UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TRANSCORE, LP

Petitioner,

v.

HAND HELD PRODUCTS, INC.,

Patent Owner

IPR2024-00443

Patent 8,919,654

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,919,654

DECLARATION OF DANIEL W. ENGELS, PH. D.

TransCore LP
Exhibit 1003

TABLE OF CONTENTS

I. Introduction And Qualifications 1
A. Qualifications and Experience 2
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 15
C. Obviousness 16
IV. Technology Background 17
A. Software Defined Radios 17
B. Encoded Reading Devices 20
V. The '654 Patent 22
VI. Opinions Regarding the '654 Patent's Invalidity 24
A. Prosecution History of the '654 patent 26
B. The Prior Art 26
1. Tolonen 26
2. Katz 28
3. Ishizu 30
VII. Application of the Prior Art to Asserted Claims 31
VIII. Ground 1: Claims 1–20 are anticipated over Tolonen 31
A. Tolonen Invalidates the Claims 31
1. Claim 1 36
2. Claim 2 54
3. Claim 3 55
4. Claim 4 57

5. Claim 5 61
6. Claim 6 62
7. Claim 7 66
8. Claim 8 68
9. Claim 9 70
10. Claim 10 73
11. Claim 11 74
12. Claim 12 75
13. Claim 13 77
14. Claims 14, 16-18 78
15. Claim 15 78
16. Claim 19 78
17. Claim 20 79

IX. Ground 2: Anticipation of Claims 1-3 over Katz 83

A. Katz discloses claims 1-3 83
1. Claim 1 83
2. Claim 2 97
3. Claim 3 98

X. Ground 3: Obviousness of Claims 4–20 over Katz in view of Ishizu 99

A. Motivation to Combine 99
B. Katz in view of Ishizu Invalidates the Claims 103
1. Claim 4 103
2. Claim 5 105
3. Claim 6 106
4. Claim 7 110
5. Claim 8 110
6. Claim 9 112

7. Claim 10 112
8. Claim 11 114
9. Claim 12 115
10. Claim 13 116
11. Claims 14, 16-18 116
12. Claim 15 116
13. Claim 19 116
14. Claim 20 117
XI. Ground 4: Anticipation of Challenged Claims 1–20 by Ishizu 118
A. Ishizu Invalidates the Claims 118
1. Claim 1 118
2. Claim 2 147
3. Claim 3 152
4. Claims 4-12, 14-20 153
5. Claim 13 153
XII. No Secondary Considerations of Non-Obviousness 154
XII. Conclusion 157

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. 8,919,654 ("the '654 patent"), and I have been asked to provide my opinions as to the patentability or unpatentability of the claims of the '654 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. My CV sets forth the details of my educational history, work history, patents, and other related experience. Ex. 1004.

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, Berkeley 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. 8,919,654 ("the '654 patent," Ex. 1001), the file history of the '654 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 8,919,654 to Wang, *et al.* ("the '654 patent").
1002	File History for U.S. Patent 8,919,654
1004	Curriculum Vitae of Daniel W. Engels, Ph.D
1005	U.S. Patent Publication 2010/0056200 to Tolonen ("Tolonen")
1006	David Katz, *et al.*, "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, *et al*. ("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 (5th 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)
1019	E. Triantaphyllou et al., *Multi-Criteria Decision Making: An Operations Research Approach*
1020	English Translation of Japanese Application Laid Open 2003-152732A
1021	Japanese Application Laid Open 2003-152732A
1022	Affidavit by John Kevin Marchioro Attesting to the Accuracy of Translation
1023	File History for U.S. Patent 8,141,784

II. PERSON OF ORDINARY SKILL IN THE ART

21. I understand that an assessment of claims of the ’654 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 ’654 patent states that the invention relates to “[a]n apparatus … [comprised of] a microprocessor and a wireless communication interface,” with the microprocessor “configured to execute at least one of a base-band encoder software program or a base-band decoder software program,” where the “apparatus may be further configured to execute a wireless communication protocol selector software program that may be configured to optimize a value of a user-defined criterion.” Ex. 1001, Abstract. In my opinion, a person of ordinary skill in the art for the ’654 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 '654 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.

31. Having reviewed the claims, it is my opinion that because claims 6 and 15 use the language "one of," a POSITA would read claims 6 and 15 to claim each one of the listed calculations for determining user-defined criterion as an alternative of one another. It is, therefore, my opinion that a POSITA would

understand claim 6 should be construed such that infringement would be had if the device practiced any one of the calculations claimed, meaning the art anticipates claim 6 if it teaches: *wherein said value of said user-defined criterion is calculated as a weighted sum of components … [wherein] at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput*. In this way, it is my opinion that a reference teaching any one of these calculations would anticipate claim 6.

32. Likewise, for claim 15, the claim's recitation "wherein one of" in the preamble indicates that art teaches claim 15 if it teaches: *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, or communication channel throughput.*

B. Anticipation

33. 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.

34. 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

35. 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 ’654 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.

36. I understand that in order to be valid, a patent must 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

37. The ’654 patent relates to an apparatus such as an EIR terminal whose structure and operation relates to the fields of Software Defined Radios and Encoded Reading Devices, such as bar code scanners.

A. Software Defined Radios

38. 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.





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)

39. All wireless communication systems comprise the same four subsystems: The antenna, the RF Front-End, the Baseband, and the Controller. *See* Ex. 1011 at 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.

40. 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. 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 front end radio frequency (RF) subsystem with the functionality implemented in software. Ex. 1011 at 10. By 2009, when the '654 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. Ex. 1012 at Fig. 1.8; *see also,* Ex. 1015 (showing the Atheros AR5007EG chipset).

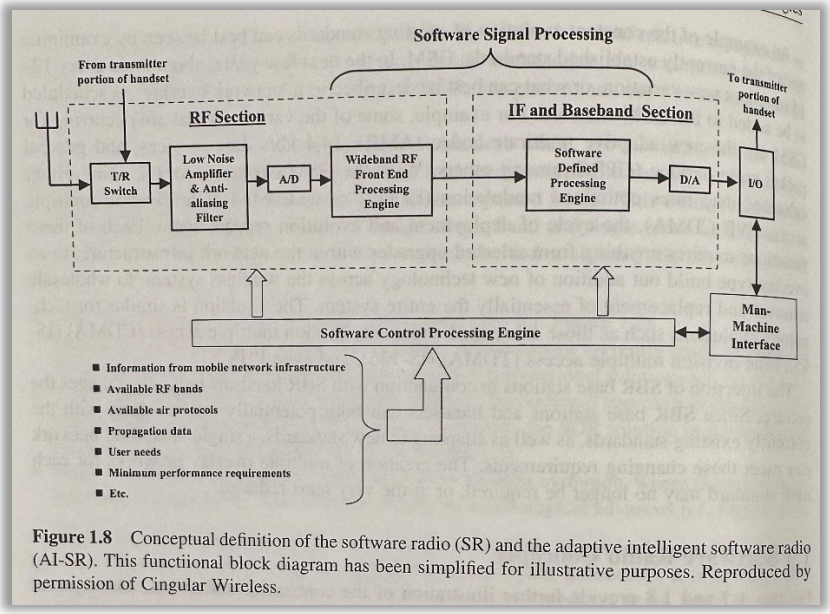


Figure 1.8 Conceptual definition of the software radio (SR) and the adaptive intelligent software radio (AI-SR). This functiional block diagram has been simplified for illustrative purposes. Reproduced by permission of Cingular Wireless.

Ex. 1012, Figure 1.8

B. Encoded Reading Devices

41. Encoded reading devices, such as barcode reading devices and RFID tag reading devices, have existed since well before the filing of the ’654 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 dark lines with thick and thin white space between adjacent dark 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.

42. 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.

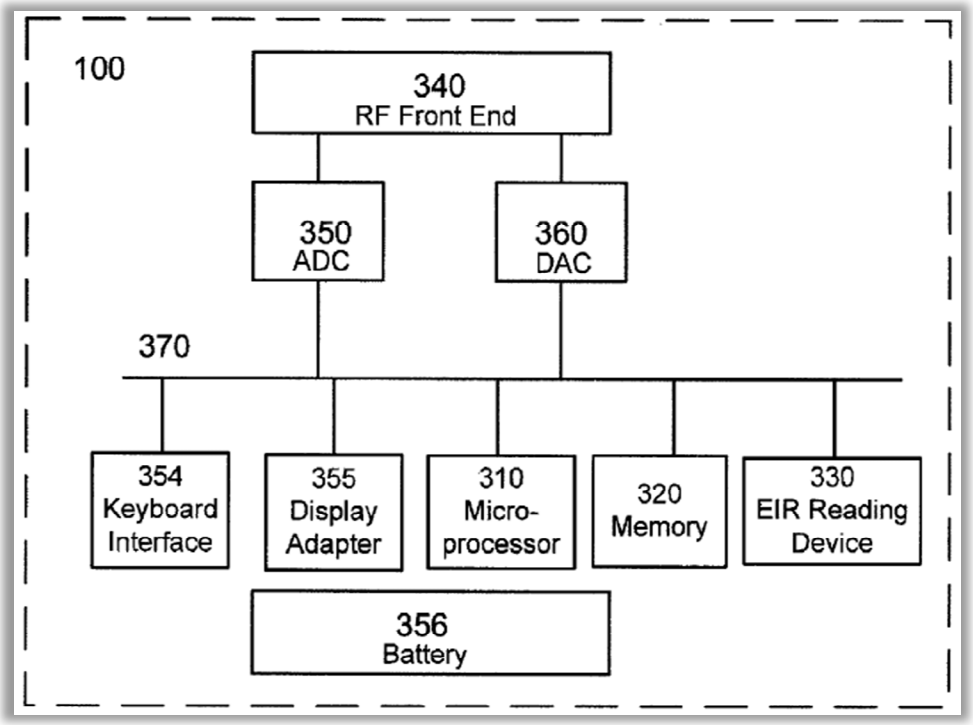
43. RFID transponders (i.e., tags) operate similarly to the RFID readers. The tags receive the radio waves, demodulate the signal, decode the digital command and data, execute the received command, and reverse the receiving process to transmit digital data to the reader over the analog wireless interface. 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 (i.e., the bit values stored in memory). That tag signal is received by the reader where it is demodulated and decoded by the reader to retrieve the information which then may be communicated to a storage or application system.

V. THE '654 PATENT

44. The '654 patent is directed to "encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface." '654 patent, 1:17-20. The '654 patent generally expresses the "need for further advances in EIR terminals and systems which would support multiple communication protocols and standards." '654 patent, 1:32-34.

45. 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. '654 patent, 2:9-14, Fig. 3.



'654 patent, Fig. 3

46. To select between different wireless communication networks, communication protocols, or parameters, the '654 patent describes a "wireless communication protocol selector software program." '654 patent, Abstract, 3:4-6, 9:12-14. In particular, the '654 patent explains that the "wireless communication protocol selector software program can optimize a value of a user-defined criterion," ('654 patent, 9:12-14; *see also*, '654 patent, 3:4-6), 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." '654 patent, 9:15-21.

VI. OPINIONS REGARDING THE '654 PATENT'S INVALIDITY

47. It is my opinion that everything claimed by the '654 patent was well-known and conventional. For example, long before the '654 patent was ever filed, RFID readers and barcode readers were commonly available. *See, e.g.*, Ex. 1006 at 1; Ex. 1005 at ¶¶ 55-6, Fig. 3. Additionally, by the time the '654 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 at ¶¶ 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) (introducing SDR concepts).

48. Even the hardware limitations of the '654 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.

49. 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 '654 patent

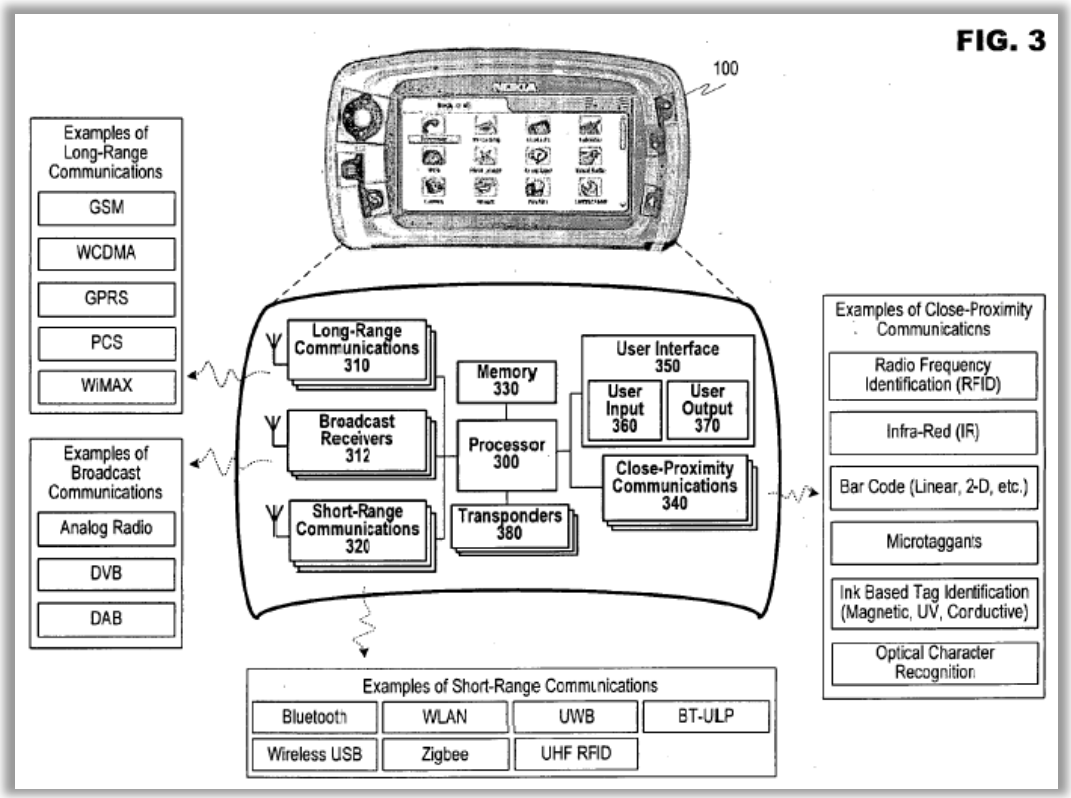
50. In forming my opinion as to the novelty or obviousness of the '654 patent, I reviewed the '654 patent's prosecution history. As I describe in the previous section, the '654 patent describes aspects of RFID technology and SDR technology that was commonplace at the time the '654 patent was filed. As such, it is not surprising the Examiner attempted to reject the '654 patent by taking official notice that what the '654 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

51. 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.*, Ex. 1005 at Fig. 3. As shown in Figure 3, the WCD includes communication

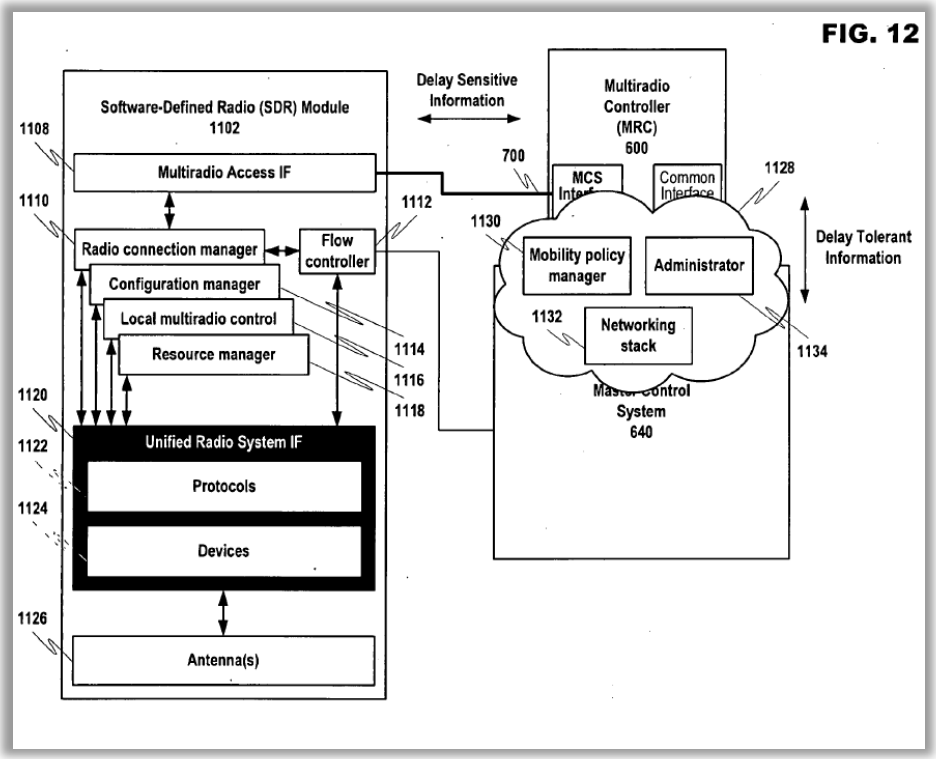
protocols like Bluetooth and WLAN and close-proximity communications such as RFID and/or Bar Code.



Ex. 1005, Fig. 3

52. 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 at ¶ 59. Tolonen's processor runs software for "calculat[ing], translat[ing], conver[ting], and/or packetizing … data" for transmission, among other things. Ex. 1005 at ¶¶ 59-60,

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



Ex. 1005, Fig. 12

2. Katz

53. 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. Ex. 1006 at 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. Ex. 1006 at 1–2; Figs. 1, 5.

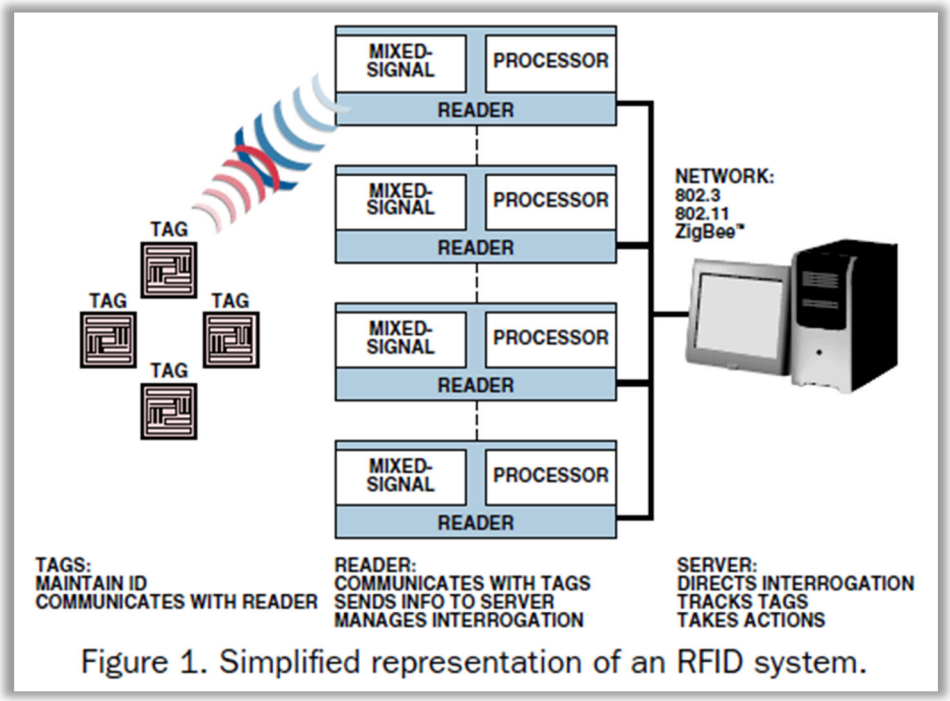
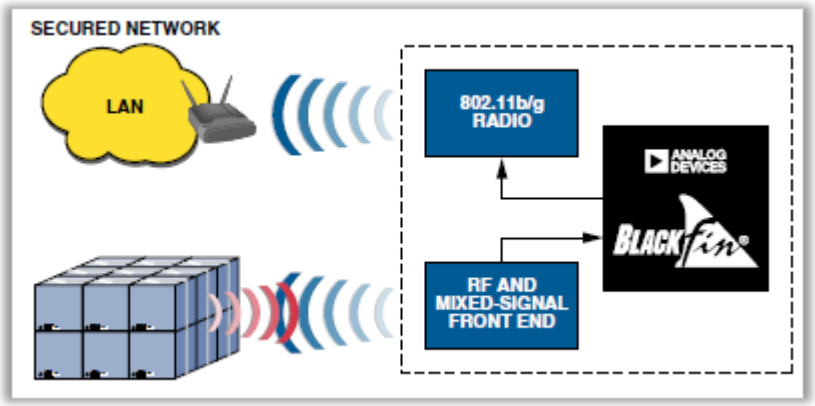


Figure 1. Simplified representation of an RFID system.

Ex. 1006, Fig. 1



Ex. 1006, Fig. 5

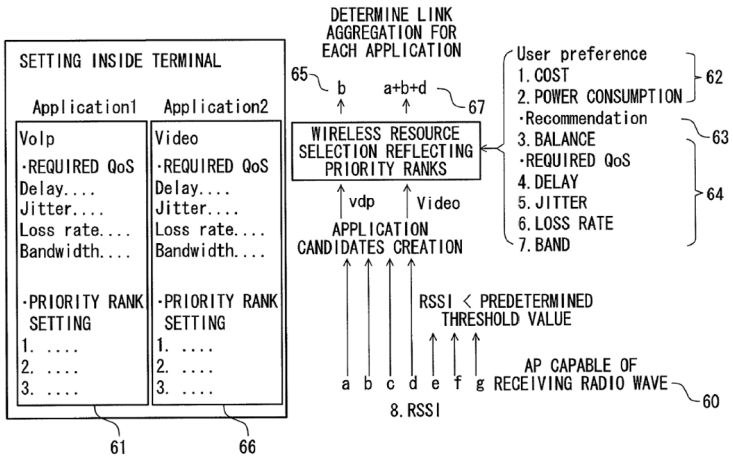
54. Katz's Blackfin processor executes software to filter and transform radio signals as well as translate and filter the outputted data. Ex. 1006 at 2–3. Katz

also employs ADC/DACs in its radio frequency front end to transform radio signals between the analog and digital domains. Ex. 1006 at 3, Fig. 2.

3. Ishizu

55. Ishizu teaches a dynamically reconfigurable software defined wireless communication terminal where reconfiguration is 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, Figs. 1, 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.

FIG. 6



Ishizu, Fig. 6

VII. APPLICATION OF THE PRIOR ART TO ASSERTED CLAIMS

56. I have reviewed and analyzed the prior art references and materials cited herein. In my opinion the claims of the '654 patent are anticipated and rendered obvious based on the following prior art:

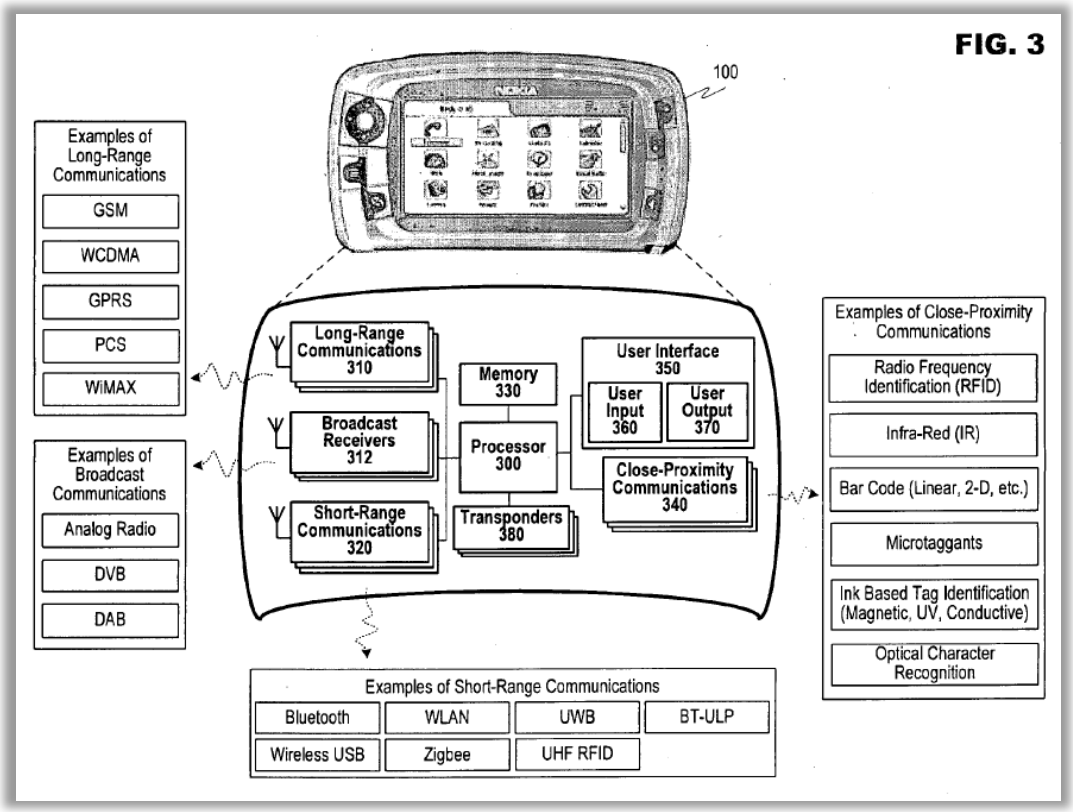
- **GROUND 1:** Claims 1–20 are anticipated over Tolonen pursuant to 35 U.S.C. § 102 or are obvious over Tolonen in view of the knowledge of a POSITA as detailed below.
- **GROUND 2:** Claims 1–3 are anticipated over Katz pursuant to 35 U.S.C. § 102.
- **GROUND 3:** Claims 4–20 are obvious over Katz in view of Ishizu pursuant to 35 U.S.C. § 103.
- **Ground 4:** Claims 1-20 are anticipated over Ishizu pursuant to 35 U.S.C. § 102.

VIII. GROUND 1: CLAIMS 1–20 ARE ANTICIPATED OVER TOLONEN

A. Tolonen Invalidates the Claims

57. It is my opinion that Tolonen anticipates the '654 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 at ¶¶ 50, 92.



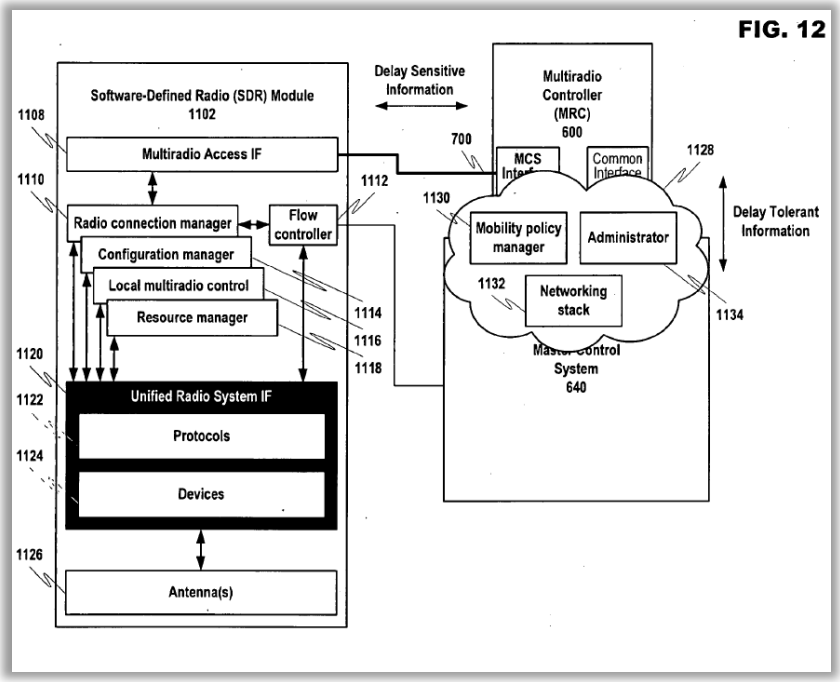
Ex. 1005, Fig. 3

58. Tolonen's Processor 300 controls the overall device operation through software stored in Memory 330. Ex. 1005 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 at ¶ 52. For example, Tolonen teaches that any one or more of Tolonen's communication

modules can be replaced by an SDR. Ex. 1005 at ¶ 92. In this particular arrangement, Tolonen's software program, executed by the processor, performs the software-based elements of the SDR. Ex. 1005 at ¶ 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.*

59. 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 at ¶ 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 at ¶¶ 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 at ¶¶ 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 at ¶ 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. Ex. 1005 at ¶ 95; *see also* ¶ 70 (teaching that delay tolerant information such as configuration information may be "delivered . . . by master control system 640"), Ex. 1005 at ¶¶ 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 at ¶ 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 at ¶ 96.



Ex. 1005, Fig. 12

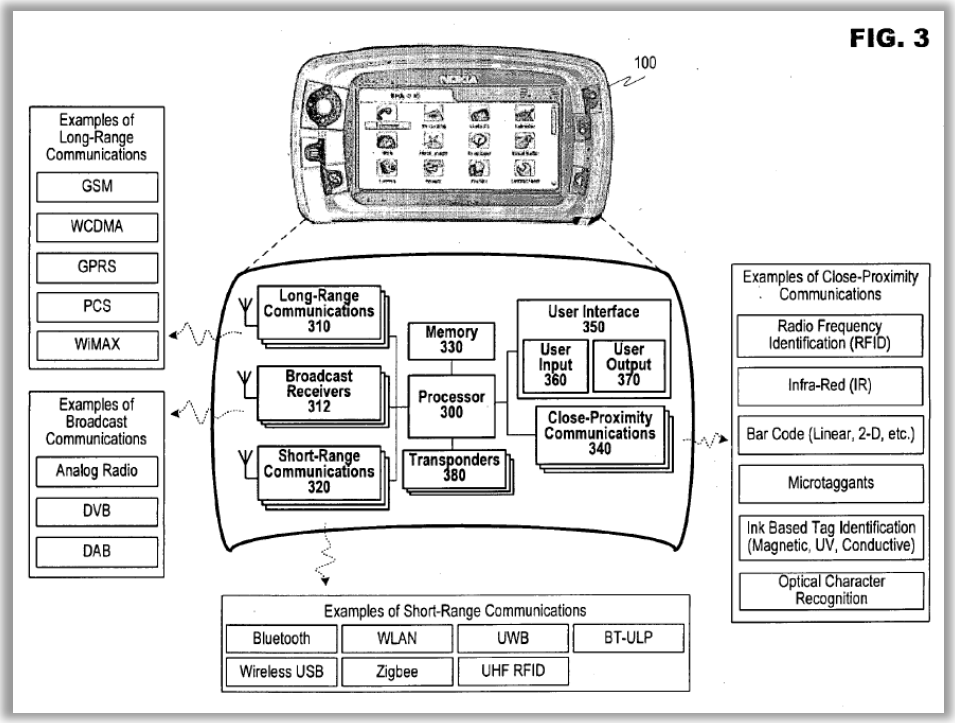
60. Because Tolonen's WCD 100 includes communication modules, where one or more may be implemented as an SDR, and because Tolonen's WCD is capable of switching communication protocol and characteristics based on user preferences, it is my opinion that Tolonen anticipates each claim of the '654 patent.

61. In the paragraphs that follow, I describe on a claim-by-claim basis my opinions as to why Tolonen anticipates the '654 patent.

1. Claim 1

a) 1[pre] Tolonen discloses "[a]n apparatus comprising"

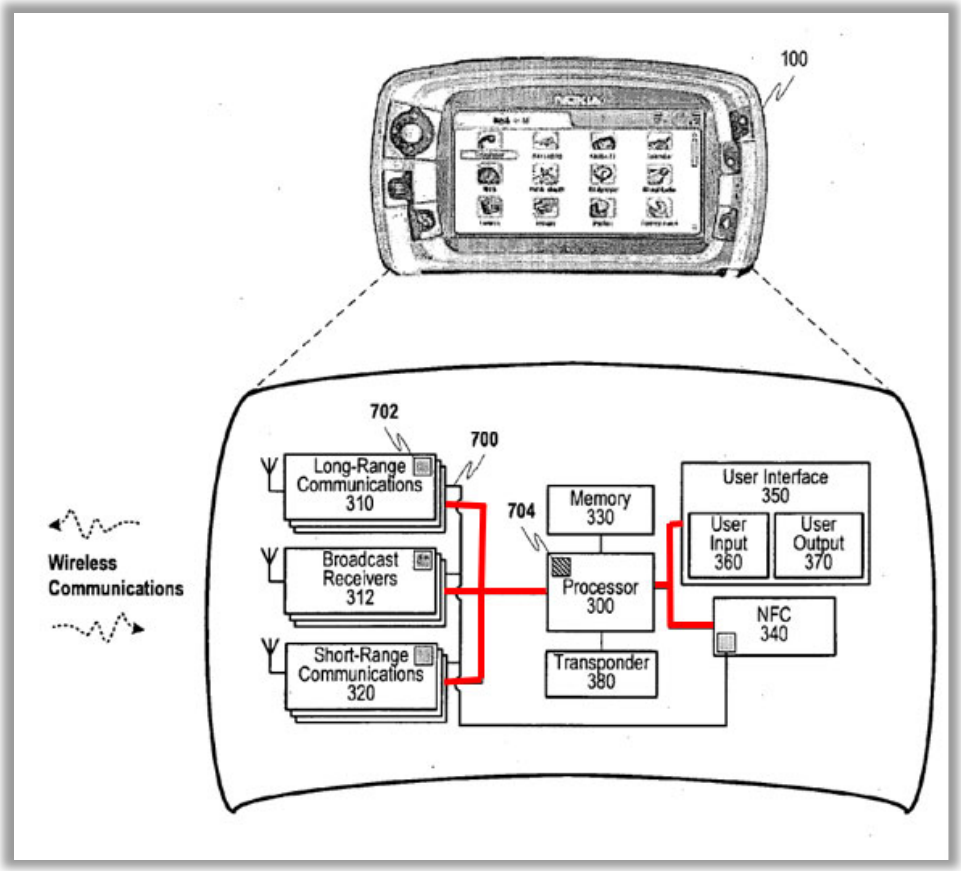
62. Tolonen discloses a wireless communication device ("WCD") comprising at least a processor, a memory, a user interface, and multiple communication methods and devices, including a radio frequency identification (RFID) device and a bar code reading device, to interface with other devices. Ex. 1005 at ¶¶ 50–57, Fig. 3.



Ex. 1005, Fig. 3.

b) 1[A] Tolonen's apparatus comprises "a microprocessor."

63. It is my opinion that Tolonen's apparatus comprises a microprocessor. 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 at ¶ 50; *see also* Ex. 1005 at ¶ 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 at ¶ 59; *see also*, ¶¶ 71-73, Fig. 8A (describing the use of an I^2C bus to connect the processor 300 with communication modules 310, 312, 320, and 340).



Ex. 1005, Fig. 8A (annotated to show system bus)

c) *1[B] Tolonen's apparatus comprises "a wireless communication interface configured to perform at least one of receiving a first radio signal or transmitting a second radio signal, said wireless communication interface electrically coupled to at least one of an analog-to-digital converter (ADC) or a digital-to-analog converter (DAC)."*

64. 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") are wireless

communication interfaces 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 at 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.").

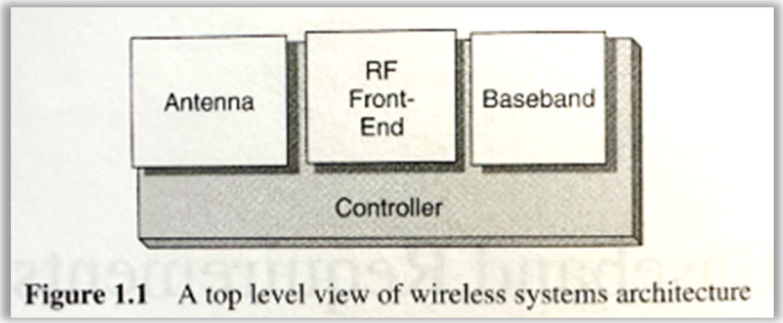


Figure 1.1 A top level view of wireless systems architecture

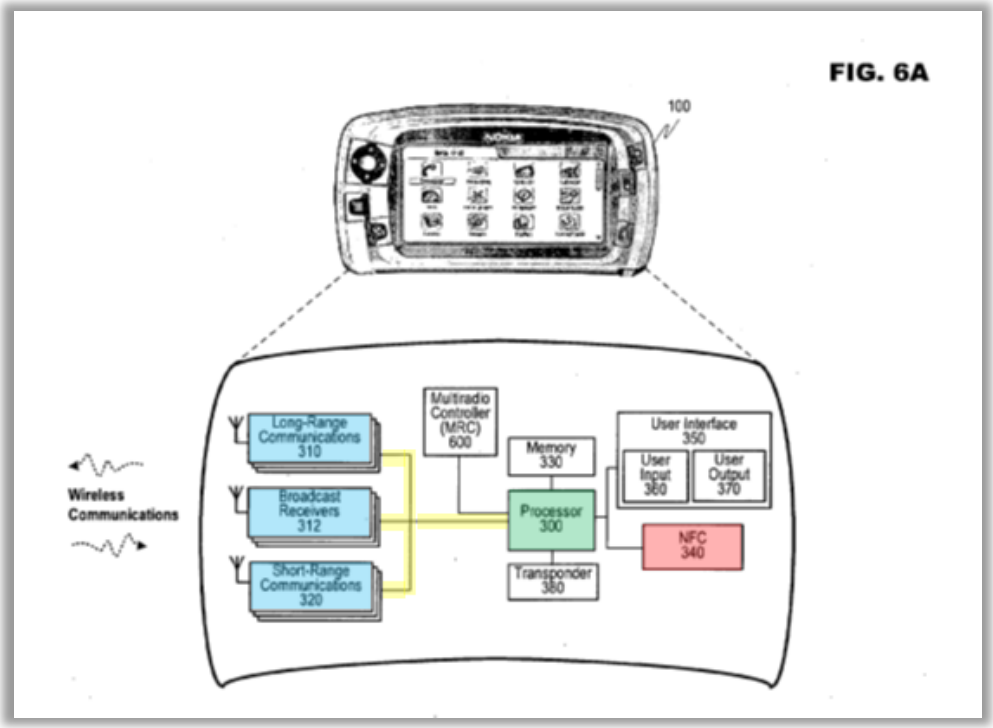
Ex. 1011, Fig. 1.1

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.

65. 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.

66. 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 at ¶ 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.*, Ex. 1005 at Fig. 6A; *see also* Ex. 1011 at 7-8.



Ex. 1005, Fig. 6A (annotated)

67. 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 at ¶ 5 (explaining that "GSM is an example of a widely employed 2G digital cellular network"), Fig. 3.

68. 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, 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.

69. The below image, taken from Tuttlebee's book on Software Defined Radios (Ex. 1012), 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. *See also,* Ex. 1011 at 4, Chapter 1 by Mark Cummings.

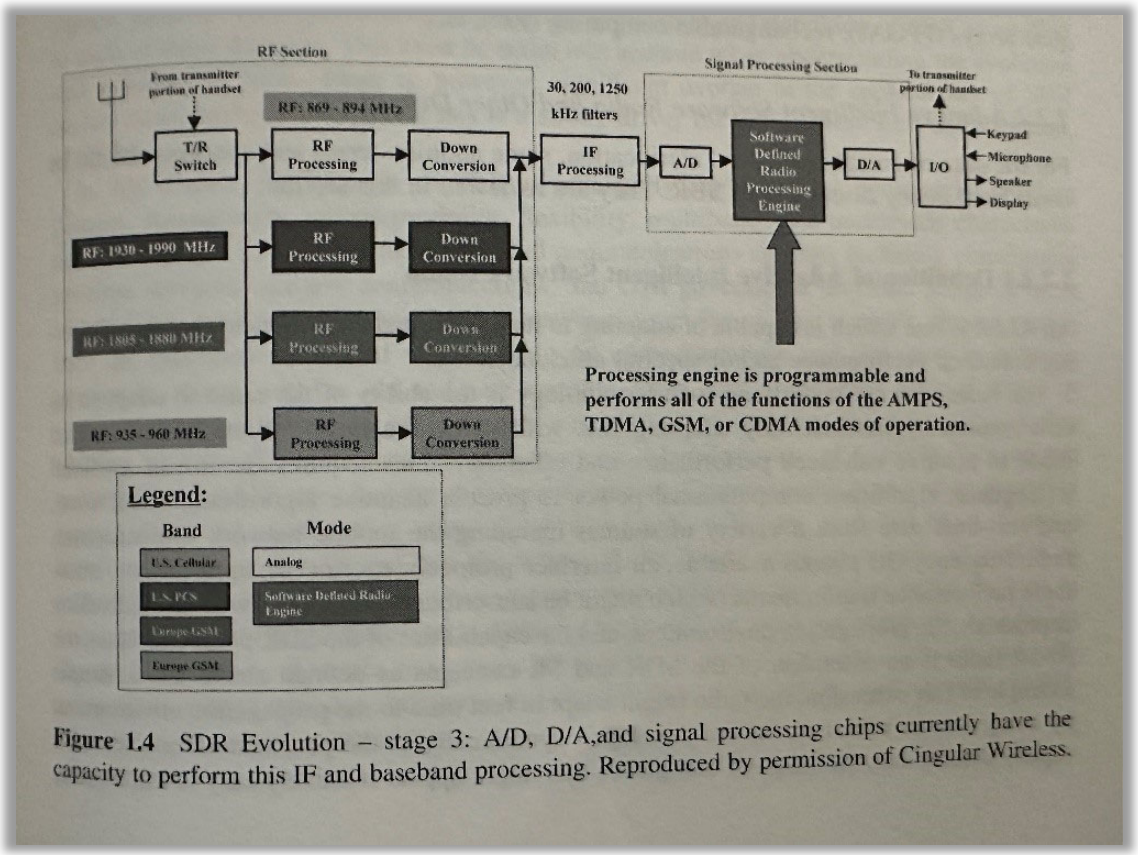


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

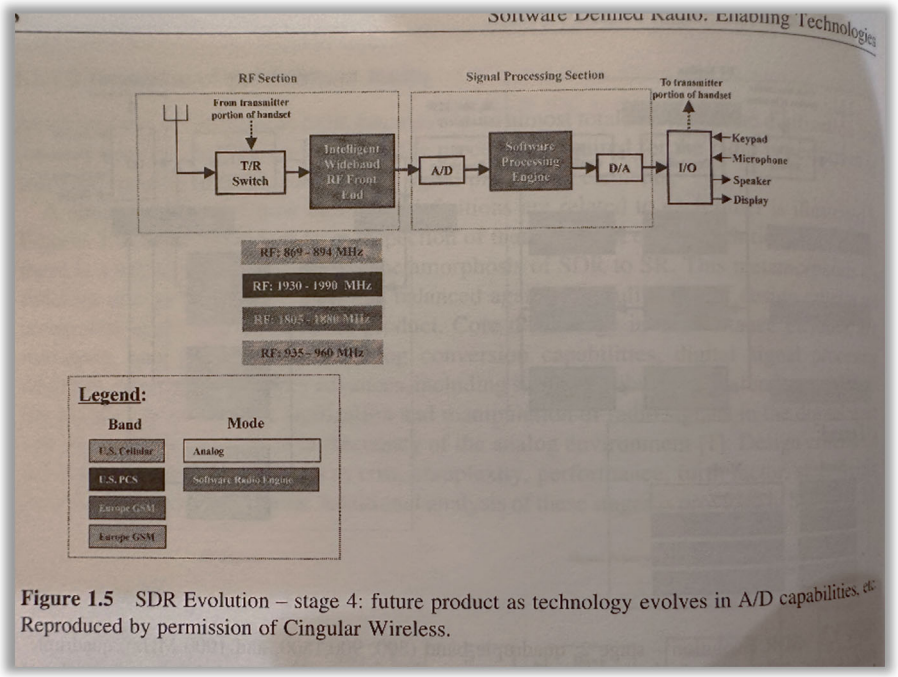


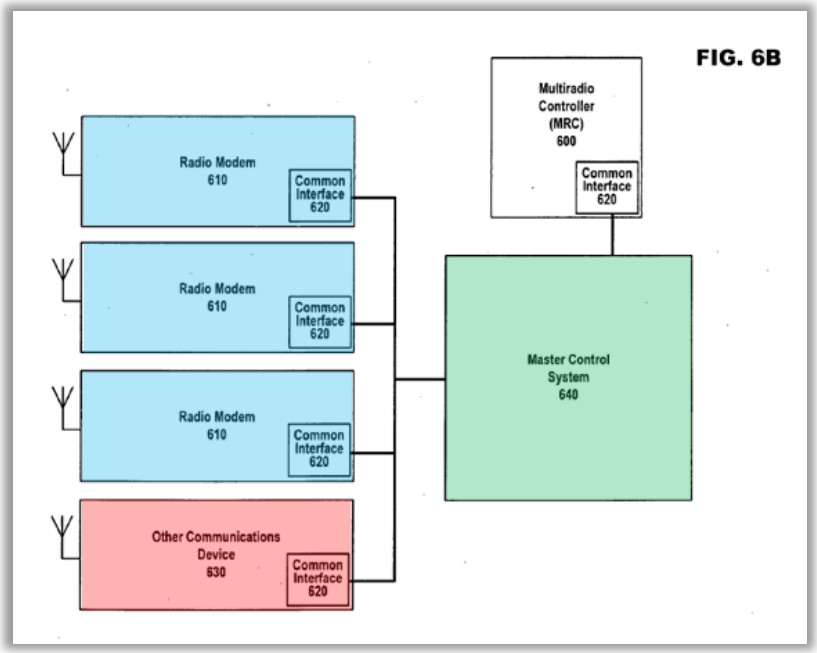
Figure 1.5 SDR Evolution – stage 4: future product as technology evolves in A/D capabilities, etc
Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.5

70. 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. 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 implemented 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 at ¶¶ 89-98.

71. As further support for my position that Tolonen's communication modules include an ADC and DAC, Tolonen refers to its communication modules in some places as "modems."

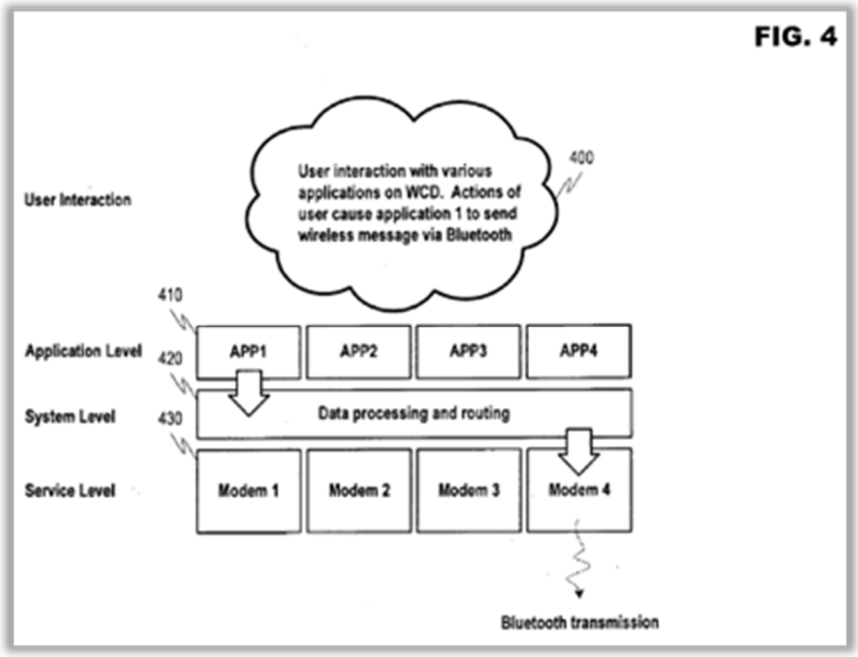


Ex. 1005, Fig. 6B (annotated)

72. 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 at ¶¶ 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 3-21.

73. As further support, 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.



Ex. 1005, 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.

74. 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. *See, e.g.,* Ex. 1011. 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.

75. A POSITA implementing Tolonen's invention would have chosen from one of many available off-the-shelf SDRs and SDR chipsets and 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.

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

76. 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 at ¶¶ 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 at ¶ 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.

e) 1[D] 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."

77. As described for limitation 1[C] 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 at ¶¶ 59-60, 62; *see supra* VIII.A.1.d. 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 at ¶ 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.

f) 1[E] Tolonen's "DAC is configured to output an analog signal corresponding to said first encoded bit stream."

78. 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. *Supra* Section VIII.A.1.c. 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(B), SDR engines send 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.

g) 1[F] Tolonen's "ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said wireless communication interface."

79. 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.b-f. 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 at ¶¶ 6, 13, 40, 53-54, 79, 96, 106-112, Fig. 14A; *supra* Section VIII.A.1.b-f.

h) *1[G] 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, or source decoding."*

80. 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.b-g. This means that upon receipt of an analog signal and its conversion from analog to an encoded digital bit stream, 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 at ¶¶ 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 at ¶ 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) Tolonen's "apparatus … 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."

81. 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 at ¶ 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" that is—"a software-

defined radio." Ex. 1005 at ¶¶ 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 at ¶¶ 59–62. In this way Tolonen's baseband encoder software is run in software devoid dedicated of hardware components.

3. Claim 3

(a) Tolonen's "base-band encoder software program and said base-band decoder software program are implemented as a single software program."

82. Tolonen stores its overall WCD operation software, "specialized software modules configured to manage particular functions such as communications modules," and application-related software modules on the WCD's memory. Tolonen, ¶ 52. Examples of the software modules include "communication utilities modules required to support WCD," "for example, the calculation, translation, conversion and/or packetizing [of] data" for transmission. *Id.* ¶¶ 52, 62.

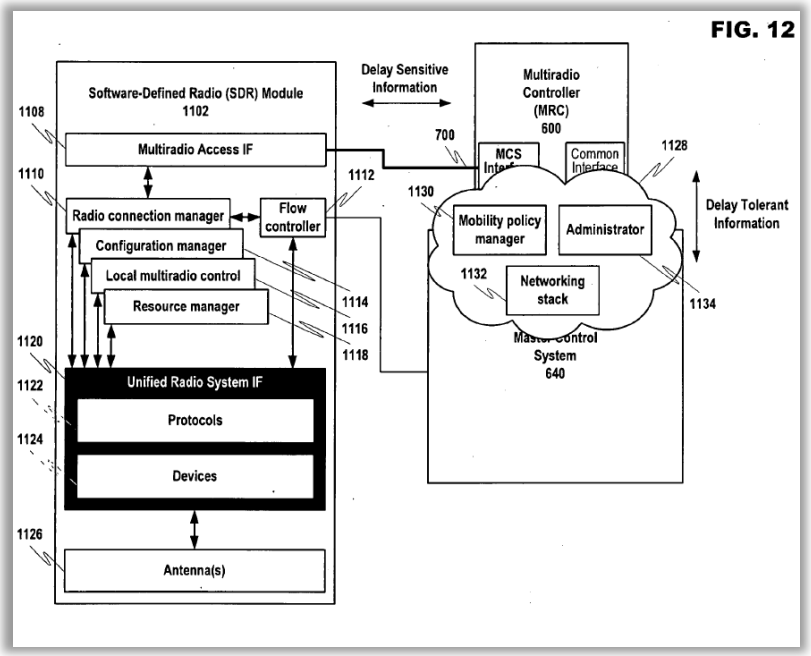
83. A POSITA would recognize that software modules may either be standalone or implemented as part of a single software program. Indeed whether

and how to combine various software modules into a full program is a design choice based, primarily, on the software's required functionality. For example, if a software designer intends for software to be part of different packages, for example a premium and less-premium option, the software designer may initially keep some software modules separate and bundle others in to the premium edition. This is also common with software add-ons. For Tolonen, it is clear that whether or not to include all the software supporting each of the communication modules (e.g., the baseband encoding and decoding software supporting the communication modules) would purely be a design choice based on what communication modules and protocols within each module the software designer expected the end product to include. For communication modules that both send and receive communications using the same protocol, such as Tolonen's Long Range Communication module 310 that may implement the GSM communications protocol (Ex. 1005, Fig. 3), then the software designer would necessarily choose to include both the baseband encoder software and baseband decoder software for that protocol within the installed software program within Tolonen's WDC 100 to enable the required functionality.

4. Claim 4

a) Tolonen's "apparatus 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."

84. 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 at ¶¶ 10-4, 92-6, 98.



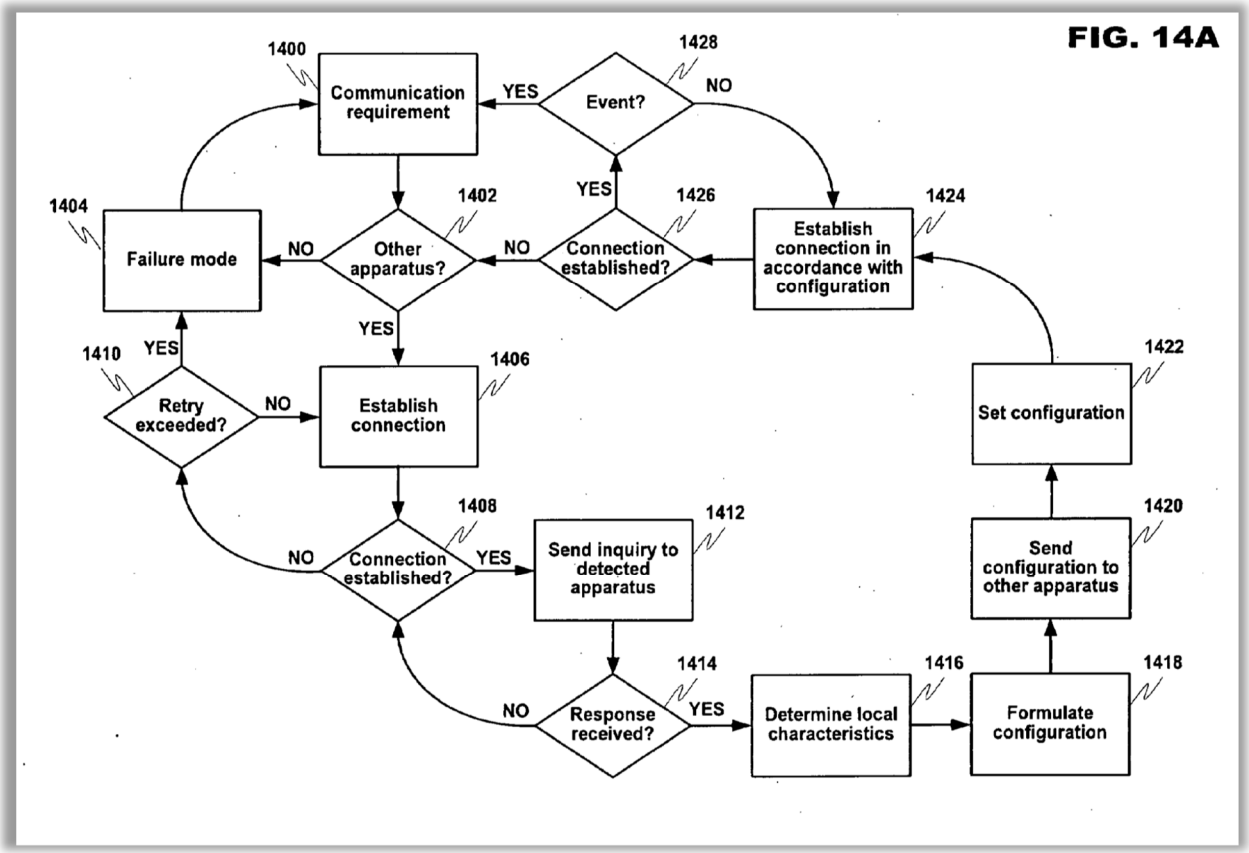
Ex. 1005, Fig. 12

85. 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 at ¶¶ 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 at ¶ 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 at ¶ 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 at ¶ 96.

86. 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 at ¶ 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 at ¶ 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 at ¶ 104; *see also* Fig. 14A.



Ex. 1005, Fig, 14A

5. Claim 5

a) 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."

87. It is my opinion that Tolonen discloses claim 4 and 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 at ¶¶ 94-5; *see supra* Section VIII.A.4. Tolonen teaches that the "preferences and/or rules may be based on various apparatus, application or ***user-defined characteristics***." Ex. 1005 at ¶ 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 at ¶ 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).

6. Claim 6

88. It is my opinion that Tolonen discloses claim 4 and, as set forth above, claim 6 requires satisfaction of only one of its claimed algorithms. Tolonen teaches "[t]he apparatus of claim 4, wherein said value of said user-defined criterion is calculated as a weighted sum of components" wherein "at least one of said

components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput."

89. To implement a particular radio configuration, Tolonen's SDR 1102 receives data from MCS 700 indicating "rules or preferences regarding which transports to utilize in certain situations." Ex. 1005 at ¶ 95; *see supra* Section VIII.A.4. Tolonen's "preferences and/or rules may be based on various apparatus, application or ***user-defined characteristics***" and set by the mobility policy manager 1130. *Id.* ¶ 98. In addition to user preferences, Tolonen also teaches that when two devices are in communication with one another, characteristics, such as "communication capabilities and/or preferences [including user-defined characteristics]" and "signals sensed in proximity to the apparatus that may potentially cause interference" *Id.* ¶ 101 (i.e., network status, user preferences, and communication quality), may define the configuration of the SDR, which include "channel selection for each transport …, error correction, Quality of Service (QoS) requirements, operational schemes (e.g., power saving, high speed, etc.), radio module priority (for conflict resolution), etc." *Id.* ¶ 102; *see also, id.* ¶ 104 (teaching that communications continue in accordance with the set, existing configuration until an event occurs that necessitates a new configuration).

Furthermore, Tolonen teaches that once an apparatus "has both the remote and local characteristic information, a configuration for SDR module 1102 may be formulated." *Id.* ¶ 102.

90. Although Tolonen does not expressly teach that the mobility policy manager performs a weighted sum of these characteristics in setting the policy for the radio configuration, a POSITA would have determined the weighted sum an obvious means for determining the best way of satisfying at least the user's preferences taught by Tolonen. Indeed, the "weighted sum model … is the earliest and probably the most widely used method" for multi-criteria decision making. *See* Ex. 1019 at 3.

91. A POSITA would have realized that choosing the weighted sum model ("WSM") would predictably accomplish Tolonen's goal of setting a policy based on user-defined characteristics. According to the WSM model, Tolonen's radio transport alternatives would represent the M alternatives, and each of the criteria (e.g., error correction, Quality of Service, power saving, high speed, etc.) would represent the N criteria. The figure below represents the calculation that would be performed using the WSM.

4.2.1 The Weighted Sum Model

The weighted sum model (or WSM) is probably the most commonly used approach, especially in single dimensional problems. If there are M alternatives and N criteria then, the best alternative is the one that satisfies (in the maximization case) the following expression [Fishburn, 1967]:

$$A^*_{WSM} = \max_i \sum_{j=1}^{N} q_{ij} w_j, \quad for \quad i = 1, 2, 3, \ldots, M. \qquad (4\text{-}1)$$

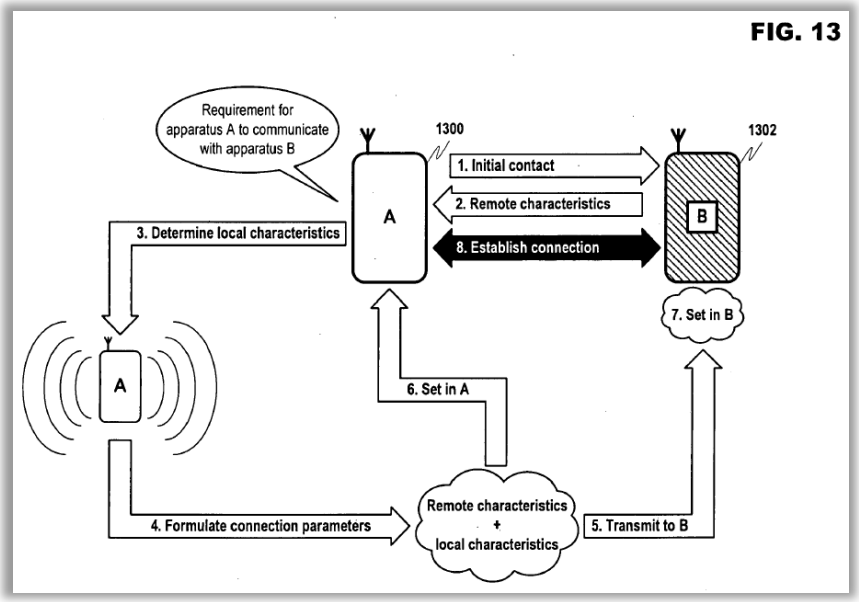
where: A_{WSM}* is the WSM score of the best alternative, N is the number of decision criteria, a_{ij} is the actual value of the i-*th* alternative in terms of the j-*th* criterion, and W_j is the weight of importance of the j-th criterion.

Ex. 1019 at 3. According to the above equation, a POSITA would have expected using the Weighted Sum Model to predictably arrive at a determination of the best alternative based on weighting each of the different characteristics.

7. Claim 7

a) Tolonen discloses "[t]he apparatus of claim 4, wherein said apparatus 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 discloses claim 4 and 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. As shown in Figure 13 below, Tolonen describes a scenario where a first device establishes a connection with a second device. Ex. 1005 at ¶ 100.



Ex. 1005, 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 at ¶ 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 (i.e., on the predefined channel), as it searches for an "inquiry" message from Apparatus A. This communication channel comprises a predefined frequency range. From there, the first device determines "remote characteristics" that is information relating to the second device's "status and/or environmental conditions proximate to the second device" and local characteristics which are the same as the remote characteristics but pertaining to itself. Ex. 1005 at ¶¶ 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 at ¶ 102; *see also, id*. at ¶¶ 110-2, Fig. 14b.

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

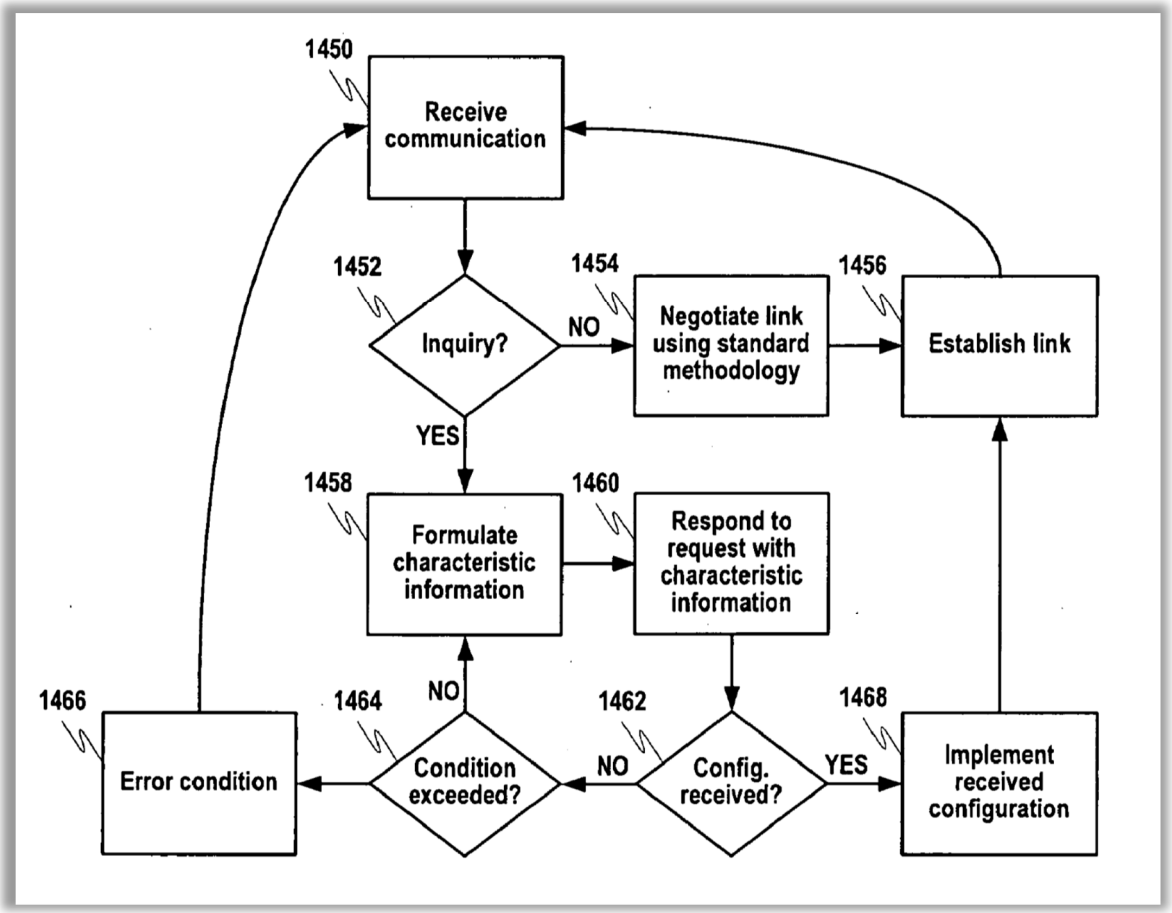
In this example, Tolonen's first device searches for second devices, or apparatuses, to connect to. Ex. 1005 at ¶ 105. Tolonen's "process may begin … with the realization of a communication requirement in an apparatus." *Id.* "A determination [is] … made … as to whether any other apparatuses that can 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 ¶¶ 105-07; *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.

8. Claim 8

a) Tolonen discloses "[t]he apparatus of claim 4, wherein said apparatus is configured to evaluate said user-defined criterion before attempting to initiate a communication session."

95. It is my opinion that Tolonen discloses claim 4 and that Tolonen's apparatus is configured to evaluate said user-defined criterion before attempting to

initiate a communication session. As discussed previously, using characteristic information (based on user-defined criteria) such as "Quality of Service (QoS) requirements, operational schemes (e.g., power saving, high speed, etc.), [and] radio module priority," Tolonen's WCD formulates a configuration for the SDR. Ex. 1005 at ¶¶ 95, 102; *see also supra* Section VIII.7. Although Tolonen's WCD may evaluate the characteristic information after receiving an initial wireless inquiry, as shown in Figure 14B, "[t]he formulation of characteristic information may also occur before receiving the inquiry." Ex. 1005 at ¶ 111; *see also* ¶ 102 (explaining that "the determination of local characteristics may occur before, during or after the receipt of remote characteristics from apparatus B 1302"). Tolonen further teaches that only after the formulation of the configuration for the communication section is complete (i.e., only after the user-defined criterion are evaluated) is the configuration sent to the second apparatus (i.e., apparatus B 1302). Ex. 1005 at ¶ 103. Only after both apparatus A and apparatus B have set their configurations "either apparatus may initiate communication (e.g., establish a wireless link between apparatuses)." Ex. 1005 at ¶ 103. Thus, the user-defined criteria are evaluated before attempting to initiate a communication session.



Ex. 1005, Fig. 14B

9. Claim 9

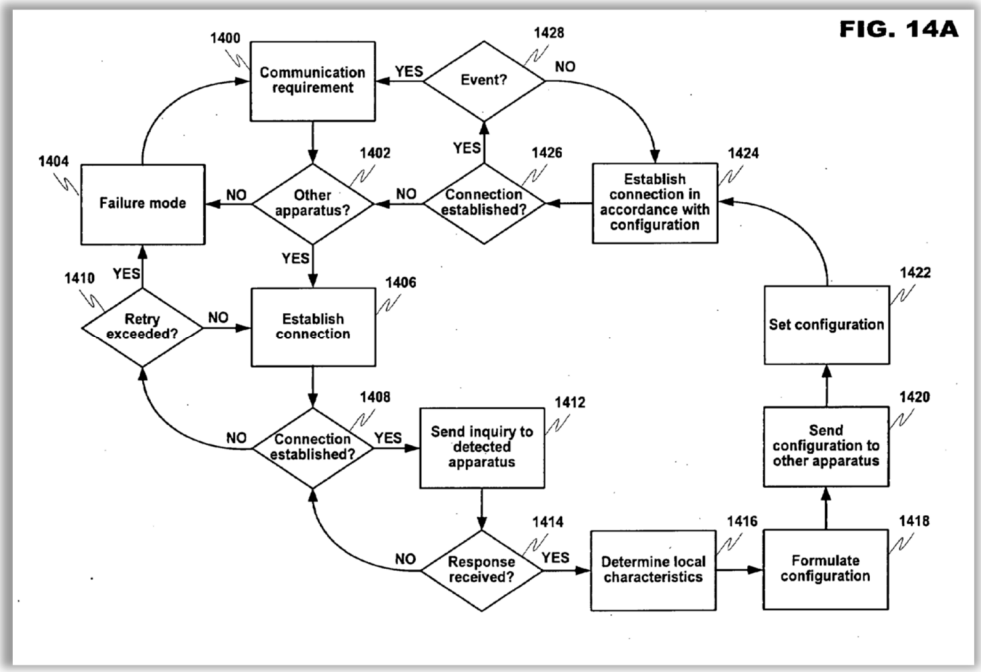
a) Tolonen discloses "[t]he apparatus of claim 4, wherein said apparatus is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion."

96. It is my opinion that Tolonen discloses claim 4 and that Tolonen's WCD apparatus is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to

evaluating said user defined criterion. Tolonen recognizes that signal interference issues arise when communicating using multiple communication protocols simultaneously on multiple radio modems. Ex. 1005 at ¶¶ 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 at ¶ 64. This overlap causes interference, which results in the loss of packets and diminishes signal quality and efficiency. Ex. 1005 at ¶ 64.

97. To remedy the interference, Tolonen teaches that the "[multiradio controller] may schedule communication in a multiradio system." Ex. 1005 at ¶ 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 at ¶ 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 at ¶ 104, Fig. 14A.



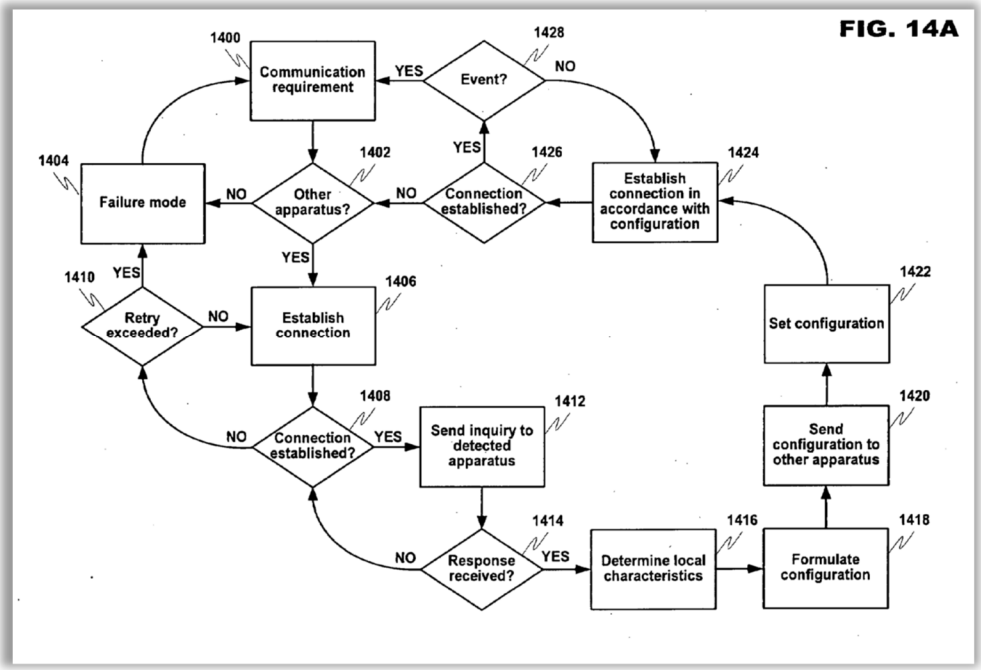
Ex. 1005, Fig. 14

98. In redefining the communications, Tolonen performs the steps I describe with respect to claims 5 and 7, which I incorporate by reference herein. Accordingly, the configuration is according to a user preference.

10. Claim 10

a) Tolonen discloses "[t]he apparatus of claim 4, said apparatus is configured to evaluate said user-defined criterion responsive to a pre-defined event."

99. It is my opinion that Tolonen discloses claim 4 and that Tolonen's WCD apparatus is configured to evaluate said user-defined criterion responsive to a pre-defined event. As described previously, Tolonen's WCD can dynamically switch communication configuration mid-transmission. Ex. 1005 at ¶¶ 97, 109. For example, as shown below in figure 14, Tolonen illustrates a process by which a communication apparatus may define a new communication configuration whenever a *predefined 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 at ¶¶ 104, 109.



Ex. 1005, Fig. 14

11. Claim 11

a) Tolonen discloses "[t]he apparatus of claim 4, said apparatus is configured to periodically evaluate said user-defined criterion."

100. It is my opinion that Tolonen discloses claim 4 and that Tolonen's WCD apparatus is configured to periodically evaluate said user-defined criterion. As discussed previously, using characteristic information (based on user-defined criteria) such as "Quality of Service (QoS) requirements, operational schemes (e.g., power saving, high speed, etc.), [and] radio module priority," Tolonen's WCD formulates a configuration for the SDR. Ex. 1005 at ¶¶ 95, 102; *see also supra* Sections VIII.A.5-10. Although Tolonen's WCD may evaluate the

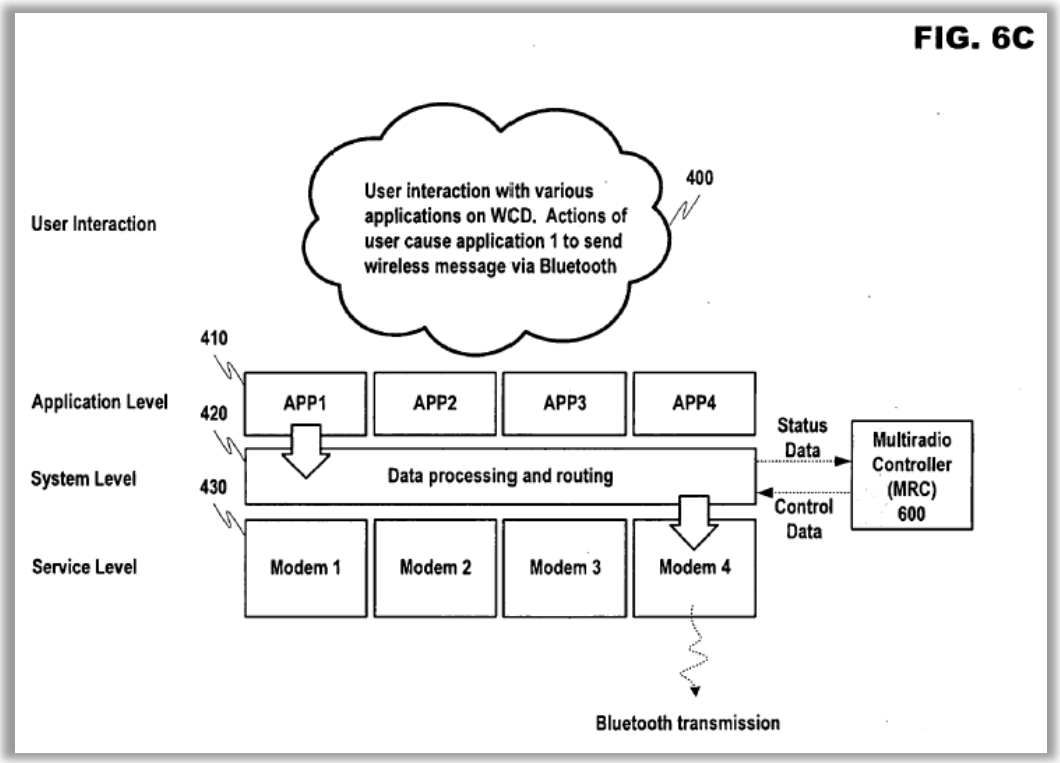
characteristic information before or after receiving an initial wireless inquiry, "[t]he formulation of characteristic information may also occur . . . periodically." Ex. 1005 at ¶ 111.

12. Claim 12

a) Tolonen's "apparatus 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."

101. 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 describe with respect to claims 5 and 7, 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 at ¶ 42. In this example, the user action is the user moving into communication range of the other device.

102. Additionally, Tolonen teaches that the user's interaction with the interface determines what communication modules, and, thus, what protocols, are employed. Ex. 1005 at ¶¶ 48-49, 67, Fig. 6C; *see also* ¶¶ 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 at ¶ 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 at ¶ 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 at ¶ 67, Fig. 6C.



Ex. 1005, Fig. 6C

103. 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.").

13. Claim 13

104. Claim 13 is identical to claims 1 and 4 except that claim 13 does not require that the wireless communication interface includes either an ADC or DAC.

Accordingly, Claim 13 is anticipated by Tolonen for the same reasons set forth for claim 1 and 4.

14. Claims 14, 16-18

105. Claims 14, 16, 17, and 18 are identical to claims 3, 7, 8, and 9 respectively, except that claims 14, 16, 17, and 18 depend from claim 13 and claims 3, 7, 8, and 9 depend from claim 1. Accordingly, claims 14, 16, 17, and 18 are anticipated by Tolonen for the same reasons set forth for claims 3, 7, 8, and 9 respectively.

15. Claim 15

106. Claim 15 is identical to claim 6, with the only difference being that Claim 15 depends from Claim 13 whereas Claim 5 depends from Claim 4; both claim 4 and claim 13 are anticipated by Tolonen. Accordingly, Tolonen teaches claim 15 for the same reasons. *See supra* Sections VIII.A.4, VIII.A.6, VIII.A.13.

16. Claim 19

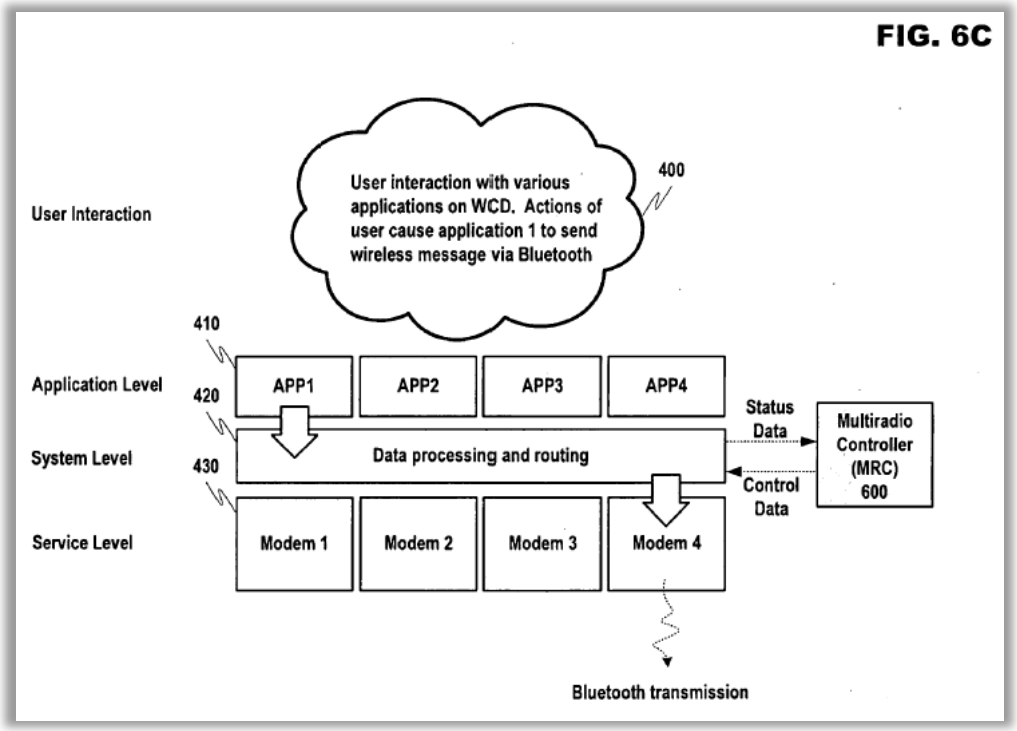
107. Claim 19 is a mere alternative combination of Claims 10 and 11, with the only difference being that Claim 19 depends from Claim 13 whereas Claims 10 and 11 depend from Claim 4; both claim 4 and claim 13 are anticipated by Tolonen. Accordingly, Tolonen teaches Claim 19 for the same reasons. *See supra* Sections VIII.A.10, VIII.A.11, VIII.A.13.

17. Claim 20

108. It is my opinion that Tolonen discloses claim 13 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 scanning a pre-defined bar code. As explained for claim 12, incorporated herein, Tolonen teaches that the dynamic selection of a wireless communication network, wireless communication protocol, or a parameter of a wireless communication protocol 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 at ¶ 42. In this example, the user action is the user moving into communication range of the other device.

109. Additionally, Tolonen teaches that the user's interaction with the interface determines what communication modules, and, thus, what protocols, are employed. Ex. 1005 at ¶¶ 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 at ¶ 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 at ¶ 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 at ¶ 67, Fig. 6C.



Ex. 1005, Fig. 6C

110. 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. *See, e.g.*, Ex. 1005 at Fig. 6C ("User interaction with various applications on WCD. Actions of user cause application 1 to send wireless message via Bluetooth.").

111. 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 at ¶ 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 at ¶ 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.

112. 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 340) 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. Ex. 1005 at 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.

IX. GROUND 2: ANTICIPATION OF CLAIMS 1-3 OVER KATZ

A. Katz discloses claims 1-3

1. Claim 1

a) 1[pre] Katz discloses "[a]n apparatus comprising."

113. 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 radio for communication with backend servers, and a CMOS image sensor that may be used to read 1D and 2D bar codes. Ex. 1006 at 1, 3, Figs. 5, 6.

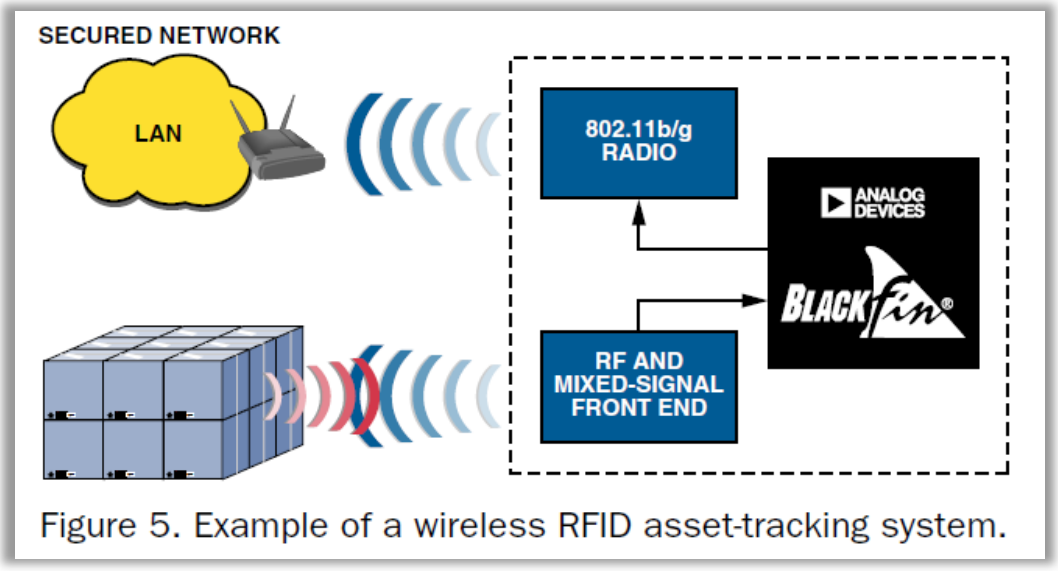


Figure 5. Example of a wireless RFID asset-tracking system.

Ex. 1006, Fig. 5

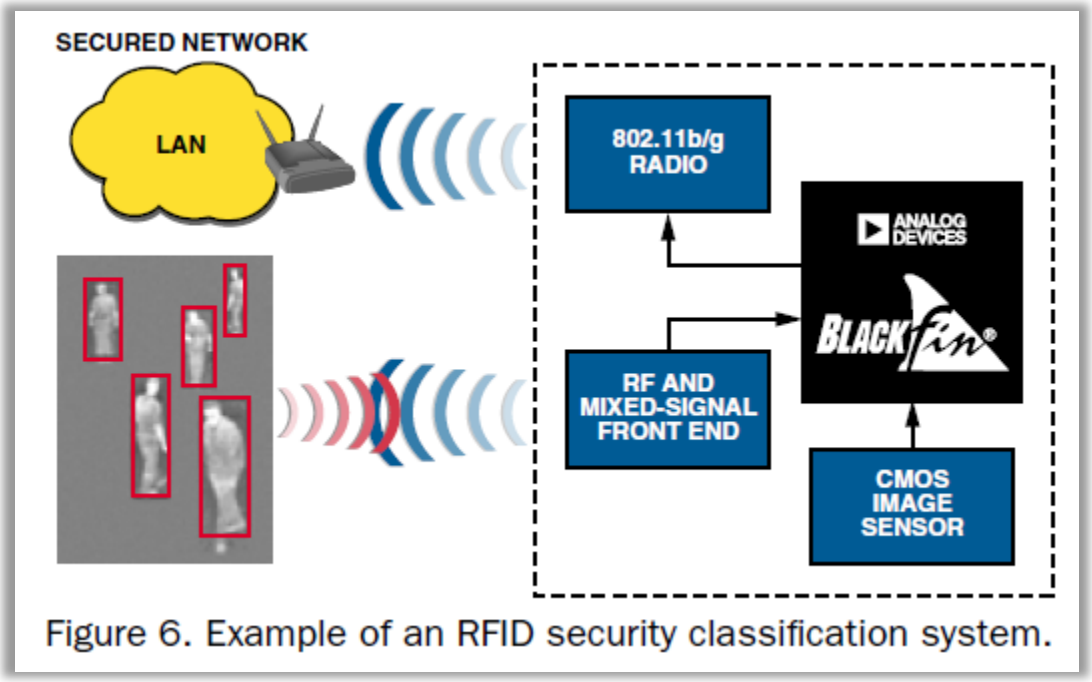


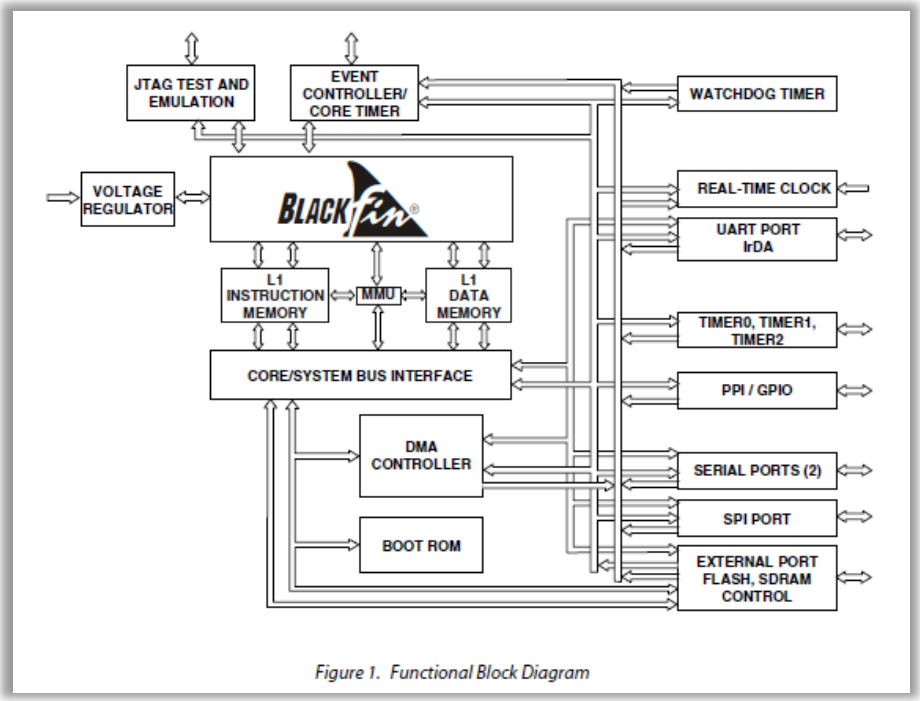
Figure 6. Example of an RFID security classification system.

Ex. 1006, Fig. 6

b) 1[A] Katz's RFID system comprises "a microprocessor."

114. 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. Ex. 1006 at 3, 4; ADSP-BF531 Data Sheet at 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 at 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

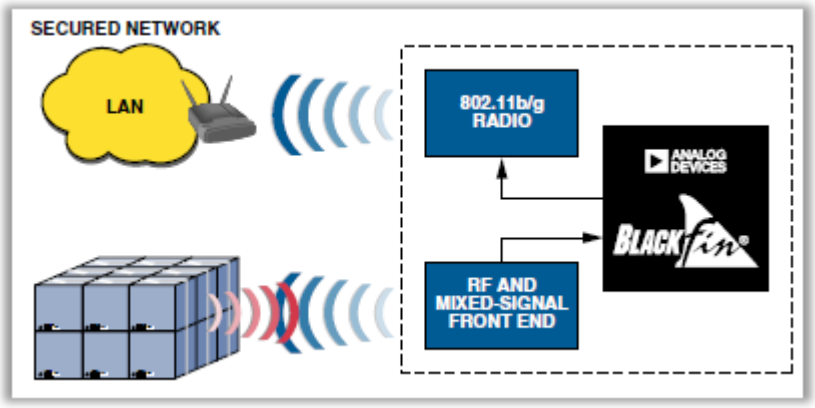
a signal processing engine with RISC-like microprocessor instruction sets, which is an instruction set architecture used for "Microprocessors without interlocked Pipelined Stages." ADSP-BF531 Data Sheet at 4. As shown below in Figure 1 of a datasheet for the ADSP-BF531 Blackfin processor, Katz's processor 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 at 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 at 4, Fig. 1.



ADSP-BF531 Data Sheet, Fig 1

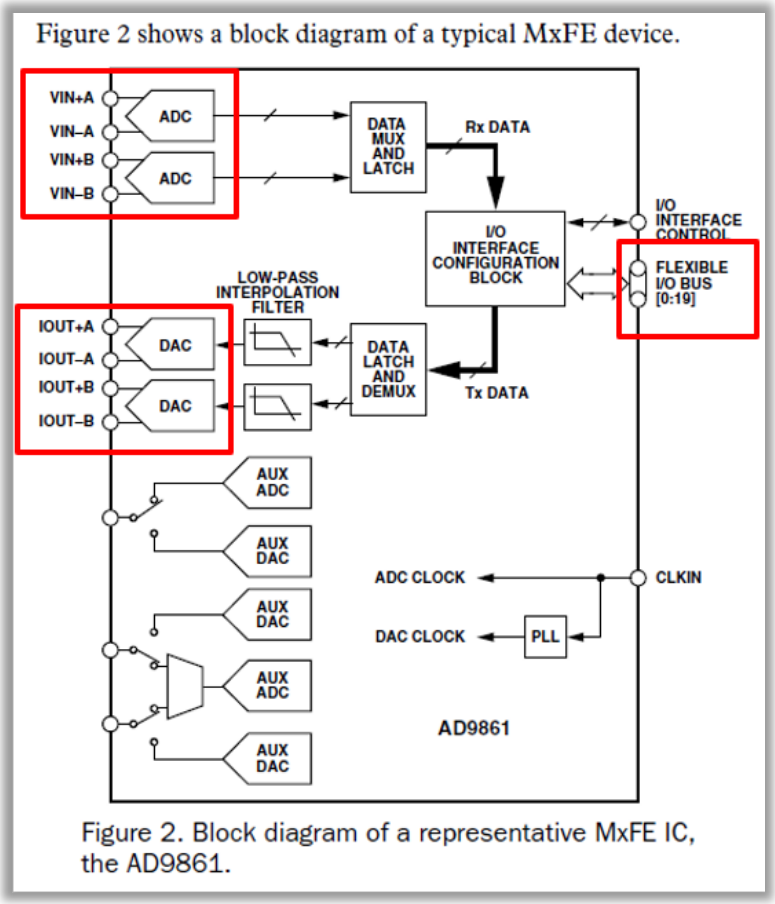
c) *1[B] Katz's RFID system comprises "a wireless communication interface configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said wireless communication interface electrically coupled to at least one of an analog-to-digital converter (ADC) or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

115. 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." Ex. 1006 at 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. *See, e.g.,* Ex. 1006 at Fig. 5.



Ex. 1006, Fig. 5

116. For its RF and Mixed-Signal Front End, for example, Katz describes Analog Device's MxFE. Ex. 1006 at 3, Fig. 2. 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." Ex. 1006 at 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. Ex. 1006 at 3.

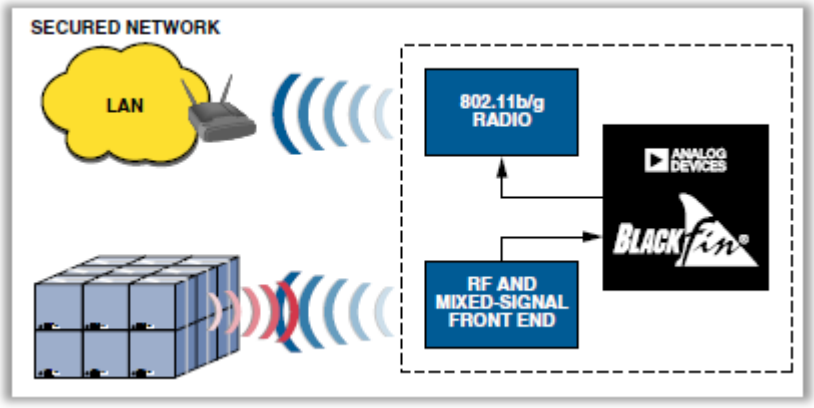


Ex. 1006, Fig. 2 (annotated)

117. 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." Ex. 1006 at 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." Ex. 1006 at 3. Katz further

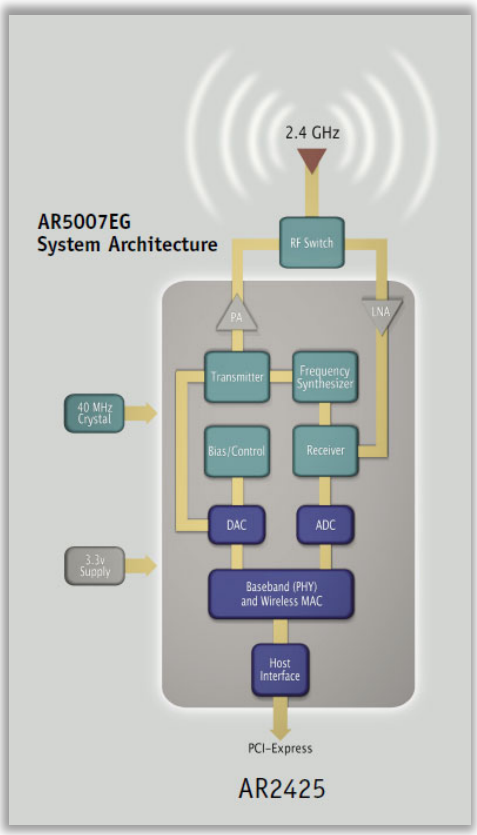
teaches that "the PPI is reconfigured as a receiver in a small number of processor system clock pulses" such that "the downconverted RF signal can be sampled by an ADC and brought into the Blackfin directly." Ex. 1006 at 3.

118. Additionally, 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." Ex. 1006 at 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. Ex. 1006 at 3, Fig. 2, Fig. 5; *see also* ADSP-BF561 Data Sheet (showing the PPI pins connected to the system bus).



Ex. 1006, Fig. 5

119. IEEE 802.11 radios, 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 radio. 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.



Ex. 1015, Atheros AR5007EG data sheet

120. 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.

d) 1[C] 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."

121. 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*." Ex. 1006 at 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." Ex. 1006 at 3. Katz teaches that the MxFE device output streams of I&Q data directly to the Blackfin processor. Ex. 1006 at 3. Katz's Blackfin processor necessarily performs baseband decoding as this occurs after the I&Q data is processed to recover the baseband encoded data. Katz's Blackfin processor baseband encodes and decodes and performs 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." Ex. 1006 at 5.

> *e) 1[D] 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."*

122. As discussed above, Katz's processor executes front-end, middleware, and backend software, including performing "filter and transformative-intensive signal processing." Ex. 1006 at 2–3; *see supra* Section IX.A.1.(b)–(d). 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. Ex. 1006 at 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." Ex. 1006 at 4. Thus, Katz teaches, the MAC, or Medium Access Control, functionality is "executed in Blackfin software." Ex. 1006 at 4.

f) 1[E] Katz's "DAC is configured to output to an analog signal corresponding to said first encoded bit stream."

123. 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. Ex. 1006 at 3; *see supra* Section IX.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.*

124. 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. Ex. 1006 at 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]." Ex. 1006 at 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. Ex. 1006 at 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.").

g) 1[F] Katz's "ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said wireless communication interface."

125. 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. Ex. 1006 at 3; *see supra* Section IX.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.

126. 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. Ex. 1006 at 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]." Ex. 1006 at 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. Ex. 1006 at 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."). Katz further explains that the MxFE chip outputs, upon reception of a signal, "[o]tput streams of I&Q data," which are necessarily a stream of bits that are encoded according to the data encoding method used in the received RF signal. Ex. 1006 at 3.

h) 1[G] 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."

127. Katz's processor executes software for "manag[ing] the interrogation, *decoding*, and processing of the received tag information." Ex. 1006 at 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." Ex. 1006 at 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. Ex. 1006 at 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." Ex. 1006 at 4. Thus, as Katz teaches, the MAC, or Medium Access Control, functionality is "executed in Blackfin software." Ex. 1006 at 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) Katz's "apparatus 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."

128. 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." Ex. 1006 at 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." Ex. 1006 at 4. Solely relying on software to perform all requisite tag reading functions, Katz's RFID system is *devoid of dedicated hardware components*. *Id*.

3. Claim 3

a) Katz's "base-band encoder software program and ... base-band decoder software program are implemented as a single software program."

129. It is my opinion that Katz discloses claim 1 and that Katz's software defined radio is configured wherein said base-band encoder software program and said baseband decoder software program are implemented as a single software program. As described in Claim 2, *supra*, Katz's RFID reader "has embedded software that manages the interrogation, decoding, and processing of the received tag information." Ex. 1006 at 1–2. All "three elements" of this RFID reader's embedded software architecture, "the back-end server interface, the middleware, and the front-end tag reader algorithms," concurrently run on Katz's Blackfin processor. Ex. 1006 at 1–2.

130. A POSITA would recognize that software modules may either be standalone or implemented as part of a single software program. Indeed, whether and how to combine various software modules into a full program is a design choice based, primarily, on the software's required functionality. For example, if a software designer intends for software to be part of different packages, for example a premium and less-premium option, the software designer may initially keep some software modules separate and bundle others into the premium edition. This is also common with software add-ons. For Katz, it is clear that whether or not to include

all the software supporting each of the wireless radios (e.g., the baseband encoding and decoding software supporting the wireless communication with the RFID tags and the wireless communication using IEEE 802.11 b/g) would purely be a design choice based on what wireless modules and protocols within each module the software designer expected the end product to include. For communication modules that both send and receive communications using the same protocol, such as Katz's 802.11b/g radio and MxFE-based RFID front end, then the software designer would necessarily choose to include both the baseband encoder software and baseband decoder software for that protocol within the installed software program within Katz's software defined radio (*see, e.g.*, Ex. 1006 at Figs. 5, 6) to enable the required functionality.

X. GROUND 3: OBVIOUSNESS OF CLAIMS 4–20 OVER KATZ IN VIEW OF ISHIZU

A. Motivation to Combine

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

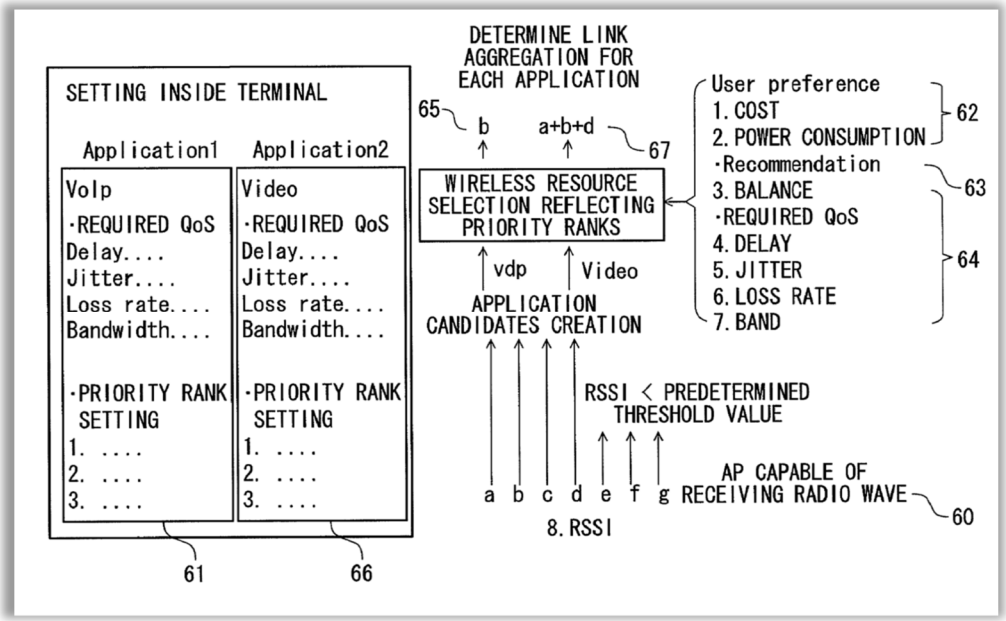
132. Katz teaches an RFID system that includes an RF and Mixed-Signal Front End and an 802.11b/g Radio connected to a Blackfin Processor. Ex. 1006 at 4, Fig. 5. Katz teaches that the IEEE 802.11b/g radio is necessary for mobile and portable systems, and that these systems will need to connect to access points for

communication. Ex. 1006 at 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." Ex. 1006 at 2-4. For example, Katz's processor performs "[m]anaged power consumption … using dynamic power management capabilities." Ex. 1006 at 4.

133. Katz teaches that "[t]hese dynamic power modes are designed to enable flexible performance and power arrangements for just about any networked system." Ex. 1006 at 4. 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." Ex. 1006 at 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." Ex. 1006 at 2. In keeping with the goal of flexible performance, Katz teaches that its μClinux 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." Ex. 1006 at 5.

134. 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.

135. Ishizu teaches "a communication terminal capable of dynamic reconfiguration … of connection to a plurality of wireless communication networks." Ex. 1010 at ¶ 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." Ex. 1010 at ¶ 38. Ishizu teaches that the connection policy information creation processing considers communication priorities specified by the user, *see, e.g.*, Ex. 1010 at ¶¶ 77, 95, as well as, information about the communication channel and the access points. *See, e.g.*, Ex. 1010 at ¶¶ 97-129. As shown in Figure 6, below, Ishizu's connection policy is based on an algorithm that considers user preferences. Ex. 1010 at ¶ 144, Fig. 6.



Ex. 1010, Fig. 6

136. As Ishizu's connection policy information pertains to "connection methods" like IEEE 802.11b, *see* Ex. 1010 at ¶ 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*." Ex. 1006 at 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.

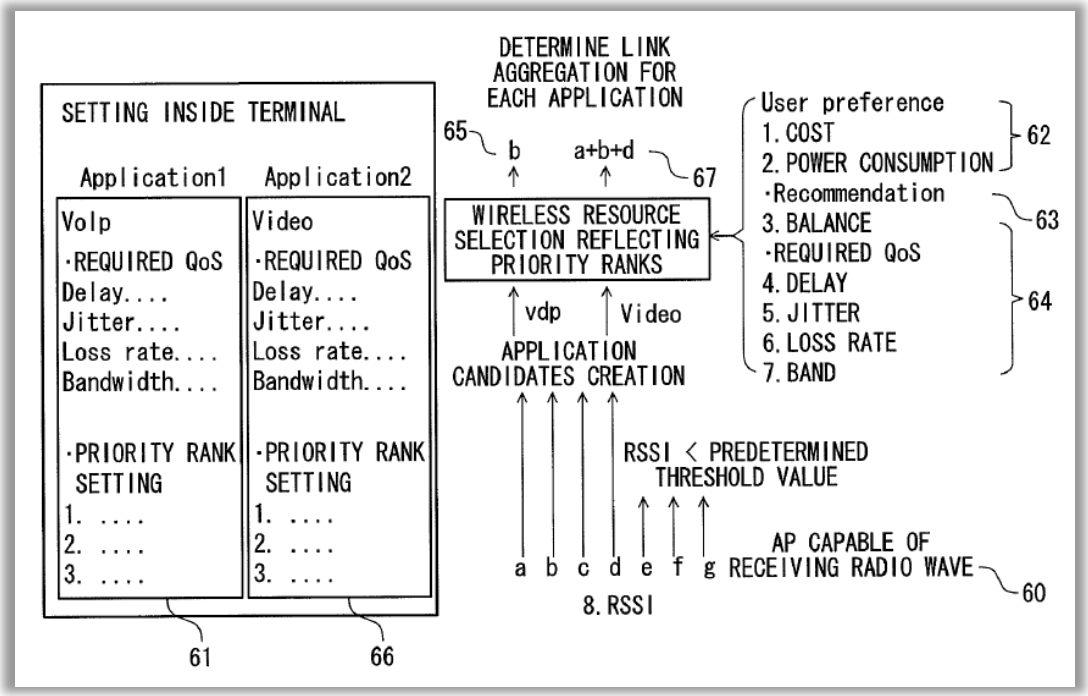
B. Katz in view of Ishizu Invalidates the Claims

1. Claim 4

a) Katz in view of Ishizu discloses "[t]he apparatus 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."

137. It is my opinion that Katz discloses claim 1. 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 X.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.

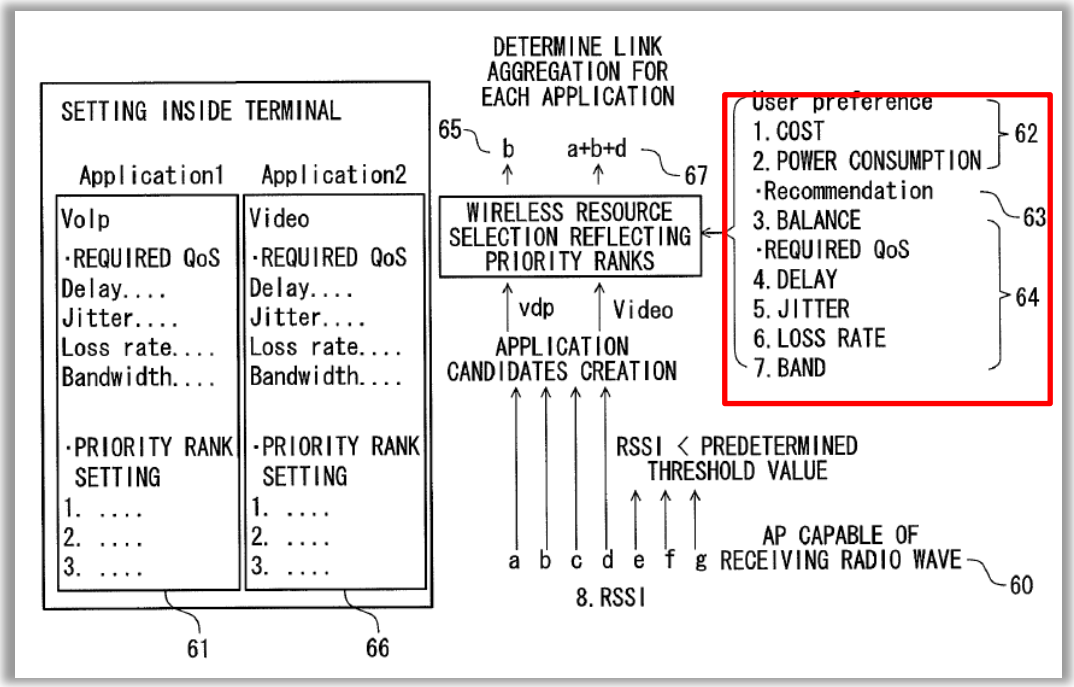


Ishizu, Fig. 6.

2. Claim 5

a) 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."

138. It is my opinion that Katz in view of Ishizu discloses claim 4. 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)

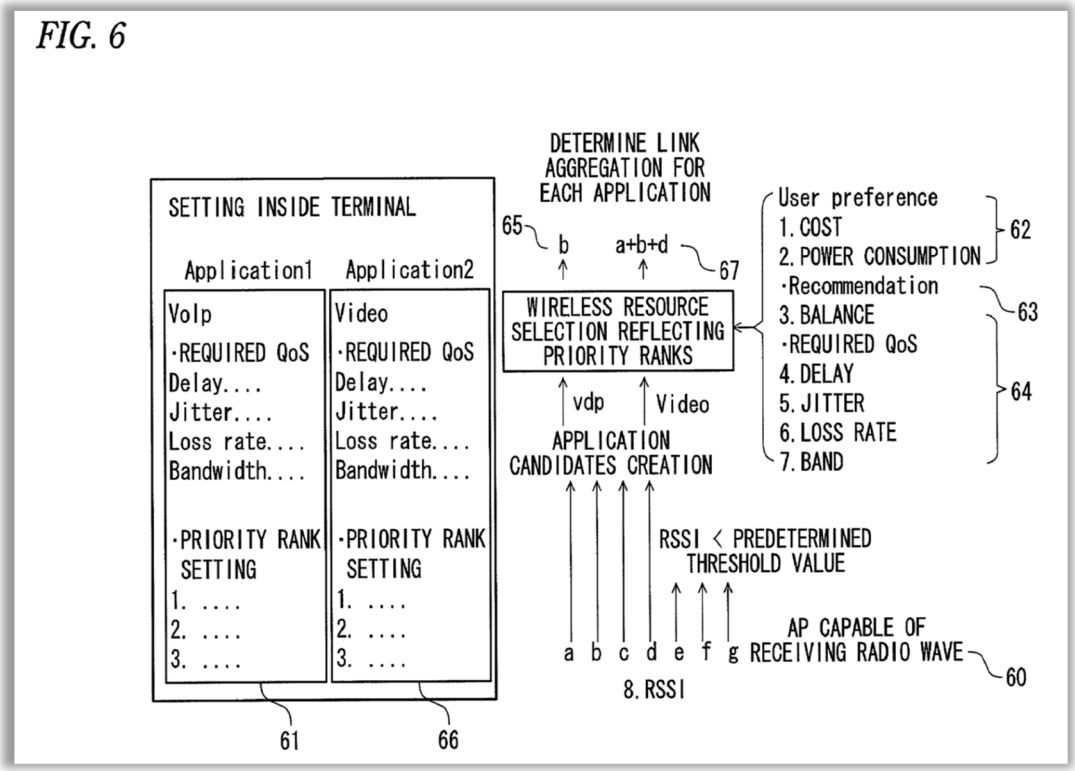
3. Claim 6

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 4, wherein said value of said user-defined criterion is calculated as a weighted sum of components" wherein at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput."

139. It is my opinion that Katz in view of Ishizu discloses claim 4. Ishizu's apparatus calculates a balance to maximize user satisfaction based on user requirements and required Quality of Service factors. Ex. 1010 at ¶ 147. In every wireless resource selection, Ishizu aims to maximize user satisfaction that is defined as "an evaluation value expressing subjective satisfaction." Ex. 1010 at ¶¶

137, 143. For example, "[i]n addition to a requirement (62) and a required QoS (64), a balance (63) of the above-mentioned user satisfaction" is calculated to select a wireless resource. Ex. 1010 at ¶ 147.

140. Specifically, to select a communication network, Ishizu first selects access points that meet the Quality of Standard factors as plausible selection candidates and then narrows the selection candidates to those who meet the "cost requirement and power consumption requirement of the user." Ex. 1010 at ¶ 147. "If two or more selection candidates remain, the balance (63) is considered." Ex. 1010 at ¶ 149. As shown below in Figure 6, Ishizu's device must determine which factors are more important than others to calculate and employ a balance. Ishizu describes that "in the case of video streaming, for example, some users are not satisfied by saying 'what a poor image quality for that amount of fee', while other users are well satisfied by saying 'how good the image quality is for a mobile' with video reproduction with the same evaluation point." Ex. 1010 at ¶ 141.



Ishizu, Figure 6

141. To calculate a balance using multiple user requirements and Quality of Service factors, it would have been obvious for Ishizu's device to employ a weighted sum calculation. Ostensibly, Ishizu must employ a weighting system for user requirement and quality of service if Ishizu is to balance a user's satisfaction with the Quality of Service Factors. A POSITA would, therefore, have determined the weighted sum an obvious means for accomplishing this balance. Indeed, the "weighted sum model … is the earliest and probably the most widely used method" for multi-criteria decision making. *See* Ex. 1019 at 3.

142. A POSITA would have realized that choosing the weighted sum model ("WSM") would predictably accomplish Ishizu's goal of determining network communication link based on user satisfaction. According to the WSM model, Ishizu would have M communication link alternatives and each of the criteria (e.g., QOS, delay, jitter, loss rate, bandwidth etc.) would represent one of N criteria. The figure below represents the calculation that would be performed using the WSM.

4.2.1 The Weighted Sum Model

The weighted sum model (or WSM) is probably the most commonly used approach, especially in single dimensional problems. If there are M alternatives and N criteria then, the best alternative is the one that satisfies (in the maximization case) the following expression [Fishburn, 1967]:

$$A^*_{WSM} = \max_i \sum_{j=1}^{N} q_{ij} w_j, \quad for \quad i = 1, 2, 3, \ldots, M. \qquad (4\text{-}1)$$

where: A_{WSM}* is the WSM score of the best alternative, N is the number of decision criteria, a_{ij} is the actual value of the i-*th* alternative in terms of the j-*th* criterion, and W_j is the weight of importance of the j-th criterion.

Ex. 1019 at 3. According to the above equation, a POSITA would have expected using the Weighted Sum Model to predictably arrive at a determination of the best alternative based on weighting each of the different characteristics.

4. Claim 7

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 4, wherein said apparatus 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."

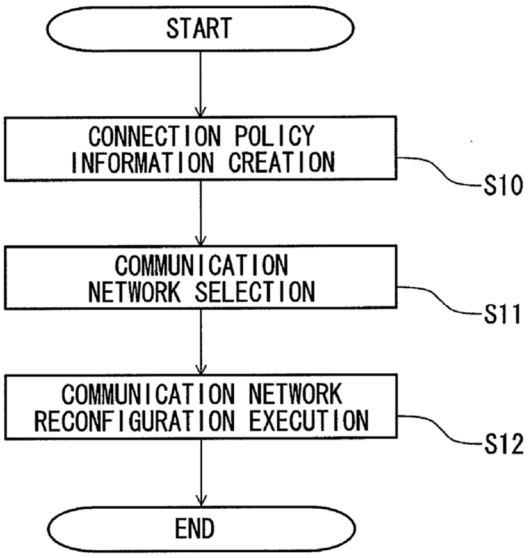
143. It is my opinion that Katz in view of Ishizu discloses claim 4. Ishizu teaches that its data communication aggregation device can determine the (frequency) Band of the Access Point (e.g., beacon), which is "a value specific to [the] access point." *See* Ishizu, ¶¶ 108–109. Ishizu explains that certain 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.

5. Claim 8

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 4, wherein said apparatus is configured to evaluate said user-defined criterion before attempting to initiate a communication session."

144. It is my opinion that Katz in view of Ishizu discloses claim 4. Ishizu's data communication aggregation device evaluates user preference and transmission requirements to create connection policy information and select a wireless network. Ishizu, ¶¶ 75–95. As shown below in Figure 4, Ishizu's device creates the connection policy information *before* selecting and initiating communication with a wireless network. *Id.*

FIG. 4



Ishizu, Fig. 4.

6. Claim 9

a) Katz in view of Ishizu discloses "wherein said apparatus is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion."

145. It is my opinion that Katz in view of Ishizu discloses claim 4. 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 criterions (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*, Ex. 1010 at ¶¶ 75–95. *See also supra* Sections X.B.4-6.

7. Claim 10

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 4, said apparatus is configured to evaluate said user-defined criterion responsive to a pre-defined event."

146. It is my opinion that Katz in view of Ishizu discloses claim 4. As described previously, Ishizu teaches a selection algorithm and reconfiguration means, based on the connection policy information, to dynamically select a wireless network. Ishizu, ¶ 38; *see supra* Section X.B.7.a. Connection policy

information—comprised of requirement information from the user and the communication parameters—can contain predetermined threshold values. Ishizu, ¶¶ 39–41. When one of the predetermined threshold values is not satisfied, Ishizu's device reevaluates the connection policy information and reconfigures the connection to select a different wireless network responsive to the failure of meeting the predetermined threshold values. *Id.* As one example, a device no longer meeting the threshold value constitutes an event that triggers a reconfiguration of the wireless network and protocols. *See, e.g.* Ex. 1010 at ¶ 56 (teaching that by "integrating different types of wireless communication networks in the data communication aggregation device and dynamically re-setting them, a user efficiency of the frequency, load distribution of network traffic, communication quality demanded by users and applications and the like can be improved"); *Id.* at ¶ 132 (describing the system to provide an "architecture to maximize satisfaction according to preference of a user in an environment where the communication quality is dynamically changing"); *Id.* at 172 (describing the data communication aggregation device to be configured while the wireless communication networks are being dynamically reconfigured); *see also* Ex. 1010 at cl. 1 (claiming "[a] communication terminal capable of dynamic reconfiguration").

8. Claim 11

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 4, said apparatus is configured to periodically evaluate said user-defined criterion."

147. It is my opinion that Katz in view of Ishizu discloses claim 4. Ishizu's device constantly reconfigures wireless network connections to ensure the selected wireless network always adheres to user preference and connection requirements. Ishizu, ¶¶ 16, 157. To accomplish this, Ishizu teaches communication network reconfiguration management means. Ishizu, ¶ 16. As shown below in Figure 8, after measuring the communication parameters of a currently selected wireless network, the parameters are "compared and evaluated if the values satisfy the requirement information (2162) or not or are contained in a predetermined threshold value from the requirement information (2162) or not, and if not contained, the measured values are *re-calculated* in the connection policy information creation portion (2101b), and the connection policy information table (2161) is updated." Ishizu, ¶ 157; *see also Id.* ¶ 56 (teaching that by "integrating different types of wireless communication networks in the data communication aggregation device and dynamically re-setting them, a user efficiency of the frequency, load distribution of network traffic, communication quality demanded by users and applications and the like can be improved"); *Id.* ¶ 132 (describing the system to provide an "architecture to maximize satisfaction according to

preference of a user in an environment where the communication quality is dynamically changing"); *Id.* at 172 (describing the data communication aggregation device to be configured while the wireless communication networks are being dynamically reconfigured); *see also* Ex. 1010 at cl. 1 (claiming "[a] communication terminal capable of dynamic reconfiguration").

9. Claim 12

a) 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."

148. It is my opinion that Katz discloses claim 1. 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 criterions (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 X.B.4-6. *See also*, Ex. 1010 at ¶¶ 75–95.

10. Claim 13

149. Claim 13 is identical to claims 1 and 4 except that claim 13 does not require that the wireless communication interface includes either an ADC or DAC. Accordingly, Claim 13 is anticipated by Katz in view of Ishizu for the same reasons set forth for claim 1 and 4.

11. Claims 14, 16-18

150. Claims 14, 16, 17, and 18 are identical to claims 3, 7, 8, and 9 respectively, except that claims 14, 16, 17, and 18 depend from claim 13 and claims 3, 7, 8, and 9 depend from claim 1. Accordingly, claims 14, 16, 17, and 18 are anticipated by Katz in view of Ishizu for the same reasons set forth for claims 3, 7, 8, and 9 respectively.

12. Claim 15

151. Claim 15 is identical to Claim 6, with the only difference being that Claim 15 depends from Claim 13 whereas Claim 6 depends from Claim 4; both of which are anticipated by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 15 for the same reasons. *See supra* Sections X.B.4, X.B.13.

13. Claim 19

152. Claim 19 is a mere alternative combination of Claims 10 and 11, with the only difference being that Claim 19 depends from Claim 13 whereas Claims 10

and 11 depend from Claim 4, both of which are anticipated by Katz in view of Ishizu. Accordingly, Katz in view of Ishizu teaches Claim 19 for the same reasons. *See supra* Sections X.A.10, X.A.11, X.A.13.

14. Claim 20

a) Katz in view of Ishizu discloses "[t]he apparatus of claim 13 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."

153. In combination, Katz and Ishizu implement an RFID system that includes an RFID reader front end, an 802.11b/g chipset, and a processor running software for controlling the RFID Reader system, including scheduling communications according to Ishizu's teachings. *See supra* Section VIII.A. As discussed previously, Katz's RFID system can also integrate with a CMOS image sensor to function as a bar code reader. As Katz endeavors to enable flexible performance and power management, a POSITA would have recognized the need for Katz's system to react to the increased transmission requirements from a CMOS image sensor and would have implemented Ishizu. Ex. 1006, 4; Ex. 1003, ¶¶ 190-92; *see also supra* Section VII.A.1.d. For example, Ishizu teaches 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.'" Ex. 1010, ¶ 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. Ex. 1010, ¶¶ 96, 147; *see also, supra* Section VII.B.6-8.

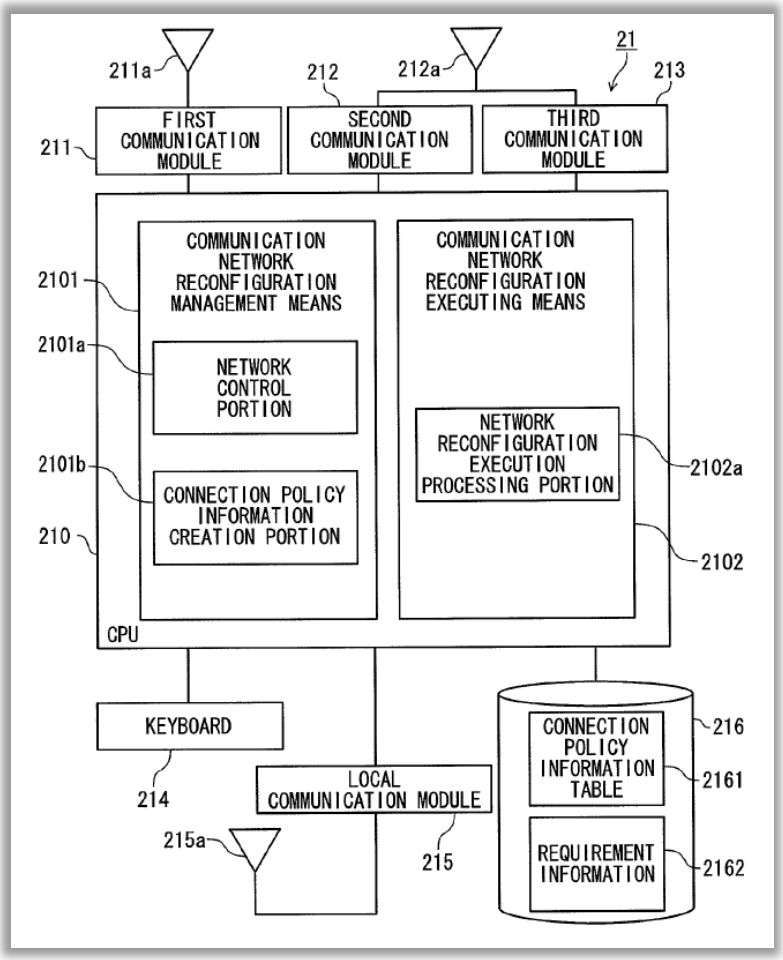
XI. GROUND 4: ANTICIPATION OF CHALLENGED CLAIMS 1–20 BY ISHIZU

A. Ishizu Invalidates the Claims

1. Claim 1

a) 1[pre] *Ishizu discloses "[a]n apparatus comprising."*

154. Ishizu discloses a communication terminal capable of dynamic reconfiguration of connection to a plurality of wireless communication networks. Ex. 1010 at ¶ 32. Ishizu's communication terminal is represented by figure 2, below, which can be in the form of a personal computer, cellular phone, or PDA. *Id.* at ¶¶ 57, 68, Fig. 2.



Ex. 1010, Fig. 2

b) 1[A] *Ishizu's apparatus comprises "a microprocessor."*

155. As a personal computer, Ishizu's communication terminal comprises a microprocessor. Indeed, Ishizu's "CPU (221) executes and processes a program of execution software (223a) stored in the hard disk or the like by an application execution processing portion (221a)." Ex. 1010 at ¶ 69. Ishizu also teaches that the microprocessor performs digital signal processing including demodulation of a

received analog-digital converted signal. Ex. 1010 at ¶ 16 (incorporating by reference Japanese Patent Laid-Open No. 2003-152732).

c) 1[B] *Ishizu's apparatus comprises "a wireless communication interface configured to perform at least one of receiving a first radio signal or transmitting a second radio signal, said wireless communication interface electrically coupled to at least one of an analog-to-digital converter (ADC) or a digital-to-analog converter (DAC)."*

156. Ishizu's communication terminal includes first, second, and third communication modules, each of which are wireless communication interfaces configured to receive and transmit radio signals. For example, Ishizu teaches that the communication modules "can be connected to a plurality of wireless communication networks," and that one of the wireless communication parameters pertains to the "type of radio transmission." Ex. 1010 at ¶¶ 99-100. For example, Ishizu's connection methods pertain to wireless protocols such as WiFi (IEEE 802.11b) and WiMAX. Ex. 1010 at ¶ 37.

157. Ishizu's communication modules include at least an AD converter. Ishizu incorporates Japanese Patent Laid-Open No. 2003-152732 and explains that the "wireless communication device can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [analog]-digital converted by an AD converter once, and demodulation or the like

is performed by a digital signal processor or microprocessor and software." Ex. 1010 at ¶¶ 16, 27.

158. What Ishizu is describing, a wireless communication device that "can handle a plurality of frequencies or wireless methods by switching software" is a Software Defined Radio. Indeed, SDRs "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). SDRs communicate digital messages from a processor through analog radio waves and, therefore, include ADCs and DACs. 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. *See also,* Ex. 1011 at 4, Chapter 1 by Mark Cummings.

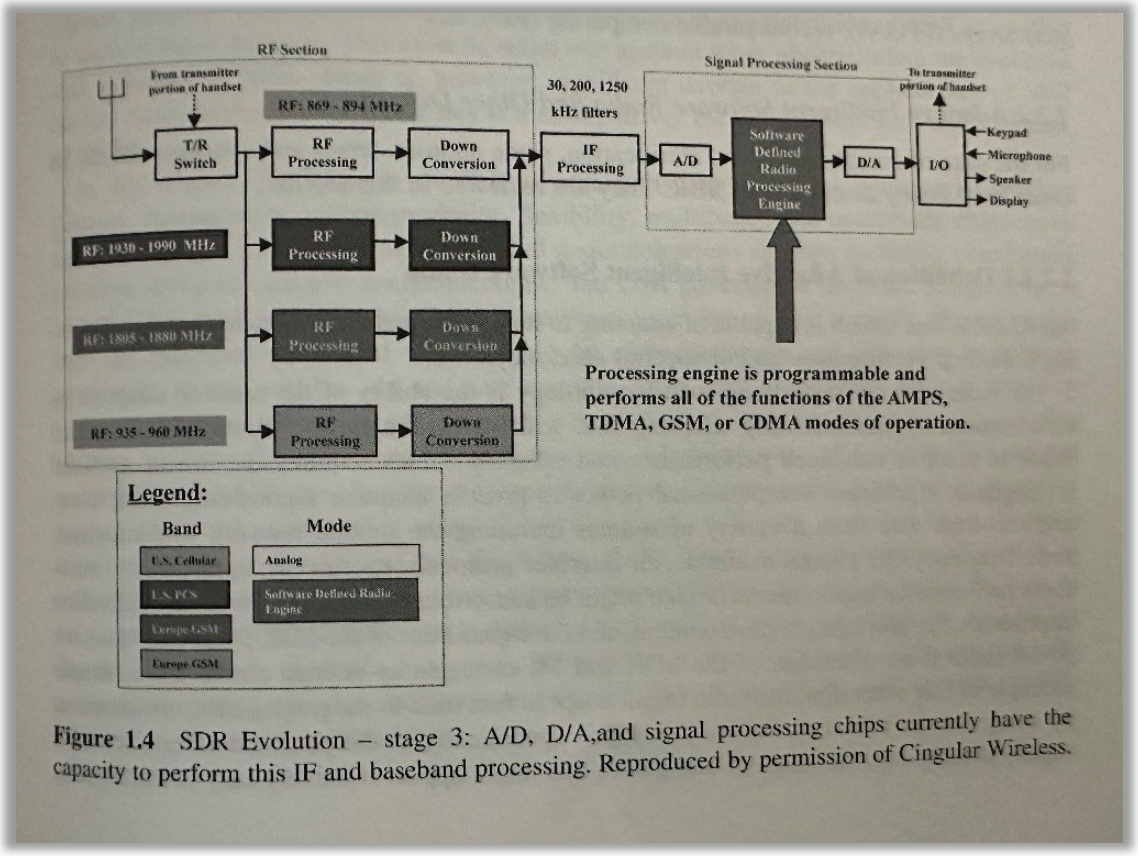


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

As can be seen from this image, the SDR Evolution stage 3 included an A/D and a D/A coupled between the RF Section and the processor (e.g., Software Defined Radio Processing Engine).

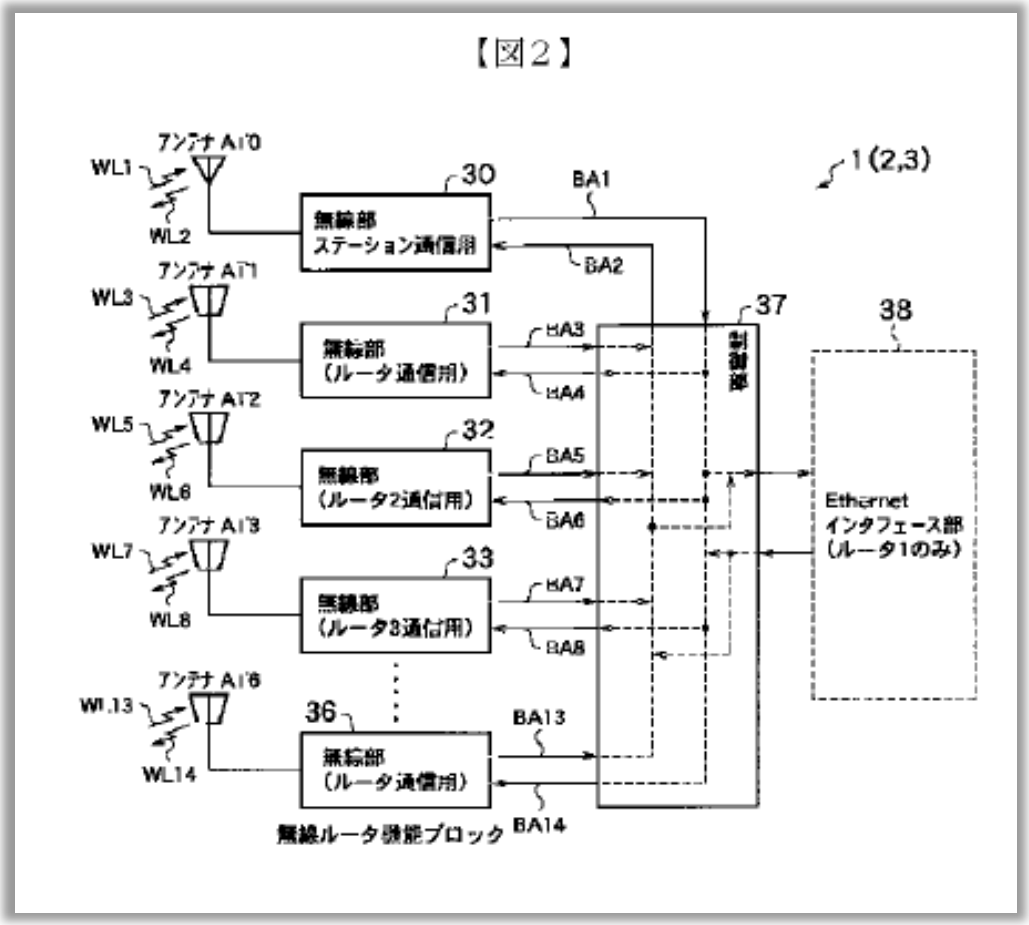
159. Moreover, Ishizu teaches that its communication terminals connect through networks such as 3G. 3G SDRs like the example shown in Tuttlebee's figure 1.4, includes an ADC and DAC electrically coupled to the RF front end and further electrically coupled to the processor (Software Defined Radio Processing

Engine in Tuttlebee's figure 1.4). According to the figure above, the processor is what is operating the Software Defined Processing Engine. *See* Ex. 1012 at Fig. 1.4 ("Processing Engine is Programmable and Performs all of the AMPS, TDMA, GSM, or CDMA modes of operation"). As Ishizu's communication modules may implement 3G cellular communications, it is necessarily the case that at least Ishizu's communication module that implements 3G cellular communications, 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, e.g.*, Ex. 1010 at ¶ 50.

d) 1[C] *Ishizu's "microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program."*

160. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding/decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and software. Ex. 1010 at ¶ 16. In other words, the Software Defined Radio receives an analog radio signal, converts the signal to digital form (i.e., a bit stream), and demodulates that bitstream in the microprocessor.

161. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

162. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operated SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu disclosed a base-band encoder software program configured to produce a first encoded bit stream by performing at least one of encoding, encryption, and multiplexing.

163. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end.

164. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded

message is passed through the DAC before it is communicated through the SDR's RF front end. For Illustration, I again reference Tuttlebee's Figure 1.4.

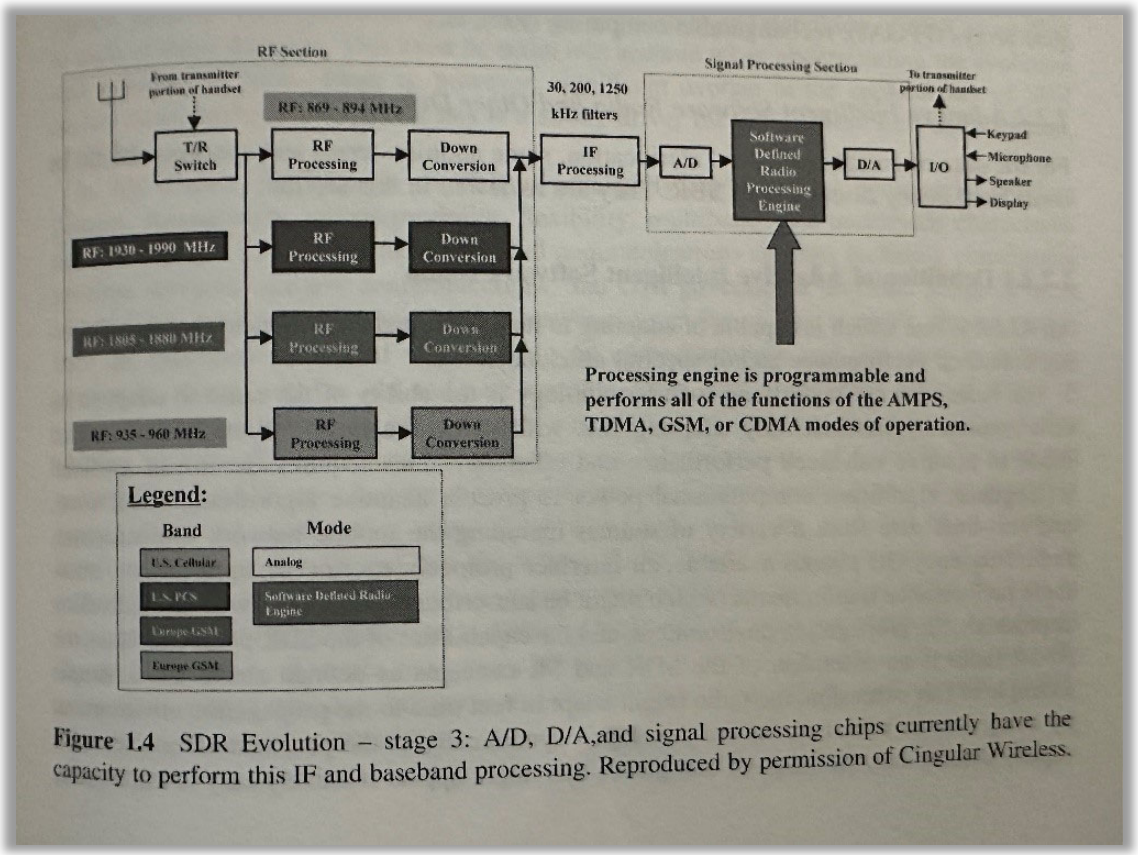


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

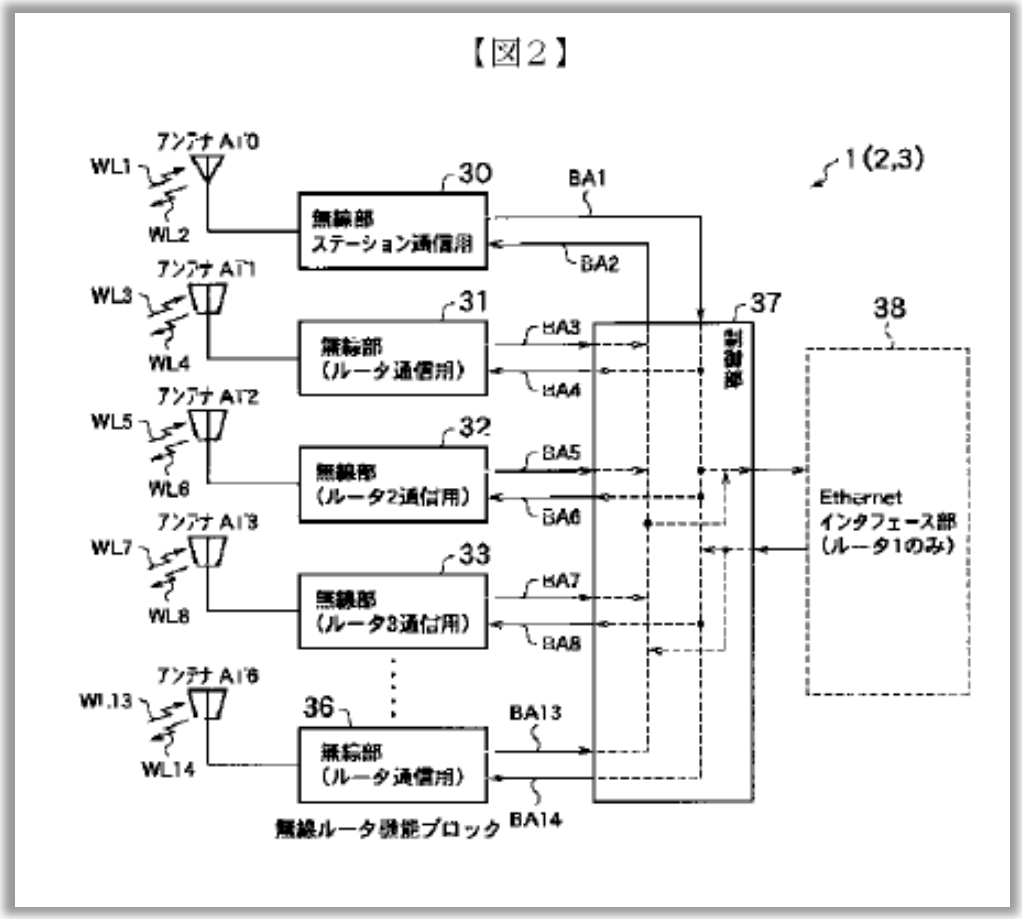
As Tuttlebee's Figure 1.4 shows, the Processing Engine (i.e., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

165. Ishizu is describing a software wireless communication device (i.e., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital decoding and encoding performed by the SDR's microprocessor.

e) 1[D] *Ishizu'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."*

166. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding and decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and software. Ex. 1010 at ¶ 16. In other words, the Software Defined Radio receives an analog radio signal, converts the signal to digital form (i.e., a bit stream), and demodulates that bitstream in the microprocessor.

167. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

168. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operates SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu discloses a base-band encoder software program configured to produce a first encoded bit stream by performing at least one of encoding, encryption, and multiplexing.

169. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end.

170. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded

message is passed through the DAC before it is communicated through the SDR's RF front end. For Illustration, I again reference Tuttlebee's Figure 1.4.

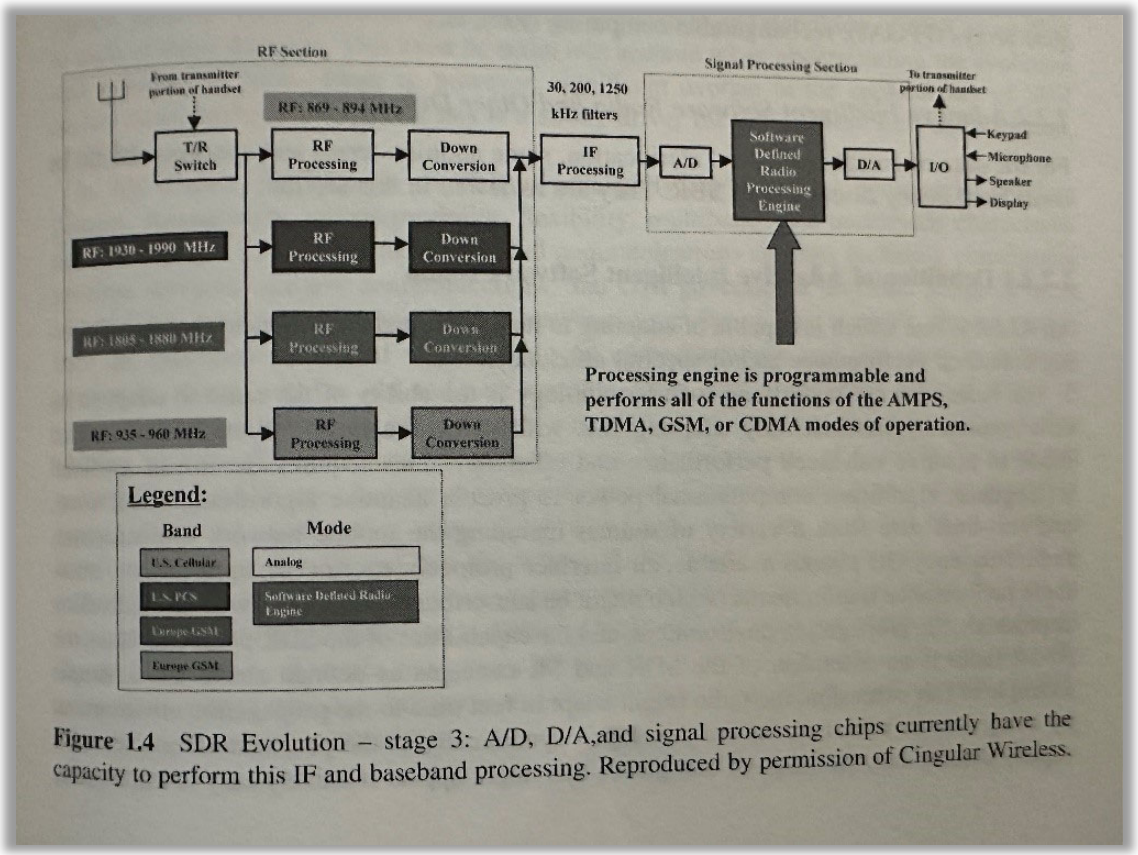


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

As Tuttlebee's Figure 1.4 shows, the Processing Engine (e.g., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

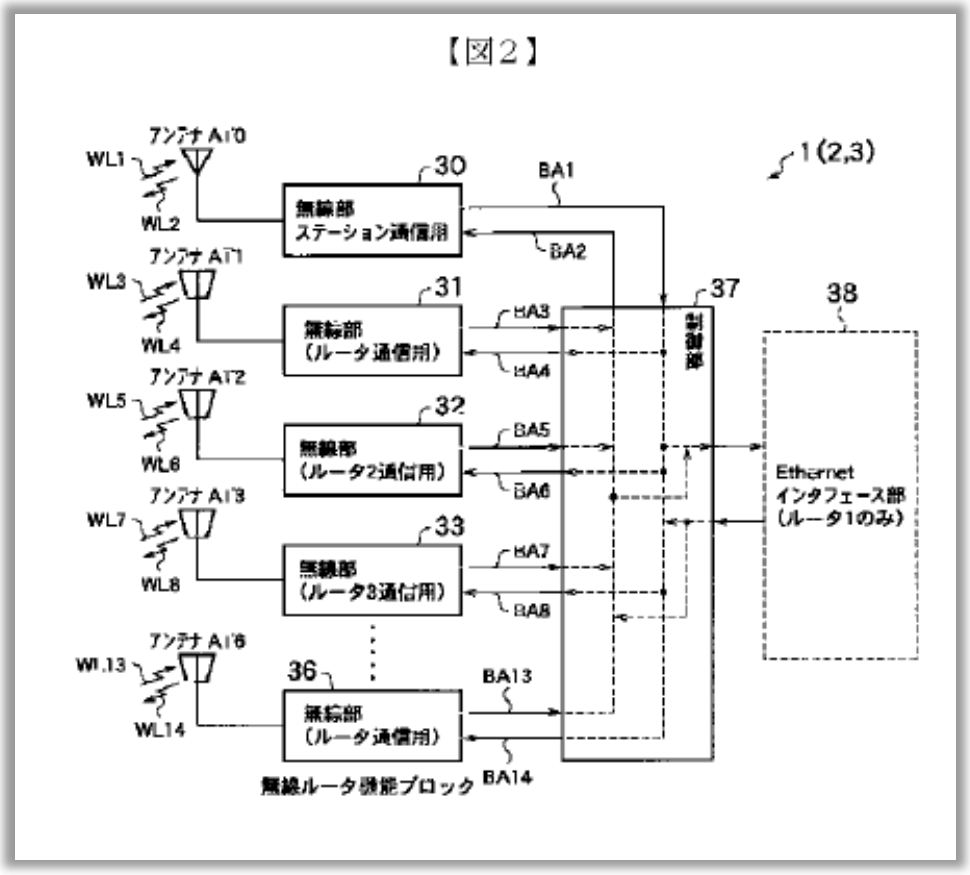
171. Ishizu is describing a software wireless communication device (i.e., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital encoding and decoding performed by the SDR's microprocessor.

f) 1[E] *Ishizu's "DAC is configured to output an analog signal corresponding to said first encoded bit stream."*

172. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding/decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and software. Ex. 1010 at ¶ 16. In other words, the Software Defined Radio receives an analog radio signal, converts the signal to digital form (e.g., a bit stream), and demodulates that bitstream in the microprocessor.

173. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless

communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

174. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operates SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu discloses a base-band encoder software program configured to produce a first encoded bit stream by performing at least one of encoding, encryption, and multiplexing.

175. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to

communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end.`

176. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded message is passed through the DAC before it is communicated through the SDR's RF Front End. For Illustration, I again reference Tuttlebee's Figure 1.4.

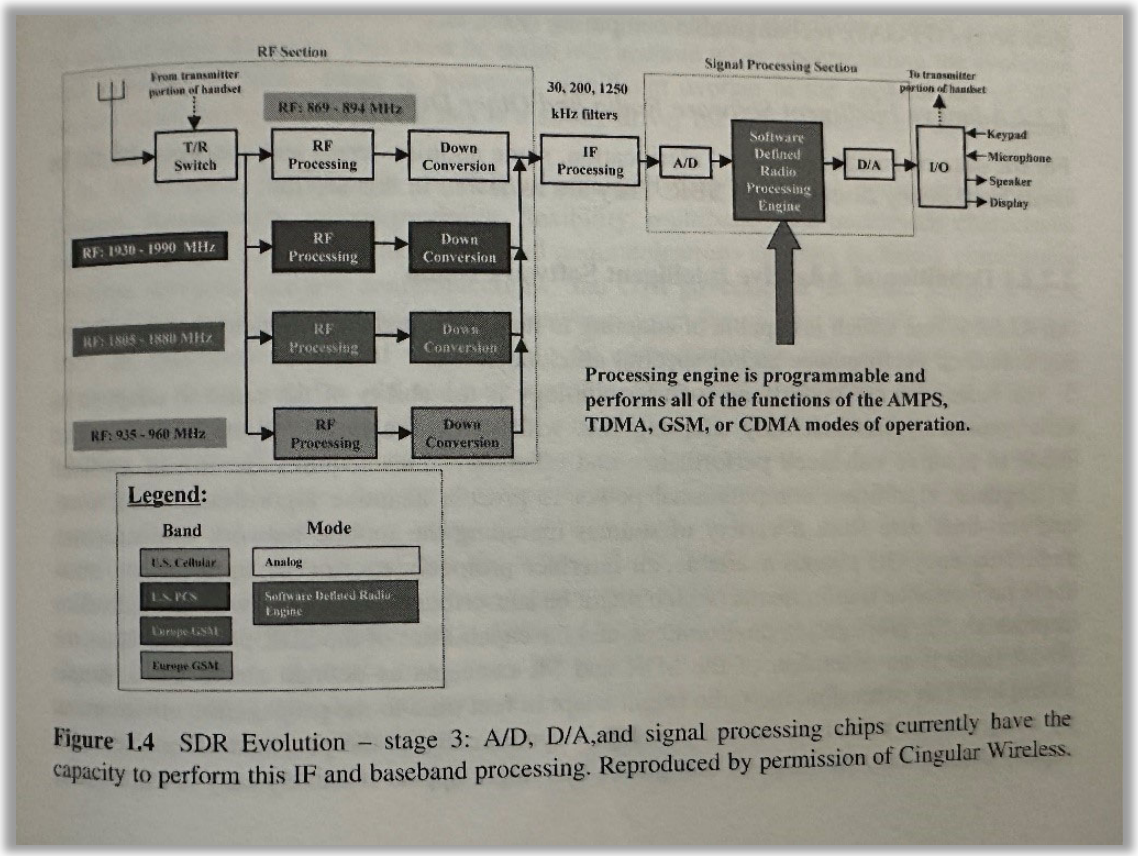


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

As Tuttlebee's Figure 1.4 shows, the Processing Engine (e.g., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

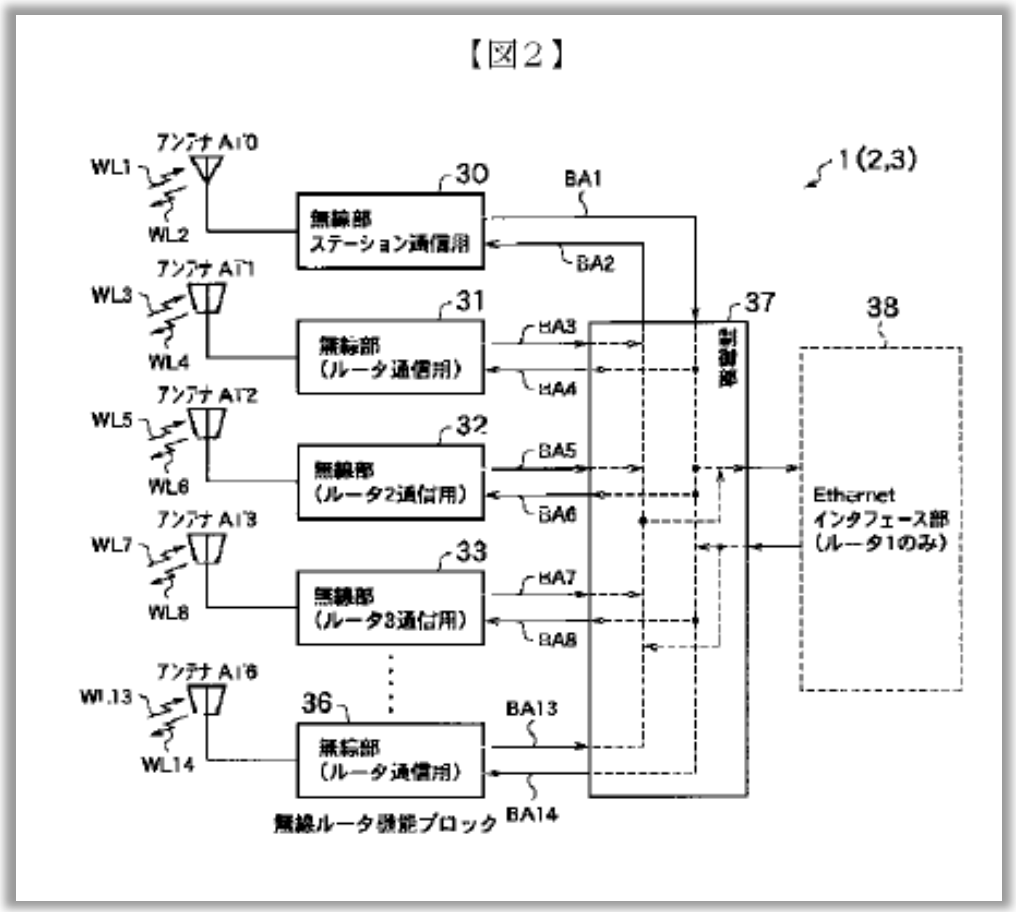
177. Ishizu is describing a software wireless communication device (e.g., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital encoding and decoding performed by the SDR's microprocessor.

g) 1[F] *Ishizu's "ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said wireless communication interface."*

178. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding/decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and software. Ex. 1010 at ¶ 16. In other words, the Software

Defined Radio receives an analog radio signal, converts the signal to digital form (e.g., a bit stream), and demodulates that bitstream in the microprocessor.

179. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

180. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operated SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu disclosed a base-band encoder software program configured to produce a first encoded bit stream by performing at least encoding, encryption, and multiplexing.

181. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end.

182. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded

message is passed through the DAC before it is communicated through the SDR's RF Front End. For Illustration, I again reference Tuttlebee's Figure 1.4.

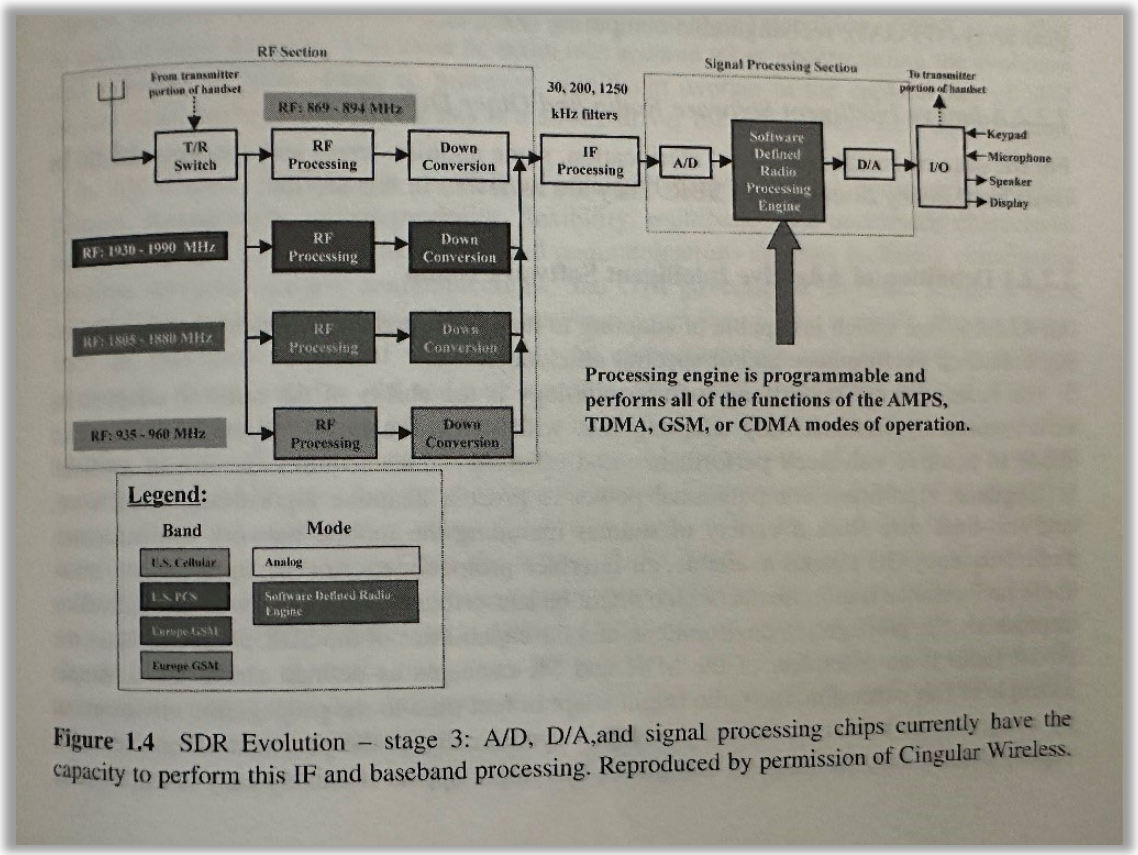


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

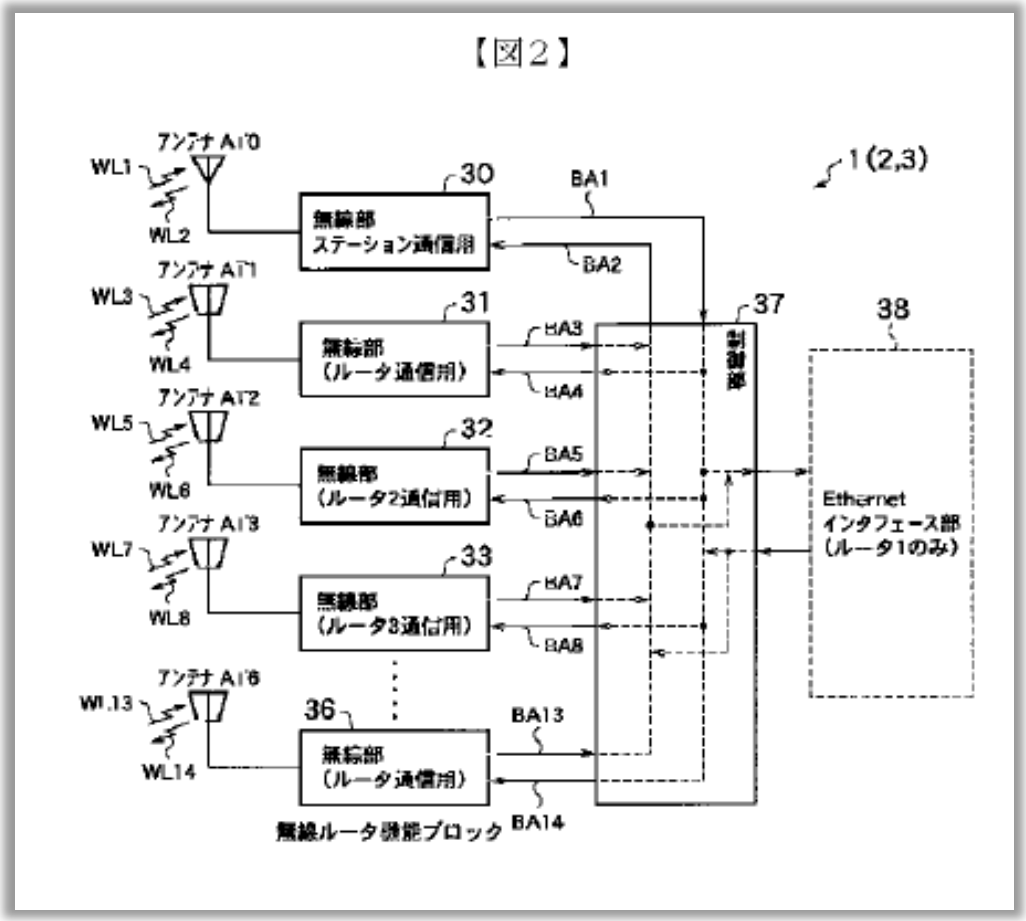
As Tuttlebee's Figure 1.4 shows, the Processing Engine (e.g., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

183. Ishizu is describing a software wireless communication device (e.g., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital encoding performed by the SDR's microprocessor.

h) 1[G] *Ishizu'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."*

184. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding/decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and software. Ex. 1010 at ¶ 16. In other words, the Software Defined Radio receives an analog radio signal, converts the signal to digital form (e.g., a bit stream), and demodulates that bitstream in the microprocessor.

185. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

186. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operated SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu disclosed a base-band encoder software program configured to produce a first encoded bit stream by performing at least encoding, encryption, and multiplexing.

187. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end

188. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded

message is passed through the DAC before it is communicated through the SDR's RF Front End. For Illustration, I again reference Tuttlebee's Figure 1.4.

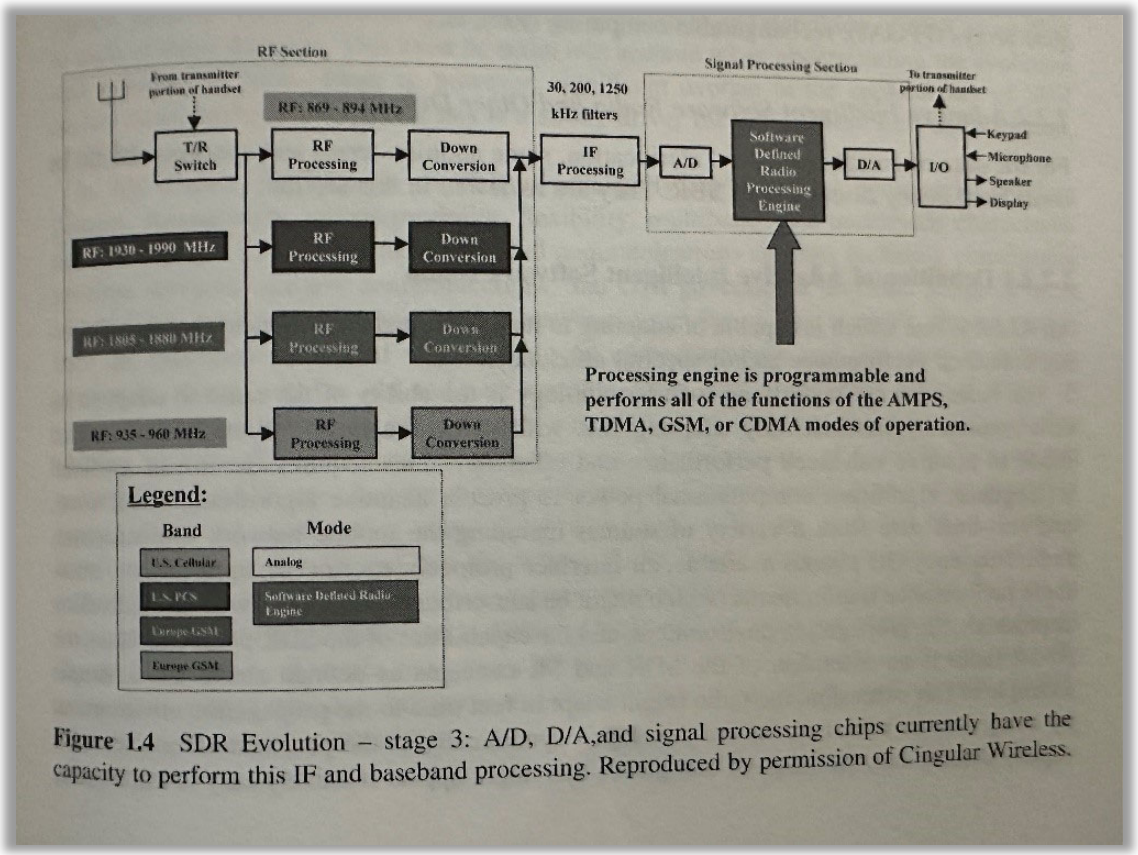


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

As Tuttlebee's Figure 1.4 shows, the Processing Engine (e.g., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

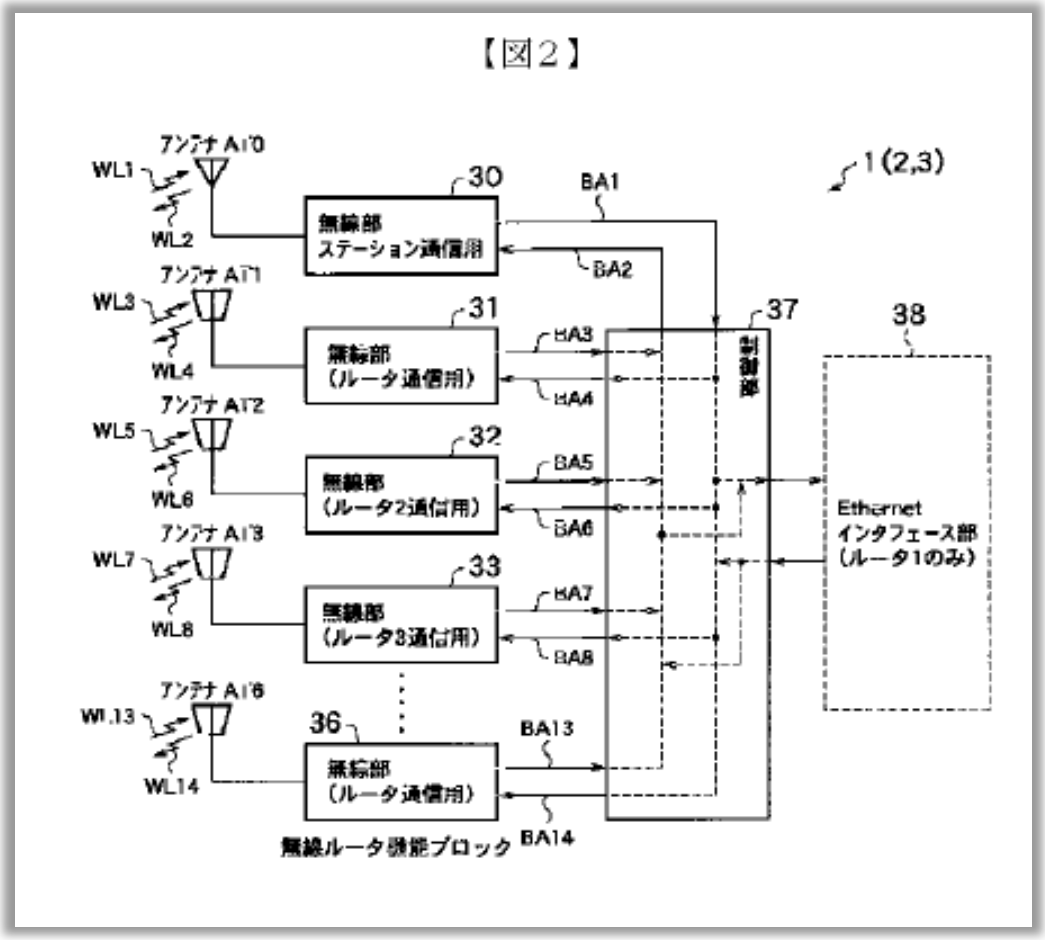
189. Ishizu is describing a software wireless communication device (i.e.., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital encoding and decoding performed by the SDR's microprocessor.

2. Claim 2

a) Ishizu's "apparatus 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, or source decoding."

190. Ishizu discloses an SDR that includes a microprocessor for performing encoding/decoding of the digital message (bit stream) by performing at least modulation and encoding/decoding. With reference to Japanese Application No. 2003-152732, Ishizu teaches a Software Defined Radio where the radio device "can handle a plurality of frequencies or wireless methods by switching software since a received radio wave is along [sic]-digital converted by an AD converter once, and demodulation or the like is performed by a digital signal processor or micro processor and ***software***. Ex. 1010 at ¶ 16. This software performs the baseband encoding/decoding in lieu of dedicated hardware.

191. Reviewing the incorporated Japanese Application No. 2003-152732 confirms the same. In connection with Figure 2, the Japanese Application explains that the wireless units 30 to 36 are connected to antennas, and when "wireless communication is performed from an antenna that has been connected modulation is executed and encoding, encryption, etc. are carried out as needed, and conversely if a wireless signal is received from the antenna demodulation is executed and decoding is carried out as needed." Ex. 1020 ¶ 37. The Japanese Application further teaches that the radio unit executes the processing in the layers below the MAC sublayer and that the control unit performs the basic functions as the routing processing. *Id.* ¶¶ 43-44.



Ex. 1021, Fig. 2; *see also* Ex. 1020 at p. 21 (translating the figure)

192. As Ishizu relies on the Japanese Application No. 2003-152732 to describe SDRs and describes communications, such as 3G, it is clear that Ishizu's communication terminal operated SDRs, such as those described by Japanese Application No. 2003-152732. Accordingly, Ishizu disclosed a base-band encoder software program configured to produce a first encoded bit stream by performing at least encoding, encryption, and multiplexing.

193. In addition to Ishizu and Japanese Application No. 2003-152732's explicit disclosure that the microprocessor performs modulation and encoding/decoding, it is also the case that Ishizu's SDR must have a baseband encoder/decoder software running on its microprocessor. For example, for Ishizu's SDR to perform modulation of an encoded digital message at the microprocessor, the message must first pass through a baseband encoder software. Similarly, for Ishizu's SDR to perform decoding, the received packet must first be demodulated creating a sequence of bits corresponding to the received packet. The baseband decoder software simply translates the received sequence of bits into one or more data elements consisting of 0s and 1s, which can be processed by the processor. *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"). The exact same is true in reverse. For Ishizu's SDR to communicate out, modulation would happen after the baseband encoder software encodes a packetized series of 0s and 1s, which can be digital-to-analog converted for communication via an RF front end

194. Again, this is how Software Defined Radios inherently operate. The software performs the encoding of the digital message such that the encoded

message is passed through the DAC before it is communicated through the SDR's RF Front End. For Illustration, I again reference Tuttlebee's Figure 1.4.

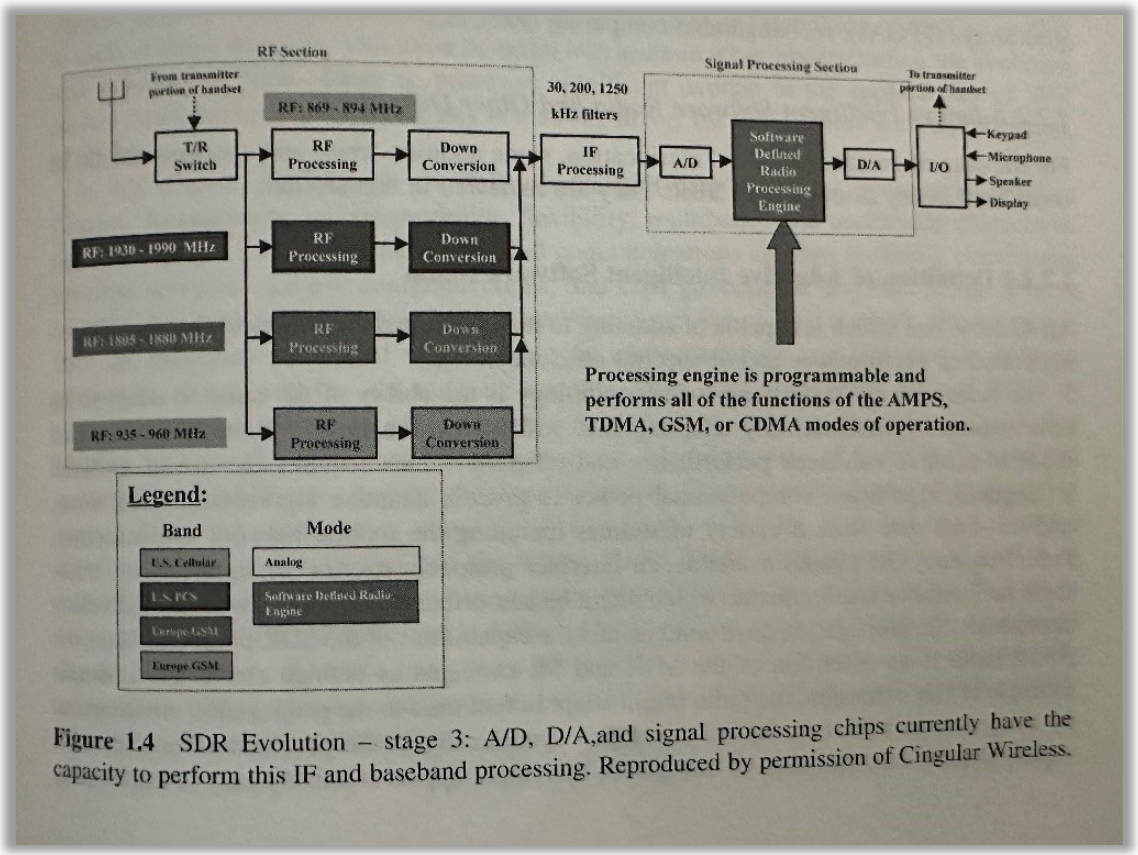


Figure 1.4 SDR Evolution – stage 3: A/D, D/A,and signal processing chips currently have the capacity to perform this IF and baseband processing. Reproduced by permission of Cingular Wireless.

Ex. 1012, Fig. 1.4

As Tuttlebee's Figure 1.4 shows, the Processing Engine (e.g., the Software Defined Radio Processing Engine/Microprocessor) performs the message encoding, TDMA, GSMA, or CDMA, the signal is then communicated through the DAC for transmission. The reverse is true for received signals.

195. Ishizu is describing a software wireless communication device (i.e.., a Software Defined Radio). Accordingly, when Ishizu teaches that the digital signal processing is done on a microprocessor including performing "demodulation and the like," Ishizu is referring to the digital encoding and decoding performed by the SDR's microprocessor.

3. Claim 3

a) Ishizu's "base-band encoder software program and ... base-band decoder software program are implemented as a single software program."

196. It is my opinion that Ishizu discloses claims 1 and 2, Ishizu teaches that the microprocessor performs digital signal processing including demodulation of a received analog-digital converted signal. Ex. 1010 at ¶¶ 16, 27 (incorporating by reference Japanese Patent Laid-Open No. 2003-152732). *See Supra* Section XI.A.2

197. A POSITA would recognize that software modules may either be standalone or implemented as part of a single software program. Indeed, whether and how to combine various software modules into a full program is a design choice based, primarily, on the software's required functionality. For example, if a software designer intends for software to be part of different packages, for example a premium and less-premium option, the software designer may initially keep some

software modules separate and bundle others into the premium edition. This is also common with software add-ons. For Ishizu, it is clear that whether or not to include all the software supporting each of the wireless radios (e.g., the baseband encoding and decoding software supporting the wireless communication using IEEE 802.11 b) would purely be a design choice based on what protocols the software designer expected the end product to include. For communication protocols that both send and receive communications, such as Ishizu's 802.11b, then the software designer would necessarily choose to include both the baseband encoder software and baseband decoder software for that protocol within the installed software program within Ishizu's software defined radio to enable the required functionality.

4. Claims 4-12, 14-20

198. As claims 4-12 and 14-20 of ground 3 are mapped exclusively to Ishizu, claims 4 to 20 are anticipated for the same reasons set forth for Ground 3 with claim 1 anticipated by Ishizu. *See supra* Section X.B.1-9, X.B.11-14.

5. Claim 13

199. Claim 13 is identical to claims 1 and 4 except that claim 13 does not require that the wireless communication interface includes either an ADC or DAC.

Accordingly, Claim 13 is anticipated by Ishizu for the same reasons set forth for claim 1 and 4.

XII. NO SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

200. 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.

201. 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 ’654 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.

202. 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 ’654 patent, as follows:

203. *No commercial success of the claimed invention*. The Patent Owner has not cited any evidence of particular commercial success of products embodying the ’654 patent as opposed to products that do not embody the ’654 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 ’654 patent’s claims and not due to any other facts.

204. *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 ’654 patent. To the contrary, as discussed above, the prior art solved the problems that the ’654 patent purports to address.

205. *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 ’654 patent. As shown by my analysis above, there existed prior art references that successfully disclosed and rendered obvious the subject matter claimed by the ’654 patent.

206. *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 ’654 patent and its claimed invention.

207. *No unexpected results of the claimed invention*. The Patent Owner has not cited any evidence of unexpected results achieved by the ’654 patent’s claimed

invention. To the contrary, the prior art disclosed the predictable, expected results that show why the '654 patent's claims are obvious as discussed in my Declaration.

208. *No praise for the claimed invention*. The Patent Owner has not cited any evidence of praise for the claimed invention recited in the '654 patent.

209. *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 '654 patent.

210. *No departure from the wisdom of the prior art*. The Patent Owner has not cited any evidence that the claimed inventions of the '654 patent departed from the wisdom of the prior art. The '654 patent claims subject matter that was already present in the prior art, including in the references discussed in my Declaration.

211. 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 '654 patent is directed to techniques known in the prior art and does not provide any inventive technology.

212. 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.

XII. CONCLUSION

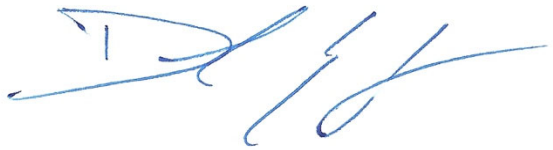
213. For at least the preceding reasons, in my opinion, claims 1–20 of the '654 patent would have been obvious to a person of ordinary skill in the art based on the prior art references that I have cited and analyzed above.

214. 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 '654 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 12, 2024

Respectfully submitted,



Daniel W. Engels, Ph.D.

APPENDIX OF THE CLAIMS