tolonen explains that the applications module 250 may be “invoked by control module 210 to read information provided by the various modules, and in turn, may supply information to requesting modules in WCD 100.” Ex. 1005 ¶ 49. And as shown in Figure 6C

below, Tolonen's master radio controller ("MRC") 600 uses, amongst other things, information about the "applications running in application level 410" to "issue scheduling commands to the communication devices in service level 430." Ex. 1005 ¶ 67, Fig. 6C.



Tolonen, Fig. 6C

101. In this way, the user's interaction with the WCD 100, including inputting information and/or choosing the application to operate, causes the WCD to select the appropriate wireless communication protocol or the parameters thereof. Fig. 6C ("User interaction with various applications on WCD. Actions of user cause application 1 to send wireless message via Bluetooth.").

8. Claim 8

- a) *[8a] Tolonen's "EIR terminal of claim 1, [is] further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code."*

102. It is my opinion that Tolonen discloses claim 1 and that Tolonen's WCD is further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code. *See supra* Section VIII.A.1. As I described above for claim 7, a user interacting with various applications in the WCD 100 causes the WCD 100 to determine the wireless communication protocol or parameter. *See supra* Section VIII.A.7; *see also* Tolonen, Fig. 6C. Moreover, as Tolonen teaches using close-proximity communications 240, such as "scanning methods for reading machine-readable data" such as "IR communication, linear and 2-D (e.g., QR) bar code readers (including processes related to interpreting UPC labels)," (Ex. 1005 ¶ 56) Tolonen teaches that a user interacting with the bar-code scanning application, for example, would cause the WCD 100 to capture information "without the need for manual entry by a user" (Ex. 1005 ¶ 7). A bar code requires that the bar code scanner in WCD 100 be positioned in such a way that the bar code may be read. This requires either the WCD 100 to be moved to read the bar code or the bar code to be moved

so that the WCD 100 bar code scanner may read the bar code. Thus, scanning a bar code requires a user action.

103. Furthermore, to the extent Tolonen does not expressly define entering data via a bar code scan as equivalent to a user action, a POSITA would have found scanning a bar code to be an obvious equivalent method of user data entry over Tolonen's disclosures. For example, a POSITA would have realized that because Tolonen's WCD 100 includes a bar-code scanner (e.g., close proximity communications 100) that may be used to input information without the need for manual entry by a user and Tolonen's WCD 100 is operable to dynamically select different communication protocols, e.g., Bluetooth, cellular, and WiFi, based upon user interactions and input information, it would have been an obvious and straightforward application to dynamically select one of these protocols in response to scanning a bar code (which would be equivalent to a user entering the same data contained in the bar code). For example, the POSITA would have understood that scanning a bar code requires the user to interact with the bar code application in the WCD 100 and the scan provides a fast and error free method for a user to enter data and other information into the WCD 100 instead of the user manually entering the data and other information. A POSITA would further understand that bar code scans are used in exactly this way for billions of items

sold in retail stores annually. Tolonen teaches that user interactions with the applications in the WCD 100 can cause the WCD 100 to choose a wireless communication protocol such as Bluetooth. Tolonen Fig. 6C. Therefore, a POSITA would have understood that the WCD 100 would communicate by Bluetooth or by some other wireless communication protocol, for example WiFi, responsive to a bar code scan.

9. Claim 9

104. Claim 9 is comprised of a preamble and six claim limitations—all of which are disclosed by Tolonen as analyzed above. Specifically, claim 9 and claim 1 have the same preamble; claim limitations 9[A]–[E] are identical to claim limitations 1[A]–[E]; and claim limitation 9[F] is identical to claim 3. Therefore, Tolonen discloses claim 9 and all arguments from Claims 1 and 3 are herein reasserted.

10. Claim 10

105. Claim 10 is identical to Claim limitation 4[B], with the only difference being that Claim 10 depends from Claim 9 whereas Claim 4 depends from Claim 1. Both Claim 9 and Claim 4[B] are anticipated by Tolonen as I describe above. Therefore, all arguments from Claim 4[B] and Claim 9 are herein reasserted.

11. Claim 11

- a) *[11a] Tolonen discloses “[t]he EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.”*

106. Claim limitation 11[A] is identical to Claim limitation 5[B], with the only difference being that Claim 11 depends from Claim 9 whereas Claim 5 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 5[B] and Claim 9 are herein reasserted.

12. Claim 12

- a) *[12a] Tolonen discloses “[t]he EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.”*

107. Claim limitation 12[A] is identical to Claim limitation 6[B], with the only difference being that Claim 12 depends from Claim 9 whereas Claim 6 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 6[B] and Claim 9 are herein reasserted.

13. Claim 13

108. Claim 13 is identical to Claim 7, with the only difference being that Claim 13 depends from Claim 9 whereas Claim 7 depends from Claim 1—both of

which are anticipated by Tolonen. Therefore, all arguments from Claim 7 and Claim 9 are herein reasserted.

14. Claim 14

109. Claim 14 is identical to Claim 8, with the only difference being that Claim 14 depends from Claim 9 whereas Claim 8 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 8 and Claim 9 are herein reasserted.

15. Claim 15

110. Claim 15 is comprised of a preamble and six claim limitations—all of which are disclosed by Tolonen as analyzed above. Specifically, claim 15 and claim 1 have the same preamble; claim limitations 15[A]–[E] are identical to claim limitations 1[A]–[E] and claim limitation 15[F] is functionally the same as claim 8. Accordingly, Tolonen teaches claim 15 for the same reasons as 1[A]–1[E] and 15.

16. Claim 16

- a) *[16a] Tolonen’s “[t]he EIR terminal of claim 15 wherein said base-band encoder software program is performed by at least one of a general-purpose microprocessor, a specialized microprocessor.”*

111. It is my opinion that Tolonen discloses claim 15 and that Tolonen’s base-band encoder software program is performed by at least one of a general-purpose microprocessor, a specialized microprocessor. *See supra* Section

VIII.A.15. Tolonen's memory includes "specialized software modules configured to manage particular functions such as communication sections." Ex. 1005 ¶ 52. Specialized functionality such as "calculat[ing], translat[ing], conver[ting], and/or packetizing the data" exists in the memory. Ex. 1005 ¶¶ 52, 62; Any software functionality, including software to packetize information exists in Tolonen's memory and is executed by the processor. Tolonen's processor is configured to execute base-band encoder software program, *see supra* Section VIII.A.1.e–g, and Tolonen also describes a processor implementation "utilizing one or more microprocessors that are each capable of executing software instructions stored in memory." Ex. 1005 ¶ 50. Therefore, Tolonen's base-band encoding software program must be performed by Tolonen's processor, which is disclosed to optionally be one or more microprocessors. *Id.*

17. Claim 17

- a) *[17a] Tolonen discloses "[t]he EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor."*

112. It is my opinion that Tolonen discloses claim 15 and that Tolonen's base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor. *See supra* Section VIII.A.15. Analogous to a base-band encoder software program being performed

on a microprocessor, Tolonen’s specialized software also includes base-band decoder software stored on the memory. Ex. 1005 ¶ 52; *see supra* Section VIII.A.16. Again, Tolonen describes a processor implementation “utilizing one or more microprocessors that are each capable of executing software instructions stored in memory”—software instructions including specific communication module functionality, such as base-band encoding software. Ex. 1005 ¶ 50. Since Tolonen’s processor may be one or more microprocessors and execute specific communication module functionality, such as base-band decoding software stored on the memory, Tolonen discloses a base-band decoding software program performed by at least one of a general-purpose microprocessor or a specialized microprocessor. Ex. 1005 ¶¶ 50, 52; *see also, supra* Section VIII.A.16.

18. Claim 18

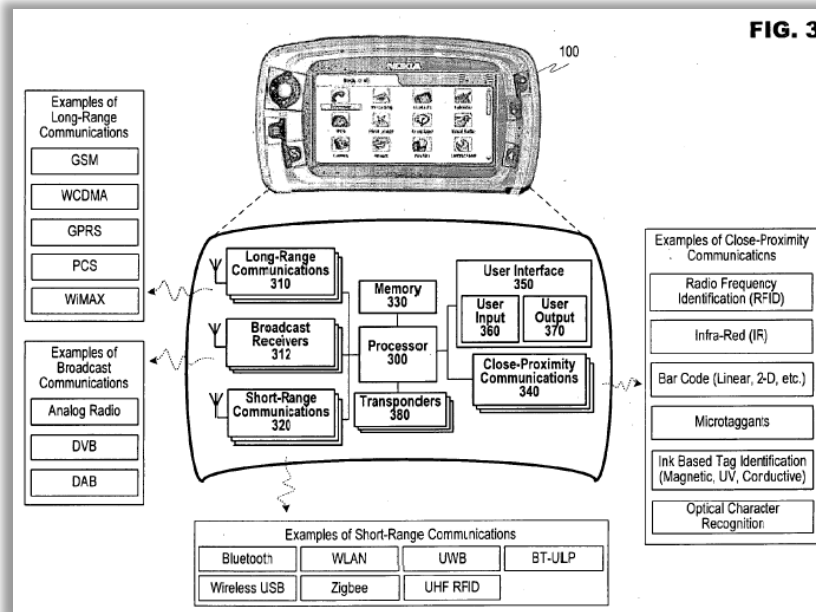
113. Claim 18 is comprised of a preamble and five claim limitations—all of which are disclosed by Tolonen as analyzed above. Specifically, claim 18 and claim 1 have the same preamble; claim limitations 18[A]–[C] are identical to claim limitations 1[A]–[C]; and claim limitation 18[E] is identical to claim 3. Only claim limitation 18[D] is separate and unique from prior analyzed claim limitations. Therefore, Tolonen discloses claim limitations 18[A]–[C] and 18[E] and all

arguments from Claims 1 and 3 are herein reasserted. Therefore, in this section, only claim limitation 18[D] is discussed in detail.

a) [18d] Tolonen discloses 18[D], “a wireless communication interface configured to support at least two wireless communication protocols.”

114. It is my opinion that Tolonen’s communication interfaces are configured to support at least two wireless communication protocols. As shown in Figure 3 below, Tolonen’s WCD 100 includes different communication modules (*i.e.*, *wireless communication interfaces*), for example, long-range communications 310 and short-range communications 320. Ex. 1005 ¶ 50, Fig. 3; *see also supra* Section VIII.A.1.e (describing how each of these interfaces include the components of an RF front end). Each of these wireless communication interfaces is disclosed to support at least two-different communication protocols. Tolonen, Fig. 3. For example, Tolonen discloses that the long-range communication module is operable to communicate according to multiple protocols including GSM (which itself encompasses both a voice communication protocol and a short messaging system (“SMS”) communication protocol) and WCDMA cellular communication standards. Ex. 1005 ¶ 53, Fig. 3; *see also*, Ex. 1005 ¶¶ 5, 78. Similarly, the short range communication module is disclosed to be operable to communicate according to multiple protocols including WLAN (which itself encompasses multiple protocols such as 802.11a and 802.11b) and Bluetooth (which itself

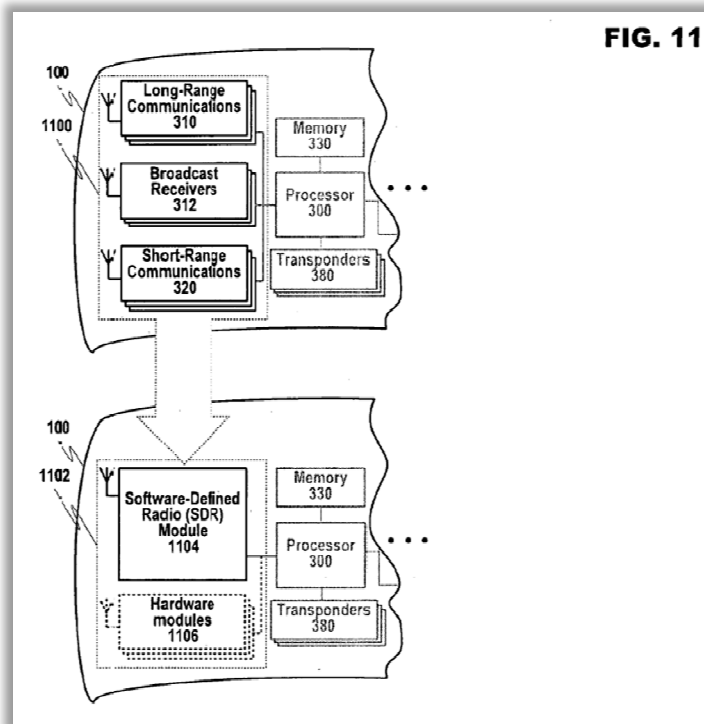
encompasses multiple protocols such as Traditional Bluetooth and Bluetooth Low Energy). Ex. 1005 ¶ 55, Fig. 3.



Tolonen, Fig. 3

115. Additionally, Tolonen teaches that all of these communication modules (interfaces) can be substituted with a single software defined radio (“SDR”) as shown in figure 11 below. Ex. 1005 ¶¶ 89, 91-2, Fig. 11. Tolonen teaches that SDRs that “rely more heavily upon a reconfigurable software-based element ... may be reconfigured at runtime, and therefore, these radio modules may be reconfigured to emulate various functionality that was traditionally only available through discrete modules.” *Id.* Tolonen teaches that SDR allows for a single platform to implement different wireless connectivity features, such that the

“radio programs may serve the purpose of cellular communication, local connectivity, broadcast, etc.” Ex. 1005 ¶¶ 89-93; *see also supra* Section VIII.A.3 (describing Tolonen’s teaching about the SDR dynamically switching between communication protocols).



Tolonen Fig. 11

19. Claim 19

- a) [19a] Tolonen discloses “[t]he EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.”

116. It is my opinion that Tolonen discloses claim 18 and that Tolonen discloses the wireless communication interface is implemented using a single

multi-protocol chipset. *See supra* Section VIII.A.18. As discussed for claim 18, Tolonen's communication modules may be substituted with a single SDR, which supports runtime configuration of different communication protocols. *See supra* Section VIII.A.18.a (citing Ex. 1005 ¶¶ 89-93). Tolonen also teaches that for the communication modules, "any and all individual components may be replaced by integrated circuits in the form of a programmable logic device, gate array, ASIC, multi-chip module, etc. that may be programmed to replicate the functions of the stand-alone devices." Ex. 1005 ¶ 59.

20. Claim 20

- a) *[20a] Tolonen discloses "[t]he EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets."*

117. It is my opinion that Tolonen discloses claim 18 and that Tolonen discloses the wireless communication interface is implemented using two or more chipsets. *See supra* Section VIII.A.18. As discussed for claim 18, Tolonen's communication modules may be substituted with an SDR, which supports runtime configuration of different communication protocols. *See supra* Section VIII.A.18.a (citing Ex. 1005 ¶¶ 89-93). Tolonen also teaches that for the communication modules, "any and all individual components may be replaced by integrated circuits in the form of a programmable logic device, gate array, ASIC, multi-chip

module, etc. that may be programmed to replicate the functions of the stand-alone devices.” Ex. 1005 ¶ 59.

21. Claim 21

- a) *[21a] Tolonen discloses “[t]he EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.”*

118. It is my opinion that Tolonen discloses claim 18 and that Tolonen discloses that the value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput. *See supra* Section VIII.A.18. Claim 21 is identical to Claim limitation 4[B], with the only difference being that Claim 21 depends from Claim 18 whereas Claim 4 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 4[B] and Claim 18 are herein reasserted.

22. Claim 22

- a) *[22a] Tolonen discloses “[t]he EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.”*

119. It is my opinion that Tolonen discloses claim 18 and that Tolonen discloses that the WCD 100 (an EIR terminal) is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion. *See supra* Section VIII.A.18. Claim 22 is identical to Claim limitation 5[B], with the only difference being that Claim 22 depends from Claim 18 whereas Claim 5 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 5[B] and Claim 18 are herein reasserted.

23. Claim 23

- a) *[23a] Tolonen discloses “[t]he EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.”*

120. It is my opinion that Tolonen discloses claim 18 and that Tolonen discloses that the WCD 100 (an EIR terminal) is configured to switch at least one

of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion. *See supra* Section VIII.A.18.

Claim 23 is identical to Claim limitation 6[B], with the only difference being that Claim 23 depends from Claim 18 whereas Claim 6 depends from Claim 1—both of which are anticipated by Tolonen. Therefore, all arguments from Claim 6[B] and Claim 18 are herein reasserted.

IX. GROUND 2: OBVIOUSNESS OF CLAIMS 1–23 OVER TOLONEN IN VIEW OF KATZ.

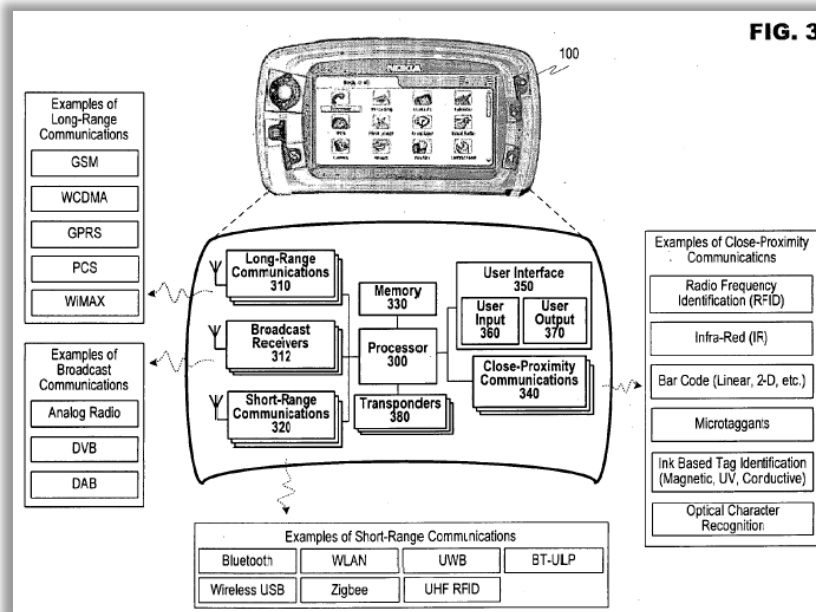
A. Motivation to Combine

121. A POSITA would have been motivated to combine Tolonen with Katz. Tolonen teaches a wireless communication device (“WCD”) that comprises a close proximity communication module, such as a bar code reader, and different communication modules, such as close-proximity, short-range, and long-range communications, that may be implemented as either a single software defined radio that replaces all of the communication modules or a combination of a software defined radio module plus one or more communication modules.

122. Katz teaches a system that comprises a bar code reader, a software defined radio, and a communication module, such as a short range communication module. Additionally, Katz provides the specific details behind the software

defined radio and communication module hardware configurations. Accordingly, combining Tolonen with Katz would have constituted combining prior art elements according to known methods to yield predictable results; would have constituted a simple substitution of one known element for another to obtain predictable results; and/or would have constituted choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.

123. As shown in figure 3, below, Tolonen describes a WCD that includes communication modules 310, 312, 320, and 340, corresponding to long-range communications, broadcast communications, short-range communications, and close-proximity communications, respectively. Tolonen, Fig. 3.



Tolonen, Fig. 3

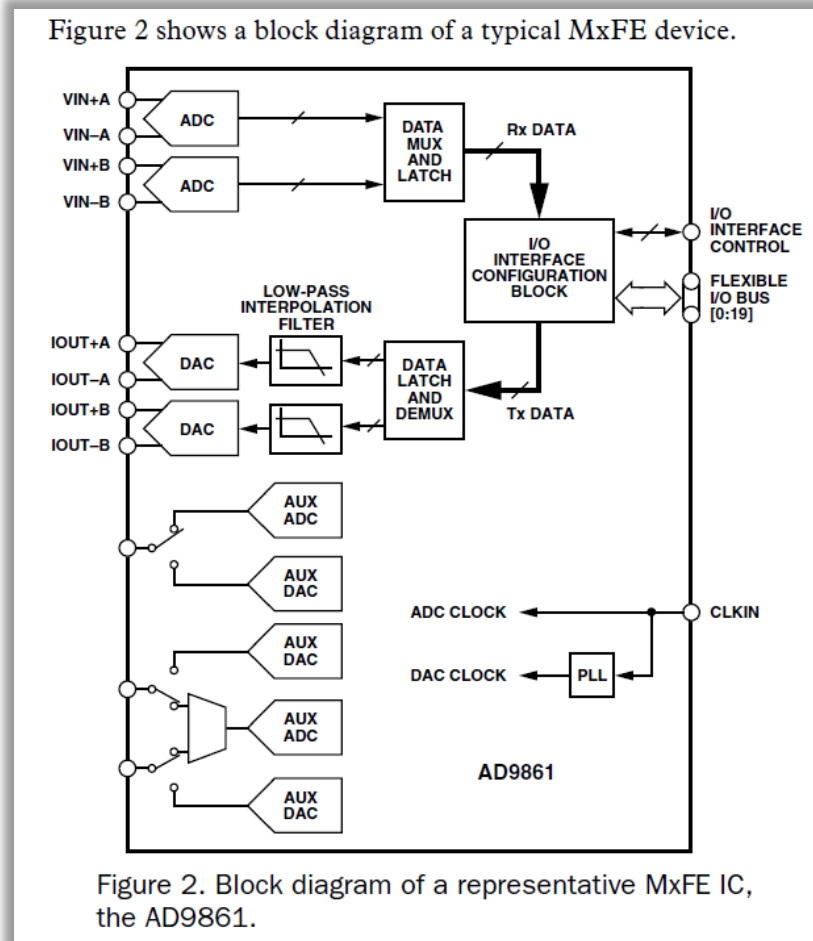
124. Tolonen teaches that “[l]ong-range communications 310 may manage functionality related to the wireless exchange of information over large geographic areas (such as cellular networks) via an antenna” (e.g., through “1 G to 3 G”). Ex. 1005 ¶ 53. Tolonen teaches that “[s]hort-range communications 320 is responsible for functions involving the exchange of information across short-range wireless networks” (e.g., “Bluetooth, WLAN, ... Zigbee, and Ultra High Frequency Radio Frequency Communication (UHF RFID)”). Ex. 1005 ¶ 55. Tolonen further teaches that “[c]lose proximity communications 340 may provide functionality related to the short-range scanning of machine readable data” (e.g., RFID and bar code reading). Ex. 1005 ¶ 56.

125. Tolonen teaches that the “[h]ardware corresponding to communications sections 310, 312, 320 and 340 provide for the transmission and reception of signals” and teaches that “these portions may include components (e.g., electronics) that perform functions, such as modulation, demodulation, amplification, and filtering.” Ex. 1005 ¶ 59. Tolonen also teaches that “the [WCD 100] may incorporate at least one SDR module 1104 in lieu of one or more discrete hardware-based radio modules” and that “[i]mplementations incorporating both SDR radio modules 1104 and hardware-based modules 1106 ... are possible.” Ex. 1005 ¶ 92; *see also* Tolonen, Figs. 11, 12. These SDR modules “include

platform architectures in which the different radio systems are loaded as software (e.g., as radio programs) and in which a[] single HW/SW platform can be used to implement different wireless connectivity features on shared processing resources. The radio programs may serve the purpose of cellular communication, local connectivity, broadcast, navigation, etc.” Ex. 1005 ¶ 93; *see also*, Tolonen, Fig. 12. “In implementing a particular radio configuration, some or all of software modules 1110-1118 may interact with unified radio system interface 1120 in order to establish settings that will allow SDR 1102 to emulate a desired radio functionality.” Ex. 1005 ¶ 96; *see also*, Tolonen, Fig. 12. However, to the extent Tolonen assumes the exact details of the hardware, a POSITA would have looked to Katz to supply these details.

126. Katz describes a Blackfin processor that is operable to control the different functionalities of a software defined radio configured to operate as a RFID reader. *See generally* Katz. As part of its background, Katz describes the general architecture of an RFID reader including hardware common to RFID readers and other communication modules. For example, Katz describes a mixed-signal front-end for communication with a transponder. As shown in the image below, Katz’s example mixed-signal front-end, which is designed to “cover the mixed-signal front end needs of multiple wireless communication systems”

includes the hardware components of an RF front end. Katz, p. 3; *See also* AD9861 Data Sheet, at p. 22.



Katz, Fig. 2.

127. To the extent a POSITA reading Tolonen needed to find and implement hardware components corresponding to Tolonen's communication modules (also referred to as "communication sections"), the POSITA would have looked to Katz to supply the details. Indeed, Katz regularly cites and incorporates

data sheets of various RF Front ends and processors capable of performing the functions, including the software defined functionality, described by Tolonen.

128. A POSITA would have combined Tolonen with Katz according to known methods and would have realized predictable results. For example, a POSITA would have known that Tolonen's communication modules 310, 312, 320, and 340 and Tolonen's SDR module each require an RF Front End and would have simply chosen to use the AD9861 mixed-signal front end ("MxFE") described by Katz. The POSITA would have further known that Tolonen's Processor 300 and other components, such as Memory 330, would need to connect to the chosen AD9861 front end and control the wireless devices operations and would have known that Katz's blackfin processors (e.g., ADSP-BF531, ADSP-BF536, or ADSP-BF537) would be suitable to perform these functions as well as those taught by Tolonen. For example, a POSITA would have determined Katz's blackfin processor suitable for running embedded software for performing reader functions such as TDMA, as well as operating the front end, back-end, and middleware software architecture of the reader terminal. Katz at 2. A POSITA would further have understood that, because Katz's Blackfin processor interfaces with RFID Front end and 802.11b/g chipsets and operates the μ Clinux operating system, it would be suitable for dynamically selecting the communication

protocols and characteristics as taught by Tolonen. *Compare* Katz 4-5, *with* Ex.

1005 ¶¶ 99-109, Figs. 13, 14a-b. Indeed, like Katz, a POSITA would have recognized that “[t]he μ Clinux operating system is a popular choice for facilitating both network connectivity—which is the largest software component of the reader—and the critical requirements of robustness and standards compliance.” Katz at 4-5.

129. Because Katz’s processor includes the components needed to execute the SDR functionality and other software functions described in Katz, the POSITA would also have determined it a straightforward substitution to implement Tolonen with Katz’s blackfin processor (or vice versa implement Tolonen’s software on Katz’s blackfin processor) and Katz’s MxFE. Again, Tolonen’s communication modules communicate according to radio frequency signals, and Katz’s MxFE includes the requisite components. In this way, the POSITA would have realized the predictable results of Tolonen’s WDC communicating radio frequency signals according to Katz’s MxFE and performing the software functionality using Katz’s blackfin processor. Finally, because Tolonen and Katz both describe SDRs and communication interfaces (e.g., Tolonen’s communication modules and Katz’s MxFE) the POSITA would have had a reasonable expectation that Katz’s

processor and mixed-signal front end would accomplish the communication goals set forth in Tolonen.

B. Tolonen in view of Katz Invalidates the Claims

130. For the limitations that follow, Katz at least supplies the hardware limitations not described in express detail by Tolonen. Accordingly, for claim 1 and the claims that follow, Katz is discussed with respect to the hardware limitations, specifically claim limitations 1[d] through 1[I], claims 2, 18-21. Nevertheless, as the hardware limitations 1[d] through 1[I] rely on Katz's blackfin processor, 1[A], and memory, 1[B], I discuss those limitations as well.

1. Claim 1

- a) *[1a] Tolonen in view of Katz discloses limitation 1[A], "a microprocessor electrically coupled to a system bus."*

131. As I set forth above in ground 1, Tolonen discloses Processor 300 or microprocessors coupled to a system bus. Ex. 1005 ¶ 50, Fig. 3. Katz also discloses a microprocessor, the blackfin processor by Analog. As I discussed above in my motivation to combine section, to combine Tolonen with the RF Front end taught by Katz, it would have been a straightforward and simple substitution to implement or substitute Tolonen's processor with Katz's blackfin processor and a POSITA would have realized predictable results in doing so. *See supra* Section IX.A.

b) *[1b] Tolonen in view of Katz discloses limitation 1[B], “a memory communicatively coupled to said microprocessor.”*

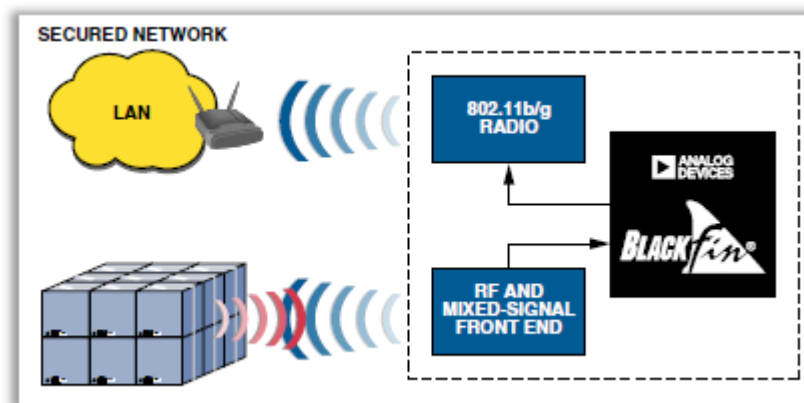
132. As I set forth above for claim limitation 1[B], *see supra* Section VIII.A.1.c, Tolonen discloses Memory 330 communicatively coupled to Processor 300. Ex. 1005 ¶ 51, Fig. 3. Katz also discloses a software that, when run on Katz’s blackfin processor, implements the functionality of Katz’s EIR reader, including the front-end, middleware, and backend functionalities of Katz’s EIR reader. Katz, p. 4 (disclosing that “[t]he dual-core ADSP-BF561 contains both dual high-speed L1 instruction and data memories (local to each core), and a shared L2 memory between the two cores”). In its disclosure, Katz incorporates by reference Analog Devices’ ADSP-BF531 Blackfin processor data sheet, which shows in figure 1 that the Blackfin processor block is coupled to the L1 instruction memory block and the L1 data memory block. ADSP-BF531, Fig. 1 (showing the “Functional Block Diagram” of the ADSP-BF531 chip). Accordingly, to operate Katz’s RF Front end, a POSITA would determine it a simple substitution to replace Tolonen’s memory 330 with Katz’s instruction and data memory.

- c) *[1d] Tolonen in view of Katz discloses limitation 1[D], “a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus.”*

133. As I set forth above for claim limitation 1[D], *see supra* Section VIII.A.1.e, Tolonen discloses communication modules 310, 312, 320 (“communication modules”) that transmit and receive radio signals. Ex. 1005 ¶ 59. Tolonen also teaches that the communication modules include the “[h]ardware ... *for the transmission and reception of signals*, ... I[ing] components (e.g., electronics) that perform functions, such as modulation, demodulation, *amplification*, and *filtering*.” Ex. 1005 ¶ 59. However, to the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics. Moreover, and as I described in full in my motivation to combine section, replacing Tolonen’s communication modules with Katz’s RF Front End would have been, for example, a simple substitution that would have predictably yielded Tolonen’s invention that communicates according to Katz’s Front End. *See supra* IX.A.

134. Like Tolonen, Katz discloses a software defined radio system configured as a RFID Reader that includes multiple communication modules. Katz

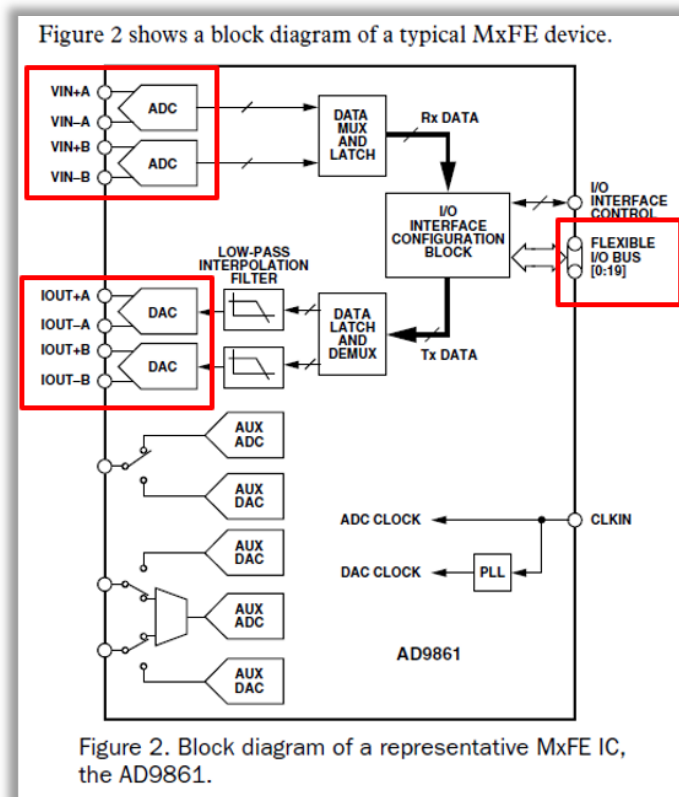
explains that RFID readers “provide[] the connectivity between individual tags and the tracking/management system” by providing “three main functions: bidirectional communication with the tags ... ; initial processing of received information; and connection to the server that links the information into the enterprise.” Katz at pp. 1–2. Accordingly, as shown in figure 5 below, Katz discloses a software defined radio configured as a RFID Reader that includes both a “RF and Mixed-Signal Front End” (*i.e.*, *wireless communication interface*) coupled to a blackfin processor, which is further coupled to an 802.11b/g Radio chipset. Katz at Fig. 5.



Katz, Fig. 5.

135. For its RF and Mixed-Signal Front End, for example, Katz describes Analog’s MxFE. Katz at p. 3, Fig. 2. For example, Katz explains that the MxFE allows the RFID reader to communicate with RFID Transponders (“Tags”), which Katz explains happens through sending and receiving “radio-frequency (RF)

transmissions of bit streams.” Katz at 1006 pp. 1–3; *see also* Fig. 1. As shown in Katz’s Figure 2, below, Katz’s MxFE includes ADCs and DACs which are electrically coupled to the RF Front out (e.g., VIN and IOUT), and coupled to the I/O Bus that connects to the parallel peripheral interface (“PPI”) of the Blackfin chip. Katz at p. 3.



Katz, Fig. 2 (annotated).

136. With specific regards to the “system bus”, the ADC and DAC electrically connect to, Katz teaches the processors “include[s] a *parallel peripheral interface* (PPI), which can connect directly to ADCs and DACs.” Katz

at p. 3. Katz teaches that when “the PPI is configured in *transmit* mode, ... the processor sends a digital sequence to a DAC,” and “[t]he transmitted sequence is converted to an analog signal, which is then upconverted and sent out to excite/wake up local RFID tags, which then respond.” Katz, p. 3. Katz further teaches that “the PPI is reconfigured as a receiver in a small number of processor system clock pulses” such that “the downconverted RF signal can be sampled by an ADC and brought into the Blackfin directly.” Katz at p. 3.

d) *[1e] Tolonen in view of Katz discloses limitation 1[E], “wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program.”*

137. As I set forth above for claim limitation 1[E], *see supra* Section VIII.A.1.f, Tolonen discloses that said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program. Tolonen discloses a wireless communication device with a processor “control[ling] overall device operation.” Ex. 1005 ¶ 50. Baseband encoding is the process of defining the sequence and timing of binary levels to indicate the logical bit values. For example, non-return to zero (“NRZ”) is an example baseband encoding scheme commonly used on wired communication channels. Thus, a sequence of ‘0’s and ‘1’s can be used to represent a baseband encoding for data to be transmitted wirelessly when the wired bus communication

speed is known. However, to implement Katz's RF Front end, a POSITA would have considered including or substituting Tolonen's baseband decoder software with Katz's. And as I discussed above in my motivation to combine section, *see supra* Section IX.A, doing so would have been a straightforward substitution that yields predictable results. For example, a POSITA would reasonably expect that implementing Katz's RF Front end and encoded software program would yield the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics.

138. Katz discloses Analog Devices' Blackfin processor. Katz teaches that "reader[s] ha[ve] embedded software that manage[] the interrogation, decoding, and processing of ... received tag information; and it communicates with a storage system that houses a tag database and other relevant information." Katz, p. 1. For example, Katz explains that the Blackfin processor is operable to operate the "three elements of the RFID reader software architecture ...: the *back-end server interface*, the *middleware*, and the *front-end tag reader algorithms*." Katz, p. 2 (emphasis in original). Katz teaches that "[t]he software components that make up the infrastructure of a Blackfin RFID reader are available on the Blackfin.uClinux.org website. This offering includes the drivers necessary to interface to the mixed signal, front end IC". Katz, p. 3. Furthermore, Katz teaches

“the uClinux schedule is not strictly real-time, it can be replaced with the ADEOS real-time scheduler, ... This means that the front-end reader software can execute from the ADEOS domain in real time, while the middleware and back-end server interface can run in the traditional uClinux environment.” Katz, p. 5. Katz teaches that “the processor sends a digital sequence to a DAC. The transmitted sequence is converted to an analog signal, which is then upconverted and sent out to excite/wake up local RFID tags, which then respond.” Katz, p. 3. The digital sequence is necessarily a baseband encoded sequence sent by the processor to the DAC, and this digital sequence is necessarily baseband encoded by software running on the processor prior to being sent to the DAC, since, as Katz explains, this digital sequence is “converted to an analog signal”, “upconverted”, and then “sent out to ... local RFID tags”. Katz, p. 3. Furthermore, in its disclosure, Katz incorporates by reference Analog Devices’ ADSP-BF531 Blackfin processor data sheet, which explains that “[t]he processor provides a parallel peripheral interface (PPI) that can connect directly to parallel A/D and D/A converters, ITU-R 601/656 video encoders and decoders, and other general-purpose peripherals.” ADSP-BF531 Data Sheet, p. 11.

- e) *[1f] Tolonen in view of Katz discloses the “base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control.”*

139. As I set forth above for claim limitation 1[F], *see supra* Section VIII.A.1.g, Tolonen discloses that the baseband encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. However, to the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics.

140. Like Tolonen, Katz discloses a software defined radio system configured as a RFID Reader where the baseband encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. As one example, Katz teaches that “a digital sequence [is sent] to a DAC” where that sequence is then “converted to an analog signal,” “upconverted”, and then “sent out to excite/wake up local RFID tags, when then respond.” Katz, p. 3. The digital sequence, as Katz describes, is necessarily baseband encoded data

represented as a sequence of bits, and this sequence of bits is necessarily the result of source encoding performed by the software executing on the processor. A POSITA would know that baseband encoding is the process of defining the sequence and timing of binary levels to indicate the logical bit values. And, a sequence of '0's and '1's can be used to represent a baseband encoding for data to be transmitted wirelessly when the wired bus communication speed is known. As another example, Katz teaches that the processor implements software that operates the "time-division multiplexing algorithm," which is designed to avoid collisions in multiple reader and multiple tag scenarios (noting that "It is clear that having the ability to implement this function in embedded software provides additional flexibility."). Katz, p. 2.

141. As another example, as discussed in the previous limitations, Katz's Blackfin processor is operable to run the RFID reader front-end software, middleware software, and backend software, including by performing the "system's filter- and transform-intensive signal processing, occurring in the front end of the reader, [that] requires a device with the kind of strong signal-processing performance typically associated with Blackfin processors." Katz, p. 3; *see supra* Section IX.B.1.b. To explain further, the filter- and transform-intensive signal processing at the front end of the reader includes at least frequency spreading,

multiplexing, and modulation because this functionality is a requirement for the front end of the reader to communicate with tags.

f) [1g] Tolonen in view of Katz discloses limitation 1[G], the “DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream.”

142. As I set forth above for claim limitation 1[G], *see supra* Section VIII.A.1.h, Tolonen discloses that the DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream. However, to the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics. *See also supra* Section IX.A.

143. Like Tolonen, Katz discloses a software defined radio system configured as a RFID Reader where the DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream. For example, Katz explains that when “the PPI is configured in transmit mode, ... the processor sends a digital sequence to a DAC” and “[t]he transmitted [digital] sequence is converted to an analog signal [by the DAC], which is then upconverted and sent out to excite/wake up local RFID tags, which then respond.” Katz, p. 3.

- g) *[1h] Tolonen in view of Katz discloses limitation 1[H] the “ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end.”*

144. As I set forth above for claim limitation 1[H], *see supra* Section VIII.A.1.i, Tolonen discloses that the ADC is configured to output an encoded bit stream corresponding to an analog signal produced by the radio frequency front end. However, to the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics. *See also supra* Section IX.A.

145. Like Tolonen, Katz discloses a software defined radio system configured as a RFID Reader where the ADC is configured to output an encoded bit stream corresponding to an analog signal produced by the radio frequency front end. For example, Katz teaches that when “the PPI is reconfigured as a receiver ... [a] down converted RF signal can be sampled by an ADC and brought into the Blackfin [processor] directly.” Katz, p. 3. The Blackfin processor necessarily receives an encoded bit stream corresponding to the down converted RF signal that is sampled by the ADC.

- h) *[1i] Tolonen in view of Katz discloses limitation 1[I] the “base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.”*

146. As I set forth above for claim limitation 1[I], *see supra* Section VIII.A.1.j, Tolonen discloses that the baseband decoder software program is configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding. Nevertheless, to implement Katz’s RF Front end, as explained in the motivation to combine, a POSITA would have included or substituted Tolonen’s baseband decoder software with Katz’s. *See also supra* Section IX.A.

147. Like Tolonen, Katz discloses a software defined radio system configured as an RFID Reader where the baseband decoder software program is configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding. For example, Katz teaches that RFID readers rely on software for “manag[ing] the interrogation, *decoding*, and processing of the

received tag information.” Katz, p. 1. Katz further teaches that this software performs “the front-end tag reader algorithms,” which includes “time-division multiplexing,”—for example to avoid collisions from multiple tags responding at the same time. Katz, p. 2. A person having ordinary skill in the art would recognize that software that utilizes time-division multiplexing when prompting tags must also include software time-division *de-multiplexing* to understand the information sent by the tags. Accordingly, when Katz’s Blackfin processor receives the “downconverted RF signal ... sampled by an ADC” that signal must be demultiplexed and decoded for processing.

2. Claim 2

- a) *Tolonen in view of Katz discloses claim 2 “[t]he EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.”*

148. As I set forth above for claim 2, *see supra* Section VIII.A.2, Tolonen discloses a WCD (i.e., an EIR terminal) devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing,

channel decoding, decryption, and source decoding. Tolonen discloses a wireless communication device (WCD) with a processor and memory. However, to the extent Tolonen does not expressly describe these features in great detail, a POSITA would have looked to Katz to provide these specifics. A POSITA would have combined Tolonen with Katz for the reasons I set forth above in section II.A.

149. Like Tolonen, Katz discloses a software defined radio system configured as a RFID Reader where at least the source encoding and baseband encoding occur in the processor. Katz teaches a software-based radio executed on the processor, devoid of dedicated hardware components. For example, Katz notes that RFID readers “ha[ve] embedded software that manages the interrogation, decoding, and processing of the received tag information” and explains that there are “three elements” of this RFID reader software: “the back-end server interface, the middleware, and the front-end tag reader algorithms.” Katz, at 1–2. At least one of the tag reader algorithms performs “*time-division multiplexing*.” Because “all of these [distinct] elements. . . concurrently” run on the Blackfin processor and the time-division multiplexing occurs exclusively in the software, the wireless communication device disclosed by Tolonen in view of Katz is devoid of *dedicated hardware components* configured to implement at least time-division *multiplexing*.

3. Claim 18

150. Claim 18 is comprised of a preamble and five claim limitations—all of which are disclosed by Tolonen as analyzed above. Specifically, claim 18 and claim 1 have the same preamble; claim limitations 18[A]–[C] are identical to claim limitations 1[A]–[C]; and claim limitation 18[E] is identical to claim 3. Only claim limitation 18[D] is separate and unique from prior analyzed claim limitations. Accordingly, Tolonen and Katz teach Claim 18 for the same reasons. *See supra* Sections VIII.A.1, VII.A.3. This section will only discuss claim limitation 18[D].

- a) *18(d) Katz’s “wireless communication interface [is] configured to support at least two wireless communication protocols.”*

151. Katz’s RF and Mixed-Signal Front End performs RFID communications with tags that operate according to different RFID protocols. For example, Katz explains different types of RFID tags—Katz describes “[l]ow-frequency (LF) tags that utilize the 125-kHz-to-135-kHz portion of the [RF frequency] spectrum” and “[h]igh-frequency (HF) tags, [which] mostly operat[e] in the 13.56-MHz band.” These high-frequency and low-frequency tags cover different protocols of communication. Accordingly, Katz’s RFID reader front end is operable to communicate with different RFID reader protocols.

152. Additionally, the AD9861 MxRF, described and incorporated into Katz, is operable to communicate according to different protocols, as it is designed for various applications including “broadband access,” “broadband LAN,” and other “communications (modems).” *See* AD9861 datasheet at 1.

153. Finally, Katz’s 802.11 chipsets are able to support different IEEE protocols such as 802.11a, b and/or g. *See* Katz at 4.

4. Claim 19

- a) Katz’s “wireless communication interface is implemented using a single multi-protocol chipset.”*

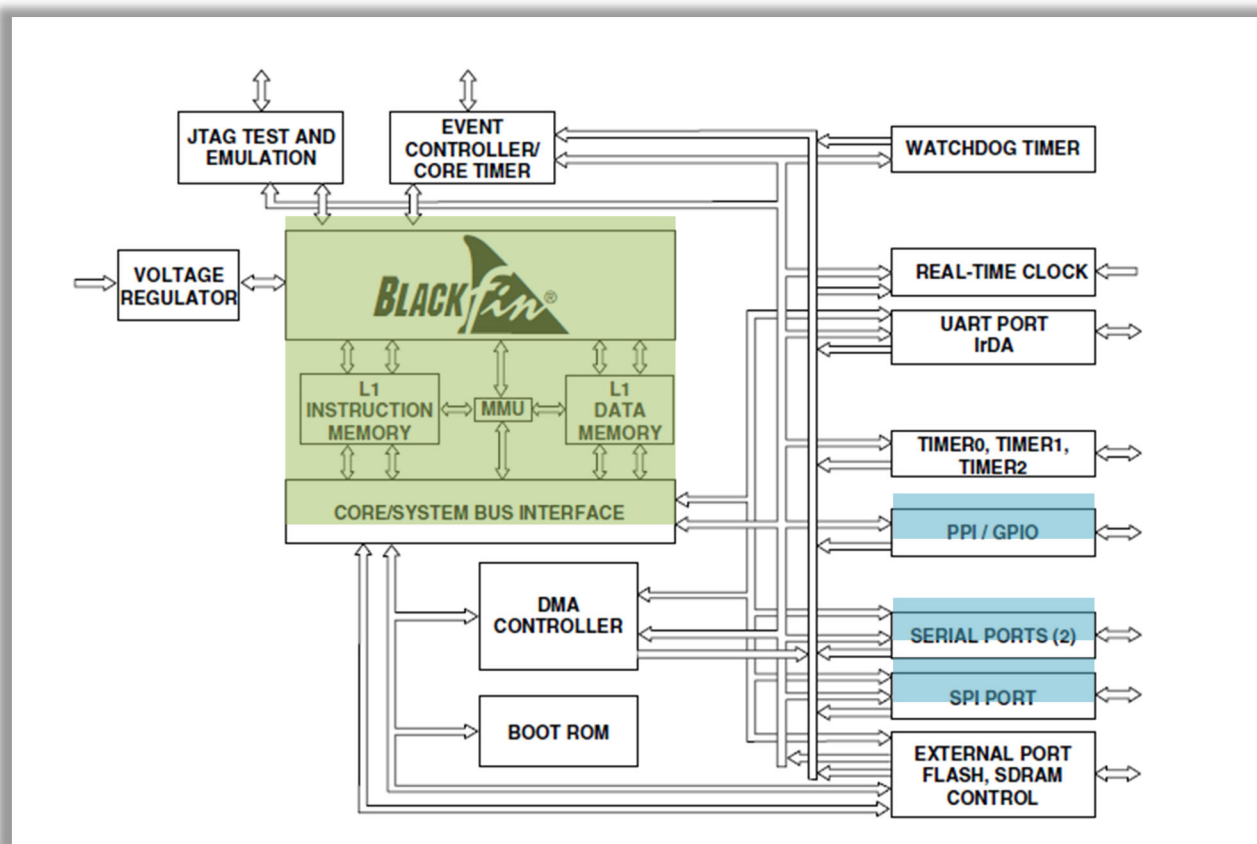
154. The AD9861 MxFE described and incorporated into Katz is “provided in a 64-lead lead frame chip scale package (LFCSP).” AD9861 Datasheet at 22.

5. Claim 20

- a) Tolonen in view of Katz includes a “wireless communication interface is implemented using two or more chipsets.”*

155. Katz’s processor “can connect directly to 802.15.4 ZigBee and IEEE 802.11 chipsets via the SPI and SPORT peripherals.” Katz, at 3. Implementing the entire interface, Katz’s processor connects to the MxFE via the parallel peripheral interface, and connects to the wireless protocol chipsets using SPI and SPORT

peripherals, as shown below in Figure 1 of the ADSP-BF531 Data Sheet. Katz, at 3; *see also* Katz, Fig. 7.



ADSP-BF531 Data Sheet, Fig. 1 (annotated).

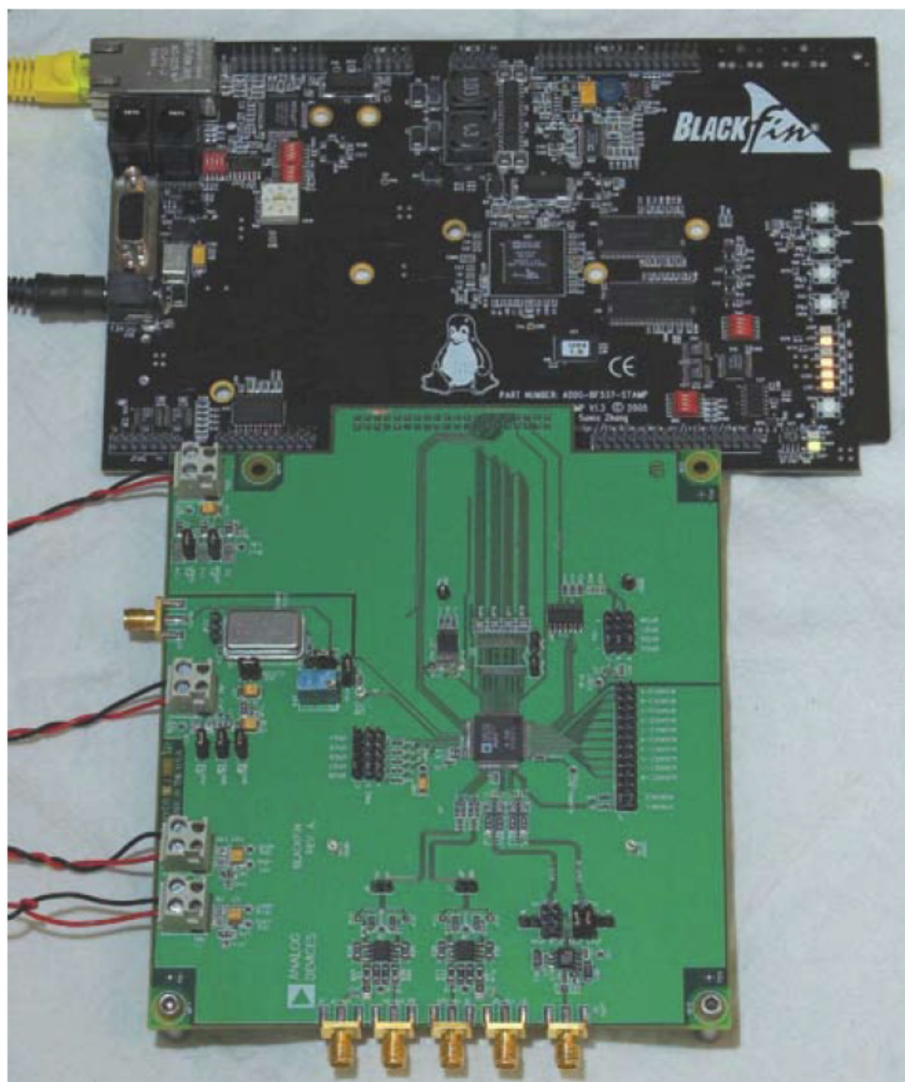


Figure 7. A Blackfin-based evaluation system for RFID reader applications.

Katz, Fig 7.

6. Claim 21

- a) *Tolonen in view of Katz discloses “[t]he EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.”*

156. Claim 21 is identical to Claim limitation 4[B], with the only difference being that Claim 21 depends from Claim 18 whereas Claim 4 depends from Claim 1—both of which are obvious by Tolonen in view of Katz.

Accordingly, Tolonen and Katz teaches Claim 21 for the same reasons. *See supra* Sections VIII.A.4.b, VIII.A.7, IX.B.3.

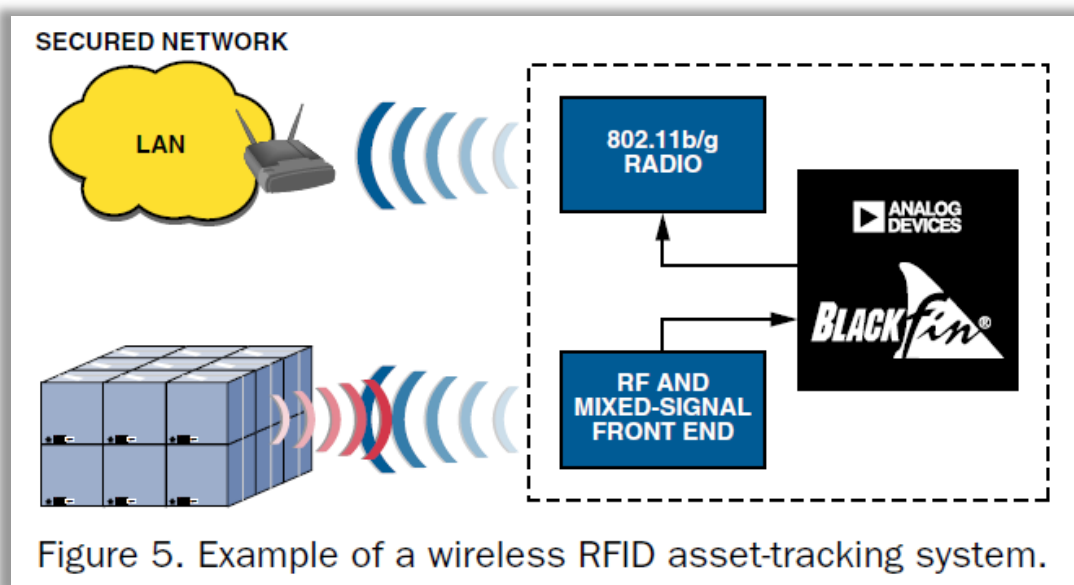
X. GROUND 3: ANTICIPATION OF CLAIMS 1 AND 2 OVER KATZ.

A. Katz discloses claims 1 and 2

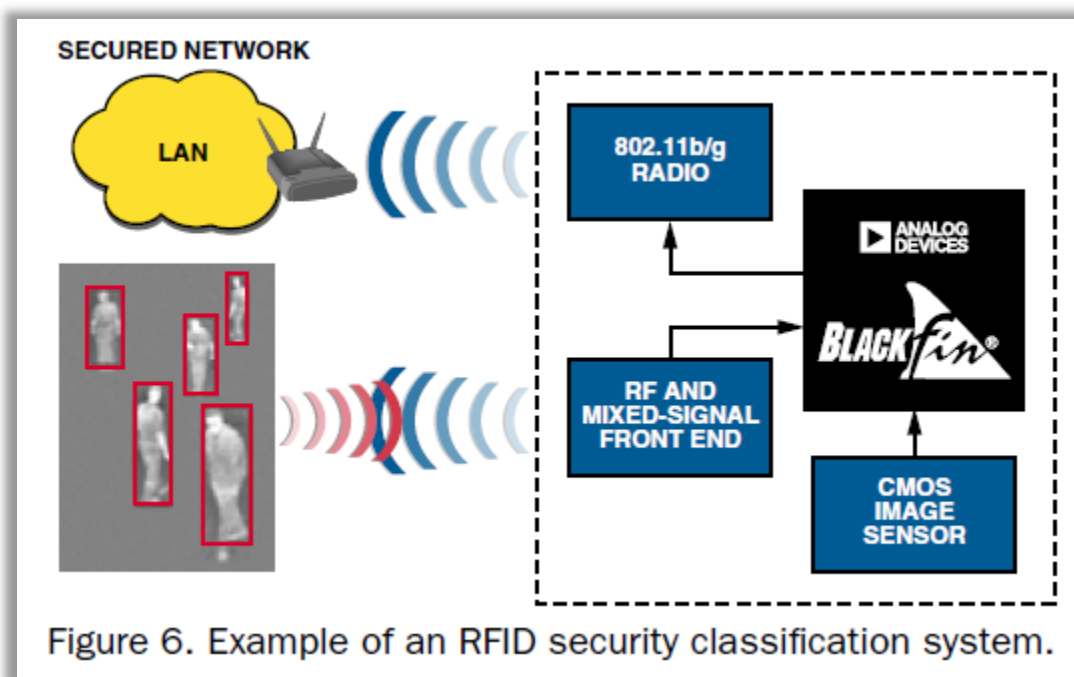
1. Claim 1

- a) *[I]pre] Katz discloses “[a]n encoded information reading (EIR) terminal.”*

157. Katz discloses a software defined radio system configured as a RFID tag reading system, which includes a Blackfin Processor, mixed-signal front ends to “communicate with tags,” an 802.11 chipset for communication with backend servers, and a CMOS image sensor that may be used to read 1D and 2D bar codes. Katz, pp. 1, 3, Figs. 5, 6.



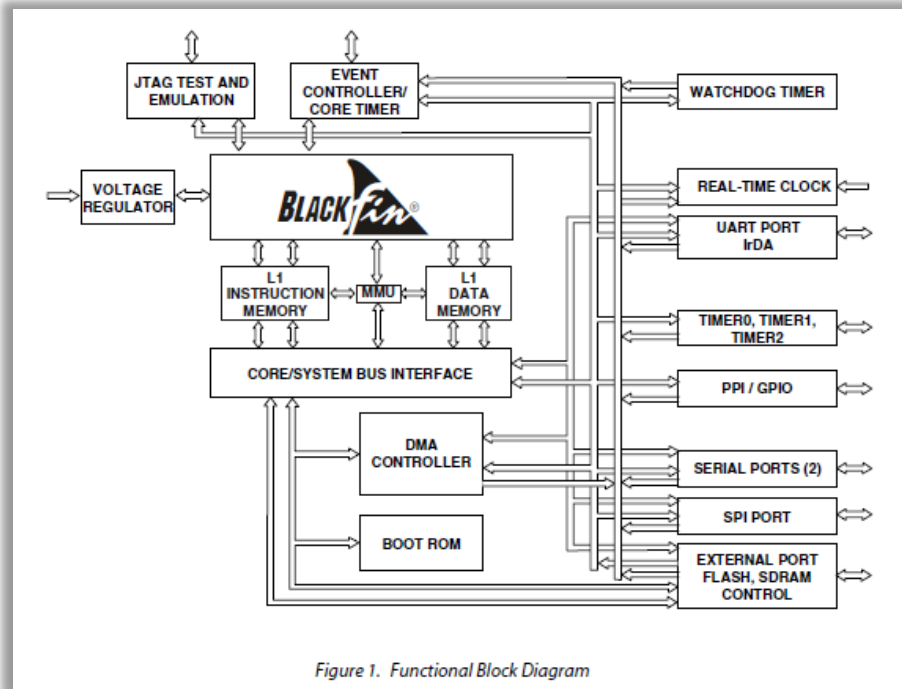
Katz, Fig. 5



Katz, Fig. 6

b) *[1a] Katz's RFID system comprises "a microprocessor electrically coupled to a system bus."*

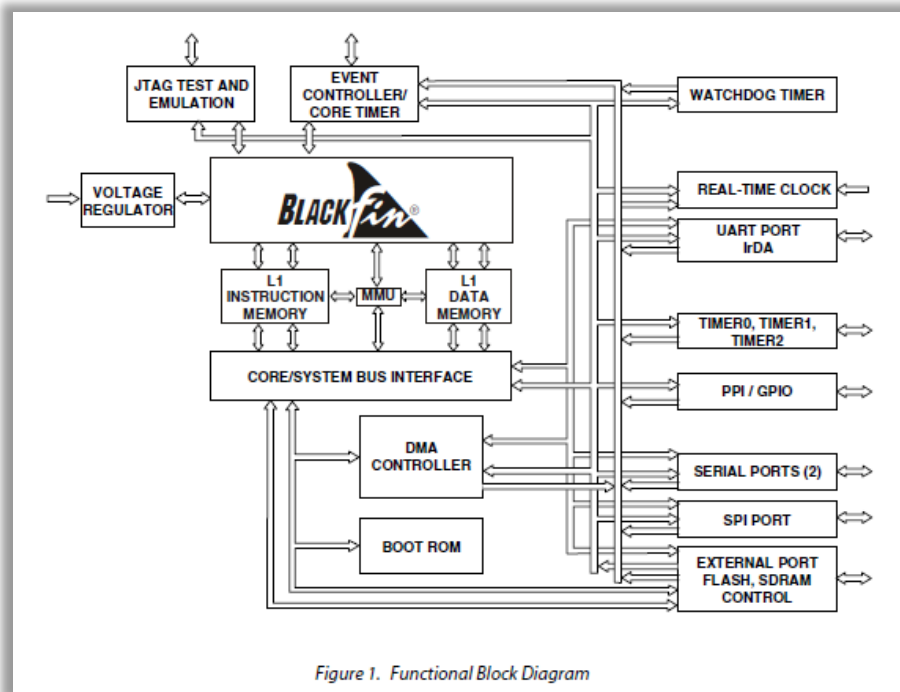
158. Katz's RFID system includes a Blackfin processor that is connected to peripherals via several bus protocols including the SPI (Serial Peripheral Interface) bus and the SPORT (Synchronous Serial Peripheral Port) bus. Katz, pp. 3, 4; ADSP-BF531 Data Sheet, pp. 1, 4. Katz's Blackfin processor is a microprocessor. For example, the Blackfin processor has also been referred to as an "embedded processor" since the Blackfin chips contain a large number of interfaces for peripherals common to embedded systems. ADSP-BF531 Data Sheet, pp. 1, 4, Fig. 1. An embedded processor is an example of a microprocessor designed for an embedded system. Additionally, Katz teaches that the Blackfin processor combines a signal processing engine with RISC-like microprocessor instruction sets, which is an instruction set architecture used for "Microprocessors without interlocked Pipelined Stages." ADSP-BF531 Data Sheet, p. 4. As shown below in Figure 1 of a datasheet for the ADSP-BF531 Blackfin processor, Katz's processor is electrically coupled to the core/system bus interface via the level one (L1) instruction and data memories, and the memory management unit (MMU). ADSP-BF531 Data Sheet, p. 4, Fig. 1. Also, as shown below in Figure 1, the peripheral interfaces are all electrically connected to the core/system bus interface either directly or through the direct memory access (DMA) controller. ADSP-BF531 Data Sheet, p. 4, Fig. 1.



ADSP-BF531 Data Sheet, Fig 1

c) [1b] Katz's RFID system comprises "a memory communicatively coupled to said microprocessor."

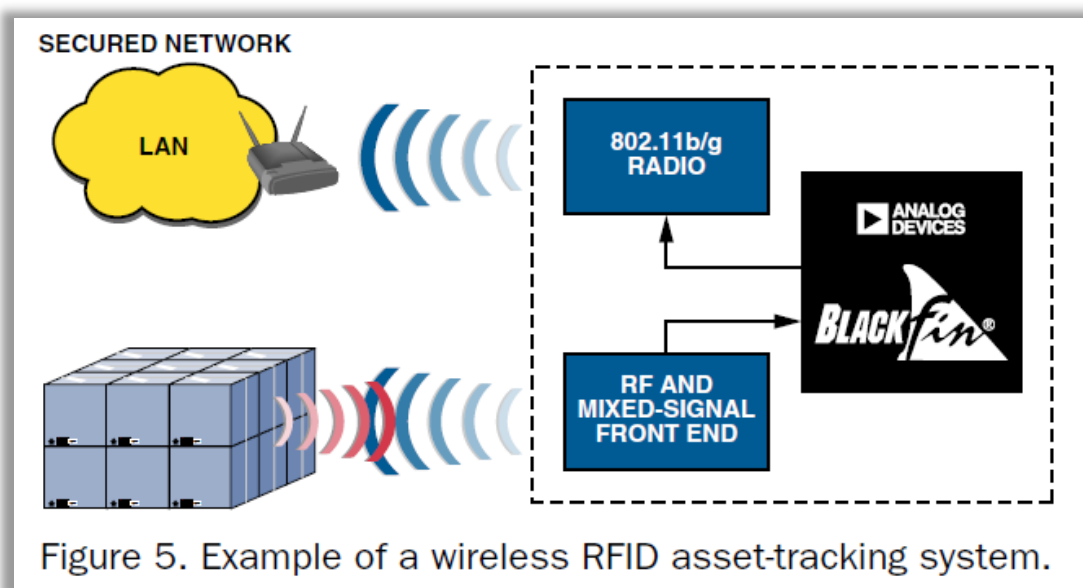
159. As shown in Figure 1 below, Katz's Blackfin processor interfaces directly with (i.e., is communicatively coupled to) L1 Instruction Memory and L1 Data Memory. ADSP-BF561 Data Sheet, at 5–7, Fig. 1. *See also*, Katz, p. 1 (stating that "[t]he reader has embedded software that manages the interrogation, decoding, and processing of the received tag information"), p. 3 (stating that the Blackfin processor executes "RFID acquisition software" that is inherently stored in memory).



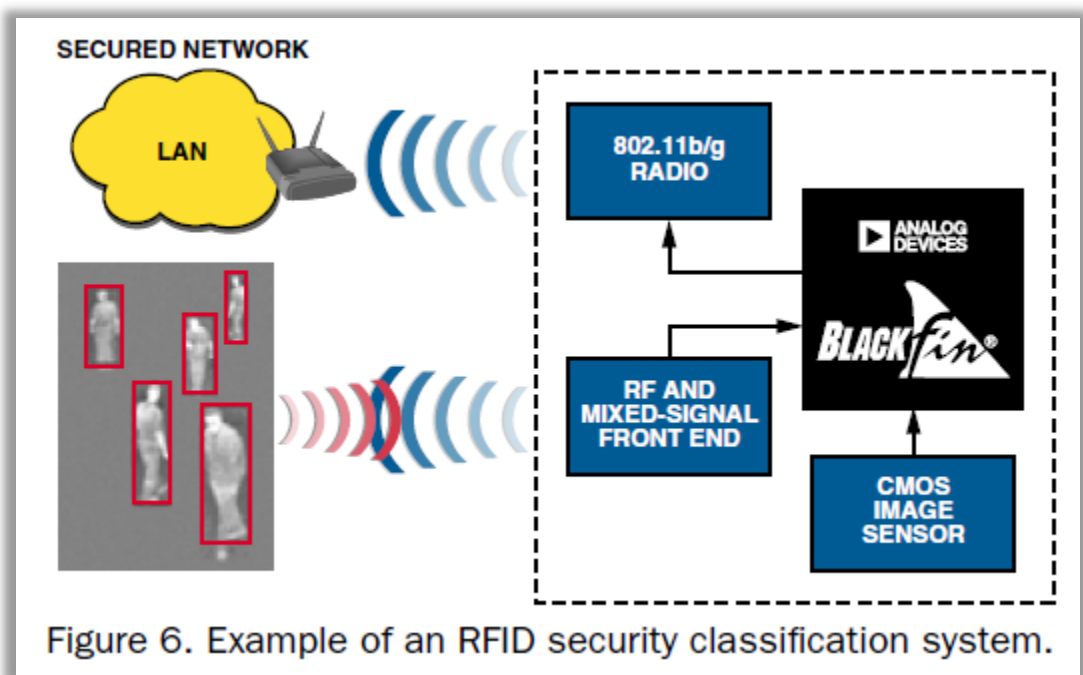
ADSP-BF531 Data Sheet, Fig 1

- d) [1c] Katz's RFID system comprises "an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message."

160. As shown in Figure 5 and Figure 6 below, Katz's processor interfaces with RF and Mixed-Signal Front End, and Katz's processor interfaces with a CMOS image sensor (i.e., a camera). Katz, p. 4, Figs. 5, 6. Either and or both operate as an encoded information reading device.

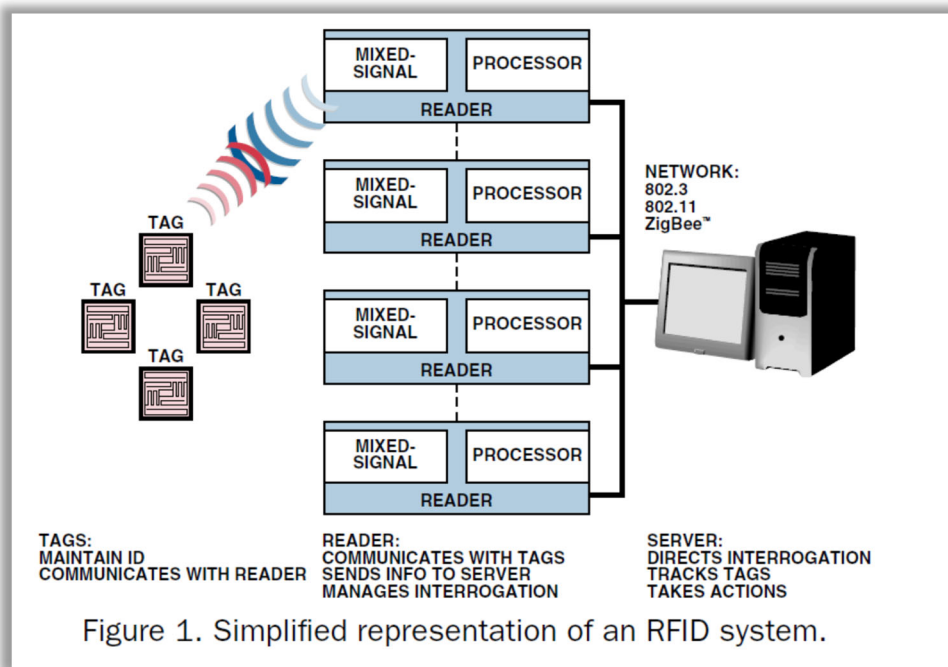


Katz, Fig. 5



Katz, Fig. 6

161. Katz teaches that the Mixed-Signal Front End (MxFE) integrated circuit “forms the interface” (Katz, p. 3) with RFID tags, performing “interrogation, decoding, and processing of ... received tag information.” Katz, pp. 1-4. For example, as shown in figure 1, below, Katz’s mixed-signal front end receives signals from tags after interrogation, and the reader decodes those signals and outputs the decoded message through the 802.3, 802.11, or ZigBee networks. Katz, p. 1.



Katz, Fig 1

162. Katz’s MxFE operates to perform the encoding and decoding of radio messages for RF communication. For example, Katz teaches that the software for

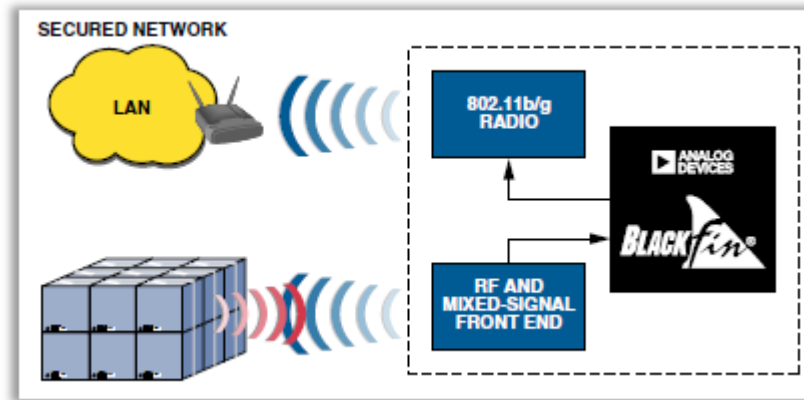
the Reader's front end performs the "filter- and transform-intensive signal processing." Katz, p. 3. In this way, Katz's MxFE front end outputs raw message data containing an encoded message. RFID tags communicate utilizing encoded data, for example, tags compliant to the ISO/IEC 15693 HF passive RFID standard utilize pulse position data encoding in communication from the tag to the reader, and EPCGlobal Generation 2 Passive UHF RFID ("Gen2") compliant tags, the most common passive UHF RFID tags in use in 2006, communicate using FM0 data encoding in communication from the tag to the reader. *See generally* Ex. 1017 (ISO/IEC 15693-3 First Edition (2001)); Ex. 1018. (EPCglobal, Radio-Frequency Identify Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz–960 MHz version 1.1.0 (2005)). Accordingly, Katz's RF Front end receives analog encoded data from the tag, converts the analog encoded data to raw digital encoded data and outputs it to the Blackfin processor.

163. As an additional example, Katz contemplates that a camera can "be connected to an RFID reader" such that "[b]esides RFID applications, ... Blackfin features are also especially attractive for 1D and 2D barcode applications, because of Blackfin's ability to perform system control, networking, and imaging processing on the same device." Katz p. 3. In this arrangement, the camera (e.g., EIR device or CMOS image sensor (shown in Katz, Fig. 6)) receives encoded

information (e.g., machine readable barcode data) and outputs that raw encoded data, such as the captured image, to the Blackfin processor.

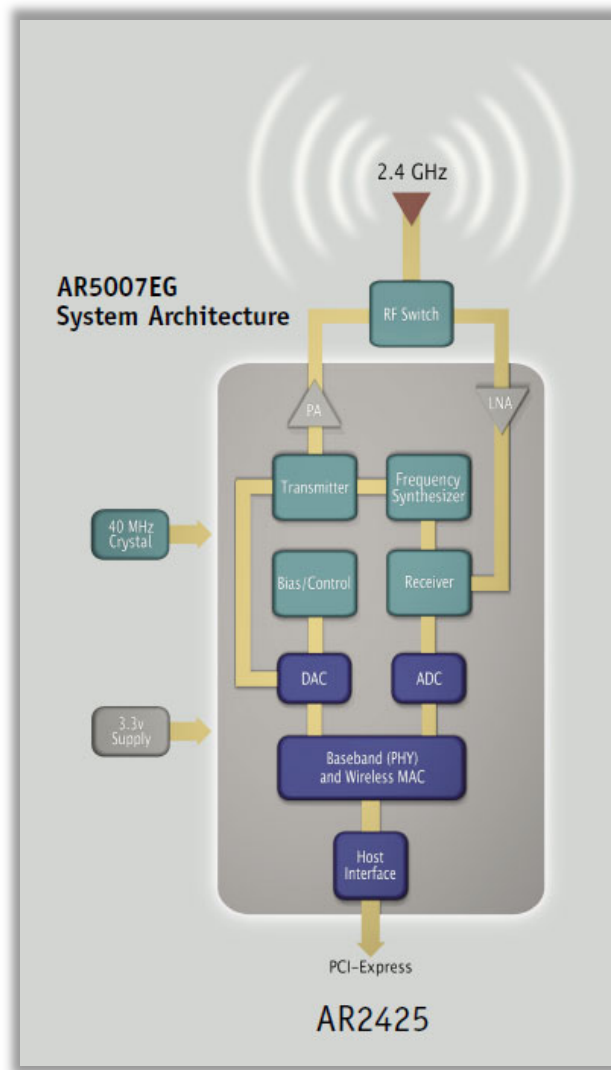
- e) *[1d] Katz's RFID system comprises "a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus."*

164. Katz teaches that the Blackfin processor "can connect directly to both 802.15.4 ZigBee and IEEE 802.11 chipsets via the SPI and SPORT peripherals." Katz, p. 3, Fig. 5; *see also* ADSP-BF561 Data Sheet (showing the SPI and SPORT peripherals connected to the system bus). Furthermore, Katz teaches that the Blackfin processor "include[s] a parallel peripheral interface (PPI), which can connect directly to ADCs and DACs" such as those shown in Katz Figure 2, contained in the RF and mixed-signal front end. Katz, p. 3, Fig. 2, Fig. 5; *see also* ADSP-BF561 Data Sheet (showing the PPI pins connected to the system bus).



Katz, Fig. 5

165. IEEE 802.11 chipsets, by design, are configured to perform at least one of receiving a first radio signal and transmitting a second radio signal as required by the IEEE 802.11 communication protocol, and they include an RF front end electrically coupled to an ADC and DAC, which are both electrically coupled by bus to the processor that controls the chip. For example, as shown in the data sheet from Atheros, the AR5007EG 802.11b/g chip includes an RF front end electrically connected to a DAC and an ADC, which are electrically connected to the “Host Interface” (*i.e.*, the system bus). Ex. 1015; *see also* Ex. 1016.



Atheros AR5007EG data sheet, Ex. 1015

166. To the extent other 802.11b/g chips existed at the time that did not include an ADC and DAC on-chip electrically coupled to the RF front end and to a system bus, which I cannot think of any as I draft this declaration, then a POSITA would at least have considered it obvious to combine Katz with the Atheros chip, as one possible option available at the time.

167. As another example, Katz's MxFE RF mixed signal front end IC, as shown in Katz Figure 2, contains an ADC and a DAC that are electrically coupled to both an RF front end (via the "VIN" terminals for the ADC and the "IOUT" terminals for the DAC), including an antenna, and by system bus (via the "Flexible I/O Bus" terminals) to the processor that controls the chip. Katz, p. 3, Fig. 2, Fig. 5, Fig. 6. Katz teaches that the "Blackfin processor[]" include[s] a parallel peripheral interface (PPI), which can connect directly to ADCs and DACs such as those mentioned above [related to Figure 2]." Katz, p. 3; *see also* ADSP-BF561 Data Sheet (showing the PPI pins electrically connected to the system bus which is electrically connected to the processor). Katz explains that the wireless communication interface comprising the RF front end and the MxFE chip is configured to at least transmit a second radio signal. Katz, p. 3 (explaining that "[f]or RFID applications, a single PPI is often sufficient because of the way the RFID reader interrogates tags. First, the PPI is configured in transmit mode, and the processor sends a digital sequence to a DAC. The transmitted sequence is converted to an analog signal, which is then upconverted and sent out to excite/wake up local RFID tags, which then respond.").

- f) [1e] Katz's RFID system discloses "wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program."

168. Katz's processor concurrently executes all "three elements of the RFID reader software architecture. . . : the *back-end server interface*, the *middleware*, and the *front-end tag reader algorithms*." Katz, p. 2 (emphasis in original). In the front-end, Katz identifies that the "system's filter- and transform-intensive signal processing, occurring in the front end of the reader, requires a device with the kind of strong signal-processing performance typically associated with Blackfin processors." Katz, p. 3. Katz's Blackfin processor base-band encodes and decodes by performing filtering and transformative signal processing. Katz teaches that the ADEOS real-time scheduler can be used instead of the uClinux operating system's normal scheduler to allow the "front-end reader software [to] execute ... in real time, while the middleware and back-end server interface can run in the traditional uClinux environment." Katz, p. 5.

- g) *[1f] Katz's "base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control."*

169. As discussed above, Katz's processor executes front-end, middleware, and backend software, including performing "filter and transformative-intensive signal processing." Katz, pp. 2–3; *see supra* Section X.A.1.b–c. The filter- and transform-intensive signal processing at the front end includes at least encryption and channel encoding as needed to support IEEE 802.11b/g. Katz, p. 4. Furthermore, Katz explicitly teaches that "because of their [Blackfin processors] computational horsepower, these processors support both split-MAC and full-MAC 802.11a/b/g implementations." Katz, p. 4. Thus, Katz teaches, the MAC, or Medium Access Control, functionality is "executed in Blackfin software." Katz, p. 4.

- h) *[1g] Katz's "DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream."*

170. For example, Katz teaches that the Blackfin processor can connect directly to both 802.15.4 ZigBee and IEEE 802.11 chipsets via the SPI and Sport Peripherals. Katz, p. 3; *see supra* Section X.A.1.e. As the 802.11 chipset has a

DAC, for example, the 802.11 chipset receives encoded data from the Blackfin processor, converts it to an analog signal, and communicates the analog signal as a radio wave through the chipset's front end. *See, e.g.*, Ex. 1015. The Atheros chipset, for example, includes a DAC as shown in the data sheet. *Id.*

171. Katz's MxFE RF mixed signal front end IC, as shown in Katz Figure 2, contains a DAC that is electrically coupled to both an RF front end (via the "IOUT" terminals for the DAC), including an antenna, and by system bus (via the "Flexible I/O Bus" terminals) to the processor that controls the chip. Katz, p. 3, Fig. 2, Fig. 5, Fig. 6. Katz teaches that the "Blackfin processor[] include[s] a parallel peripheral interface (PPI), which can connect directly to ADCs and DACs such as those mentioned above [related to Figure 2]." Katz, p. 3; *see also* ADSP-BF561 Data Sheet (showing the PPI pins electrically connected to the system bus which is electrically connected to the processor). Katz explains that the wireless communication interface comprising the RF front end and the MxFE chip is configured to at least transmit a second radio signal. Katz, p. 3 (explaining that "[f]or RFID applications, a single PPI is often sufficient because of the way the RFID reader interrogates tags. First, the PPI is configured in transmit mode, and the processor sends a digital sequence to a DAC. The transmitted sequence is converted to an analog signal [by the DAC], which is then upconverted and sent

out [via the RF front end] to excite/wake up local RFID tags, which then respond.”).

- i) *[1h] Katz discloses “wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end.”*

172. For example, Katz explains that the Blackfin processor can connect directly to both 802.15.4 ZigBee and IEEE 802.11 chipsets via the SPI and Sport Peripherals. Katz at 3; *see supra* Section X.A.1.e. As the 802.11 chipset has an ADC, for example, the 802.11 chipset receives encoded analog data through the RF Front end and converts it to a digital signal for receipt by the Blackfin processor. Simply, this is how digital wireless communication works. *See also* Ex. 1015.

173. With regards to Katz’s MxFE RF mixed signal front end IC, as shown in Katz Figure 2, the MxFE contains an ADC that is electrically coupled to both an RF front end (via the “VIN” terminals for the ADC), including an antenna, and by system bus (via the “Flexible I/O Bus” terminals) to the processor that controls the chip. Katz, p. 3, Fig. 2, Fig. 5, Fig. 6. Katz teaches that the “Blackfin processor[] include[s] a parallel peripheral interface (PPI), which can connect directly to ADCs and DACs such as those mentioned above [related to Figure 2].” Katz, p. 3; *see also* ADSP-BF561 Data Sheet (showing the PPI pins electrically connected to the

system bus which is electrically connected to the processor). Katz explains that the wireless communication interface comprising the RF front end and the MxFE chip is configured to at least receive a first radio signal. Katz, p. 3 (explaining that “the PPI is reconfigured as a receiver ... as shown in Figure 3. In this way, a downconverted RF signal can be sampled by an ADC and brought into the Blackfin directly. In the figure, the time ... is measured in system clock cycles. The elapsed time allows for the transmitted signal to reach the tag and for the tag to transmit a response.”).

j) *[1i] Katz’s “base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.”*

174. Katz’s processor executes software for “manag[ing] the interrogation, *decoding*, and processing of the received tag information.” Katz, p. 1. Moreover, when Katz’s processor executes filter-and transformative-intensive signal processing front-end software, the software must include channel and/or source decoding since Katz’s processor sends data that can be stored on a central database application “with functions that include matching, tracking, and storage.” Katz, p. 2. Because Katz’s RFID system is directed toward helping a user in “read[ing] the information [the tags] carry . . . maintain[ing] and update[ing] the tag database,

generating alerts or initiating other information-based processes within the enterprise,” the software must inherently (either channel or source) decode the bit stream into data that can be matched, tracked, stored, and retrieved later from a database in a readable form. Katz, p. 1. Furthermore, Katz explicitly teaches that “because of their [Blackfin processors] computational horsepower, these processors support both split-MAC and full-MAC 802.11a/b/g implementations.” Katz, p. 4. Thus, as Katz teaches, the MAC, or Medium Access Control, functionality is “executed in Blackfin software.” Katz, p. 4. This medium access control functionality includes receiving messages that must be decoded and understood to correctly perform the medium access control functionality. Additionally, the signal processing software programs include at least frequency de-spreading, demultiplexing, and demodulation because a front end requires these functions to understand information received via RF analog signals.

2. Claim 2

- a) [2] Katz’s “EIR terminal of claim 1 is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.”

175. To implement a RFID tag reading system, Katz discloses three elements of software architecture: “the back-end server interface, the middleware, and the front-end tag reader algorithms.” Katz, p. 1 (emphases omitted). “Though distinct, all these elements of the software architecture can run concurrently on a single Blackfin processor.” *Id.* Katz further notes that for 802.11 communications, “their stack and processing requirements can be easily handled on a single-core processor”. Katz, p. 4. Solely relying on software to perform all requisite tag reading functions, Katz’s RFID system is *devoid of dedicated hardware components. Id.*

XI. GROUND 4: OBVIOUSNESS OF CLAIMS 3–23 OVER KATZ IN VIEW OF ISHIZU.

A. Motivation to Combine

176. It is my opinion that a POSITA would have been motivated to combine Katz with Ishizu.

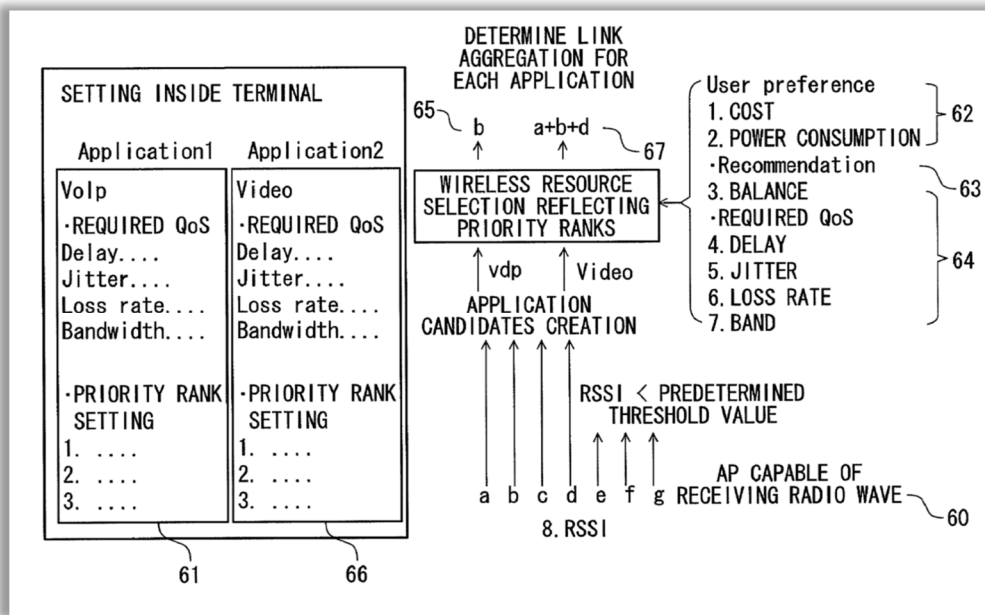
177. Katz teaches an RFID system that includes an RF and Mixed-Signal Front End and an 802.11b/g Radio connected to a Blackfin Processor. Katz, p. 4, Fig. 5. Katz teaches that the IEEE 802.11b/g radio is necessary for mobile and portable systems, and that these systems will need to connect to access points for communication. Katz, p. 4. Katz teaches that the processor in the RFID system runs software for controlling the operation of the reader and that the stack and processing requirements for the 802.11 communications “can be easily handled on a single-core processor.” Katz, pp. 2-4. For example, Katz’s processor performs “[m]anaged power consumption ... using dynamic power management capabilities.” Katz, p. 4.

178. Katz teaches that “[t]hese dynamic power modes are designed to enable flexible performance and power arrangements for just about any networked system.” *Id.* Katz further teaches that “[t]he primary challenge in a multiple reader/tag scenario is that collisions will occur when many readers send out queries and multiple tags respond at the same time.” Katz, p. 2. Katz notes that the approaches to mitigate collisions can be implemented in software, and that “the ability to implement this function in embedded software provides additional flexibility.” Katz, p. 2. In keeping with the goal of flexible performance, Katz teaches that its μ Clinux operating system in connection with the ADEOS real-time

scheduler “gives the user hard real-time control of the application, while at the same time allowing access to all the benefits of open-source software.” Katz, p. 5.

179. A POSITA reading Katz would understand Katz’s problems, such as mobile connections to access points, collision avoidance, and power versus performance trade-offs, and the resulting need to implement a flexible radio and scheduling program that enables flexible performance and power management. Accordingly, the POSITA would have looked to a reference like Ishizu.

180. Ishizu teaches “a communication terminal capable of dynamic reconfiguration ... of connection to a plurality of wireless communication networks.” Ishizu, ¶ 32. Ishizu’s terminal employs a “connection policy information table” and a “communication network reconfiguration management means for selecting a connection method of a wireless communication network ... on the basis at least of the connection policy information.” Ishizu, ¶ 38. Ishizu teaches that the connection policy information creation processing considers communication priorities specified by the user, *see, e.g.*, Ishizu, ¶¶ 77, 95, as well as, information about the communication channel and the access points, *see, e.g.*, Ishizu, ¶¶ 97-129. As shown in Figure 6, below, Ishizu’s connection policy is based on an algorithm that considers user preferences. Ishizu, ¶ 144, Fig. 6.



Ishizu, Fig. 6

181. As Ishizu's connection policy information pertains to "connection methods" like IEEE 802.11b, *see* Ishizu, ¶ 37, a POSITA would have realized Ishizu's usefulness to Katz's RFID reader system, which in one application uses an 802.11b/g radio for mobile RFID systems such as "a forklift-mounted scanner or a portable hand-held scanner" to "allow RFID readers to connect to a wireless *access point*". Katz, p. 4. A POSITA would have implemented Ishizu's "communication network reconfiguration management means", including Ishizu's connection policy, in Katz's Blackfin processor as part of Katz's RFID and communication control software. And, the POSITA would have realized the predictable benefit of optimized power and system performance by controlling network connections

according to Ishizu’s teaching. Moreover, because Ishizu’s policy is designed to control communications through communication modules, such as those employing IEEE 802.11b, a POSITA would have expected the combination of Katz and Ishizu to predictably result in an RFID reader system as described by Katz that relies on the connection policy methodologies described by Ishizu.

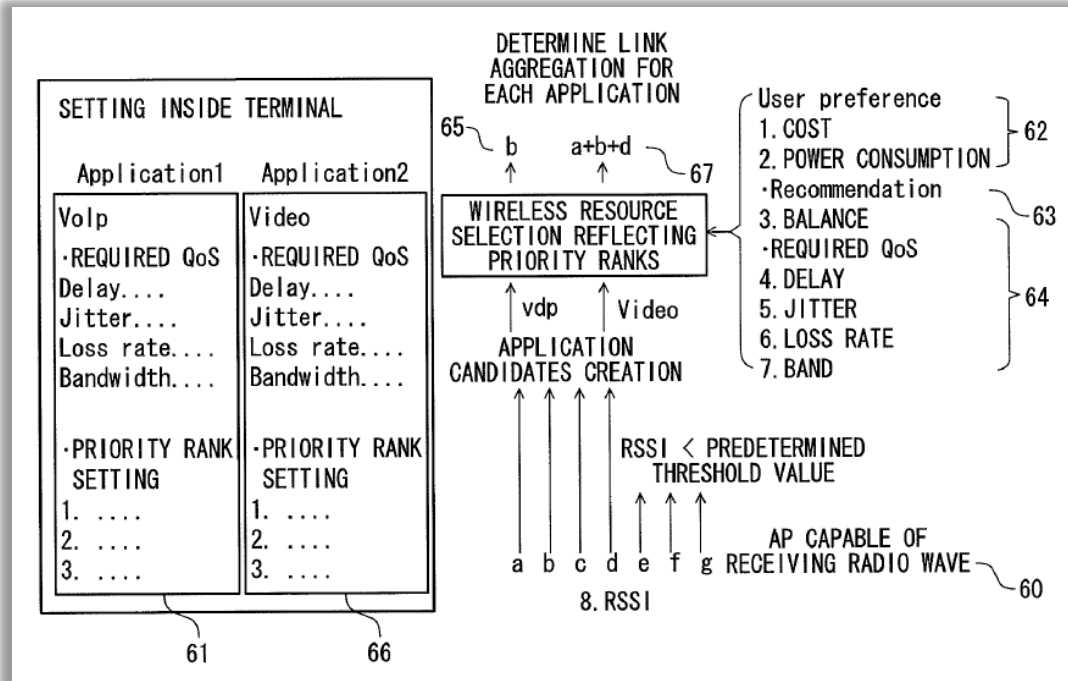
B. Katz in view of Ishizu Invalidates the Claims

1. Claim 3

- a) *[3] Katz in view of Ishizu discloses “[t]he EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”*

182. In combination, Katz and Ishizu implement an RFID system that includes an RFID reader front end, an 802.11b/g radio, a bar code reader, and a processor running software for controlling the RFID Reader system, the 802.11b/g radio, and the bar code reader, including scheduling communications according to Ishizu’s teachings. *See supra* Section XI.A. Employing Ishizu’s connection policy, the Katz–Ishizu RFID system is “capable of *dynamic reconfiguration* of connection with different wireless communication networks” based on “priority

specified by the user.” Ishizu, ¶¶ 30, 77. As shown below in Figure 6, Ishizu’s data aggregation device includes “a selection algorithm . . . in order to select an optimal wireless resource according to preference of a user.” Ishizu, ¶ 144.



Ishizu, FIG. 6.

2. Claim 4

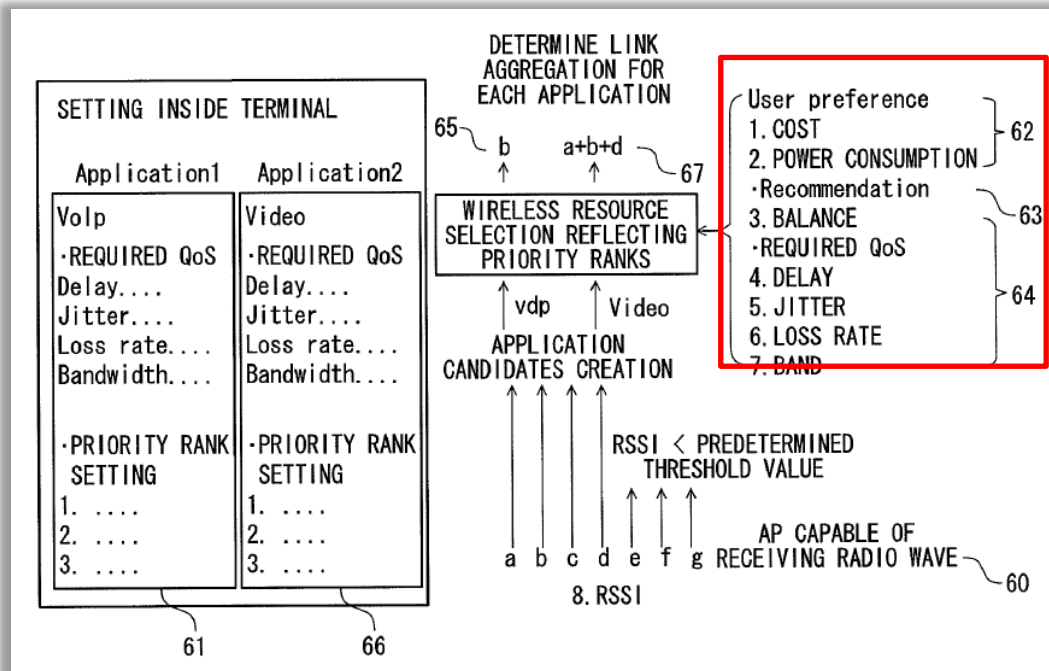
- a) *[4a] Katz in view of Ishizu discloses “[t]he EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”*

183. Claim limitation 4[A] is identical to Claim 3. Therefore, all arguments from Claim 3 and Claim 1 are herein reasserted.

- b) *[4b] Katz in view of Ishizu discloses “wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.”*

184. Ishizu’s data communication aggregation device uses a selection algorithm “to select an optimal wireless resource according to *preference of a user*,” which balances the user’s preference for “cost,” “communication quality,” and “power consumption,” against the required Quality of Service standard. Ishizu, ¶¶ 79, 144, 147 (“For example, access points satisfying the required QoS are selected from usable access points as selection candidates and they are narrowed into the selection candidates matching the cost requirement and power consumption requirement of the user.”), Fig. 6. Using the selection algorithm,

Ishizu iteratively evaluates wireless communication selection candidates to dynamically select the candidate “matching the cost requirement and power consumption requirement of the user.” Ishizu, ¶ 147, Fig. 6; *see also*, Ishizu, ¶¶ 79-95.



Ishizu, Fig. 6 (annotated)

3. Claim 5

- a) *[5a] Katz in view of Ishizu “[t]he EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”*

185. Claim limitation 5[A] is identical to Claim 3. Accordingly, Katz and Ishizu teach Claim 5[A] for the same reasons, and all arguments from Claim 3 and Claim 1 are herein reasserted. *See supra* Sections X.A.1, XI.B.1.

- b) *[5b] Katz in view of Ishizu “wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.”*

186. Ishizu teaches that its data communication aggregation device can determine the frequency band of the access point (e.g., from its WiFi advertising beacon), which is “a value specific to [the] access point.” *See* Ishizu, ¶¶ 108–109. Ishizu explains that certain communication values can be derived from the access point “by known art in the application execution processing portion of the application executing device,” and that these values include usable frequency band, frequency band of access, and number of terminals connected to an access point.

Ishizu, ¶¶ 107–112 (reference numerals omitted). Based on this information, Ishizu’s data communication aggregation device determines “a congestion degree of an access point,” which affects whether to connect to this access point. *See* Ishizu, ¶ 147.

4. Claim 6

- a) *[6a] Katz in view of Ishizu discloses “[t]he EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.”*

187. Claim limitation 6[A] is identical to Claim 3. Accordingly, Katz and Ishizu teach Claim 6[A] for the same reasons and all arguments from Claim 3 and Claim 1 are herein reasserted. *See supra* Sections X.A.1, XI.B.1.

- b) *[6b] Katz in view of Ishizu discloses “wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.”*

188. Ishizu teaches that because mobile communication terminals, like Katz’s RFID system, “are provided with a plurality of wireless communication

methods, a user can select and *switches* to an optimal one from those methods or use some at the same time so as to increase the communication speed and to conduct wireless communication.” Ishizu, ¶ 6. Ishizu’s selection algorithm, in calculating the benefits of alternatives including alternative access points (e.g., alternative wireless communication networks), uses at least user preferences and quality of service factors, and then iteratively evaluates the possible choices to select a connection method and/or access point. Ishizu, ¶ 147; *see also supra* Section XI.B.1. Using the device’s wireless communication network reconfiguration executing means, the device then switches to the selected connection method and/or access point. Ishizu, ¶¶ 38, 144-9, Fig. 6.

5. Claim 7

- a) *[7] Katz in view of Ishizu discloses “[t]he EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.”*

189. Ishizu’s data communication aggregation device requires a user’s interaction using a keyboard to input the user’s preferences (i.e., the user must perform a *user action*). Ishizu ¶ 95. A user may prefer criteria (selecting a criterion being a *user action*) such as “cost” or “power consumption.” *See* Ishizu ¶ 143, Fig. 6. Responsive to the user’s preference, the selection algorithm will then

calculate the optimal wireless network and “select an optimal wireless resource according to *preference of a user*.” Ishizu, ¶¶ 143, 145–47. *See also supra* Sections XI.B.4–6.

6. Claim 8

- a) *[8] Katz in view of Ishizu discloses “[t]he EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.”*

190. As discussed previously, Katz’s RFID system can also integrate with a CMOS image sensor to function as a bar code reader. A POSITA would have recognized the increased transmission requirements of sending an image from a CMOS image sensor and, in connection with Katz’s motivation to provide flexible performance and power management, would have combined Katz with a reference like Ishizu that teaches means for managing power based on the power requirements of different applications. Katz, p. 4 (where Katz notes “the video-processing piece of the human-recognition algorithm might run on the second core, and the resulting data packets might be passed to the first core for transmission over a network interface.”); *see also supra* Section X.A.1.d.

191. Ishizu discloses that image data may be moved from the device to a server and from servers to be displayed on a monitor. Ishizu, ¶ 70. To manage such data transfers, Ishizu discloses that when “an application requiring high-speed communication *such as image transmission is started by a user,*” Ishizu’s requirement information would “automatically change[] to ‘emphasis on communication quality.’” Ishizu, ¶ 96. Using the changed requirement information, Ishizu’s selection algorithm would recalculate and reevaluate to determine the preferred network candidate and dynamically reconfigure the network. Ishizu, ¶¶ 96, 147; *see also supra* Section XI.B.1–2.

192. Given Katz’s described concerns with mobile connections to access points, collision avoidance, and power versus performance trade-offs, and the resulting need to implement a flexible radio and scheduling program that enables flexible performance and power management, a POSITA would have been motivated to look to a reference, like Ishizu, that provides this solution. In doing so, the POSITA would have readily understood the benefits of Ishizu’s teachings regarding image data transfers and would have applied it to Katz’s teachings about using CMOS image sensor to capture and communicate image data.

7. Claim 9

193. Claim 9 is comprised of a preamble and six claim limitations—all of which are disclosed by Katz and Ishizu as analyzed above. Specifically, claim 9 and claim 1 have the same preamble; claim limitations 9[A]–[E] are identical to claim limitations 1[A]–[E]; and claim limitation 9[F] is identical to claim 3. Accordingly, Katz in view of Ishizu teaches Claim 9 for the same reasons. *See supra* Sections X.A.1, XI.B.1.

8. Claim 10

194. Claim 10 is identical to Claim limitation 4[B], with the only difference being that Claim 10 depends from Claim 9 whereas Claim 4 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teach Claim 10 for the same reasons. *See supra* Sections X.A.1, XI.B.2.b.

9. Claim 11

195. Claim 11 is identical to Claim limitation 5[B], with the only difference being that Claim 11 depends from Claim 9 whereas Claim 5 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 11 for the same reasons. *See supra* Sections XI.B.3.b, XI.B.7.

10. Claim 12

196. Claim 12 is identical to Claim limitation 6[B], with the only difference being that Claim 11 depends from Claim 9 whereas Claim 6 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 12 for the same reasons. *See supra* Sections XI.B.4.b, XI.B.7.

11. Claim 13

197. Claim 13 is identical to Claim limitation 7, with the only difference being that Claim 13 depends from Claim 9 whereas Claim 7 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 13 for the same reasons. *See supra* Sections XI.B.5, XI.B.7.

12. Claim 14

198. Claim 14 is identical to Claim limitation 8, with the only difference being that Claim 14 depends from Claim 9 whereas Claim 8 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 14 for the same reasons. *See supra* Sections XI.B.6, XI.B.7.

13. Claim 15

199. Claim 15 is comprised of a preamble and six claim limitations—all of which are disclosed by Katz and Ishizu. Specifically, claim 15 and claim 1 have the same preamble; claim limitations 15[A]–[E] are identical to claim limitations 1[A]–[E]; and claim limitation 15[F] is identical to claim 8. Accordingly, Katz in view of Ishizu teaches Claim 13 for the same reasons. *See supra* Sections X.A.1, XI.B.6.

14. Claim 16

200. Katz’s RFID system includes a Blackfin processor for the wireless communication device. Katz, p. 3. A microprocessor is a single integrated circuit on which the arithmetic and logic functions of a computer are placed. Ex. 1013, McGraw-Hill Dictionary of Scientific and Technical Terms, Fifth Edition, 1994. The Blackfin processor “combine[s] a dual-MAC state-of-the-art signal processing engine, the advantages of a clean, orthogonal RISC-like microprocessor instruction set, and single instruction, multiple data (SIMD) multimedia capabilities into a single instruction set architecture.” ADSP-BF531 Data Sheet, p. 3, Fig. 1. Accordingly, the Blackfin processor is a microprocessor. In the same way, Ishizu discloses a “software wireless communication device . . . [where] *demodulation* or

the like is performed *by a digital signal processor or micro processor* and software.” Ishizu ¶ 16.

15. Claim 17

- a) [17] *Katz in view of Ishizu discloses “[t]he EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.”*

201. Katz’s RFID system includes a Blackfin processor for the wireless communication device. Katz, p. 3. A microprocessor is a single integrated circuit on which the arithmetic and logic functions of a computer are placed. Ex. 1013, McGraw-Hill Dictionary of Scientific and Technical Terms, Fifth Edition, 1994. The Blackfin processor “combine[s] a dual-MAC state-of-the-art signal processing engine, the advantages of a clean, orthogonal RISC-like microprocessor instruction set, and single instruction, multiple data (SIMD) multimedia capabilities into a single instruction set architecture.” ADSP-BF531 Data Sheet, p. 3, Fig. 1. Accordingly, the Blackfin processor is a microprocessor. In the same way, Ishizu discloses a “software wireless communication device . . . [where] *demodulation* or the like is performed *by a digital signal processor or micro processor* and software.” Ishizu ¶ 16.

16. Claim 18

202. Claim 18 is comprised of a preamble and five claim limitations—all of which are disclosed by Katz in view of Ishizu. Specifically, claim 18 and claim 1 have the same preamble; claim limitations 18[A]–[C] and [E] are identical to claim limitations 1[A]–[C] and [E]. Only claim limitation 18[D] is not contained within claim 1. This section only discusses claim limitation 18[D] in detail. In all other limitations, Katz in view of Ishizu discloses claim 18, and all arguments from Claims 1 are herein reasserted. *See supra* Section X.A.1.

a) *[18d] Katz in view of Ishizu discloses “a wireless communication interface configured to support at least two wireless communication protocols.”*

203. Katz’s device includes a wireless communication interface using a MxFE that supports multiple RFID wireless communication protocols. Katz, pp. 2, 3, Fig. 2. Additionally, Katz’s device includes a wireless communication interface that supports at least two wireless communication protocols including IEEE 802.11b and IEEE 802.11g. Katz, p. 4, Figs. 5, 6. In the same way, Ishizu’s device uses communication modules acting as radio frequency front ends. Ishizu’s communication modules, however, also “include [wireless] communication methods such as *WiFi* (compatible Wireless Fidelity, IEEE 802.11 b standard) and

WiMAX (Worldwide Interoperability for Microwave Access, IEEE 802.16 standard) used in communication.” Ishizu ¶ 37.

17. Claim 19

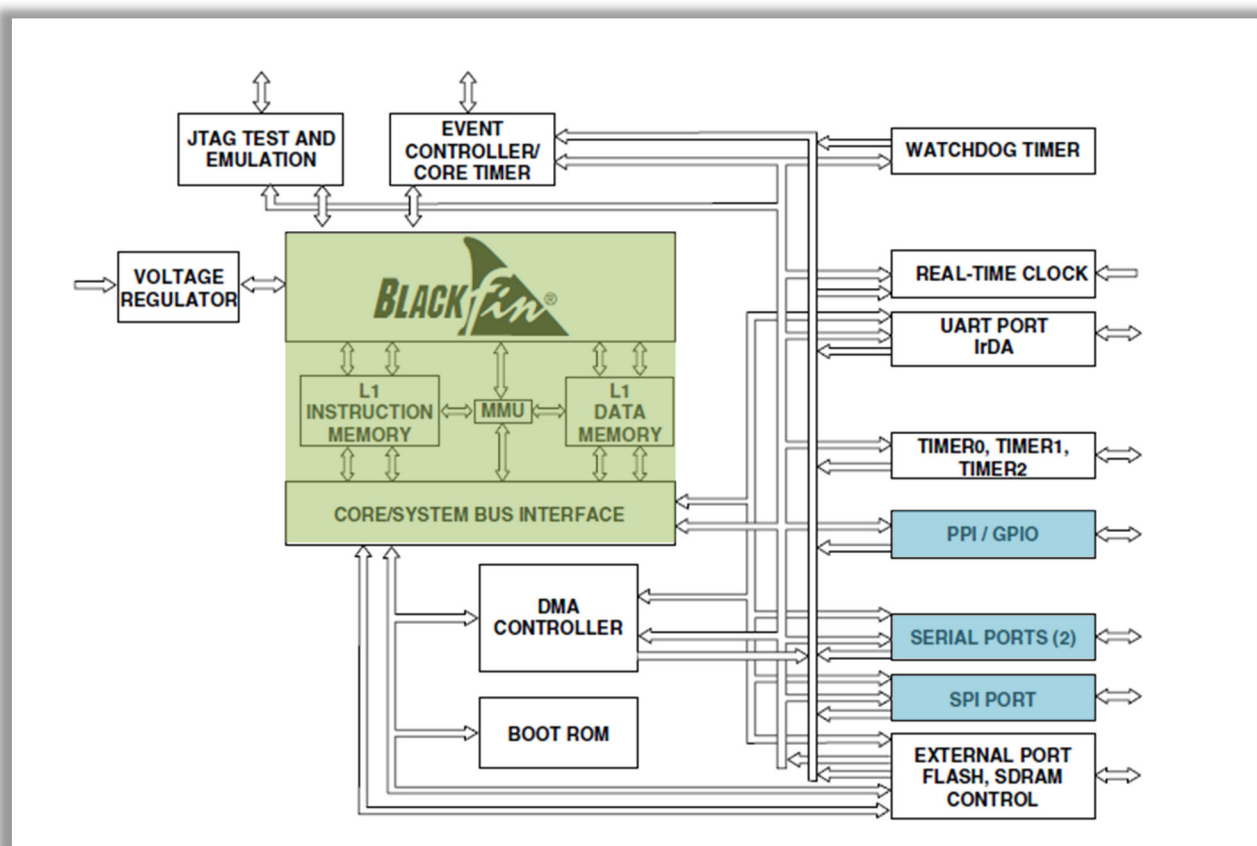
- a) Katz’s “wireless communication interface is implemented using a single multi-protocol chipset.”*

204. The AD9861 MxFE described and incorporated into Katz is “provided in a 64-lead lead frame chip scale package (LFCSP).” AD9861 Datasheet at 22.

18. Claim 20

- b) Katz’s “wireless communication interface is implemented using two or more chipsets.”*

205. Katz’s processor “can connect directly to 802.15.4 ZigBee and IEEE 802.11 chipsets via the SPI and SPORT peripherals.” Katz, at 3. Implementing the entire interface, Katz’s processor connects to the MxFE via the parallel peripheral interface, and connects to the wireless protocol chipsets using SPI and SPORT peripherals, as shown below in Figure 1 of the ADSP-BF531 Data Sheet. Katz, at 3; *see also* Katz, Fig. 7.



ADSP-BF531 Data Sheet, Fig. 1 (annotated).

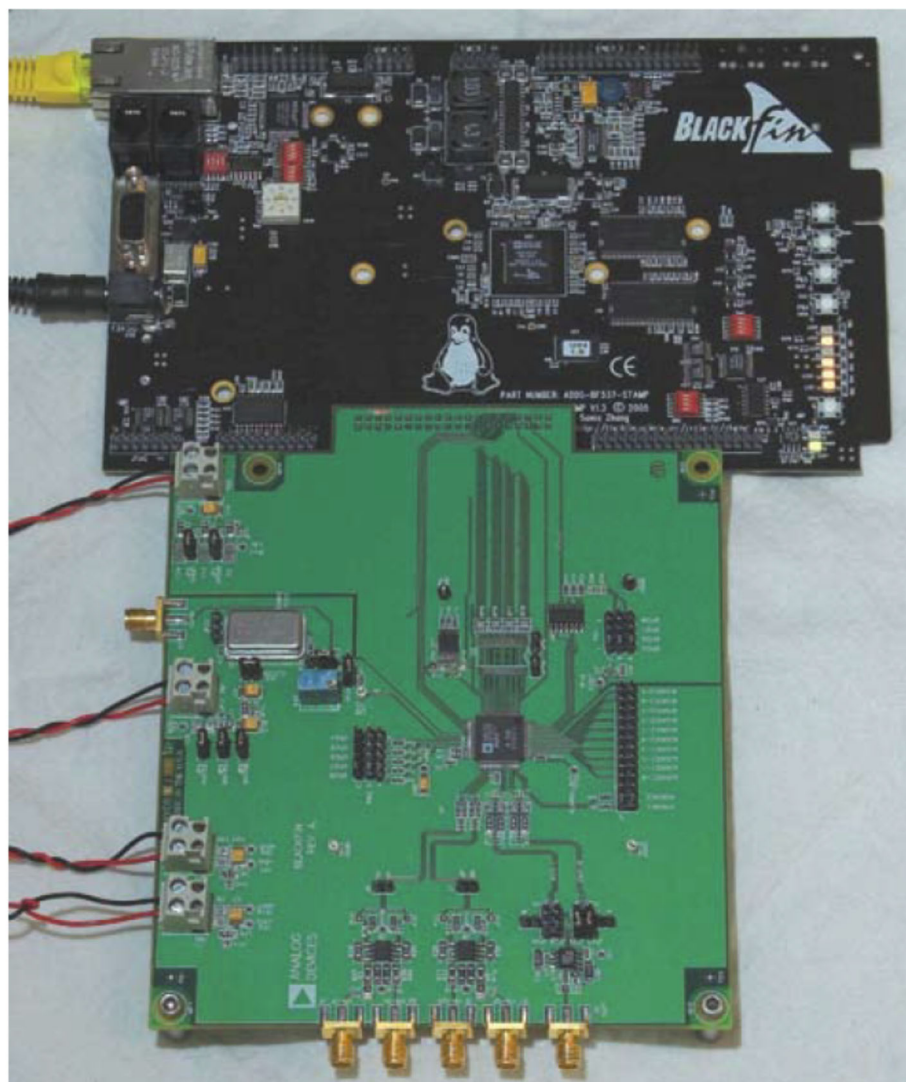


Figure 7. A Blackfin-based evaluation system for RFID reader applications.

Katz, Fig 7.

19. Claim 21

206. Claim 21 is identical to Claim limitation 4[B], with the only difference being that Claim 21 depends from Claim 18 whereas Claim 4 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly,

Katz in view of Ishizu teaches Claim 21 for the same reasons. *See supra* Sections XI.B.2.b, XI.B.16.

20. Claim 22

207. Claim 22 is identical to Claim limitation 5[B], with the only difference being that Claim 22 depends from Claim 18 whereas Claim 5 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 22 for the same reasons. *See supra* Sections XI.B.3.b, XI.B.16.

21. Claim 23

208. Claim 23 is identical to Claim limitation 6[B], with the only difference being that Claim 23 depends from Claim 18 whereas Claim 6 depends from Claim 1—both of which are obvious by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 23 for the same reasons. *See supra* Sections XI.B.4, XI.B.16.

XII. NO SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

209. I understand from counsel that the Patent Owner in the underlying district court litigation has not yet identified any evidence with respect to secondary considerations of non-obviousness.

210. To the extent the Patent Owner cites any evidence of sales or any praise or any industry recognition of products that the Patent Owner asserts to implement the claimed invention, I am not aware of any information demonstrating that any increased sales, commercial success, praise, or any other secondary factor (that the Patent Owner may assert) was a result of the particular features recited in the '784 patent's claims. Because the Patent Owner has not yet identified any evidence of secondary considerations, the Patent Owner cannot demonstrate that the limitations of the claimed invention in particular, as opposed to other features of the products at issue, were the factors that caused any increased sales, praise, or any other asserted secondary considerations.

211. Thus, based on my review of the evidence to date, I can summarize my opinions regarding any alleged secondary considerations of non-obviousness relating to the '784 patent, as follows:

212. *No commercial success of the claimed invention.* The Patent Owner has not cited any evidence of particular commercial success of products embodying the '784 patent as opposed to products that do not embody the '784 patent. The Patent Owner has not cited any evidence that any commercial success of any products is particularly a result of the claimed inventions recited in the '784 patent's claims and not due to any other facts.

213. *No long-felt but unsolved need.* The Patent Owner has not cited any evidence of any long-felt need that remained unsolved in the prior art before the '784 patent. To the contrary, as discussed above, the prior art solved the problems that the '784 patent purports to address.

214. *No failure of others.* The Patent Owner has not cited any evidence of anyone who tried, but failed, to solve the problems addressed by the '784 patent. As shown by my analysis above, there existed prior art references that successfully disclosed and rendered obvious the subject matter claimed by the '784 patent.

215. *No copying of the claimed invention.* The Patent Owner has not cited any evidence that any other party (including TransCore or third parties) ever copied from the '784 patent and its claimed invention.

216. *No unexpected results of the claimed invention.* The Patent Owner has not cited any evidence of unexpected results achieved by the '784 patent's claimed invention. To the contrary, the prior art disclosed the predictable, expected results that show why the '784 patent's claims are obvious as discussed in my Declaration.

217. *No praise for the claimed invention.* The Patent Owner has not cited any evidence of praise for the claimed invention recited in the '784 patent.

218. *No surprise or skepticism at the claimed invention.* The Patent Owner has not cited any evidence that observers were surprised by, or skeptical of, the claimed invention recited in the '784 patent.

219. *No departure from the wisdom of the prior art.* The Patent Owner has not cited any evidence that the claimed inventions of the '784 patent departed from the wisdom of the prior art. The '784 patent claims subject matter that was already present in the prior art, including in the references discussed in my Declaration.

220. Moreover, with respect to the considerations discussed above, I also refer to and incorporate my opinions stated throughout this Declaration, including my analysis showing that the '784 patent is directed to techniques known in the prior art and does not provide any inventive technology.

221. To the extent the Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to comment on it.

XIII. CONCLUSION

222. For at least the preceding reasons, in my opinion, claims 1–23 of the '784 patent would have been obvious to a person of ordinary skill in the art based on the prior art references that I have cited and analyzed above.

223. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in this proceeding. If required, I will appear for cross-examination at the appropriate time. I reserve the right to offer opinions relevant to the invalidity of the '784 patent claims at issue and/or offer testimony in support of this Declaration.

I hereby declare that all statements made herein of my own knowledge are true and that all statements are 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 18 U.S.C. § 1001.

Dated: January 8, 2024

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'D. Engels', with a stylized flourish extending to the right.

Daniel W. Engels, Ph.D.

APPENDIX 1 – CLAIMS

[1P] An encoded information reading (EIR) terminal comprising:

[1A] a microprocessor electrically coupled to a system bus;

[1B] a memory communicatively coupled to said microprocessor;

[1C] an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

[1D] a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

[1E] wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

[1F] wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

[1G] wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

[1H] wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

[1I] wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[2] The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[3] The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

[4A] The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

[4B] wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

[5A] The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication

network, a wireless communication protocol, and a parameter of a wireless communication protocol;

[5B] wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

[6A] The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

[6B] wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

[7] The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

[8] The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

[9P] An encoded information reading terminal comprising:

[9A] a microprocessor electrically coupled to a system bus;

[9B] a memory communicatively coupled to said microprocessor;

[9C] an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

[9D] a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

[9E] wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

[9F] wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

[10] The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

[11] The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

[12] The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

[13] The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

[14] The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

[15P] An encoded information reading terminal comprising:

[15A] a microprocessor electrically coupled to a system bus;

[15B] a memory communicatively coupled to said microprocessor;

[15C] an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

[15D] a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting

a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

[15E] wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

[15F] wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

[16] The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

[17] The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

[18P] An encoded information reading terminal comprising:

[18A] a microprocessor electrically coupled to a system bus;

[18B] a memory communicatively coupled to said microprocessor;

[18C] an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

[18D] a wireless communication interface configured to support at least two wireless communication protocols;

[18E] wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

[19] The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

[20] The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

[21] The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication

quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

[22] The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

[23] The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.