

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WAVELYNX TECHNOLOGIES CORP.
Petitioner,

v.

ASSA ABLOY IDENTIFICATION TECHNOLOGY GROUP AB
Patent Owner.

Case No. IPR2023-00730
Patent No. 7,439,862

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.1 *et seq.***

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APPENDIX LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 7,439,862
1002	File History of U.S. Patent Application No. 10/848,246
1003	File History of U.S. Patent Application No. 11/016,576
1004	Declaration of Emmanouil (Manos) Tentzeris, Ph.D
1005	Curriculum Vita of Emmanouil (Manos) Tentzeris
1006	U.S. Patent Publication No. 2005/0204167 (“Conlin”)
1007	U.S. Provisional Application No. 60/553,677
1008	RFID Handbook
1009	HID MIFARE Data Sheet
1010	Smart Card Alliance Report
1011	Davis Presentation
1012	Internal Images contained in FCCID JQ60006A of Thinline II Reader
1013	Internal Images contained in FCCID JQ66055BA of MIFARE Reader
1014	TIS4100 Multi-Function Reader Module
1015	Internal Images contained in FCCID JQ66070BA of pcProx, 6070B Reader
1016	Internal Images contained in FCCID JQ6609XA of iCLASS Reader
1017	Dynansys Dual Band Evaluation Kit Datasheet
1018	Stewart Declaration
1019	U.S. Patent Publication No. 2005/0258940
1020	U2270B Data Sheet
1021	U.S. Patent No. 6,904,796
1022	HID Global Corp., et al. v. WaveLynx Technologies Corp., 22-00362-GBW-JLH (D. Del.), D.I. 23, “REDACTED D22 Ans to WaveLynx Counterclaims”

1023	U.S. Patent No. 4,600,829
1024	U.S. Patent No. 2,779,908
1025	Optimizing read range in RFID Systems
1026	U.S. Patent No. 6,643,713
1027	Internal Images contained in FCCID R2LXF1100 of XceedID XF1100 Reader
1028	FCC Landing Page for FCCID R2LXF1100, available at: https://apps.fcc.gov/oetcf/eas/reports/ViewExhibitReport.cfm?mode=Exhibits&RequestTimeout=500&calledFromFrame=N&application_id=5tAyx1kY2Ndh3W29WUJNQQ%3D%3D&fcc_id=R2LXF1100
1029	Great Britain Patent No. 2,305,074
1030	<i>HID Global Corp., et al. v. WaveLynx Technologies Corp.</i> , 22-00362-GBW-JLH (D. Del.), D.I. 23, Exhibit 1 “862 Infringement Chart”
1031	<i>HID Global Corp., et al. v. WaveLynx Technologies Corp.</i> , 22-00362-GBW-JLH (D. Del.), D.I. 14, “WaveLynx’s Answer and Counterclaims”
1032	U.S. Patent No. RE44,691
1033	Thinline II Reader Data Sheet
1034	What’s INSIDE your CARD? Credential Reference Guide
1035	MultiProx Multi-Technology Proximity Reader Data Sheet
1036	Declaration of Nathaniel E Frank-White
1037	December 2022 District Court Statistics

I. INTRODUCTION

WaveLynx Technologies Corp. (“Petitioner”) requests *inter partes* review (“IPR”) of claims 1-7, 9-11, 13-20, 22-24, and 26 (the “Challenged Claims”) of U.S. Patent No. 7,439,862 (“the ’862 Patent”) (EX1001).

II. MANDATORY NOTICES

A. Real Party-In-Interest – §42.8(b)(1)

Petitioner is the real party-in-interest.

B. Related Matters – §42.8(b)(2)

The ’862 patent is asserted in *HID Global Corp., et al. v. WaveLynx Technologies Corp.*, 22-00362-GBW-JLH (D. Del.) (the “District Court Litigation”). Petitioner is unaware of any other matter that would affect, or be affected by, a decision in this proceeding.

C. Counsel and Service Information – §42.8(b)(3) and (b)(4)

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Powers of attorney are submitted herewith. Counsel for Petitioners consent to all documents being served via electronic mail.

III. CERTIFICATION OF STANDING

Petitioner affirm that it is not barred or estopped from requesting this IPR. 37 C.F.R. §42.104(a).

IV. THE '862 PATENT

A. Overview

The '862 patent “relates generally to RFID systems” and purports to be directed to an “RFID reader” with an antenna array that includes a first reader antenna tuned to operate at a first frequency and a second reader antenna tuned to operate at a second frequency. EX1001, Abstract, 1:12-16.

The '862 patent recognizes that RFID systems, including RFID readers and transponders communicating information at low frequencies such as 125 kHz and at high frequencies such as 13.56 MHz, were known in the art. EX1001, at 2:1-21. For example, the '862 Patent explains that there were at least “two standard carrier frequencies which have been generally accepted for use in RFID systems”: (1) “proximity cards or proximity tags” that typically communicate at a carrier frequency “within a range of 100 to 150 kHz,” which is “deemed low frequency”; and (2) “smart cards” that typically communicate “at a carrier frequency of 13.56 MHz, which is deemed high frequency.” *Id.*, at 2:7-18.

The '862 patent further recognizes that “[a]t present, use of RFID transponders operating at the low carrier frequency and RFID transponders operating

at the high carrier frequency have proliferated throughout the world.” 1001, at 2:22-25. Thus, the ’862 patent purports to “recognize[] a need for an RFID system having one or more RFID readers, each of which is capable of communicating with a plurality of RFID transponders, one or more of which are operating at a different carrier frequency.” *Id.*, at 2:31-35.

The ’862 patent further describes conventional components enabling data communication between the RFID reader, including low frequency antenna 34 and high frequency antenna 38, and associated control circuitry. *Id.*, at 1:57-59, 5:54-64; 6:21-31; 9:16-49.

B. Challenged Claims

The Challenged Claims are reproduced in the Claim Listing. *Infra* §XI. The independent claims are directed to RFID Readers containing first and second antennas that are tuned to operate at first and second carrier frequencies, which “enabl[es] data communication” with first and second “transponder[s] transmitting data signals” at the first and second carrier frequencies. Each independent claim also requires a specific configuration or orientation of the antennas. The dependent claims add trivial components such as a “reader housing” or conventional RFID

reader electronics, such as a signal generator or receiver electronics. EX1001, at 6:21-22.

C. Prosecution History

The '862 patent issued on October 21, 2008 from Application No. 11/016,576 filed on December 16, 2004, which is a continuation-in-part of Application No. 10/848,246 (“the '246 application”) filed on May 18, 2004. The December 16, 2004 continuation-in-part application added substantial new matter related to claimed antenna arrangements, including text and figures not contained in the original application, such as figures 2-6. *Compare* EX1001, *with* EX1026. Indeed, Patent Owner admitted in the District Court Litigation that the December-filed application “contains text and figures that are not contained in the original '246 application.” EX1031, at 63.

Pertinent here, Applicant argued during prosecution that “prior art passive transponders and readers are limited to operation at only one or the other of these two frequencies [namely, 125 kHz and 13.5 MHz] due to technical, operational and physical size constraints.” EX1003, at 214. At no point during prosecution, however, did the examiner consider or applicant disclose the physical orientation of antennas within any reader. Applicant further did not disclose—and the examiner did not consider—the existence of, let alone details about any dual- or multi-frequency RFID readers. Instead, applicant argued for “the desirability of a reader which is

capable reading two different transponders, one of which operates at a different carrier frequency than the other.” *Id.* at 214. Applicant further argued—successfully—that the prior art of record provided no motivation to use two differently tuned antennas. *Id.* at 215.

D. Priority

As noted, the ’862 patent issued from an application filed on December 16, 2004, which is a continuation-in-part of an earlier application filed on May 18, 2004. The references used in the grounds herein are prior art under the date. However, because none of the claims of the ’862 patent are fully supported by the May 18, 2004 application, the claims should be afforded a priority date of no earlier than December 16, 2004, which is the application that introduced disclosure related to the claimed antenna arrangements.

In the District Court Litigation, Patent Owner has claimed priority to February 12, 2004 for “at least claims 1–4, 14, and 16,” but Patent Owner has not provided any support for this claim. EX1022, at 13. Moreover, Grounds 3 and 4 herein rely on prior art that pre-dates Patent Owner’s purported date of invention.

E. Level of Ordinary Skill in the Art

A person having ordinary skill in the art (“POSITA”) at the time of the alleged invention would have had at least an undergraduate degree in electrical engineering, or equivalent education, and at least two years of work experience in the field of

access control. EX1004, ¶31. More education can supplement practical experience and vice versa.

The Petitioner is supported by the expert declaration of Emmanouil Tentzeris, PhD, whose experience and qualifications exceed those of a POSITA. EX1004, §II.

V. CLAIM INTERPRETATION

Claim are construed according to their ordinary meaning in light of the specification and prosecution history. 37 C.F.R. §42.100(b). For this proceeding, Petitioner proposes that “nominally 125 kHz” means “a carrier frequency within a range of 100 to 150 kHz,” as defined in the ’862 patent. EX1001, 2:8-14. Petitioner proposes that all other terms of the claims be construed in accordance with their plain and ordinary meaning.

VI. UNPATENTABILITY GROUNDS

Petitioners request cancellation of the following claims:

Ground	Reference(s)	Claim(s)	Basis
1	U.S. Patent Publication No 2005/0204167 (“Conlin”)	1-6, 14, 16-17, and 19-20	103
2	Conlin in view of U.S. Patent No. 4,600,829 (“Walton”)	7, 9-11, 13, 22-24, and 26	103
3	RFID Handbook in view of Davis Presentation	1-6 and 14-20	103
4	RFID Handbook in view of Davis Presentation in further view of Walton	7, 9-11, 13, 22-24, and 26	103

The above-identified references are prior art (at least) under pre-AIA §102.

Conlin published on September 15, 2005, and claims priority to U.S. patent application No. 60/553,677 (the '677 application), filed on March 15, 2004. As explained below, Conlin is prior art under at least pre-AIA § 102(e).

Walton issued on July 15, 1986, from an application filed on April 2, 1984. EX1023. Walton is prior art under at least pre-AIA § 102(b).

The **RFID Handbook** (EX1008) is a printed publication. The second edition of the RFID Handbook that is relied upon herein was copyrighted in 2003 in English by the publisher John Wiley & Sons Ltd. EX1008, at 2. The second edition bears an ISBN of 0-470-84402-7. *Id.* The second edition of the English version was on sale by at least August 26, 2003, when the Internet Archive had catalogued the second edition of the RFID Handbook, bearing the same ISBN, as available for purchase through amazon.com. EX1036, at 1, 14-17. The original German translation of the second edition was first published under the title “RFID-Handbuch” in 1999. *Id.* These facts support a finding of public accessibility of this reference. The RFID Handbook is thus prior art under at least pre-AIA § 102(a).

The **Davis Presentation** is a published slide deck from a presentation entitled “Migration Strategies (With an Emphasis On Moving from 125 kHz Prox to 13.56 MHz Contactless Smart Card Technology).” EX1011, at 1. The Davis Presentation indicates that it was presented at a “Workshop on Storage & Processor Card-Based Technologies” on July 8, 2003, which was hosted by the National Institute of

Standards and Technology. *Id.*; EX1036 at 1, 11. The Davis Presentation was posted for download on the workshop webpage as early as October 17, 2003, EX1036, at 1, 10-11, and the Davis Presentation itself has been cataloged on the Internet Archive as being available for download as early as February 6, 2004, *id.* at 1, 30-58. These facts support a finding of public accessibility of this reference. The Davis Presentation is prior art under at least pre-AIA § 102(a).

VII. BACKGROUND AND STATE OF THE ART

A. Radio Frequency Identification Readers

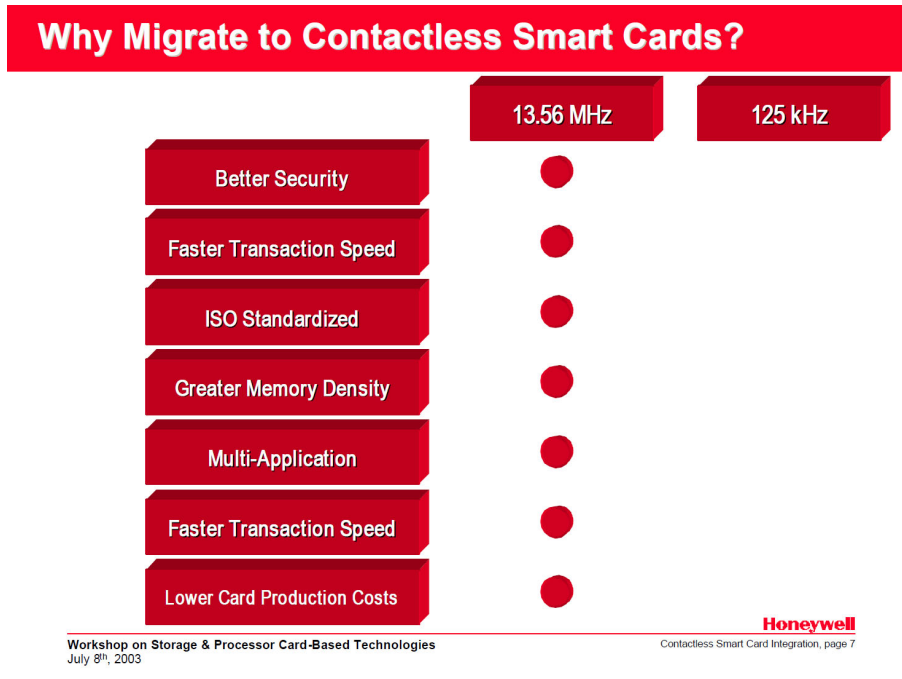
RFID systems (transponders and readers) that communicate in the frequency range of 100 to 150 kHz, and in particular 125 kHz (sometimes referred to as “low-frequency readers”), have long been used in the field of access control, and were the predominant type of RFID reader before 2004. EX1004, ¶35; *see also* EX1010 at 25; EX1011 at 4, 11; EX1008, at 54-55. Transponders communicating at 125 kHz were often referred to as “proximity”—or “prox”—cards. EX1004, ¶35; *see also* EX1011 at 4; EX1001 at 2:6-14.) These cards and associated systems, although widely used, were known to have several disadvantages, including lack of a standardized transmission protocol, relatively low data storage capacity, and security vulnerabilities. EX1004, ¶35; *see also* EX1011 at 4; EX1010 at 25.

By the mid-1990’s, RFID transponders that communicated at “high-frequency,” and in particular 13.56 MHz, began to be implemented. EX1004, ¶36.

Such transponders were often referred to as “smart” cards, and had several known advantages over low-frequency “prox” cards, including standardized transmission protocols (such as ISO14443A/B), greater data storage capacity, and greater security capabilities. EX1004, ¶36; EX1011 at 4-5, 7-11; EX1010 at 25; EX1008, at 63-78. A summary of these advantages can be seen in the following presentation published in July 2003:

What is Contactless Smart Card Technology?

- **Contactless Smart Cards**
 - Requires no physical contact between a card and reader
 - Operates at 13.56 MHz
 - Typical operating distance from 2” to 6”
 - Maximum operating distance of 39”
 - Packaged in cards, key fobs, stickers, labels, and more
 - Data content from 256 bits to 4k bytes and more
 - Memory can be segmented for *multi-application* use
 - Very high security
 - Supports true read/write on the fly
 - ISO Standardized (ISO 14443A/B & 15693)



(EX1011 at 5, 7.)

Thus, before the priority date of the '862 patent, both low-frequency RFID readers, including those transmitting at 125 kHz and compatible with prox cards, and high-frequency RFID readers, including those transmitting at 13.56 MHz and compatible with smart cards, were well known and used in the art. EX1004, ¶37; , EX1011, at 4-5, 11; EX1010, at 21-22, 25; EX1008, at 8-9, 49-55, 63-78, 79-88, 97-101, 104-135, 137-142; EX1033, at 2; EX1009, at 2; EX1001, at 2:1-21; EX1014; EX1006, ¶¶[0026], [0046]; EX1007, at 5-7, 14-20, 31, 33, 41-42, 50-52, 56; EX1023, at 3:39-43; EX1022, at 91-96; EX1012; EX1013; EX1015; EX1016; EX1025, at 1-7; EX1011; EX1036, at 1-3, 6-7; EX1034.)

B. Multi-Frequency RFID Readers

Given the widespread existing use of low-frequency prox cards and the known advantages of high-frequency smart cards, it was well known by 2003 that it would be advantageous to use a RFID reader that could communicate at both frequencies, and thus could be used with both types of cards. EX1004, ¶48. This would allow, for example, a company to keep using its existing legacy low-frequency prox cards while “migrating” to high-frequency smart cards and their associated benefits, thus avoiding the potentially substantial costs of immediately replacing all legacy prox cards. EX1004, ¶38; EX1011, at 1, 8-11; EX1010, at 34; EX1007 at 5, 14 (Fig. 10); EX1006, ¶[0026]; EX1007, at 5,7.)

Indeed, such multi-frequency readers were known, available for purchase, and in public use before the any priority date to which the '862 patent may be entitled. EX1004, ¶39; EX1010 at 34; EX1006 at ¶¶[0026], [0037]; EX1007 at 5, 7-8; EX1036, at 1-3, 6-7; EX1011, at 21-22; EX1032; EX1027; EX 1028; EX1022, at 87-90.)

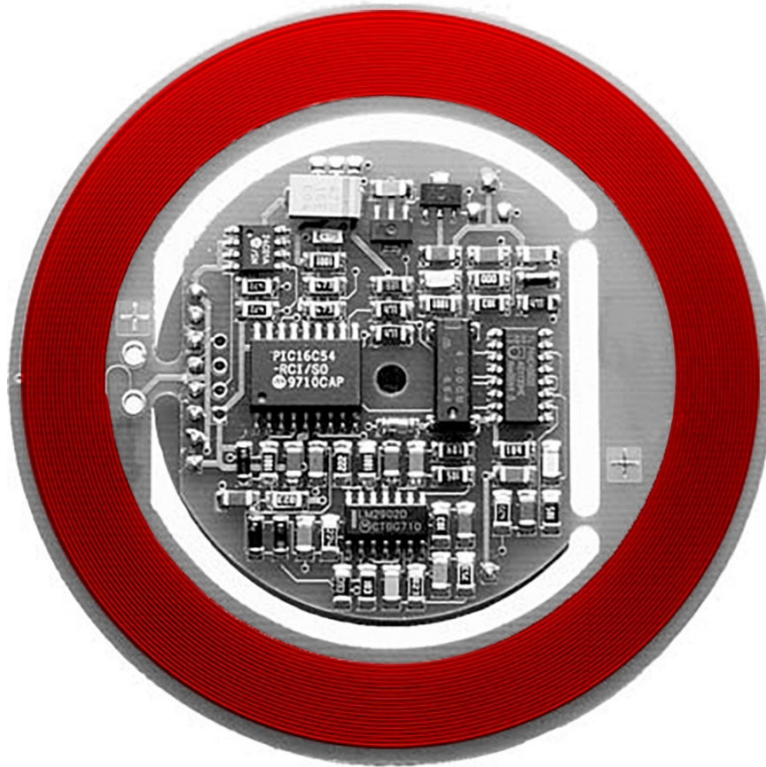
Accordingly, was known in the prior art that it would be advantageous to incorporate both high-frequency and low-frequency communication capabilities into a single RFID reader. EX1004, ¶40. It was further known that such a reader could be readily assembled using conventional RFID components such as antennas and

associated circuitry, which were all rudimentary and well known in the prior art. EX1004, ¶40.

C. Design Considerations for Multi-Frequency Readers

It was well known that an RFID reader would necessarily include conventional components such as an antenna for transmitting and receiving signals. For example, loop antennas were a well-known common design choice for both low-frequency and high-frequency RFID readers. EX1004, ¶41. Such antennas consist of many windings of a tightly wound coil, and would be placed on, or embedded within, the reader's circuit board. EX1004, ¶41; *see also* Ex1007, at 35-36, 42-44; EX1008 at 8-9, 92, 99, 140; EX1012; EX1013, at 1-3; EX1015, at 1, 3; EX1016; EX1027, at 2-4.

It was further known that while antennas for low-frequency readers typically comprised a high number of windings, antennas for high-frequency readers typically comprised a low number of windings due to their higher frequency. EX1004, ¶42; EX1008, at 8-9, 92; EX1012; EX1013, at 1-3; EX1015, at 1, 3; EX1016; EX1027, at 3.) For example, below is the circuit board for the low-frequency “easy-key” reader, which utilized an antenna (in red) with a high number of windings on the perimeter, as well as a circuit board for the high-frequency “MIFARE” reader, which utilized an antenna (in blue) with a lower number of windings integrated within the circuit board:



EX1004, ¶42; EX1008, at 9 (annotated), 92 (annotated), 137-142.

It was also well known that when using two antennas in a single RFID reader, it would be advantageous to arrange the two antennas in relatively close proximity to each other so as to minimize the total bulkiness of the reader. EX1004, ¶43; EX1023, at Figs. 2A, 2B; EX1025, at 6; EX1027. However, it was also known that antennas may be positioned such that magnetic interactions between them are minimized so as not to disrupt or degrade the transmission and reception of wireless signals. EX1004, ¶43; EX1008, at 14-35; EX1023, 5:21-43; EX1024, at 1:31-40, 2:48-3:2.

As explained further below, it was well known that both aims would be accomplished by positioning the antennas along axes that are parallel to each other (to minimize the size of the reader and maintain a single interrogation zone), yet are only partially overlapping (to minimize magnetic interactions). EX1004, ¶44. Indeed, the locations of increased and decreased magnetic field strengths surrounding a coil antenna was well known in the prior art prior to the filing of the '862 patent, including the magnetic field interactions between two antennas arranged in a parallel configuration. (*See, e.g.*, EX1008, at 14-35; EX1023, 5:21-43; EX1024, 1:31-40, 2:48-3:2.)

It was also very well known how magnetic fields operate and the effects they can have on an RFID. EX1004; ¶§43-47. For example, a POSITA would have known that a magnetic field is generated by a current moving through a wire, and that the

magnetic field would radiate around the wire in a clockwise direction around the coil in relation to the direction of the current, as shown in Fig. 4.3 of the RFID Handbook. EX1004, ¶¶45-46; EX1008, at 16. This behavior of magnetic flux can be simply modeled through the “right-hand-thumb rule.” See EX1004, ¶46; EX1023, at 5:15-20.

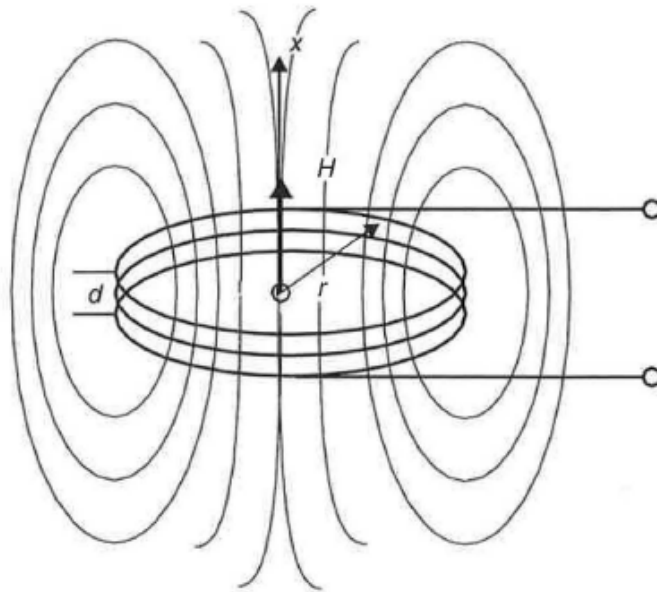


Figure 4.3 The path of the lines of magnetic flux around a short cylindrical coil, or conductor loop, similar to those employed in the transmitter antennas of inductively coupled RFID systems

EX1008, at 16.

The methods to implement multi-frequency readers having low-frequency and high-frequency antennas were also well understood. EX1004, ¶47-50. For example, it was well known that it would be advantageous to provide a low-frequency loop antenna along the perimeter of a circuit board or the perimeter of a cover to the reader housing, while integrating a high frequency antenna within the board itself. EX1004,

¶42, 47-49. Another known method was to implement a reader with two separate circuit boards—one disposed within the base of the reader housing and comprising a one antenna and associated circuitry, and one disposed within the cover of a reader housing and comprising the other antenna and associated circuitry—which was known to provide several advantages, including allowing for simple manufacturing and separation of circuit boards for easy positioning and replacement. EX1004, ¶50; EX1006, ¶¶[0009], [0026], [0045]-[0046]; EX1007, at 2-3, 5-9, 14, 33, 41-44, 50.

VIII. GROUNDS FOR UNPATENTABILITY

A. Ground 1: Conlin Renders Obvious Claims 1-6, 14, 16-17, and 19-20 of the '862 Patent

1. Conlin

Conlin “is related to systems and methods for providing security, and in particular to systems and methods for controlled access using distributed access control system.” EX1006, at ¶¶[0002], [0005]. “Such methods include providing an access control module that is capable of operating at at least two carrier frequencies.” *Id.* ¶[0006].

Figure 6 shows “a modular access control device 600 in accordance with one or more embodiments of the present invention,” including “a base portion 610 and an update portion.” *Id.* ¶[0045]. The control device 600 “facilitates a simple method for updating the functionality by replacing an existing update module with another update module,” (*id.* ¶[0046]), which enables “transitioning systems from one

generation of control to another,” such as between systems that operate at 125 kHz and 13.56 MHz, (see *id.* ¶[0026]).

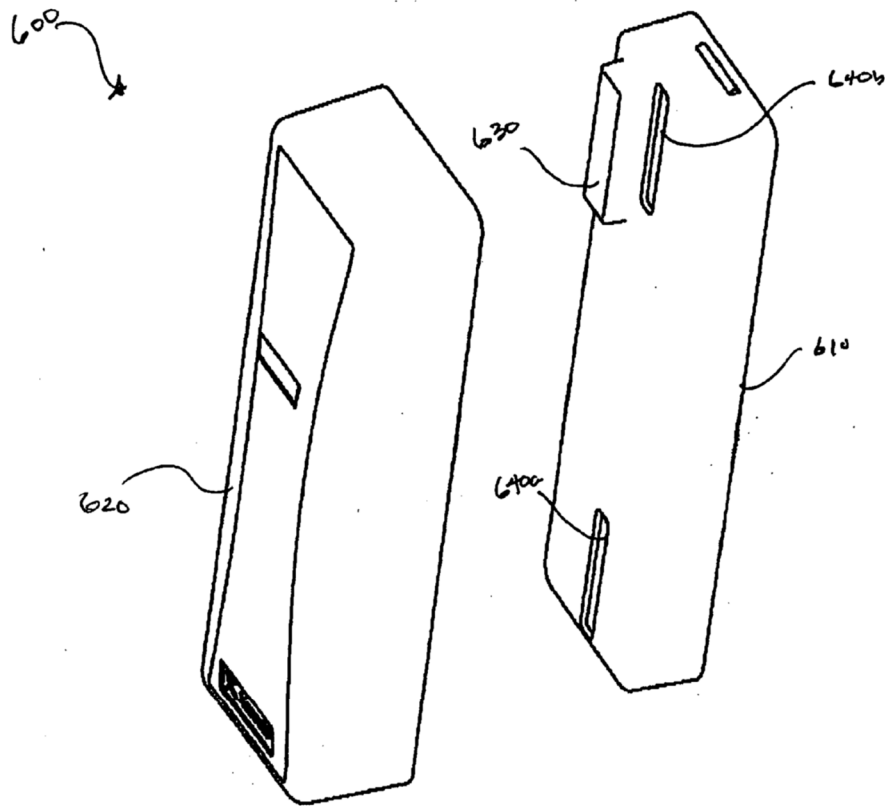


FIG. 6

Conlin is in the same field as the '862 patent because Conlin relates to RFID systems for access control. EX1004, ¶71. Conlin is pertinent to the problems the '862 patent purportedly addresses because Conlin is directed to an RFID reader capable of communicating at both high and low frequencies, and the arrangement of

antennas and circuitry within such a reader. *Id.* Conlin therefore is analogous art to the '862 patent.

2. The '677 Provisional Application

Conlin incorporates the '677 application by reference for all purposes. (EX1006, ¶[0001].)

The '677 application “relates generally to access control readers and more specifically to modular contactless smart card access control readers.” EX1007, at 2. The disclosed “system includes functionality at both 125 KHz and 13.56 MHz.” EX1007, at 7. In particular, the '677 application discloses “a modular contactless smart card access control reader, which comprises A base assembly, a cover assembly and a communication adaptor.” EX1007, at 6. In one embodiment, “the base reader board contains the antenna for one frequency,” and “the snap-on cover contains the antenna for the other frequency”:

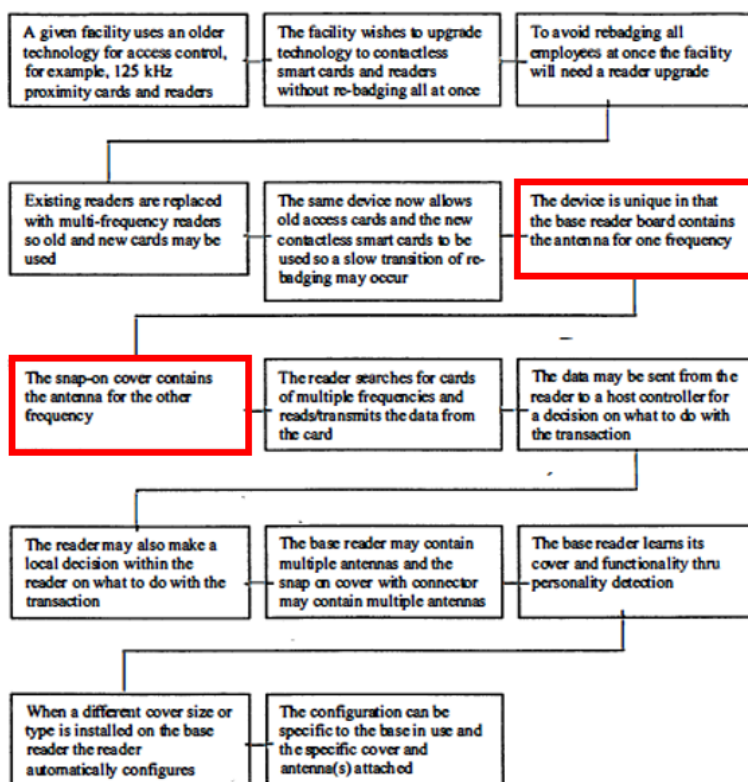
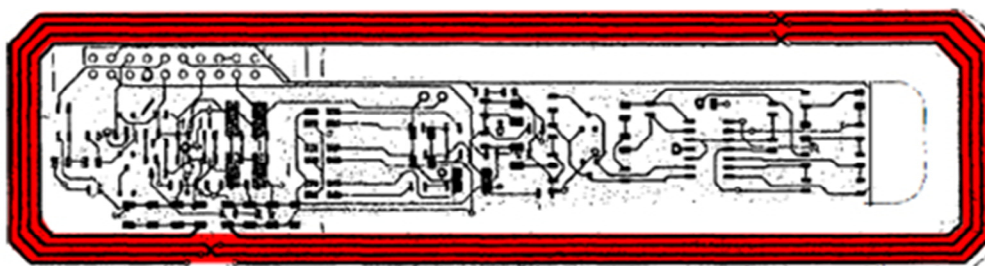


FIG. 10 illustrates yet another method in accordance with some embodiments of the present invention.

EX1007, at 14 (annotated.); *see also* 42. At least one antenna of the system described in the '677 application is printed on the circuit board:



Id. at 36 (annotated).

3. *Dynamic Drinkware*

Because Conlin incorporates the entirety of the '677 application by reference (EX1006, ¶[0001]), the disclosure of the '677 application is a part of Conlin and any citation to the '677 application in this Petition is a citation to Conlin itself. In order for a patent publication to be considered prior art as of the filing date of the provisional application to which it claims priority, the provisional application must provide support for at least one claim in the patent publication in compliance with Section 112, para. 1¹. Here, the '677 application supports at least one of the claims in Conlin, *e.g.*, claim 12, as shown below. Further, Conlin carries forward the disclosure of the '677 application, as shown in the grounds below.

Therefore, Conlin is entitled the '677 application's filing date of March 15, 2004. *Cisco v. Capella*, IPR2014-01276, Paper 40, at 21-22 (P.T.A.B. 2016) (citing *Dynamic Drinkware v. National Graphics*, 800 F.3d 1375 (Fed. Cir. 2015)).

Dynamic Drinkware analysis of claim 12 of Conlin is shown below. *See also* EX1004, ¶¶75-80. Claim 12 requires:

¹ The Supreme Court has not ruled on whether *Dynamic Drinkware* or *Giacomini* are good law, including whether they would apply to patent publications. Petitioner reserves the right to argue that such requirements do not apply in this case should those decisions be overruled or abrogated."

[12pre] An access control device, the access control device comprising:

[12A] an access control module, wherein the access control module includes a base portion and an update portion, [12B] wherein the update portion is electrically coupled to the base portion via a detachable electrical connector, and [12C] wherein operation of the access control module is based at least in part on an interaction between the base portion and the update portion.

a. [12pre] “An access control device, the access control device comprising:”

The '677 application supports [12pre] with its disclosures of an access control device. *See, e.g.*, EX1007, at 2 (“The present invention relates generally to access control readers”); *see also* EX1004, ¶77.

b. [12A] “an access control module, wherein the access control module includes a base portion and an update portion”

c. [12B] “wherein the update portion is electrically coupled to the base portion via a detachable electrical connector, and”

The '677 application discloses an access control module, including a base portion (*e.g.*, base assembly) and an update portion (*e.g.*, cover assembly) that are electrically coupled together by a detachable electrical connector (*e.g.*, male and female PCB interconnect headers). *See, e.g.* EX1007, at 4 (“The access control can be designed such that the first electronic circuit board and the second electronic

circuit board are attached together by a connector. The first electronic circuit board provides baseline functionality, and the second electronic circuit board provides modular functionality. Thus, when a system is to be upgraded, the second electronic circuit board can be removed from the first electronic circuit board, and replaced by a different electronic circuit board. This provides an ability to upgrade a system without requiring a rewiring and/or total replacement of the system.”); *id.* at 7 (describing the interconnection of components and sub-components by stating that “the back of the cover assembly is potted with a rectangular shaped cavity recessed into the potting. In this cavity, there is a mating female PCB interconnect header. The cover assembly is snapped onto the base assembly and during this process, the female connector in the cover assembly engages the male connector in the base assembly. This connector mating provides the interconnect of all of the circuits that are distributed between the base and cover assemblies.”); *see also* EX1004, ¶¶78-79.

d. [12C] “wherein operation of the access control module is based at least in part on an interaction between the base portion and the update portion.”

The '677 application discloses that the base portion (*e.g.*, base assembly) interfaces with the update portion (*e.g.*, cover assembly) through a “communications adaptor” containing an infrared interface and “circuitry necessary to program a microcontroller in the base assembly.” EX1007, at 6 (disclosing functionality of the

base assembly PCB and cover assembly and “a personality detection circuit that allows the [microcontroller] in the base assembly to determine the exact configuration of the cover assembly plugged into it”); *id.* at 7 (disclosing that the operations enabled by the interconnection of base portion and update portion “include but are not limited to configuration or reader behavior, loading keys to the reader, addressing the reader for an RS-485 bus, downloading data from the reader and flashing the reader with new firmware”); *id.* at 8-9 (“The base assembly consists of a pcb potted into a piece of plastic which contains the following functionality: (1) the contactless smart card communications engine and security functions, (2) all reader to host controller interface circuitry and (3) the reader [microcontroller] and all associated functionality. The cover assembly consists of a pcb ported into a piece of plastic which contains the following functionality: (1) One or more antennas and associated tuning circuits, (2) additional analog front end circuitry, (3) leds and (4) a part of the personality detection scheme novel in this invention. The communications adaptor consists of a small pcb poted in a piece of plastic that contains the following functionality: (1) An infrared interface, (2) several momentary switches and (3) the circuitry necessary to program a microcontroller in the base assembly.”); *see also* EX1004, ¶80.

4. Claim 1

- a. 1[pre]: “An antenna array for an RFID reader comprising:”**

To the extent the preamble is limiting, Conlin teaches it. EX1004, ¶81. For example, Conlin discloses “a control reader” that “operates at two distinct carrier frequencies, 125 KHZ and 13.56 MHz.” EX1006, ¶[0026]; EX1007, 1, 7, 33. The arrangement of multiple antennas disclosed by the ’677 application comprises an antenna array. *See* claim 1[C], *infra*, EX1004, ¶¶81, 109-113.

- b. 1[A]: “a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency”**
- c. 1[B]: “and a second reader antenna tuned to operate at a second high carrier frequency different from said first low carrier frequency enabling data communication with a second transponder transmitting data signals at said second high carrier frequency”**

Conlin discloses these limitations. EX1004, ¶82-108. For example, Conlin describes “an access control module that is capable of operating at least a first carrier frequency and a second carrier frequency,” and a method including “providing a first access credential that operates at the first carrier frequency, and providing a second access credential that operates at the second carrier frequency.” EX1006, at Abstract; EX1007, at 5.

Conlin teaches that one way of implementing a multi-frequency system is to provide an “access control module [that] includes a base portion and an update portion. The update portions is tailored for operation with a particular credential, and the methods further comprise replacing the update portion with another update portion that is tailored for operation with a replacement credential.” EX1006, ¶[0009]; *see also id.* ¶[0045]; EX1007, 2-3, 5-10, 14, 33, 41. The base portion 610 and update portion 620 are shown in Figure 6:

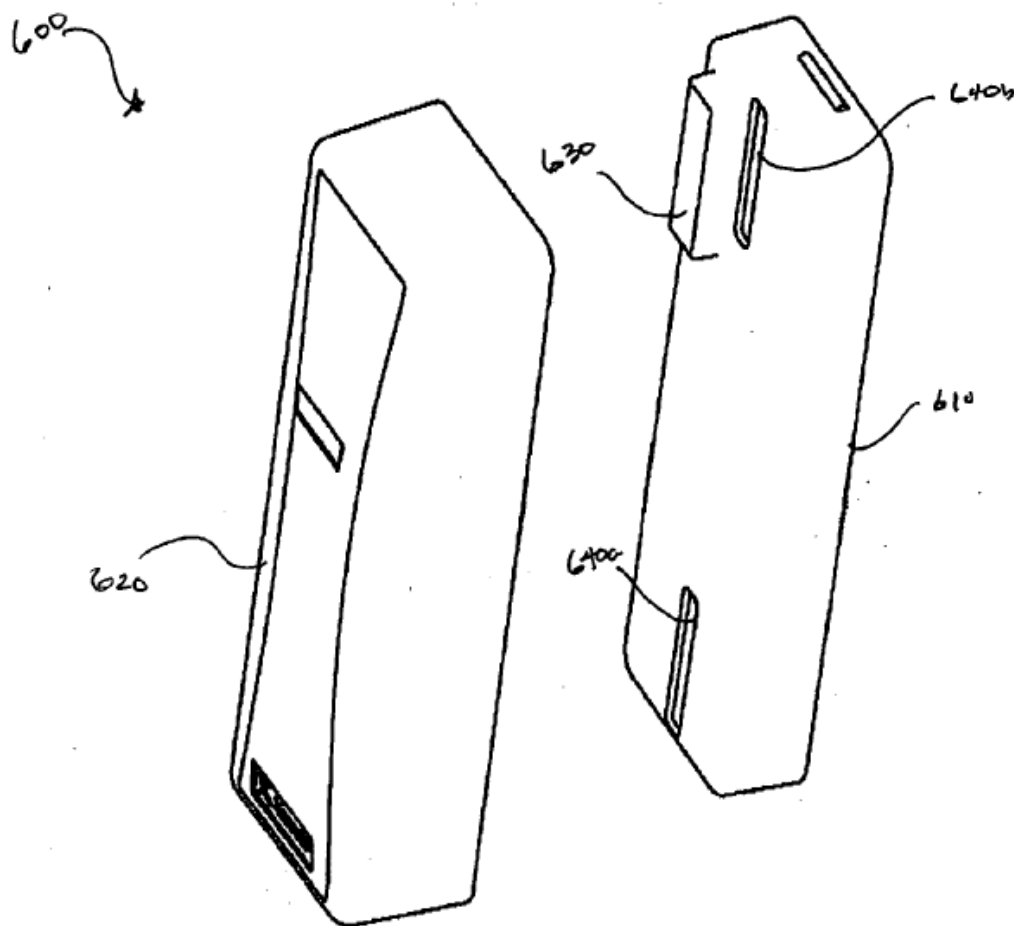


FIG. 6

EX1006, at Fig. 6; EX1007, at 10, 37-39, 45.

Conlin teaches that 125 kHz, a low carrier frequency, and 13.56 MHz, a high carrier frequency, may be used together. EX1006, ¶[0026]; EX1007, at 5, 7, 33, 41-42, 50. “This multiple frequency approach may, among other things, provide for transitioning systems from one generation of control to another. Thus, as an

example, where access control is initially provided at 125 KHZ, new processes of access control can be supported at 13.56 MHz until the new processes of access control are fully implemented and the 125 KHZ processes can then be ended.” EX1006, ¶[0026]; EX1007, 5, 7.

A POSITA implementing the multi-frequency reader disclosed in Conlin would have been motivated to place the 125 kHz reader antenna in the update portion, and place the 13.56 MHz reader antenna in the base portion. EX1004, ¶85, 89, 102. Where the modular reader described in Conlin is being used to “transition[] systems from one generation of control to another” (EX1007, ¶[0026]; EX1006, at 5) it would be simple and advantageous to place the system of the next generation as the permanent installation, and place the legacy system in the cover. Conlin discloses that once “125 KHz processes can [] be ended,” the cover containing the obsolete electronics could simply be removed and the base portion, which is anchored to the wall and thus constitutes a more permanent installation, would continue operation at 13.56 MHz. EX1006, ¶¶ [0026], [0054]; EX1007, at 5-6, 7, 13 [Figs. 8, 9]. Moreover, the ’677 application teaches that when a “facility wishes to upgrade technology to contactless smart cards and readers” from “an older technology” like 125 kHz, the “base reader board contains the antenna for one frequency” and the “snap-on cover contains the antenna for the other frequency.” EX1007, at 14; EX1006, ¶[0001].

The '677 application also discloses an “Antenna Board” that may be contained in the “Snap-on covers.” EX1007, at 41-44.



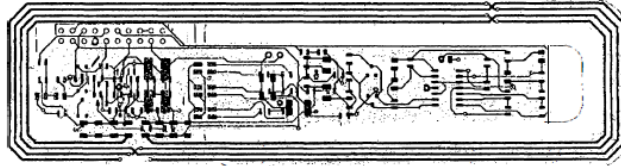
Reader Design Concept - Cover

- ◆ Snap-on covers containing “Antenna Board”:
 - 13.56 MHz antenna & tuning components
 - 125 KHz analog front end
 - LED’s (red, green & amber capability)
 - Tamper detection scheme
 - Keypad electronics
 - LCD ???
 - Personality detection
 - 2 Unused I/O (RFU)
 - Programming Interfaces:
 - Immediate hardware programming capability
 - Future Infrared “communication adapter” programming capability

EX1007, at 41; *see also id.* at 5, 7-9, 14, 41; EX1006, ¶[0001].

The '677 application discloses a circuit board containing an antenna:

Antenna Board Layout



EX1007, at 43, *see id.* at 44; EX1006, ¶[0001].

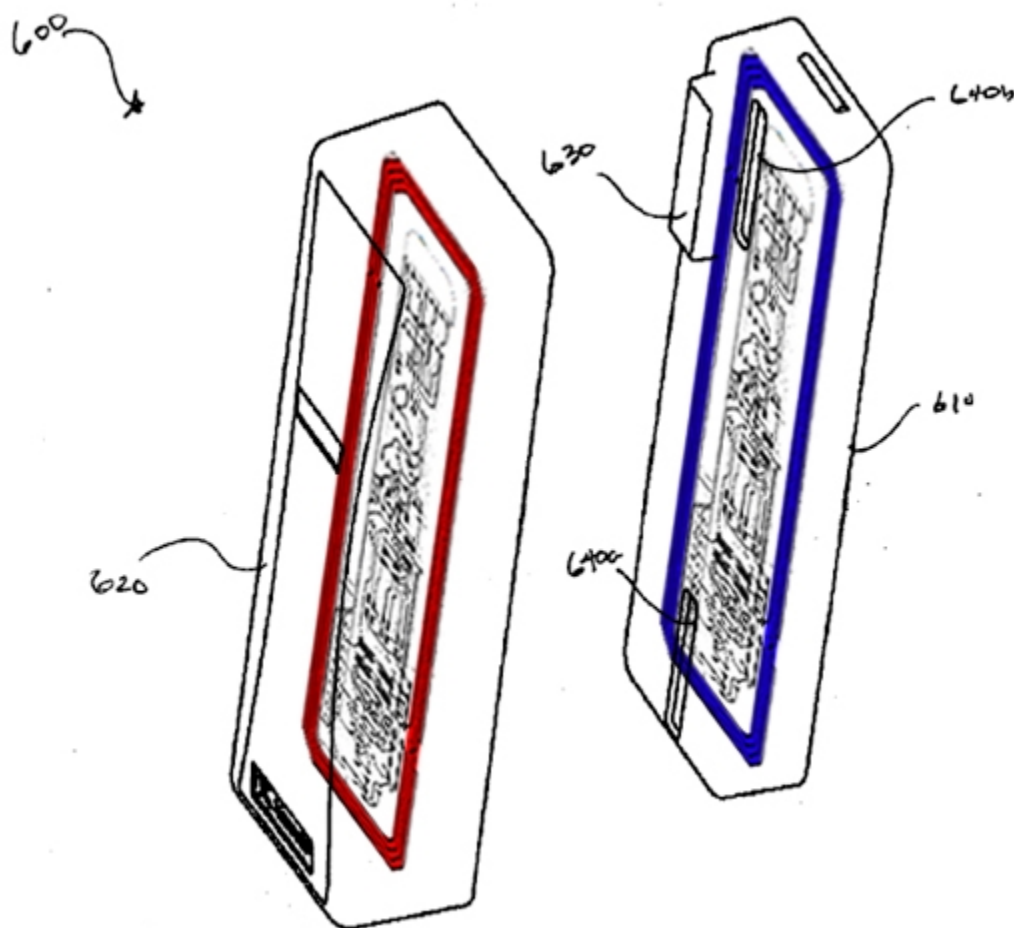
Although the '677 application does not indicate exactly which frequency this antenna board is for, it would have been obvious to a POSITA to use this antenna board for either 125 kHz or 13.56 MHz because the '677 application discloses use of that antenna in the context of 125 kHz and 13.56 MHz carrier frequencies. EX1007, at 42; EX1006, ¶[0001]; EX1004, ¶¶91-93. A POSITA would have been able to modify the antenna disclosed in the '677 application for use with either frequency, including by adjusting the length of the antenna or adjusting other conventional electronic parameters. EX1004, ¶93. Therefore, Conlin teaches “a first reader antenna tuned to operate at a first low carrier frequency.”

Conlin further discloses that the antenna “enable[es] data communication with a first transponder transmitting data signals at said first low carrier frequency” by disclosing an RFID reader that “searches for cards of multiple frequencies and reads/transmits the data from the card.” EX1007, at 14; *see also id.* at 8; EX1006, ¶[0001]; EX1004, ¶¶107-108.

- e. 1[C]: “wherein the first and second antennas are oriented along axes that are substantially parallel to one another.”**

Conlin discloses this limitation. EX1004, ¶¶109-113. As described in Claims 1[A] and 1[B], it would be obvious to place the 125 kHz antenna in the update portion, and the 13.56 MHz antenna in the base portion described in Conlin.

A POSITA would have understood that in this configuration, the antenna on the flat circuit board in the base of the reader would be oriented along an axis that is substantially parallel to the axis of the other antenna provided on the flat circuit board in the update portion (snap-on cover). EX1004, ¶¶111. Annotated Figure 6 shows the 125 kHz reader antenna (**red**) in the update portion 620 and the 13.56 MHz antenna (**blue**) in the base portion 610, as described in Claims 1[A] and 1[B], *supra* §§VIII.A.4.b, c:



5. **Claim 2: “The antenna array of claim 1, wherein said first low carrier frequency is nominally 125 kHz.”**

See Claim 1[A], supra §VIII.A.4.b; EX1004, ¶114.

6. **Claim 3: “The antenna array of claim 2, wherein said second high carrier frequency is about 13.56 MHz.”**

See Claim 1[B], supra §VIII.A.4.c; EX1004, ¶115.

7. **Claim 4: “The antenna array of claim 1, further comprising a reader housing containing said first and second antennas.”**

Conlin discloses this limitation through disclosure of a “base portion 610” and an “update portion 610,” as shown in Fig. 6”:

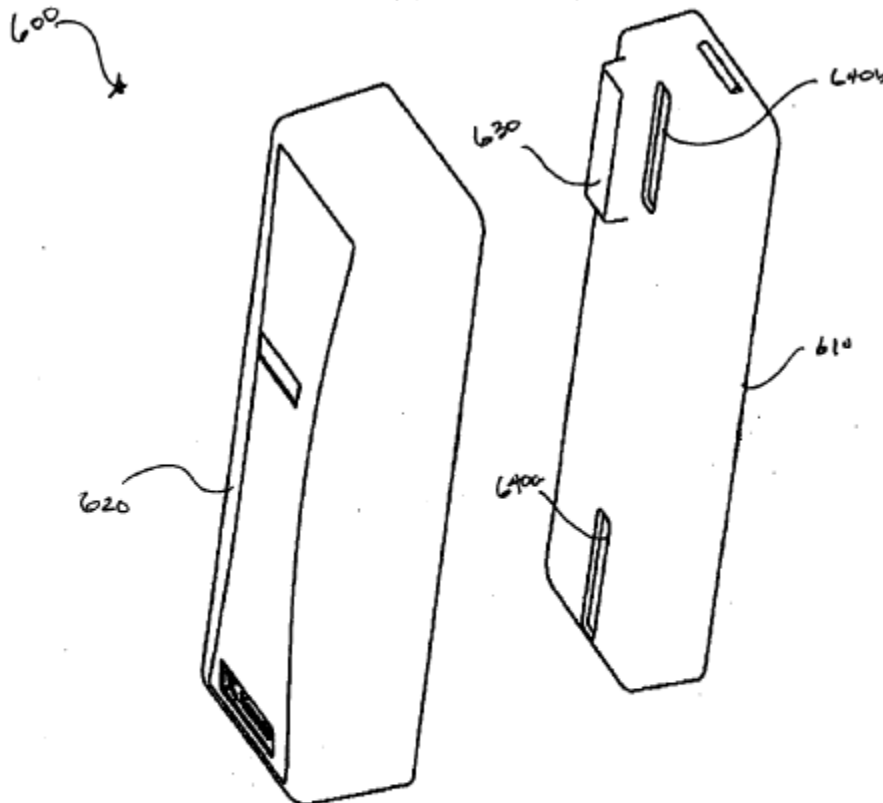


FIG. 6

See EX1006, ¶[0045], Fig. 6; see also *id.* ¶[0054]; EX1007, at 3, 7, 9-10; see also *id.* at 37-38, 41; EX1004, ¶116-117. The base and update portions of Conlin form

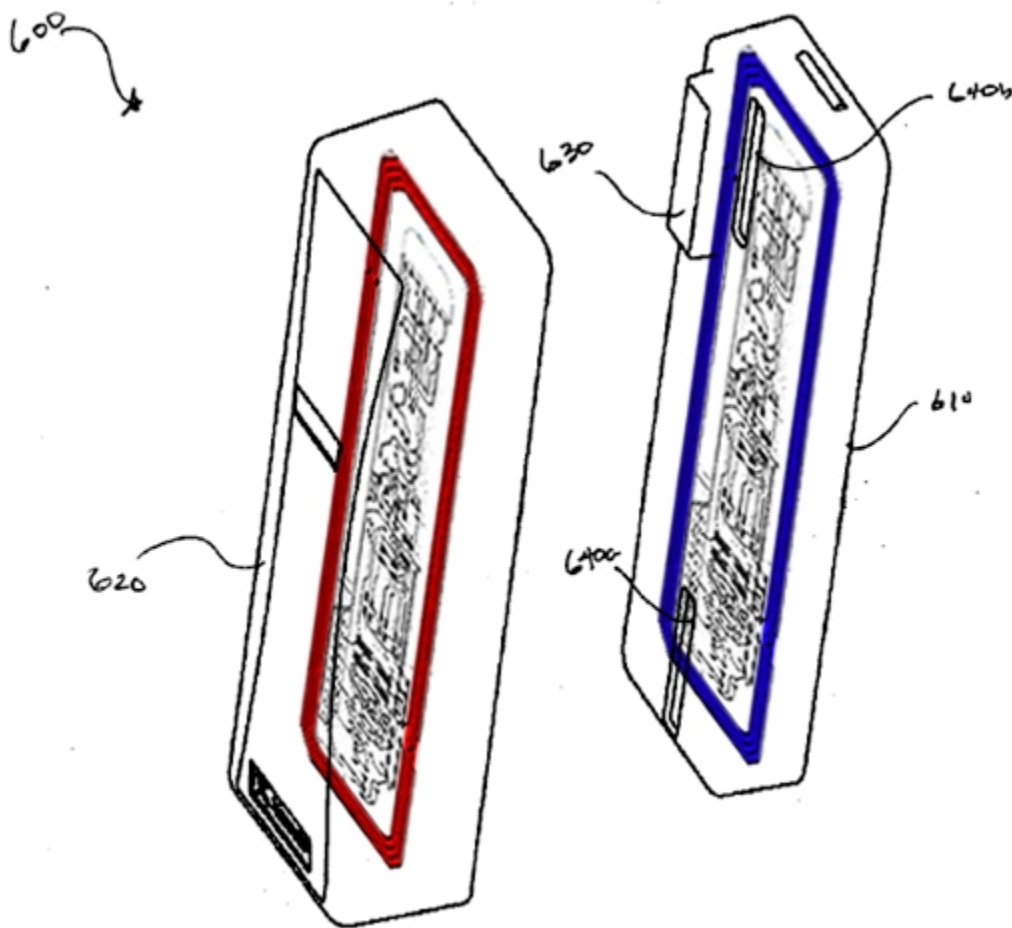
the reader housing. As described in claim 1[C], *supra* §VIII.A.4.d, the base and update portions contain first and second antennas.

8. Claim 5

All of the limitations of Claim 1 are recited in Claim 5, except Claim 5 recites that “wherein said first and second antennas are arranged in at least a partially overlapping arrangement on proximate adjacent planes,” in limitation 5[C] in place of limitation 1[C].² *See infra* §XI. As with claim 1, the ’677 application discloses this limitation. EX1004, ¶¶118-124.

As shown and described in Claims 1[A] and 1[B], Conlin discloses a multi-frequency reader in which one antenna is disposed on the plane of a circuit board within the base, and the other antenna is disposed on the plane of a circuit board within the cover. *Supra*, §§VIII.A.4.b, c. Conlin thus discloses that the two antennas are on proximate adjacent planes. As shown in the annotated image below, when these antenna boards are arranged facing each other in the confines of the reader housing, as described above with respect to claim 1[C] they are in at least a partially overlapping arrangement:

² Claim 5 does not include that the first and second carrier frequencies are “low” or “high,” respectively, rendering claim 5 broader than claim 1.



See EX1006, ¶[0045], Fig. 6; *see also id.* ¶[0054]; EX1007, at 7, 9-10; *see also id.* at 37-38, 41.

9. **Claim 6:** “The antenna array of claim 5, further comprising a reader housing containing said first and second antennas.”

See Claim 4, *supra* §VIII.A.7; EX1004, ¶125.

10. Claim 14

All of the limitations of Claim 1 are recited in Claim 14, except Claim 14 recites that the additional elements of “an RFID system” (*see* 14[pre]) “and a signal

generator coupled with said first and second reader antennas” (*see* 14[D]). *See infra* §XI. Conlin discloses these limitations. *See* EX1004, ¶¶126-132.

Relating to the “RFID System,” Conlin teaches “providing an access control module that is operable to receive communications at two or more carrier frequencies,” including “providing [] a credential operable to communicate at one carrier frequency to replace an earlier provided credential that operates at a different carrier frequency.” EX1006, ¶[0009]; *see also id.* at Abstract; EX1007; at 1 [title], 2, 5, 6, 9, 14 (Fig. 10).

Conlin also discloses limitation 14[D]. *See* EX1004, ¶¶131-132. Conlin discloses a “125 KHz analog front end” and a “13.56 MHz communication engine,” which includes an “Analog Front End and processing.” EX1007, at 42; EX1006, ¶[0001]. Conlin also discloses the use of “additional analog front end circuitry” on a PCB in the update portion. EX1006, ¶[0052]; EX1007, at 5, 6, 9. A POSITA would have understood that “analog front end” refers to a structure that includes a signal generator. Indeed, a POSITA would have known that a signal generator would be necessary for the antenna to transmit signals, and would have understood the disclosure of “analog front end” to include this structure. EX1004, ¶131-132; EX1026, at 1:35-2:31, 3:19-48.

- 11. Claim 16: “The RFID reader of claim 14, wherein said signal generator includes a discrete first signal generator coupled with said first reader antenna for generating signals for transmission from said first reader antenna and a discrete second signal generator coupled with said second reader antenna separate from said discrete first signal generator for generating signals for transmission from said second reader antenna.”**

Conlin discloses this limitation. EX1004, ¶133. As described in Claim 14, §VIII.A.11, *supra*, Conlin discloses that the base and cover portions each contain a signal generator (an analog front end) directed to 13.56 MHz and 125 kHz, respectively, which are coupled individually to the reader antennas.

12. Claim 17

All of the limitations of Claim 14 are recited in Claim 17, except that in place of reciting limitation 14[C], Claim 17 recites that “the first and second antennas are arranged in at least a partially overlapping arrangement along proximate adjacent planes,” which is substantially identical to Claim 5[C] and is disclosed by Conlin.³ EX1004, ¶¶134-137, *supra* §VIII.A.8; *see infra* §XI.

³ Claim 5[C] recites antennas arranged “*on* proximate adjacent planes” while 17[C] recites “*along* proximate adjacent planes.” This difference does not affect the obviousness grounds asserted herein.

And in place of reciting Claim 14[D], Claim 17[D] recites the element of “receiver electronics coupled with said first and second reader antennas,” which Conlin also discloses.” EX1004, ¶¶138-140.

Conlin discloses that each antenna is connected to an analog front end and that the reader contains a “receiver breadboard.” EX1007, 33, 31-42; EX1006, ¶[0001]. A POSITA would have understood these structures as including receiver electronics. *See, e.g.*, EX1026, at 1:35-2:31, 3:19-48; EX1004, ¶140. A POSITA would have understood that these structures were connected to the reader antennas. EX1007, at 41-42, *see also id* at 5, 6, 9, 14, 15-20, 31-33, 56; EX1006, ¶[0001]; EX1004, ¶140.

13. Claim 19: “The RFID reader of claim 17, wherein said receiver electronics includes discrete first receiver electronics coupled with said first reader antenna for conditioning signals received by said first reader antenna and discrete second receiver electronics coupled with said second reader antenna separate from said discrete first receiver electronics for conditioning signals received by said second reader antenna.”

Conlin discloses this limitation. EX1004, ¶141. As described above with respect to limitation 17[D], §VIII..A.13, *supra*, each of the base and cover portions each contain a discrete analog front end directed to 13.56 MHz and 125 kHz, respectively, which are coupled individually to the reader antennas. EX1004, ¶141.

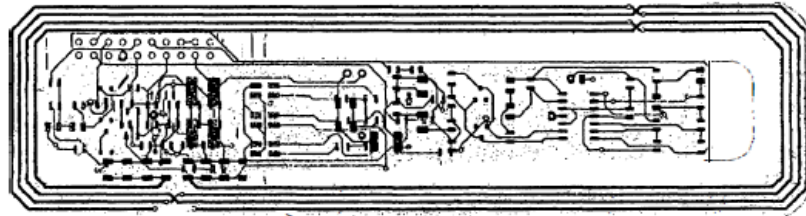
14. Claim 20

All of the limitations of Claim 1 are recited in Claim 20, except Claim 20 additionally requires that the antennas of Claims 1[A] and 1[B] have “a first loop”

and “a second loop,” respectively. *See infra* §XI. Claim 20 also recites limitations 20[C] and 20[D] in place of 1[C], which are discussed *infra*.

The limitations directed to antenna loops are met because Conlin discloses a loop antenna that could be used with 125 kHz and 13.56 MHz reader antennas:

Antenna Board Layout



EX1007, at 43-44; EX1006, ¶[0001]; *see* Claims 1[A] and [B], *supra* §§VIII.A.4,b, c; EX1004, ¶¶142-143.

- a. 20[C]: “wherein a first plane defined by the first area is substantially orthogonal to a direction of magnetic flux created through the first antenna, wherein a second plane defined by the second area is substantially orthogonal to a direction of magnetic flux created through the second antenna,”

Conlin discloses this limitation.⁴ EX1004, ¶¶144-145. The antenna loops described with reference to Claims 1[A] and 1[B] surround first and second areas, respectively, each of which sits on and defines a separate plane. §§VIII.A.4.b, c. It is inherent to the operation of loop antennas that the direction of magnetic flux created by each antenna is orthogonal to the plane on which that antenna sits, as a POSITA would have known; thus the loop antennas described under Claims 1[A] and 1[B] would inherently have orthogonal flux to the plane of the reader antenna. EX1004, ¶¶143-145.

- b. 20[D]: “wherein said first and second loops are arranged relative to one another such that a portion of the first area in the first plane overlaps a portion of the second area in the second plane.”

Conlin discloses this limitation. EX1004, ¶146. As described in §VIII.A.14.a, Conlin discloses loop antennas on separate planes, which are overlapping. *See* Claim 5, *supra* §VIII.A.8.

⁴ Petitioner assumes for the purpose of this petition that the area refers to the area encircled by the loop antennas.

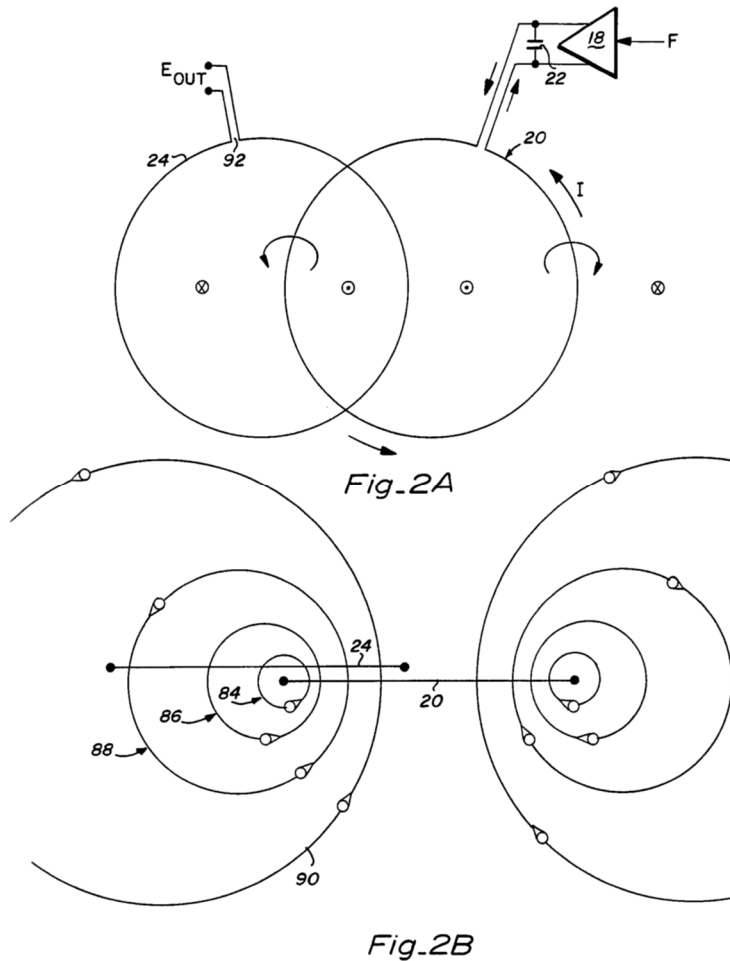
B. Ground 2: Conlin in view of Walton Renders Obvious Claims 7, 9-11, 13, 22-24, and 26 of the '862 Patent

1. Walton

Walton “relates to an electronic proximity identification and recognition system . . . wherein there is no physical contact between the identification card and recognition apparatus.” EX1023, 1:8-12. “A recognition device may be arranged to control the door latch.” *Id.*, 1:31-32.

Walton discloses a system having an “identification section and recognition section each have a sending and a receiving antenna.” EX1023, at Abstract. Walton discloses that different frequencies also may be used with the two antennas, including 13.56 MHz. *Id.*, 2:66-67, 3:39-40. Walton discloses that “[m]eans must be provided so that the two directions of communication and power do not interfere to the extent of inhibiting the desired transfers.” EX1023, 2:14-17.

FIGS. 2A and 2B of Walton show “positioning of the coils 20 and 24 relative to one another so as to establish zero mutual inductance.” *Id.*, 5:5-7. FIG 2A is “the top view of two coils 20 and 24” and FIG 2B is “the side view of the two coils which are designed to have zero net shared flux, or zero mutual inductance.” *Id.*, 5:7-11:



The above figures show “the coil 24 in a plane slightly above the plane of the coil 20 and with partial overlap of the two coils.” *Id.*, 5:11-13.

Walton recognizes that “[i]f the coil 24 were moved further to the left, the upward flux lines 88 and 90 would not intersect with coil 20 whereas their downward values would,” which would “result in a net downward or negative flux through the coil antenna 24.” *Id.*, 5:27-31. “If the coil antenna 24 is moved further to the right, the downward parts of the flux lines 86 and 88 would no longer intersect the coil

antenna 24, but the upward lines of the flux lines 88 and 90 would, for a net upward or positive flux through the coil antenna 24.” *Id.*, 5:32-36.

Walton is in the same field as the ’862 patent because Walton relates to readers using radio frequency reader systems used for access control. *Id.*, at Abstract, 1:7-24. Walton is pertinent to the problems the ’862 patent purportedly addresses because Walton is directed to a reader having two antennas that each uses a different frequency while having zero mutual inductance. *Id.* at Abstract, 2:39-3:5. Walton therefore is analogous art to the ’862 patent.

2. Conlin-Walton Combination

A POSITA would have been motivated to combine Conlin and Walton, which are in the same field of endeavor, in order to reduce the effects of magnetic flux on RFID readers and improve reader performance. EX1004, §¶160, 184; *Tyco Healthcare Grp. LP v. Ethicon Endo-Surgery, Inc.*, 774 F.3d 968, 978 (Fed. Cir. 2014) (finding motivation to combine where two references were “clearly within a common field of endeavor”).

Motivation to combine is likewise found in the prior art and knowledge of a POSITA. *Nat’l Steel Car, Ltd. v. Canadian Pacific Ry., Ltd.*, 357 F.3d 1319, 1337-39 (Fed. Cir. 2004) (“It has long been the law that the motivation to combine need not be found in prior art references, but equally can be found ‘in the knowledge generally available to one of ordinary skill in the art.’”). A POSITA would have

known that by placing two or more antennas within each of an update portion or a base portion, because of the proximity of the antennas, the magnetic fields of each antenna may interact with the other antenna. EX1004, ¶184; *In re Breiner*, 468 F. App'x 989, 994 (Fed. Cir. 2012) (finding motivation to combine in reference not asserted in obvious combination).

Walton teaches how to reduce the magnetic flux in access control readers with multiple antennas in close proximity. EX1004, ¶184; EX1023, 5:5-42, Figs. 2A and 2B. Because both Conlin and Walton are directed to multi-frequency, multi-antenna access control readers, Walton's teachings could be easily implemented on Conlin's reader. EX1004, ¶184, EX1006, ¶¶[0023], [0046], [0052]; EX1007, at 5, 6, 8, 9, 14 (Fig. 10), 33, 41-42; EX1023, 2:6-36, 5:5-43; Figs. 2A and B. It would have been within the skill of a POSITA to implement Walton's teachings on Conlin's reader, and there would not be any unexpected results of the combination. EX1004, ¶184.

3. Claim 7: “The antenna array of claim 5, wherein said first reader antenna has a first area, said second reader antenna has a second area, and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.”

Conlin and Walton render this claim obvious. EX1004, ¶¶161-170; *see* Claim 5, *supra* §VIII.A.8. Walton teaches that the placement of a first antenna near a second antenna—including on parallel, overlapping planes—affects the amount of positive magnetic flux and negative magnetic that passes through each antenna,

which can result in a net induced voltage through the one or both of the antennas. See EX1023, at 2:6-36, 2:43-3:2, 5:5-43; EX1004, ¶¶163-164. Walton teaches that this voltage, or interference, could impede any affected antenna's ability to read credentials. *Id.* This was well understood before the priority date. See EX1004, ¶¶163-165.

As shown in Figure 2B of Walton, where an antenna (coil, 24) is placed so that it symmetrically intersects both positive-directed and negative-directed magnetic flux (*i.e.*, field lines 84, 86, and 88 pass through coil 24 in both the positive and negative directions) that emanates from another antenna (coil 20), the net magnetic flux is near zero.

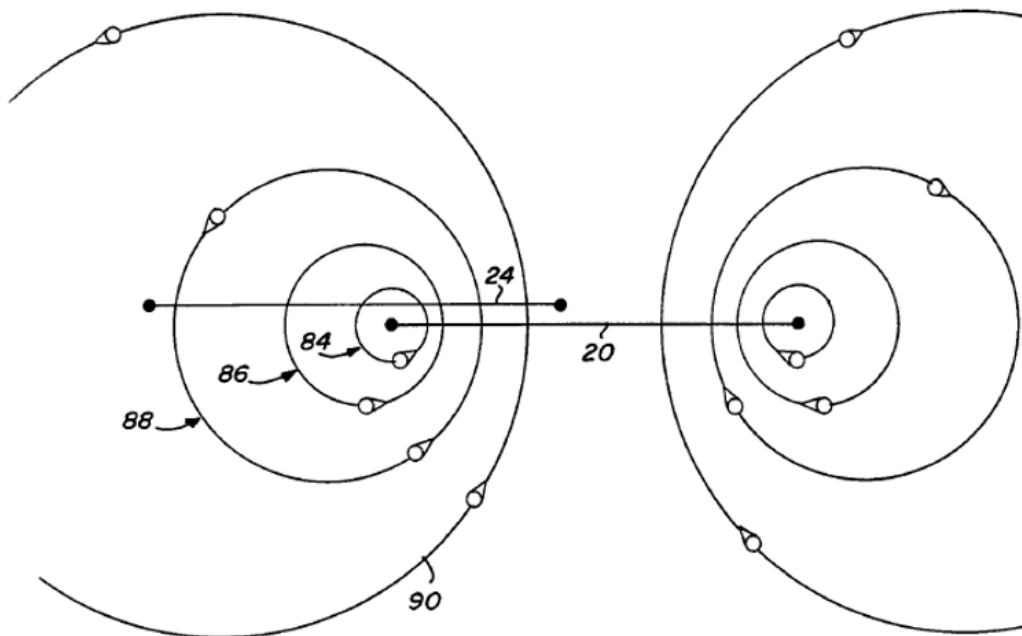


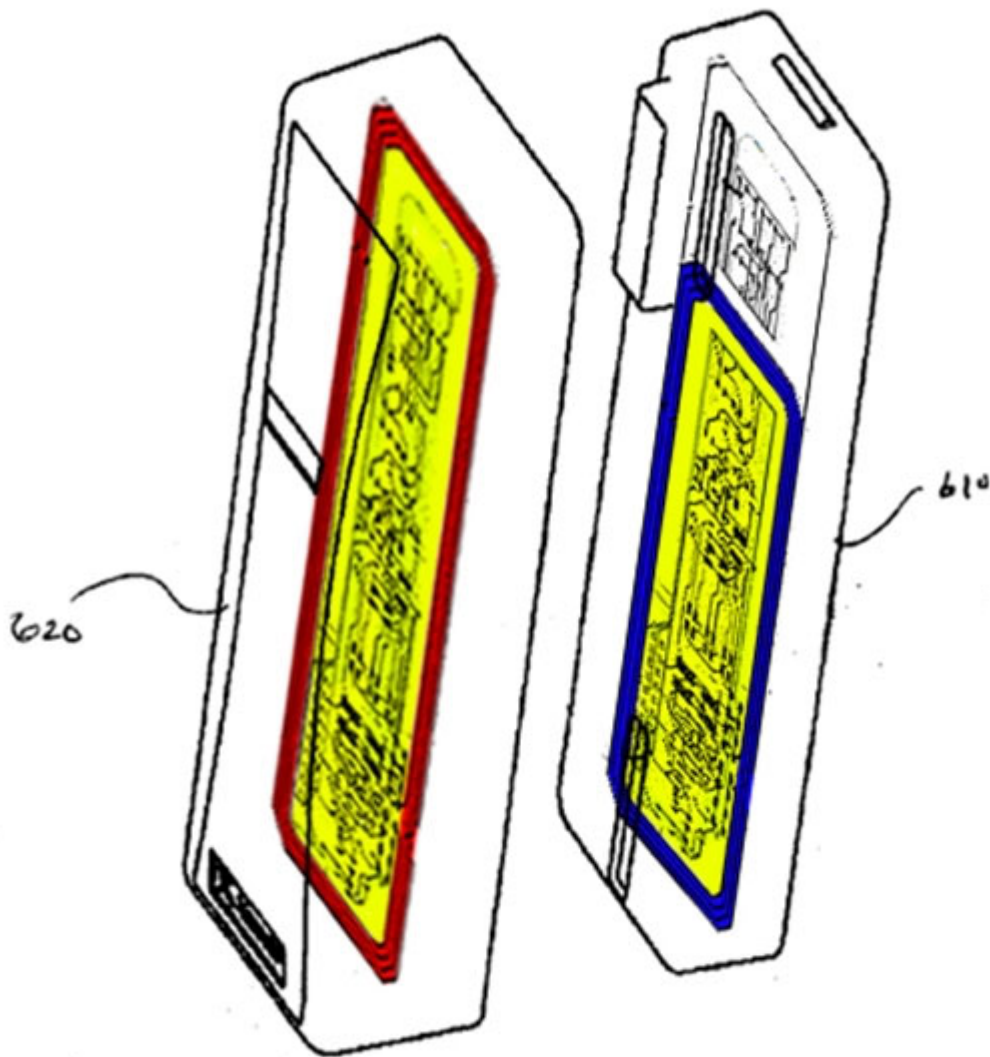
Fig.2B

EX1004, ¶163-164, *see also id.* ¶177-183; EX1023, 5:5-43, Fig. 2B.

A POSITA would have understood from this teaching that so long as there is flux passing through one reader antenna in opposing directions—*i.e.*, both a positive and negative direction—the induced voltage would be less than the maximum possible induced voltage. EX1004, ¶¶166, 174-183; EX1023, 5:5-43, Fig. 2B. Such maximum voltage occurs where both antennas are of the same size and they are placed directly parallel to each other, such that only flux in *one* direction may pass through either antenna. EX1004, ¶¶179, 188; EX1023, 5:5-43, Fig. 2B. A POSITA would have understood that conversely, an opposing magnetic flux arrangement is achieved where loop antenna areas are at least partially, and not completely overlapping. *See id.*

Therefore, a POSITA would have been motivated to modify the antennas in the update portion and base portion disclosed in Conlin and described in Ground 1, Claim 5, by shortening one of the antenna loops such that one antenna does not extend along the entirety of the length of the circuit board on which it is printed, in order to reduce the net magnetic flux through the longer antenna. EX1004, ¶¶163-164, 176-188. Because loop antennas used for 125 kHz reader antennas before the priority date generally consisted of a longer wire of more loops and because 13.56 MHz reader loop antennas generally consisted of a shorter wire of fewer loops, it would have been an obvious choice to implement the reader disclosed in Conlin so that the 125 kHz loop antenna would be disposed around the entire perimeter of the

update portion, and the 13.56 MHz loop antenna would be disposed around a smaller area of the circuit board disposed within the base portion of the reader. EX1004, ¶164. Such a modification is exemplified in annotated Figure 6, below, and would have been within the skill of a POSITA and would yield predictable results of reduced magnetic flux interference:



See EX1004, ¶165; EX1006, ¶[0045], Fig. 6; *see also id.* ¶[0054]; EX1007, at 7, 9-10, 37-38, 41.

In this arrangement, the 125 kHz antenna (red) would have a first area (yellow), the 13.56 MHz antenna (blue) would have a second area (yellow), and the antennas would be arranged relative one another such that only a portion of the first area aligns with only a portion of the second area. A POSITA would have known that such a partially overlapping arrangement of the antennas would be advantageous as it would provide the benefits of reduced magnetic field interference between the two reader antennas, which would provide the reader with a higher degree of precision when reading credentials, while still maintaining a small overall reader size. *See* EX1023, 2:6-35, 2:59-3:2, 3:49-56, 5:5-43, Figs. 2A and 2B; EX1004, ¶¶163-164; *see also* EX1024, 1:31-40, 2:48-3:2; EX1008, at 34-35.

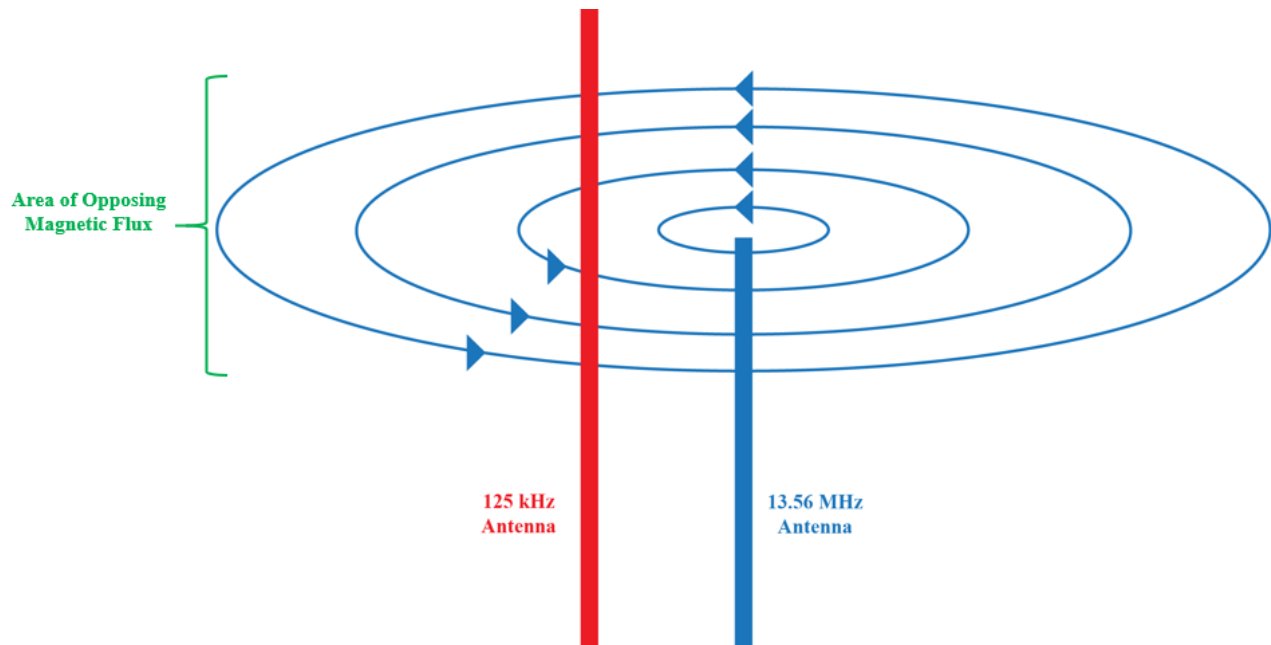
Moreover, a POSITA would also have been motivated to place the antennas in this orientation due to limited design options for integrating loop antennas in an RFID Reader. EX1004, ¶168. A POSITA would have known that such an arrangement would have been a routine implementation of two antennas using conventional components to yield predictable results by avoiding complete antenna overlap, and a POSITA would have had a reasonable expectation of success in implementing this arrangement. *See* EX1004, ¶169; EX1023, 5:21-43; *see also* EX1008, at 14-35, 81-88, 312-319; EX1024, 1:31-40, 2:48-3:2; EX1025, at 1-7.

Therefore, Conlin in view of Walton renders claim 7 obvious.

4. Claim 9

All of the limitations of Claim 5 are recited in Claim 9, except Claim 9 recites that “wherein said first and second antennas are arranged in an opposing magnetic flux arrangement,” in limitation 9[C] in place of limitation 5[C]. *See infra* §XI. As described in Ground 1, all of the other limitations recited in Claim 9 are disclosed by Conlin. *Supra*, VIII.A.8; EX1004, ¶¶171-173. Further, a POSITA implementing Conlin’s multi-frequency reader would have been motivated by Walton teachings to arrange the first and second antennas in opposing flux arrangement. EX1004, ¶¶174-189.

Walton teaches that by partially overlapping the antennas, for example by simply reducing the diameter of one antenna, places the antennas in “an opposing magnetic flux arrangement.” *See supra*, §**Error! Reference source not found.**; EX1004, ¶305. A POSITA would have known that by partially overlapping the antennas, both positive and negative flux would pass through one antenna, thereby providing an opposing magnetic flux arrangement. This is illustrated below, where magnetic flux oriented both in the positive direction (towards the left) and negative direction (towards the right) generated by the 13.56 MHz antenna (**blue**) pass through the 125 kHz antenna (**red**):



5. **Claim 10: “The antenna array of claim 9, further comprising a reader housing containing said first and second antennas.”**

See Ground 1, Claim 4, *supra* §VIII.A.7; EX1004, ¶190.

6. **Claim 11**

- c. 11[A]: “The antenna array of claim 9, wherein said first reader antenna has a first area, said second reader antenna has a second area”

Conlin discloses this limitation. EX1004, ¶191-192. The 125 kHz antenna and the 13.56 MHz antenna loops described with reference to Claim 7, surround first and second areas, respectively. *Supra* ¶VIII.B.3; EX1004, ¶192.

- d. 11[B]: “and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.”**

Conlin in view of Walton renders this limitation obvious for the reasons described with reference to Claim 7. EX1004, ¶192; *supra* §VIII.B.7.

- 7. Claim 13: “The antenna array of claim 9, wherein said first and second reader antennas are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.”**

Because the opposing magnetic flux arrangement that a POSITA would have been motivated to implement in Conlin’s multi-frequency reader, as described above with respect to Claim 9, results in the overlapping arrangement recited in Claim 7, Conlin in view of Walton teaches this claim. *See* Claims 7 and 9, *supra*, §§VIII.B.3, 4; EX1004, ¶193.

- 8. Claim 22. “The antenna array of claim 20, wherein said first and second loops have a parallel orientation and are arranged relative one another such that a size of the portion of the first area aligning with the portion of the second area is less than at least one of a size of the first area and a size of the second area.”**

For the reasons set out in Claim 7, Conlin in view of Walton teach this claim. *See, supra* §VIII.B.3; EX1004, ¶194-198; *see also* Claims 9, 11, *supra* §§VIII.B.4, 6.

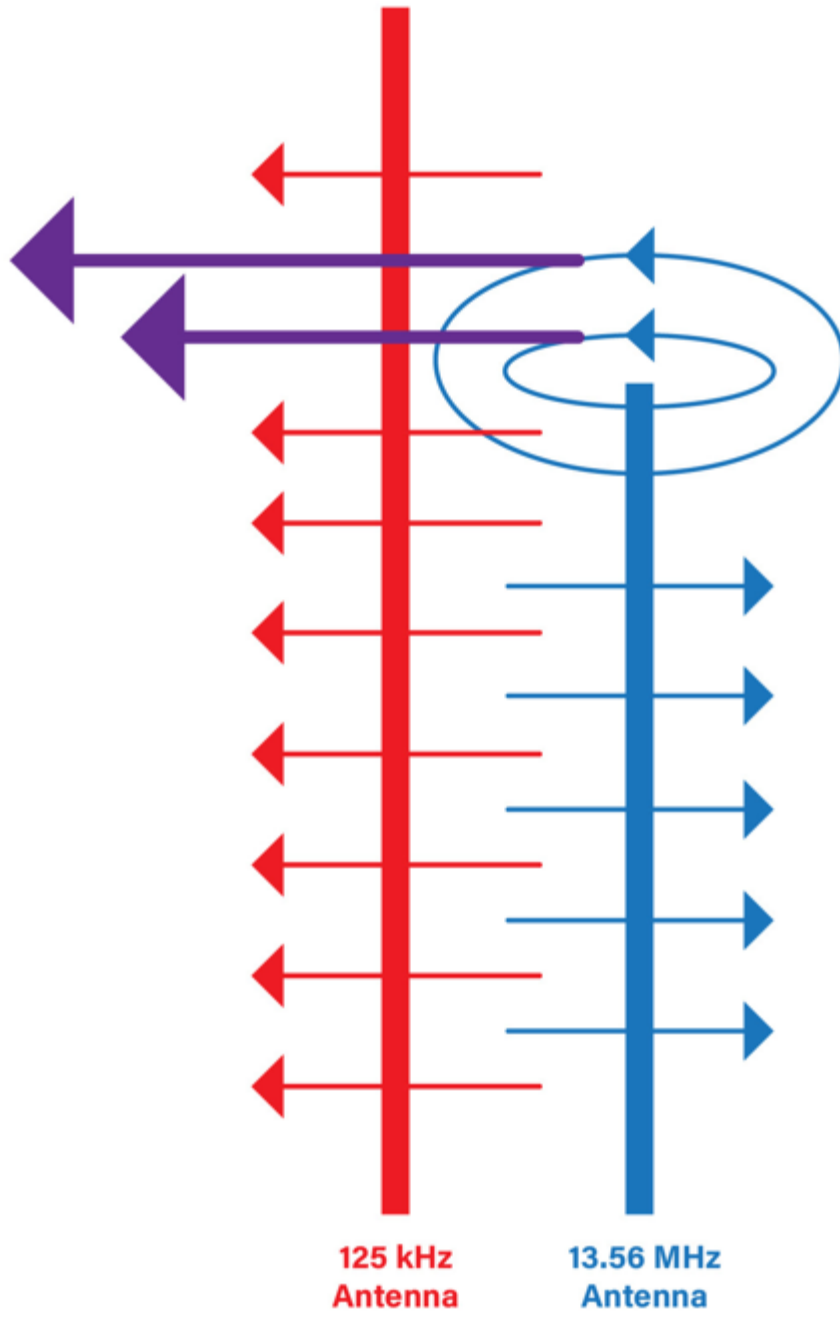
9. Claim 23

All of the limitations of Claim 20 are recited in Claim 23, except Claim 23 recites that “wherein said first and second loops are arranged in an opposing magnetic flux arrangement where the direction of magnetic flux created through the first loop is substantially parallel but opposite to the direction of magnetic flux created through the second loop,” in limitation 23[C] in place of limitation 20[C]. *See infra* §XI.

Conlin in view of Walton renders this claim obvious. EX1004, ¶¶199-205; *see also id.* ¶¶41-51. The direction of magnetic flux is dependent upon the direction of current in the wire. EX1004, ¶¶45-46, 203-205. Therefore, for two antenna loops to generate magnetic fields that are parallel but in the opposite directions through their respective loops, the current through each loop would have to go in opposite directions. *Id.*

Although Conlin does not disclose the direction of the magnetic field or of current flow for the 125 kHz or 13.56 MHz antennas, there are only two directions a current can flow in a wire. EX1004, ¶¶203-205. A POSITA would have known that implementing Conlin’s multi-frequency reader so that the currents in the two antenna coils flow in opposing directions is one of a finite number of design options, and either direction of current flow would have been obvious to try. EX1004, ¶204.

Moreover, was known to arrange two antenna loops in the claimed “opposing magnetic flux arrangement where the direction of magnetic flux created through the first loop is substantially parallel but opposite to the direction of magnetic flux created through the second loop.” EX1004, ¶¶203-205. A minor, routine modification to the arrangement described above with respect to Claim 7 provides this benefit. EX1004, ¶205; *supra* §VIII.B.3. As described above, a POSITA would have been motivated to arrange the antennas in an opposing magnetic flux arrangement. If the antennas are arranged such that the current in one antenna flows in the opposite direction of the current in the other antenna, then the non-overlapping portion of each antenna experiences *constructive* magnetic interference, which has the positive effect of increasing the magnetic strength, and thus read range, of each antenna at the portion of non-overlap. From the side-profile view below of the arrangement shown for Claim 7, the flux that curves around the exterior portion of the blue 13.56 MHz antenna wire runs in the same direction as the magnetic field for the red 125 kHz antenna, which has a magnetic field pointing the other direction. This strengthens the magnetic field of the red antenna, the strengthened portion exemplified in purple.



EX1004, ¶205.

10. **Claim 24: “The antenna array of claim 23, wherein said first loop has a first area, said second loop has a second area, and said first and second loops are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.”**

See Claim 7, *supra* §VIII.B.3; EX1004, ¶206.

11. **Claim 26: “The antenna array of claim 23, wherein said first and second loops are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.”**

See Claim 13, *supra* §VIII.B.7; EX1004, ¶207.

C. Ground 3: The RFID Handbook in view of the Davis Presentation Renders Obvious Claims 1-6 and 14-20 of the '862 Patent

1. Overview of RFID Handbook

The RFID Handbook, subtitled “Fundamentals and Applications in Contactless Smart Cards and Identification, is “aimed at an extremely wide range of readers,” including “students and engineers” and “practitioners.” EX1008, at 3.

The RFID Handbook teaches a “practical example” of an RFID system used for access control, in which the “transponder is only activated when it is within the interrogation zone of a reader”:



Figure 1.8 RFID reader and contactless smart card in practical use (reproduced by permission of Kaba Benzling GmbH)

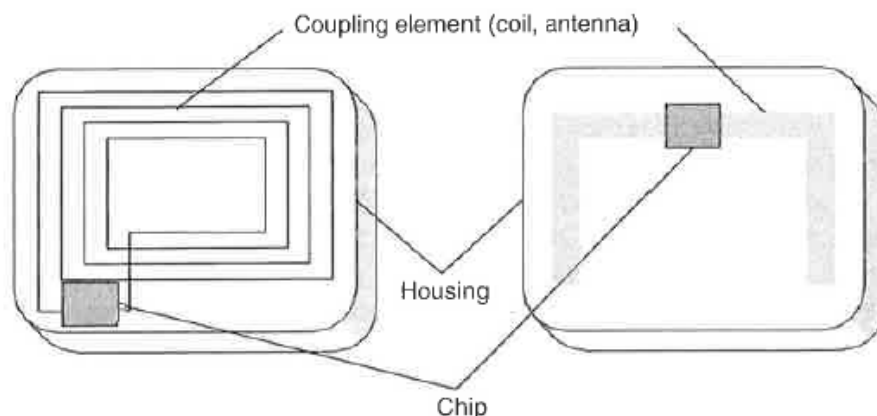
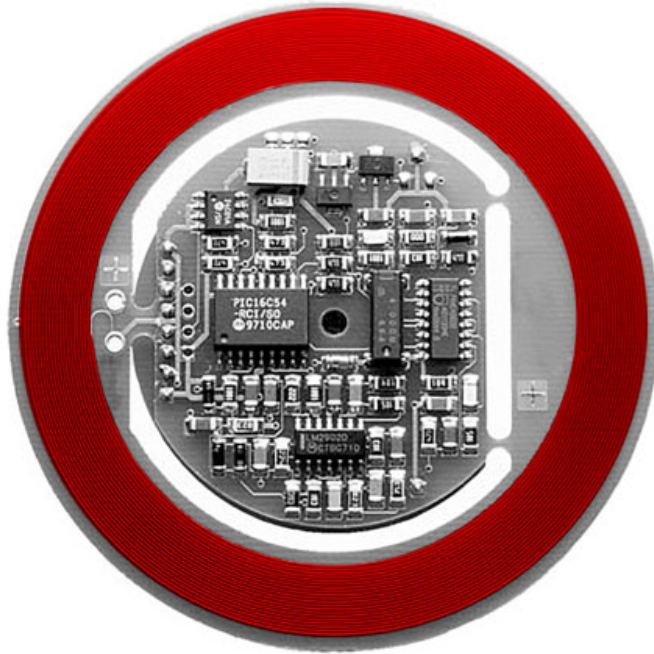


Figure 1.9 Basic layout of the RFID data-carrying device, the transponder. Left, inductively coupled transponder with antenna coil; right, microwave transponder with dipolar antenna

Id. at. 6, Figs. 1.8 and 1.9.

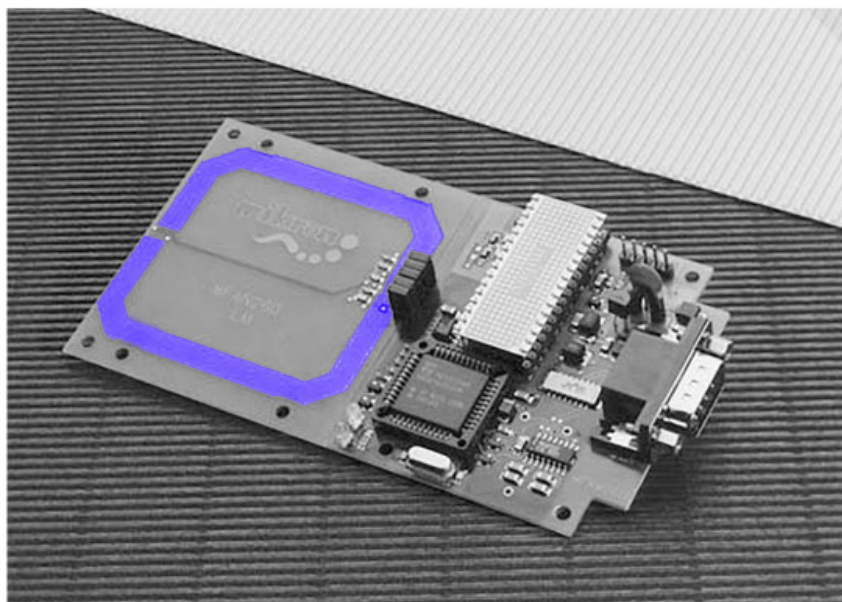
The RFID Handbook recognizes that such RFID systems were known in the art. *Id.* at 116 (“Electronic access control systems using data carriers are used to automatically check the access authorization of individuals to buildings.”) Among the RFID Handbook’s extensive disclosures and teachings related to RFID systems are reader antennas for low and high frequency readers. For the low frequency

reader, the RFID Handbook describes the “easy-key System” reader, which is used with a transponder in the frequency range <135 kHz and includes an integral antenna (red) on the perimeter of the circuit board of a with number of turns/windings:



EX1008, at 9 (annotated).

The RFID Handbook also discloses the high frequency “MIFARE reader,” as manufactured by Philips Electronics N.V., which has “an integral antenna for a 13.56 MHz system.” *Id.* at 91:



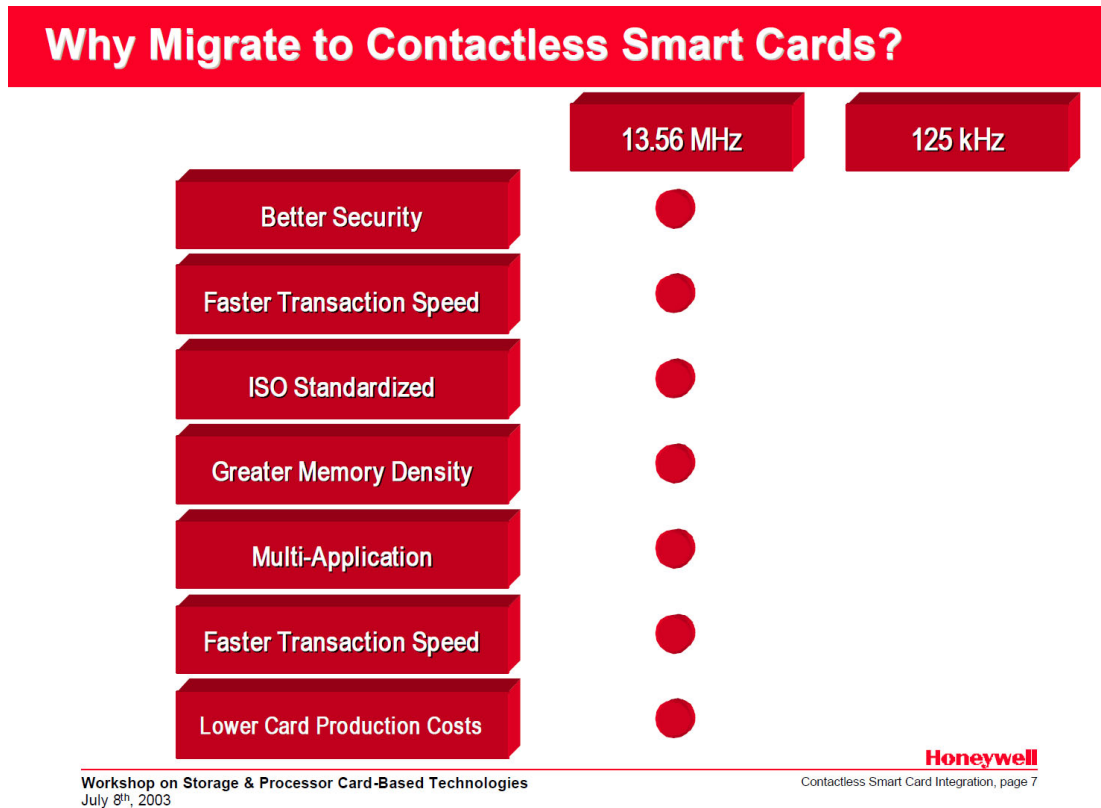
Id. at 92 (annotated).

The RFID Handbook is in the same field as the '862 patent because the RFID Handbook relates to RFID systems used for access control, including components of RFID readers. *Id.* at 6-11. The RFID Handbook is pertinent to the problems the '862 patent purportedly addresses because the RFID Handbook describes arrangements of RFID Reader antennas, the interactions between antennas, and the components of RFID readers. *Id.* at 6-11. The RFID Handbook therefore is analogous art to the '862 patent.

2. Overview of Davis Presentation

The Davis Presentation provides an overview on two known types of RFID systems and transponders: (1) those operating at 125 kHz and comprising “prox”

card transponders; and (2) those operating at 13.56 MHz and comprising “smart” card transponders. (EX1011 at 4-5.) The Davis Presentation further describes the benefits 13.56 MHz systems provide over 125 kHz systems:



Why Migrate? (cont.)

- Added Benefits With No Increase in Price
- Increased Security
- Ability to use same card for additional applications:
 - Biometrics: Carry multiple templates on card
 - Logical Access
 - ID: Carry Tamperproof Digital Photographs
 - Portable Database: Encrypted Information for authentication or emergencies
- Interoperability
- Future Growth

Why Migrate (cont.)

- International Standardization
 - Current 125 KHz Prox Technology
 - ♦ No ISO existing or planned standardization
 - ♦ Proprietary
 - HID, Motorola, AWID, Casi-Rusco, etc.
 - New 13.56 MHz Contactless Smart Cards
 - ♦ Standards DO exist
 - ISO 14443A, 14443B, 15693
 - ♦ Open standards with interoperability encourages broad supplier support and customer acceptance
 - ♦ Open standards can increase market size driving prices down
 - ♦ Facilitates interoperability between vendors and applications
 - ♦ Helps to drive costs down
 - ♦ Helps to eliminate obsolescence

(*Id.* at 7-8, 11.)

The Davis Presentation also describes benefits of moving to smart cards as including multi-application support, wherein the larger data memory in each smart (13.56 MHz) card permits the card to be used for multiple applications, as opposed to the limited application uses available due to the limited memory on prox (125 kHz) cards. *Id.* at 4-5, 9-10. Thus, the Davis Presentation teaches the benefits of migrating from a low-frequency, prox card system, to a high-frequency, smart card system.

The Davis Presentation describes the advantages of using multi-technology readers (i.e., multi-frequency readers with both high-frequency and low-frequency antennas) for migration to a smart card system. *Id.* at 20-22. The Davis Presentation indicates that multi-technology readers may aid with migrating between “Prox and Contactless Smart Card” systems, as well as other data transfer technologies and over multiple protocols and interfaces:

Migration Strategies: Use Multi-Technology Readers

- **Multi-technology readers are capable of reading two different technologies**
 - Prox and Contactless Smart Card
 - Contact and Contactless Smart Card
 - Prox and Magnetic Stripe
- **Multi-technology readers may have multiple output protocols and interfaces**
 - Wiegand
 - Clock & Data
 - RS232
 - Etc.

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July 8th, 2003

Honeywell
Contactless Smart Card Integration, page 21

(*Id.* at 21.)

The Davis Presentation Discloses that a multi-technology reader permits no “changes to cards” or “card rebadging,” thereby avoiding the “obstacle” of “[r]e-badging thousands of employees” and complications about “[w]hat to do during interim period” of removing of old reader system and implementation of new reader system, although at a higher reader cost. (*Id.* at 3, 22.)

The Davis Presentation is in the same field as the '862 patent because the Davis Presentation relates to the use of RFID systems used for access control, including the comparative advantages and disadvantages of using credentials that

operate at 125 kHz and 13.56 MHz, reasons to migrate from 125 kHz systems to 13.56 MHz systems, and methods to achieve the migration. (EX1011, at 1, 3-23.) The Davis Presentation is pertinent to the problems the '862 patent purportedly addresses because the Davis Presentation describes motivations to integrate multi-technology and multi-frequency components into a single RFID reader. (*Id.* at 20-22.) The Davis Presentation therefore is analogous art to the '862 patent.

3. RFID Handbook-Davis Presentation Combination

In light of the well-documented migration from 125 kHz systems to 13.56 MHz systems described in 2003 by the Davis Presentation, a POSITA would have been motivated to combine at least two prior art RFID readers into one [m]ulti-technology” reader “capable of reading two different technologies,” specifically “[p]rox” and “Smart Card,” which are all in the same field of endeavor. EX1011, at 21; *Tyco*, 774 F.3d at 978.

A POSITA, for example would first look to available readers in order to find a suitable 13.56 MHz reader that could be combined with 125 kHz reading capabilities. EX1004, ¶227. A suitable example of each such reader is disclosed in the RFID Handbook, which is a fundamental reference in the field. A POSITA would have easily determined that the flat MIFARE circuit board provides a suitable starting point of the previously-existing readers. *Id.*; *see also* EX1008, at 80. Because the MIFARE reader places its antenna and electronics on one side of a

circuit board, this provides the other side of the circuit board to incorporate a low frequency antenna. *See id.* Therefore, a POSITA would have applied the teachings from the Davis Presentation to the MIFARE reader circuit board by incorporating a 125 kHz antenna on the MIFARE circuit board to make an obvious combination with expected results per the teachings of the Davis Presentation. EX1004, ¶227. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-16 (2007) (“a ‘patent for a combination which only unites old elements with no change in their respective functions . . . obviously withdraws what already is known into the field of its monopoly and diminishes the resources available to skillful men.’”) (*quoting Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 152-153 (1950)); *see also* EX1010, at 34 (“A multi-technology reader can [] be as simple as two separate readers in one box . . .”). Thus, a POSITA would have had a motivation to make the combination and a reasonable expectation of success in doing so by ready reference to the RFID Handbook. *Hoffmann-La Roche Inc. v. Apotex Inc.*, 748 F.3d 1326, 1331 (Fed. Cir. 2014).

4. Claim 1

a. 1[pre]: “An antenna array for an RFID reader comprising:”

To the extent the preamble is limiting, the RFID Handbook discloses this feature. EX1004, ¶223. The RFID Handbook discloses the easy-key System reader, which communicates in the frequency range under 135 kHz and includes an integral

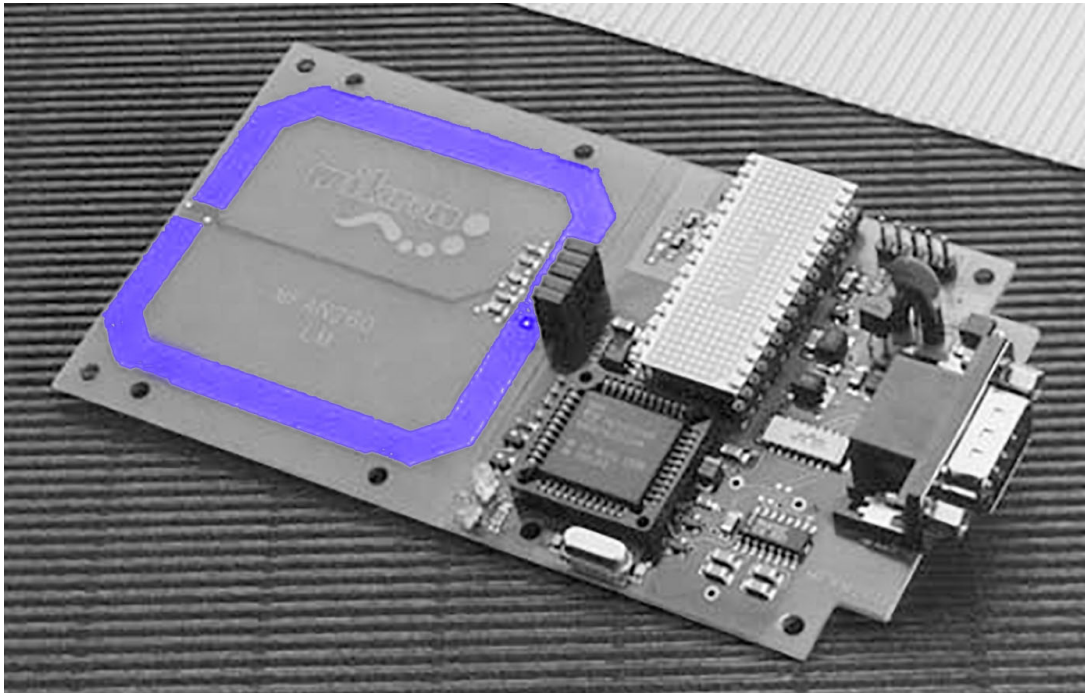
antenna on the perimeter of the circuit board. EX1008, at 9; *see also supra* §VIII.C.2. The RFID Handbook also discloses the Philips MIFARE reader, also “with integral antenna.” EX1008, at 92. As explained below, it would have been obvious to integrate a low frequency antenna and reader electronics into the MIFARE reader such that the combined reader comprises an antenna array as taught by the Davis Presentation. *See* claim 1[C], *infra* §VIII.C.4.d; EX1004, ¶¶228-238.

b. 1[A]: “a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency”

The RFID Handbook discloses this limitation. EX1004, ¶224. The RFID Handbook discloses the easy-key reader “with integral antenna” for use “in the frequency range 135 kHz. EX1008, at 9. A POSITA would have understood from this disclosure and the disclosure of a “[r]eader for inductively coupled transponders,” that the RFID Handbook teaches “a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency.” EX1008 at 9. EX1004, ¶224.

- c. 1[B]: “and a second reader antenna tuned to operate at a second high carrier frequency different from said first low carrier frequency enabling data communication with a second transponder transmitting data signals at said second high carrier frequency”

The RFID Handbook discloses this limitation. EX1004, ¶¶225-227. As shown below, the MIFARE reader has “an integral antenna for a 13.56 MHz system,” a high carrier frequency:



EX1008, at 92 (antenna annotated in blue). The RFID Handbook discloses an HF interface as part of the MIFARE reader. EX1008, at 80. A POSITA would have understood from that disclosure that the RFID Handbook teaches a system that “enable[es] data communication with a second transponder transmitting data signals at said second high carrier frequency” because an HF interface modulates and

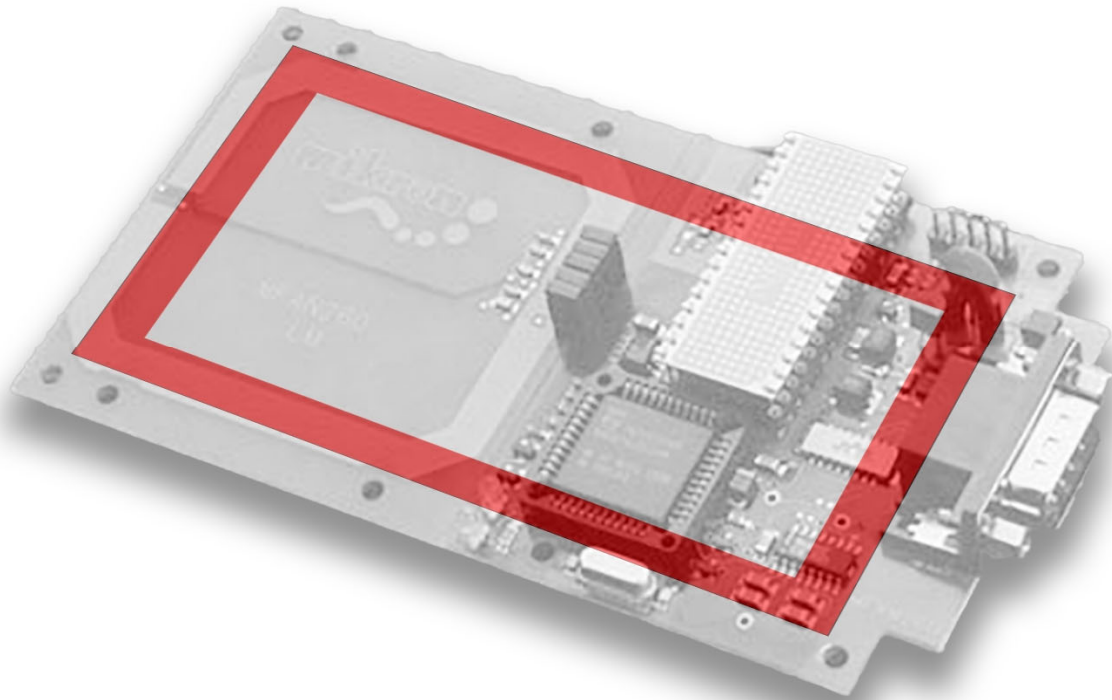
demodulates signals sent to and received from a transponder. EX1004, ¶226; EX1008, at 80, 91-92.

d. 1[C]: “wherein the first and second antennas are oriented along axes that are substantially parallel to one another.”

An obvious combination to the MIFARE reader of the RFID Handbook discloses this limitation. EX1004, ¶¶228-238. A POSITA would have been motivated by the teachings of the Davis Presentation to integrate a low frequency antenna and associated circuitry, such as that disclosed in the RFID Handbook with respect to the easy-key reader, into a high-frequency reader such as the MIFARE disclosed in the RFID Handbook, such that the reader could obtain the benefits of operating at both low and high frequencies. EX1004, ¶¶228-231. A POSITA would have known that such a combination would provide numerous advantages, including enabling the continued use of legacy low-frequency prox cards while migrating to newer high-frequency smart cards. EX1004, ¶229; EX1011, at 12, 20-23.) Similar combinations have been seen in related radio-frequency technologies. EX1004, ¶230; EX1029, at 1 (57), 4, ll. 3-7; *see also id.* at 44, ll. 3-14; 50, ll. 9-19.

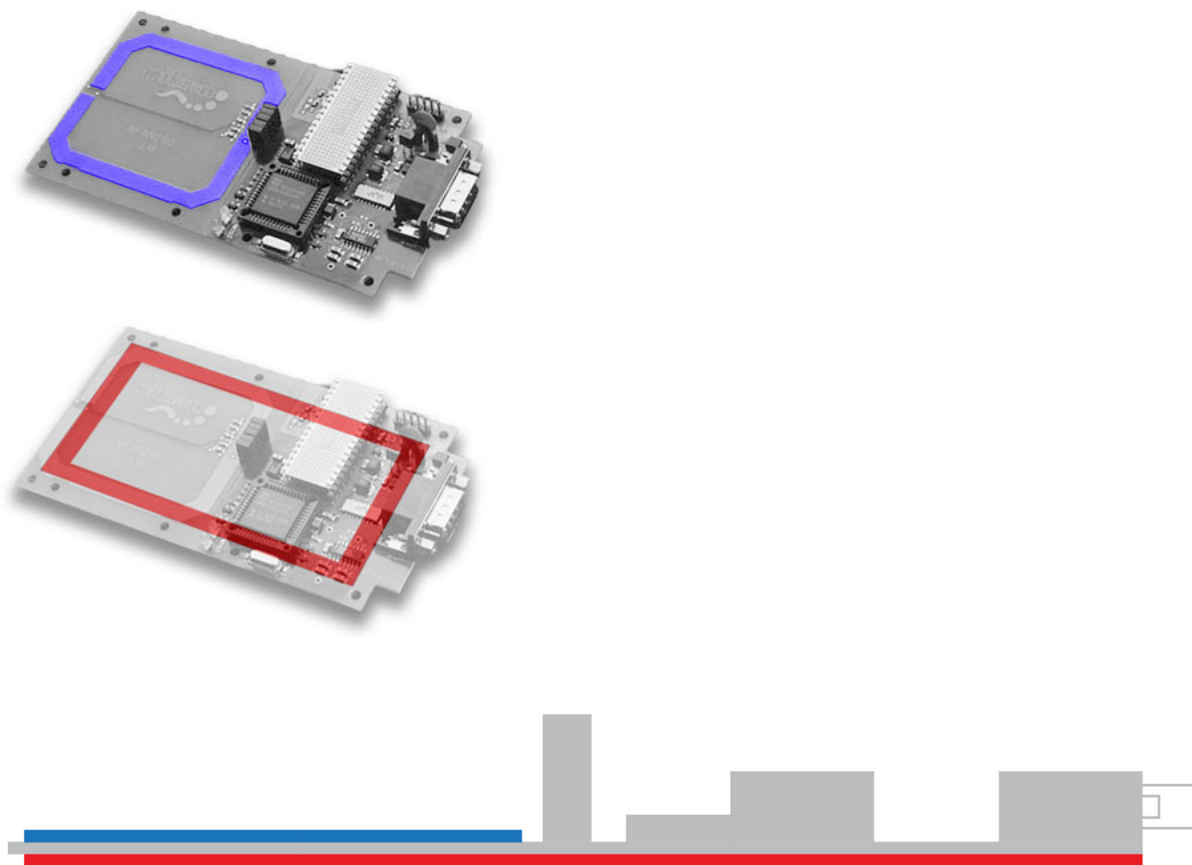
By 2003, it would have been obvious to incorporate a 125 kHz (low-frequency) antenna into a high-frequency reader such as the MIFARE disclosed in the RFID Handbook in one of several different ways, but the most practical way would have been to incorporate the antenna along the perimeter of the underside of

the MIFARE circuit board. EX1004, ¶¶231-235. An antenna integrated in this manner is shown below red, with the upper portion of the MIFARE reader board grayed-out to show the perspective of the antenna embedded on the underside of the circuit board. This arrangement around the perimeter would permit the reader antenna to have the longest possible read range and provides the largest square area around the edge for reading a credential EX1004, ¶47, 234-. Moreover, placing the low frequency antenna on the circuit board would not increase the total size of the reader, permitting the MIFARE reader to maintain the same compact reader design, and allow both antennas to communicate with credential cards presented at the same reader face. EX1004, ¶234.



EX1008, at 92 (annotated). Incorporating a 125 kHz antenna and related reader electronics in an operable manner into the MIFARE reader would have been within the skill of the POSITA by (and before) 2003. EX1004, ¶235.

In this way, the 13.56 MHz antenna (blue) would remain disposed on the planar top surface of the circuit board, the 125 kHz antenna (red) would be disposed on the underside of the circuit board, and such that the antennas would be oriented along axes that are substantially parallel to one another, as shown below.



See EX1008, at 9, 92 (annotated); EX1004, ¶¶236-238. Thus, the RFID Handbook in view of the Davis Presentation renders obvious claim 1 of the '862 patent. EX1004, ¶¶223-238.

5. Claim 2: “The antenna array of claim 1, wherein said first low carrier frequency is nominally 125 kHz.”

See Claim 1[A], *supra* §VIII.C.4.b, §V, EX1004, ¶239; EX1008, at 49-51, 53-55, 87.

6. Claim 3: “The antenna array of claim 2, wherein said second high carrier frequency is about 13.56 MHz.”

See Claim 1[B], *supra* §VIII.C.4.c; EX1004, ¶240.

7. Claim 4: “The antenna array of claim 1, further comprising a reader housing containing said first and second antennas.”

The RFID Handbook discloses this limitation. EX1004, ¶¶241-242. Although the RFID Handbook does not disclose the precise housing containing the MIFARE circuit board, the RFID Handbook teaches that such a reader would be contained in a housing (as shown for example in Figure 1.8 below), which would protect the reader antennas and sensitive electronic components from exposure to the elements, vandalism, or other wear:

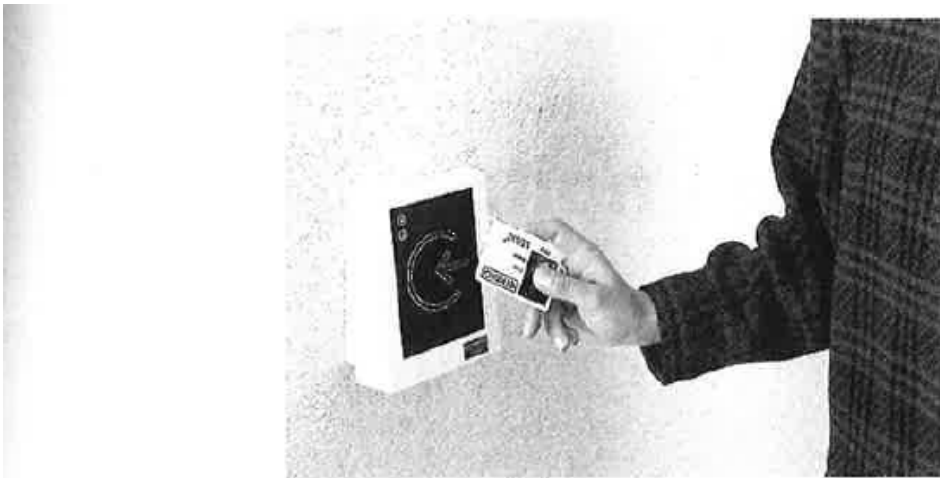


Figure 1.8 RFID reader and contactless smart card in practical use (reproduced by permission of Kaba Benzing GmbH)

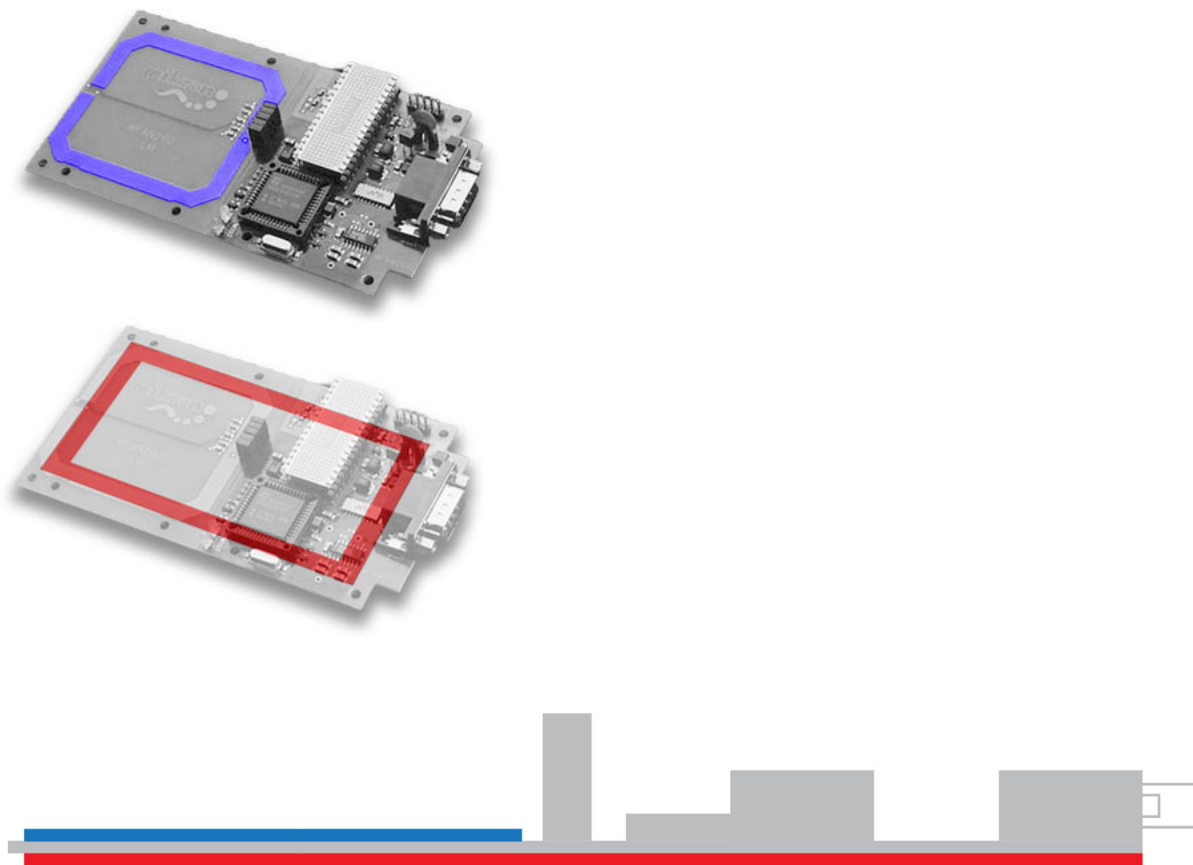
EX1008, at 6; *see also id.*, at 104-134.

8. Claim 5

All of the limitations of Claim 1 are recited in Claim 5, except Claim 5 recites that “wherein said first and second antennas are arranged in at least a partially overlapping arrangement on proximate adjacent planes,” in limitation 5[C] in place

of limitation 1[C].⁵ *See infra* §XI. As with claim 1, the RFID Handbook teaches this limitation. *See* EX1004, ¶¶243-249.

The combination described with reference to Claim 1[C] discloses this limitation. *See* §VIII.C.4.d, *supra*; EX1004, ¶¶246-249. The antennas are on proximate planes to each other because they are on opposing sides of a slim circuit board, and the 13.56 MHz antenna (blue) and 125 kHz antenna (red) would overlap, as shown below:



⁵ *See* Footnote 2, *supra*.

See EX1008, 92 (annotated); EX1004, ¶¶248-249.

9. Claim 6: “The antenna array of claim 5, further comprising a reader housing containing said first and second antennas.”

See Claim 4, *supra* §VIII.C.7; EX1004, ¶250.

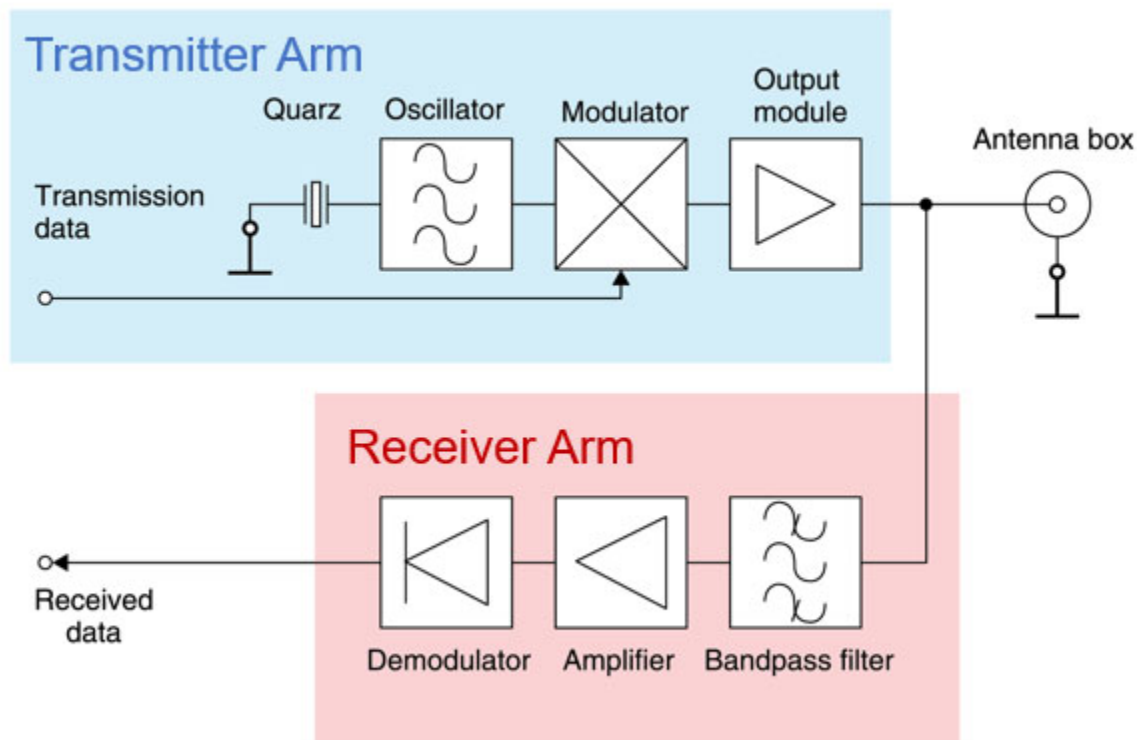
10. Claim 14

All of the limitations of Claim 1 are recited in Claim 14, except Claim 14 recites that the additional elements of “an RFID system (*see* 14[pre]) “and a signal generator coupled with said first and second reader antennas” (*see* 14[D]). See EX1004, ¶¶251-257; *see infra* §XI.

Relating to the “RFID System,” the RFID Handbook discloses that the MIFARE reader is an “Inductive System[,],” which a PHOSITA would have known would have been with inductive transponders as part of an RFID system. EX1008, at 92. The RFID Handbook and Davis presentation also disclose RFID systems for low frequency readers, and the Davis presentation further discloses RFID Systems for multi-frequency RFID systems. EX1011, at 4-22; EX1008, at 9, 79-90.

The RFID Handbook also discloses the use of a “a signal generator coupled with said first and second reader antennas.” EX1004, ¶¶256-257. “Readers in **all systems**,” including the MIFARE reader and incorporated 125 kHz reader, have an “*HF interface*, consisting of a **transmitter** and receiver.” EX1008, at 80-81 (emphasis added); EX1004, ¶257. It was known to the POSITA before the priority

date that the transmitter arm in all RFID readers would have been connected to the antenna, which is taught by the RFID Handbook, for example, in Figure 11.4:



EX1008, at 81 (transmitter arm annotated in blue); EX1004, ¶257.

11. Claim 15: “The RFID reader of claim 14, wherein said signal generator is an integrated signal generator including integral means for generating signals for transmission from said first and second reader antennas.”

It would have been obvious to utilize an integrated signal generator in the multi-frequency reader taught by the RFID Handbook and the Davis Presentation. See EX1004, ¶¶258-264. Integrated signal generators were known in the art by late 2003, and a POSITA would have been motivated to utilize one in implementing the MIFARE reader to include a low-frequency antenna. See EX1004, ¶259; see also

EX1008, at 87-88; EX1020; EX1021, at 5:23-6:32; EX1029, at 4, ll. 3-7; 4, ll. 16-21; 5, ll. 2-16; 5, ll. 17-26; 7, ll. 7-16. Moreover, because there were (and are) only two options for signal generators in such a multi-frequency reader (integrated for both frequencies and antennas, or discrete for each frequency and antenna), use of an integrated signal generator, which was well within the skill of a POSITA, would have been obvious. EX1004, ¶¶260-264. Indeed, the '862 patent notes that signal generators are “conventional.” EX1001, 6:21-27; EX1004, ¶264; see also EX1008, EX1020; EX1021.

12. Claim 16: “The RFID reader of claim 14, wherein said signal generator includes a discrete first signal generator coupled with said first reader antenna for generating signals for transmission from said first reader antenna and a discrete second signal generator coupled with said second reader antenna separate from said discrete first signal generator for generating signals for transmission from said second reader antenna.”

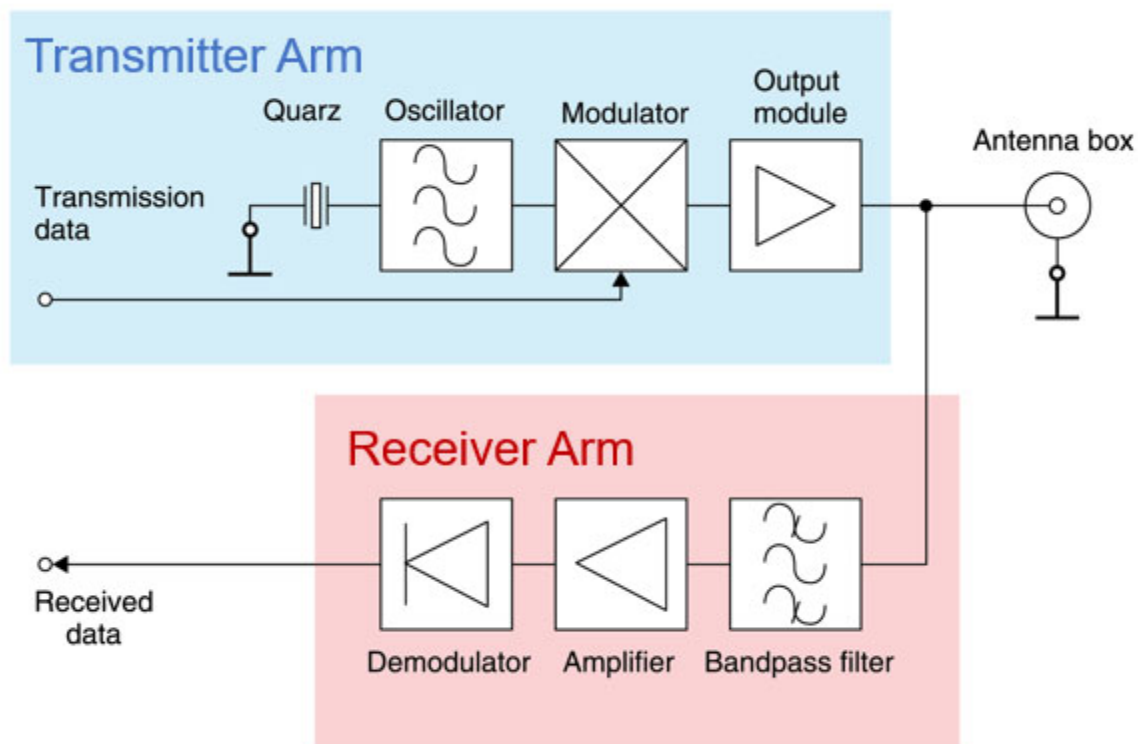
The RFID Handbook discloses this limitation. EX1004, ¶¶265-266. As described for claim 14[D], the MIFARE reader disclosed a signal generator, and 13.56 MHz and 125 kHz carrier frequency signal generators were well known in the prior art. *Supra*, §VIII.C.10; EX1004, ¶¶265-266; EX1008, at 81. It would have been within the routine skill of a POSA and would have yielded predictable results to utilize discrete signal generators with each of the 13.56 MHz and 125 kHz reader antennas; indeed, this has been done extensively in the prior art. EX1004, ¶266.

13. Claim 17

All of the limitations of Claim 14 are recited in Claim 17, except that in place of reciting limitation 14[C], Claim 17 recites that “the first and second antennas are arranged in at least a partially overlapping arrangement along proximate adjacent planes;” which is substantially identical to Claim 5[C] and is disclosed by the RFID Handbook.⁶ EX1004, ¶270, *supra* §VIII.C.8; *see infra* §XI. And in place of reciting Claim 14[D], Claim 17[D] recites the element of “receiver electronics coupled with said first and second reader antennas.” The RFID Handbook discloses this limitation. *See* EX1004, ¶¶267-271.

The RFID Handbook also discloses the use of “a signal generator coupled with said first and second reader antennas.” EX1004, ¶271. “Readers in **all systems**,” including the MIFARE reader and incorporated 125 kHz reader, have an “*HF interface*, consisting of a transmitter and **receiver**.” EX1008, at 80-81 (emphasis added); EX1004, ¶271. It was known to the POSITA before the priority date that the transmitter arm in all RFID readers would have been connected to the antenna, which is taught by the RFID Handbook, for example, in Figure 11.4:

⁶ *See* Footnote 3, *supra*.



EX1008, at 81 (transmitter arm annotated in red); EX1004, ¶271.

14. **Claim 18: “The RFID reader of claim 17, wherein said receiver electronics is integrated receiver electronics including integral means for conditioning signals received by said first and second reader antennas.”**

It would have been an obvious modification of the MIFARE-125 kHz combined reader to utilize integrated receiver electronics. *See* EX1004, ¶¶272-277. Integrated receiver electronics capable of “conditioning” signals at multiple frequencies were well known in the prior art, including being used in combined AM/FM radios and radio frequency sensor technology. *See* EX1004, ¶¶273-277.

15. Claim 19: “The RFID reader of claim 17, wherein said receiver electronics includes discrete first receiver electronics coupled with said first reader antenna for conditioning signals received by said first reader antenna and discrete second receiver electronics coupled with said second reader antenna separate from said discrete first receiver electronics for conditioning signals received by said second reader antenna.”

The RFID Handbook discloses this limitation. EX1004, ¶278. For example, as described for Claim 17[D], the MIFARE Reader discloses receiver electronics, and 13.56 MHz and 125 kHz carrier frequency receiver electronics were known in the prior art. *Supra*, §VIII.C.13; EX1004, ¶278. It would have been within the routine skill of a POSITA, and would have yielded predictable results to utilize discrete receiver electronics with each of the 13.56 MHz and 125 kHz reader antennas; indeed, this has been done extensively in the prior art. EX1004, ¶278.

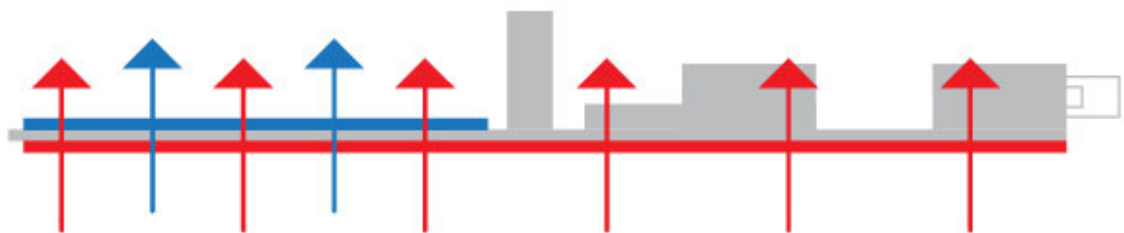
16. Claim 20

All of the limitations of Claim 1 are recited in Claim 20, except Claim 20 additionally requires that the antennas of Claims 1[A] and 1[B] be “loop antennas,” the imitations requiring having “a first loop” and “a second loop,” respectively. Claim 20 also recites limitations 20[C] and 20[D] in place of 1[C], which are discussed *infra*.

The MIFARE reader antenna described under limitation 1[B] is a loop antenna, and it would have been obvious to use a loop antenna for the low frequency reader antenna, as described in 1[A], *supra* §§VIII.C.4.b, c; EX1004, ¶§279-280.

20[C]: “wherein a first plane defined by the first area is substantially orthogonal to a direction of magnetic flux created through the first antenna, wherein a second plane defined by the second area is substantially orthogonal to a direction of magnetic flux created through the second antenna,”

The RFID Handbook discloses this limitation. EX1004, ¶¶281-282. A POSITA would have known that two loop antennas in a reader would surround first and second areas, respectively, each of which sits on and defines a separate plane. The direction of magnetic flux created by each antenna is orthogonal to the plane on which that antenna sits, as a POSITA would have known before the priority date. (See, e.g., EX1008, at 15-35; EX1023, at Fig. 2B; EX1025, at 5; EX1004, ¶¶281-282). Thus, the multi-frequency reader described above would have a first plane that is substantially orthogonal to a direction of magnetic flux created through the first antenna, and a second plane that is substantially orthogonal a direction of magnetic flux created through the second antenna, as recited in this limitation, as shown below with magnetic flux lines from each antenna annotated in.



- e. 20[D]: “wherein said first and second loops are arranged relative to one another such that a portion of the first area in the first plane overlaps a portion of the second area in the second plane.”

The RFID Handbook renders this limitation obvious. EX1004, ¶283. As described above, a POSITA would have known that it would have been advantageous to implement a low-frequency antenna into the MIFARE reader such that the areas enclosed by each antenna on separate planes overlap. *See supra*, §[Claim 5]. Accordingly, the RFID Handbook in view of the Davis Presentation renders claim 20 obvious.

D. Ground 4: RFID Handbook in view of Davis Presentation in further view of Walton Renders Obvious Claims 7, 9-11, 13, 22-24, and 26 of the '862 Patent

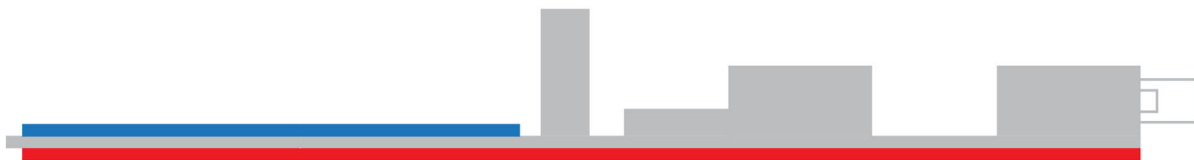
1. RFID Handbook—Davis Presentation-Walton Combination

A POSITA would have been motivated to further combine the RFID Handbook and Davis Presentation with Walton in order to further improve operability of the resulting multi-frequency reader. EX1004, ¶305. Walton explains how the positioning of multiple antennas on parallel planes would affect the ability of each reader antenna to read credentials. EX1004, ¶305 A POSITA would have known that placing the 125 kHz reader antenna on the other side of the circuit board from the 13.56 MHz antenna would place the antennas in close proximity where the magnetic fields of the antennas may interact and disrupt credential reading. EX1004, ¶305 Thus, a POSITA would have been motivated to apply Walton’s teachings

regarding magnetic flux (*see supra*, §VIII.B.1) in implementing the MIFARE reader to include a low-frequency antenna to ensure that magnetic interference is minimized while allowing for a compact reader housing and strong signal strength between the reader and cards operating at either high or low frequencies. EX1004, ¶305.

2. **Claim 7: “The antenna array of claim 5, wherein said first reader antenna has a first area, said second reader antenna has a second area, and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.**

The combination described with reference to Ground 3, Claim 1 meets this limitation because each of the integrated 125 kHz reader antenna and MIFARE reader antenna encircle first and second areas, respectively. EX1004, ¶¶284-289; §VIII.C.4, *supra*. As described in Claim 1 and shown in the annotated image below, the MIFARE reader antenna (blue) only overlaps a portion of the 125 kHz antenna (red) area.

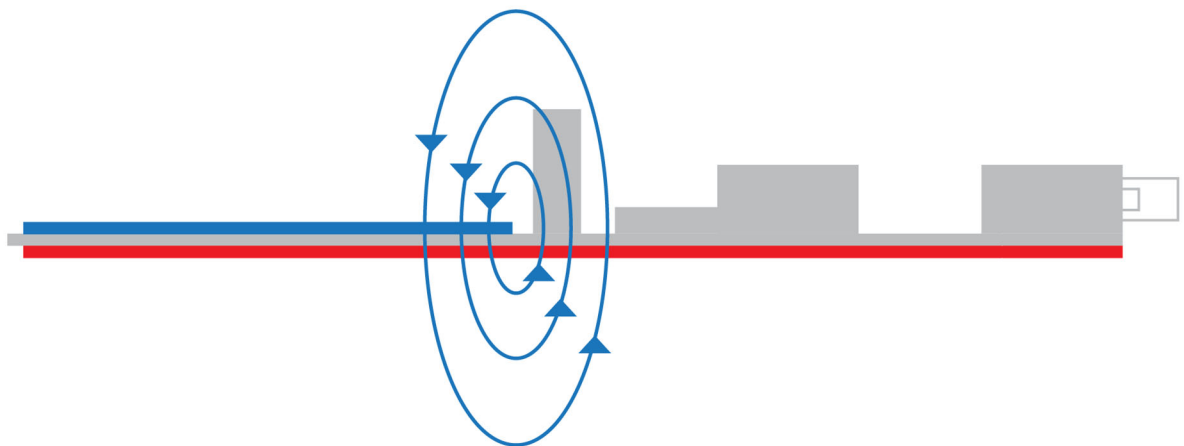


3. Claim 9

All of the limitations of Claim 1 are recited in Claim 9, except Claim 9 recites that “wherein said first and second antennas are arranged in an opposing magnetic

flux arrangement,” in limitation 9[C] in place of limitation 1[C]. *See infra* §XI. The RFID Handbook in view of the Davis Presentation and Walton teach this limitation. *See* EX1004, ¶¶290-313.

As discussed under Ground 2, Claim 7, above, Walton teaches that two parallel, overlapping antennas are in an opposing magnetic flux arrangement when they are only partially overlapping. *See* §VIII.B.3, *supra*. The obvious implementation of a 125 kHz reader with the MIFARE reader described in Ground 3, Claim 1, *supra* §VIII.C.4 is in a partially overlapping arrangement. As shown below, this results in a directions of magnetic flux generated by the MIFARE reader antenna (blue) passing through the 125 kHz reader antenna (red) in opposing directions—both upward and downward directions—thereby teaching that the antennas are in an “opposing magnetic flux relationship.” EX1004, ¶¶303-313.



4. **Claim 10: “The antenna array of claim 9, further comprising a reader housing containing said first and second antennas.”**

See Ground 3, Claim 4, *supra* §VIII.C.7; EX1004, ¶314.

5. **Claim 11:**

- f. 11[A]: **“The antenna array of claim 9, wherein said first reader antenna has a first area, said second reader antenna has a second area”**

See Claim 7, *supra* §VIII.D.2; EX1004, ¶315.

- g. 11[B]: **“and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.”**

See Claim 7, *supra* §VIII.D.2; EX1004, ¶316.

6. **Claim 13: “The antenna array of claim 9, wherein said first and second reader antennas are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.”**

Because the opposing magnetic flux arrangement of Claim 9 is the same as the overlapping arrangement described in Claim 7, the RFID Handbook in view of the Davis Presentation and in further view of Walton teach this claim. *See* Claims 7 and 9, *supra*, §§VIII.D.2, 3; EX1004, ¶317.

7. **Claim 22.** “The antenna array of claim 20, wherein said first and second loops have a parallel orientation and are arranged relative one another such that a size of the portion of the first area aligning with the portion of the second area is less than at least one of a size of the first area and a size of the second area.”

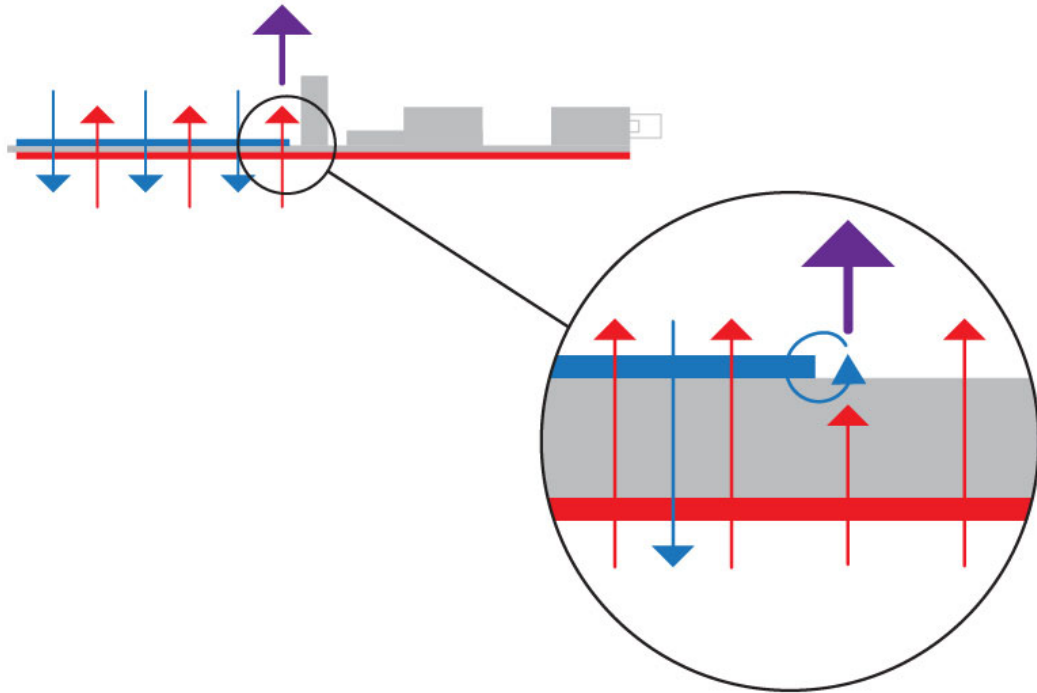
For the reasons set out in Claim 7, the RFID Handbook in view of Davis and Walton teach this claim. *See, supra* §VIII.D.2; EX1004, ¶¶318-321; *see also* Claims 9, 11, *supra* §§VIII.D.3, 5.

8. Claim 23

All of the limitations of Claim 20 are recited in Claim 23, except Claim 23 recites that “wherein said first and second loops are arranged in an opposing magnetic flux arrangement where the direction of magnetic flux created through the first loop is substantially parallel but opposite to the direction of magnetic flux created through the second loop” in limitation 23[C] in place of limitation 20[C] and 20[D]. *See infra* §XI.

The RFID Handbook renders this limitation obvious in view of the Davis Presentation and Walton. EX1004, ¶¶322-326. As described in Ground 2, Claim 23, it would have been a routine implementation and advantageous to have the current in one antenna run in the opposite direction to the current in the other antenna. §VIII.B.9, *supra*. As shown in the annotated image below and described in §VIII.B.9, by having the current in the MIFARE reader antenna (blue) run opposite to the direction of the current in the 125 kHz reader antenna (red), this can extend

the range of the red reader antenna by aligning the direction of magnetic fields on the area in which the antennas overlap, as exemplified in purple. EX1004, ¶326.



9. **Claim 24:** “The antenna array of claim 23, wherein said first loop has a first area, said second loop has a second area, and said first and second loops are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.”

See Claim 7 supra §VIII.D.2; EX1004, ¶327.

10. **Claim 26:** “The antenna array of claim 23, wherein said first and second loops are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.”

See Claim 13, supra §VIII.D.6; EX1004, ¶328.

IX. DISCRETIONARY DENIAL IS UNWARRANTED

A. Section 314(a)

As explained below, discretionary denial under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11, 6 (PTAB Mar. 20, 2020) (precedential) is unwarranted:

1. Factor 1: Stay

This factor is neutral because neither party has requested a stay in the District Court Litigation, and it is unknown whether a stay will be granted if requested. *See Sand Revolution II, LLC v. Cont'l Intermodal Grp. – Trucking LLC*, IPR2019-01393, Paper 24, at 7 (PTAB June 16, 2020) (informative).

2. Factor 2: Proximity of Trial Date to Board's Final Written Decision

The Complaint in the District Court Litigation was filed on March 21, 2022. Based on a median time from filing to trial in the District of Delaware of 33.7 months, the likely disposition date is sometime in January 2025. (EX1037, at 14.) A Final Written Decision here would be anticipated in September 2024. Thus, it is almost certain that the Board would issue its FWD before any trial in the District Court Litigation.⁷ This factor thus weighs against discretionary denial.

⁷ Petitioner filed a motion to transfer the District Court Litigation to the District of Colorado, which has a median time-to-trial of 35.9 months (EX1037, at 79), which is even longer than the District of Delaware.

3. Factor 3: Investment in Parallel Proceeding

The District Court Litigation is in its earliest stages. No discovery has taken place, no trial date has been set, and the Petitioner’s motion to transfer is pending. This also weighs against discretionary denial.

4. Factor 4: Overlap of Issues

Given its early stage, the validity issues in the litigation are unknown. Further, there is not complete overlap of issues because Petitioners are challenging additional claims not asserted in the District Court Litigation. A trial before the Board will thus address 7 claims that the district court will not address, which weighs against discretionary denial. *Markforged Inc. v. Continuous Composites, Inc.*, IPR2022-00679, Paper 7, at 32-33 (Oct. 25, 2022).

5. Factor 5: Similarity of Parties

The parties are the same.

6. Factor 6: Other Circumstances

“[T]he PTAB will not deny institution based on *Fintiv* if there is compelling evidence of unpatentability,” which this Petition provides. Director’s Interim Procedure for Discretionary Denials (June 21, 2022) (“Interim Procedure”). That is the case here—as explained herein, the Challenged Claims all recite conventional and basic RFID systems and components that were long-known before the priority date. Thus, discretionary denial is inappropriate here.

B. Section 325(d)

Denial under 35 U.S.C. §325(d) would not be appropriate under the two-part test set forth in *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*: (1) whether the same or substantially the same prior art or arguments were previously presented to the Office; and (2) whether Petitioner demonstrated that the Office erred in a manner material to the patentability of the challenged claims. IPR2019-01469, Paper 6, at 7-9 (PTAB Feb. 13, 2020) (precedential).

None of the references or prior art combinations presented in this Petition were ever presented to or considered by the Examiner. While a German language version of another edition of the RFID Handbook was cited in an IDS filed by Patent Owner during prosecution, it was never applied as a reference against any of the claims. The Board has “consistently held that a reference that was neither applied against the claims nor discussed by the Examiner does not weigh in favor of exercising discretion under §325(d).” *Bowtech, Inc. v. MCP IP, LLC*, IPR2019-00382, Paper 12, 12 (PTAB Aug. 6, 2019). Moreover, the RFID Handbook is asserted herein with at least the Davis Presentation, and this combination was never before the Examiner. Thus, the first prong of *Advanced Bionics* is not satisfied. *See, e.g., Thorne Research, Inc. v. Trustees of Dartmouth College*, IPR2021-00491, Paper 18 at 8 (PTAB Aug. 12, 2021) (“The fact that one piece of art from the

combination was previously presented and/or argued to the Office alone is insufficient to satisfy the first prong of *Advanced Bionics* two-part test....”).

X. CONCLUSION

Petitioners request cancellation of claims 1-7, 9-11, 13-20, 22-24, and 26.

Dated: March 24, 2023

Respectfully submitted,

/Thatcher A. Rahmeier/

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CERTIFICATE OF SERVICE UNDER 37 C.F.R. §42.6 (E)(4)

I certify that on March 24, 2023, I will cause a copy of the foregoing Petition, including any exhibits or appendices filed therewith, to be served via overnight delivery to the following correspondence address of record for the patent:

Todd Blakely
Sabrina Stavish
Matthew Elsworth
SHERIDAN ROSS P.C.
1560 Broadway, Suite 1200
Denver, CO 80202

I will further cause a copy of the foregoing Petition, including any exhibits or appendices filed therewith, to be served upon the following additional parties via electronic mail or file transfer:

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Date: March 24, 2023

/Thatcher A. Rahmeier/
Thatcher A. Rahmeier

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that the foregoing IPR petition contains 13,984 words excluding a table of contents, a table of authorities, Mandatory Notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing. Petitioners have relied on the word count feature of the word processing system used to create this paper in making this certification.

Date: March 24, 2023

/Thatcher A. Rahmeier/

Thatcher A. Rahmeier

XI. CLAIM LISTING

The following claim listing assigns element labels (e.g., 1[A], 1[B], etc.) to certain claims for clarity.

Claim 1
1[pre] An antenna array for an RFID reader comprising:
1[A] a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency;
1[B] and a second reader antenna tuned to operate at a second high carrier frequency different from said first low carrier frequency enabling data communication with a second transponder transmitting data signals at said second high carrier frequency,
1[C] wherein the first and second antennas are oriented along axes that are substantially parallel to one another.
Claim 2
2. The antenna array of claim 1, wherein said first low carrier frequency is nominally 125 kHz.
Claim 3
3. The antenna array of claim 2, wherein said second high carrier frequency is about 13.56 MHz.
Claim 4
4. The antenna array of claim 1, further comprising a reader housing containing said first and second antennas.
Claim 5
5[pre] An antenna array for an RFID reader comprising:
5[A] a first reader antenna tuned to operate at a first carrier frequency enabling data communication with a first transponder transmitting data signals at said first carrier frequency;
5[B] and a second reader antenna tuned to operate at a second carrier frequency different from said first carrier frequency enabling data communication with a second transponder transmitting data signals at said second carrier frequency,
5[C] wherein said first and second antennas are arranged in at least a partially overlapping arrangement on proximate adjacent planes.
Claim 6
6. The antenna array of claim 5, further comprising a reader housing containing said first and second antennas.

Claim 7
7. The antenna array of claim 5, wherein said first reader antenna has a first area, said second reader antenna has a second area, and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.
Claim 9
9[pre] An antenna array for an RFID reader comprising:
9[A] a first reader antenna tuned to operate at a first carrier frequency enabling data communication with a first transponder transmitting data signals at said first carrier frequency;
9[B] and a second reader antenna tuned to operate at a second carrier frequency different from said first carrier frequency enabling data communication with a second transponder transmitting data signals at said second carrier frequency,
9[C] wherein said first and second antennas are arranged in an opposing magnetic flux arrangement.
Claim 11
11[A] The antenna array of claim 9, wherein said first reader antenna has a first area, said second reader antenna has a second area,
11[B] and said first and second reader antennas are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.
Claim 13
13. The antenna array of claim 9, wherein said first and second reader antennas are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.
Claim 14
14[pre] An RFID reader for an RFID system comprising:
14[A] an antenna array including a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency
14[B] and a second reader antenna tuned to operate at a second high carrier frequency different from said first low carrier frequency enabling data communication with a second transponder transmitting data signals at said second high carrier frequency,
14[C] wherein the first and second antennas are oriented along axes that are substantially parallel to one another;
14[D] and a signal generator coupled with said first and second reader antennas.

Claim 15
15. The RFID reader of claim 14, wherein said signal generator is an integrated signal generator including integral means for generating signals for transmission from said first and second reader antennas.
Claim 16
16. The RFID reader of claim 14, wherein said signal generator includes a discrete first signal generator coupled with said first reader antenna for generating signals for transmission from said first reader antenna and a discrete second signal generator coupled with said second reader antenna separate from said discrete first signal generator for generating signals for transmission from said second reader antenna.
Claim 17
17[pre] An RFID reader for an RFID system comprising:
17[A] an antenna array including a first reader antenna tuned to operate at a first low carrier frequency enabling data communication with a first transponder transmitting data signals at said first low carrier frequency
17[B] and second reader antenna tuned to operate at a second high carrier frequency different from said first low carrier frequency enabling data communication with a second transponder transmitting data signals at said second high carrier frequency,
17[C] wherein the first and second antennas are arranged in at least a partially overlapping arrangement along proximate adjacent planes;
17[D] and receiver electronics coupled with said first and second reader antennas.
Claim 18
18. The RFID reader of claim 17, wherein said receiver electronics is integrated receiver electronics including integral means for conditioning signals received by said first and second reader antennas.
Claim 19

19. The RFID reader of claim 17, wherein said receiver electronics includes discrete first receiver electronics coupled with said first reader antenna for conditioning signals received by said first reader antenna and discrete second receiver electronics coupled with said second reader antenna separate from said discrete first receiver electronics for conditioning signals received by said second reader antenna.

Claim 20

20[pre] An antenna array for an RFID reader comprising:

20[A] a first reader loop antenna having a first loop and tuned to operate at a first carrier frequency enabling data communication with a first transponder transmitting data signals at said first carrier frequency;

20[B] and a second reader loop antenna having a second loop and tuned to operate at a second carrier frequency different from said first carrier frequency enabling data communication with a second transponder transmitting data signals at said second carrier frequency,

20[C] wherein a first plane defined by the first area is substantially orthogonal to a direction of magnetic flux created through the first antenna, wherein a second plane defined by the second area is substantially orthogonal to a direction of magnetic flux created through the second antenna,

20[D] wherein said first and second loops are arranged relative to one another such that a portion of the first area in the first plane overlaps a portion of the second area in the second plane.

Claim 22

22. The antenna array of claim 20, wherein said first and second loops have a parallel orientation and are arranged relative one another such that a size of the portion of the first area aligning with the portion of the second area is less than at least one of a size of the first area and a size of the second area.

Claim 23

23[pre] An antenna array for an RFID reader comprising:

23[A] a first reader loop antenna having a first loop and tuned to operate at a first carrier frequency enabling data communication with a first transponder transmitting data signals at said first carrier frequency;

23[B] and a second reader loop antenna having a second loop and tuned to operate at a second carrier frequency different from said first carrier frequency enabling data communication with a second transponder transmitting data signals at said second carrier frequency,

23[C] wherein said first and second loops are arranged in an opposing magnetic flux arrangement where the direction of magnetic flux created through the first loop is substantially parallel but opposite to the direction of magnetic flux created through the second loop.

Claim 24

24. The antenna array of claim 23, wherein said first loop has a first area, said second loop has a second area, and said first and second loops are arranged relative one another such that only a portion of said first area aligns with only a portion of said second area.

Claim 26

26. The antenna array of claim 23, wherein said first and second loops are arranged in an overlapping arrangement simultaneous with said opposing magnetic flux arrangement.