

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HID GLOBAL CORPORATION,
Petitioner,

v.

DATAMARS SA,
Patent Owner.

Case IPR2023-01445
Patent No. 11,128,027

DECLARATION OF JOSHUA R. SMITH, PH.D.

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LIST OF EXHIBITS

<u>Exhibit</u>	<u>Description</u>
1001	U.S. Patent No. 11,128,027 to Moraru et al. (“’027 Patent”)
1002	Prosecution History of U.S. Application No. 16/609,260
1005	European Patent No. 2405054 B1 to Pachoud et al. (“ <i>Pachoud</i> ”)
1006	German Patent Publication No. DE 202013100682 U1 to ASTRA Gesellschaft für Asset Management mbH & Co. KG.
1007	Certified Translation of German Patent Publication No. DE 202013100682 U1 to ASTRA Gesellschaft für Asset Management mbH & Co. KG. (“ <i>Astra</i> ”)
1008	PCT International Publication No. WO 2017/060652 A1 to Elbaz et al.
1009	Certified Translation of PCT International Publication No. WO 2017/060652 A1 to Elbaz et al. (“ <i>Elbaz</i> ”)
1010	German Patent Publication No. DE 102007016584 A1 to Stobbe et al.
1011	Certified Translation of German Patent Publication No. DE 102007016584 A1 to Stobbe et al. (“ <i>Stobbe</i> ”)
1012	Maxime Guibert et al., <i>Washing Reliability of Painted, Embroidered, and Electro-Textile Wearable RFID Tags</i> , 2017 Progress in Electromagnetics Research Symposium – Fall, pp. 828-831 (2017) (“ <i>Guibert</i> ”)
1013	PCT International Publication No. WO 2013/128299 A1 to Usta (“ <i>Usta</i> ”)
1014	Shuai Shao et al., <i>Broadband Textile-Based Passive UHF RFID Tag Antenna for Elastic Material</i> , IEEE Antennas and Wireless Propagation Letters, vol. 14, pp. 1385-1388 (2015) (“ <i>Shao</i> ”)

<u>Exhibit</u>	<u>Description</u>
1015	Elham Moradi et al., <i>Characterization of Embroidered Dipole-type RFID Tag Antennas</i> , 2012 IEEE International Conference on RFID-Technologies and Applications, pp. 248-253 (2012) (“ <i>Moradi</i> ”)
1016	Aurelian Moraru et al., <i>RFID System with Passive RFID Tags for Textiles</i> , 2017 10th International Symposium on Advanced Topics in Electrical Engineering, pp. 410-415 (2017) (“ <i>Moraru</i> ”)
1017	Certified Translation of Romanian Patent Publication No. RO 133013 A1
1018	PCT International Publication No. WO 2018/231083 A1 to Moraru et al.

All emphasis is added unless otherwise indicated.

I. INTRODUCTION

1. I have been retained by HID Global Corporation (“HID Global”), as an independent expert for the above-identified inter partes review proceeding involving U.S. Patent No. 11,128,02 (“the ’027 patent”).

2. I am over 21 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein.

3. Although I am being compensated for my time in connection with this proceeding at my standard hourly consulting rate and reimbursed for reasonable out-of-pocket expenses, no part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding.

4. I have been asked to provide my opinion whether the claims of the ’027 patent would have been obvious to a person of ordinary skill in the art at the time of the earliest claimed priority date of the ’027 patent. My opinions are set forth below.

5. Throughout this declaration, I refer to specific pages, figures, and/or line numbers of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the propositions for which they are cited.

II. SUMMARY OF OPINIONS

6. This declaration analyzes claims 1-3 and 6 of the ’027 patent. Below, I set forth the opinions I have formed, the conclusions I have reached, and the bases

for my opinions and conclusions. I believe the statements contained in this declaration to be true and correct to the best of my knowledge.

7. Based on my experience and my knowledge of the art at the time of the applicable priority date, it is my opinion that claims 1-3 and 6 of the '027 patent would have been obvious based on the asserted grounds discussed below.

III. QUALIFICATIONS AND BACKGROUND

8. I believe that I am well qualified to serve as a technical expert in this matter based upon my qualifications, discussed in detail below.

9. I am competent to write this Declaration. I am providing this Declaration as an independent professional working through my consulting company Sensor Expert LLC, not as a representative of the University of Washington or any other organization.

10. I have over 22 years of experience with RFID technology. I have worked on RFID projects as an engineer, in academic research, and as a supervisor of academic research. I am a Fellow of the National Academy of Inventors (NAI). According to the NAI, "Election to NAI Fellow status is the highest professional distinction accorded solely to academic inventors." I am also a Fellow of the Institute of Electrical and Electronic Engineers ("IEEE"). According to the IEEE, the "Grade of Fellow is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments." The specific citation in my elevation to Fellow was for

“contributions to far- and near-field wireless power, backscatter communication and electric field sensing.” At most one tenth of one percent of the worldwide membership can join the ranks of IEEE Fellow each year. Far field wireless power and backscatter communication, two of the technologies in my citation, are essential technologies for RFID.

11. I received my Ph.D. and S.M. degrees in Media Arts and Sciences from the Massachusetts Institute of Technology, and a M.A. in Physics from Cambridge University, and dual B.A. degrees in Computer Science and Philosophy from Williams College.

12. From 2004 to 2011, I worked at Intel Corporation, where I rose to the rank of Principal Engineer before leaving Intel to become a professor. At Intel, I started the Wireless Identification and Sensing Platform (“WISP”) project, in which we designed and built a fully programmable, battery-free RFID tag from the ground up. Unlike a conventional RFID tag, the WISP also includes a fully programmable microcontroller, and sensors. Thus, the WISP can collect and transmit sensor values, in addition to the identification information that most RFID tags transmit.

13. At Intel, I also served on a committee that made patent filing decisions about wireless technology, including RFID, for the company. I also served on Intel’s Strategic Patent Team for wireless technology, which allocated patent filing budgets for each year for the company among various technical subjects within the

wireless area. Prior to Intel, I was Chief Scientist at Escher Group and Director of Escher Labs, where I worked on low frequency RFID systems that relied on near field capacitive coupling between the tag and the reader, among other topics.

14. In 2011, I joined the University of Washington as an Associate Professor. I received tenure in 2014, and was promoted to Professor and awarded the Milton and Delia Zeuschel Professorship in 2017. At the University of Washington, I currently lead research in a number of areas including backscatter communication, wireless power transfer, and other topics. My research in these areas is funded by Federal agencies including the National Science Foundation (NSF), National Institutes for Health (NIH), the Department of Defense (DoD), Defense Advanced Research Projects Agency (DARPA), the Advanced Research Projects Agency for Energy (ARPA-E), and the National Aeronautics and Space Administration (NASA). I was the General Chair of the 2019 IEEE RFID conference, a leading venue for academic and industrial research on RFID. At UW, I teach courses on design of digital circuits and systems, analog electronics, wireless communication, wireless power and other topics. I am also the faculty coordinator for Electrical and Computer Engineering Department's Professional Masters' Program. In this role, I make final decisions about which courses are offered and often who will teach them. I have also co-founded three startup companies, each

based on intellectual property licensed from the University of Washington for technology developed in my lab.

15. While a Ph.D. student at the Massachusetts Institute of Technology, I was involved in some of the earliest research on electronic textiles. That work led to US Patent 6,210,771, issued in 2001, which teaches the use of conductive threads, fabrics, and textiles to make antennas, inductors, capacitors, transformers, and other electronic components.

16. I am a named inventor on 54 U.S. patents and at least 16 foreign patents. At least 26 of my U.S. patents and 13 of my foreign patents have been licensed. I have published over 167 articles and edited one book entitled “Wirelessly Powered Sensor Networks and Computational RFID.” My work has been cited over 23,000 times, and my “H-index,” which measures publication impact, is 75. All of my five most cited works, relate to RFID or technologies for components thereof.

17. My complete qualifications and professional experience are described in my curriculum vitae, a copy of which can be found in Exhibit A to this declaration.

IV. MATERIALS CONSIDERED

18. In forming my opinions, I read and considered the '027 patent and its prosecution history, the exhibits listed in the Exhibit List filed with the petition for *inter partes* review of the '027 patent, as well as any other materials referenced herein. I have reviewed at least the following documents:

<u>Exhibit</u>	<u>Description</u>
1001	U.S. Patent No. 11,128,027 to Moraru et al. (“922 Patent”)
1002	Prosecution History of U.S. Application No. 16/609,260
1005	European Patent No. 2405054 B1 to Pachoud et al. (“ <i>Pachoud</i> ”)
1006	German Patent Publication No. DE 202013100682 U1 to ASTRA Gesellschaft für Asset Management mbH & Co. KG.
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1012	Maxime Guibert et al., <i>Washing Reliability of Painted, Embroidered, and Electro-Textile Wearable RFID Tags</i> , 2017 Progress in Electromagnetics Research Symposium – Fall, pp. 828-831 (2017) (“ <i>Guibert</i> ”)
1013	PCT International Publication No. WO 2013/128299 A1 to Usta (“ <i>Usta</i> ”)
1014	Shuai Shao et al., <i>Broadband Textile-Based Passive UHF RFID Tag Antenna for Elastic Material</i> , IEEE Antennas and Wireless Propagation Letters, vol. 14, pp. 1385-1388 (2015) (“ <i>Shao</i> ”)
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1017	Certified Translation of Romanian Patent Publication No. RO 133013 A1
1018	PCT International Publication No. WO 2018/231083 A1 to Moraru et al.

19. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

V. LEGAL STANDARDS

20. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

21. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a claim “obvious” to a person of ordinary skill in the art. I understand that a claim is

patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent.

22. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

23. I have been asked to provide my opinions as to whether the cited prior art teaches or renders obvious claims 1-3 and 6 of the '027 patent from the perspective of a person of ordinary skill in the art at the '027 patent's earliest claimed priority date, as described in more detail below.

24. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means "more likely than not."

25. For purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Level of Ordinary Skill in the Art

26. I have been informed a person of ordinary skill in the art is determined by considering several factors, including the (i) type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations

are made; (iv) sophistication of the technology; and (v) educational level of active workers in the field.

27. I have been instructed to assume a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

B. Claim Construction

28. I understand that the United States Patent and Trademark Office interprets claim terms in an *inter partes* review proceeding under the same claim construction standard that is used in a United States federal court. I understand that under this standard, the meaning of claim terms is considered from the viewpoint of one of ordinary skill in the art at the time of the invention.

29. I have been informed that claim terms are generally given their ordinary and customary meaning as understood by one of ordinary skill in the art in light of the specification and the prosecution history pertaining to the patent. I understand, however, that claim terms are generally not limited by the embodiments described in the specification.

30. I understand that in addition to the claims, specification, and prosecution history, other evidence may be considered to ascertain the meaning of claim terms, including textbooks, encyclopedias, articles, and dictionaries. I have

been informed that this other evidence is often less significant and less reliable than the claims, specification, and prosecution history.

C. Priority Date

31. I have been informed that a patent's claims are not entitled to an earlier priority date merely because the patent owner lists the claim for priority. I have also been informed that to be entitled to the earlier priority date, the prior application must provide sufficient written description support. I understand that the test for sufficiency of a written description is whether the prior application's disclosure reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.

D. Anticipation

32. I have been informed that under 35 U.S.C. § 102, a patent claim is "anticipated" and thus unpatentable if the claimed subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been informed that this is referred to as unpatentability by anticipation. I have been informed that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

E. Obviousness

33. I have been informed that obviousness under 35 U.S.C. § 103, a patent claim is unpatentable if the differences between the subject matter sought to be

patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which said subject matter pertains at the time the invention was made. I have been informed that this is referred to as unpatentability by obviousness.

34. I have been informed that a proper obviousness analysis includes the following:

- a. Determining the scope and content of the prior art;
- b. Ascertaining the differences between the prior art and the claims at issue;
- c. Resolving the level of ordinary skill in the pertinent art; and
- d. Considering evidence of secondary indicia of non-obviousness (if available).

35. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For my obviousness analysis, I have generally assumed that the date of invention for the challenged claims is June 16, 2017. Although, as I state herein, in my opinion the references to which the '027 claims priority do not provide a written description of at least some elements. Accordingly, for Ground 2, I assume a later priority date of October 19, 2019, the date the '027 patent was filed.

36. I have been informed that a reference may be modified or combined with other references or with a person of ordinary skill in the art's own knowledge if the person would have found the modification or combination obvious. I have also been informed that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

37. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been informed that, while there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

38. In determining whether a prior art reference could have been combined with another prior art reference or other information known to a person having

ordinary skill in the art, I have been informed that the following principles may be considered:

- a. A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- b. The substitution of one known element for another is likely to be obvious if it yields predictable results;
- c. The use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results;
- d. The application of a known technique to a prior art reference that is ready for improvement to yield predictable results;
- e. Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- f. A person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle; and
- g. The proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a “reasonable expectation of success”—but not “absolute

predictability” of success—in achieving the claimed invention by combining prior art references.

39. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have been informed that if a person of ordinary skill in the art could have implemented a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that, in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been informed that, when there was a design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art would have had a good reason to pursue those known options.

40. I have been informed that the law permits the application of “common sense” in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been informed that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art and that a party asserting obviousness must still provide a specific motivation to combine or modify the references as recited in

the claims and explain why one skilled in the art would have reasonably expected to succeed in doing so.

41. I have been informed that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also understand that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that the “teaching, suggestion, or motivation” test seeks to counter impermissible hindsight analysis.

42. I am not aware of any evidence of secondary considerations that would support a determination of non-obviousness of the claimed subject matter in the '027 patent.

43. I have been informed that, in an obviousness analysis, prior art must be analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

VI. OVERVIEW OF THE '027 PATENT**A. The Claims and Specification**

44. The '027 patent discloses an RFID tag for use in harsh industrial laundry environments. Ex. 1001, Abstract, 2:59-61. The claimed RFID tag includes an RFID transponder inductively coupled with a UHF-SHF antenna, both of which are placed on a textile substrate. *Id.*, 3:14-21.

45. The antenna comprises an electroconductive yarn or thread embroidered on the textile substrate. *Id.*, 3:22-29. This electroconductive thread has a “double loop” that forms a central zone of the antenna, and the transponder inductively couples to the double loop when placed within the central zone. *Id.*, 3:14-18, 3:30-34. In some embodiments, the electroconductive thread is also insulated, which allows the loops to be formed by crossing itself without creating an electrical short at crossing points where the antenna overlaps. *Id.*, 3:22-29.

46. It is my understanding that the purported advantages of this tag arise from the use of insulated electroconductive thread. For example, the '027 patent advertises an antenna having: (1) improved mechanical properties as compared to metallic wire, (2) flexibility to achieve geometries to reduce overall size, and (3) construction materials similar to that of the textile substrate. *Id.*, 2:34-46, 4:17-38. Indeed, the '027 patent acknowledges encapsulated transponders, inductive coupling

with UHF antennas, and insulated antennas embroidered to a textile support were “widely adopted” at the time of filing. *Id.*, 1:33-52; 2:47-52.

47. But the '027 patent ignores that, in the field used RFID antennas, including flexible, insulated electroconductive thread in laundry applications was known and used long before the effective date of the '027 patent, as I explain further below.

B. Prosecution History

48. From the cover of the patent, I understand that the '027 patent was filed on October 29, 2019, as U.S. Application 16/609,260. Ex. 1001, cover. I have reviewed the prosecution history of the '027 patent and I understand the patent was allowed after three rejections by the Office. Ex. 1002, 58, 85, 121. The Office first rejected all claims based on a combination of two references (*Hofer* and *Chisolm*). *Id.*, 123-127. The Applicant amended the claims and argued *Hoffer's* RFID antenna was impossible to achieve using continuous conductive textile thread. *Id.*, 112-118. When faced with a second rejection, this time on anticipation grounds, the Applicant attempted to distinguish *Oroku*, again primarily on the basis of a continuous conductive textile thread. *Id.*, 81-92. The Office rejected the claims a final time as unpatentable over two additional references (*Speich* and *Vicard*). *Id.*, 85-65. In response, Applicant argued *Speich* did not teach a double-loop without electrical

contacts at its crossing points. *Id.*, 51-55. The Office allowed the claims in the next action. *Id.*, 19-27.

49. Accordingly, based on my review of the prosecution history, it is my opinion that insulated conductive textile thread arranged in a double loop was the basis for the allowance. *Id.*, 4, 19-27, 81-92, 112-118.

C. Priority Date

50. From the cover of the patent, I understand that the '027 patent claimed priority as a national stage entry of PCT International Application No. PCT/RO2017/000023, filed December 19, 2017 (the "PCT Application"), which claimed priority to Romanian Patent Application No. 201700388, filed June 16, 2017 (the "Romanian Application"). Ex. 1001, cover page. However, in my opinion, these prior applications do not support the claims, and the patent.

51. Neither the PCT Application nor the Romanian Application describe "the whole assembly being sealed by hot-dipping of a second textile substrate," as recited in independent claim 1. The term "hot-dipping" never appears in the Romanian Application. *See generally* Ex. 1017. Instead, the claims in the Romanian Application recite "hot gluing" of a second fabric substrate, which I understand to be a different term entirely. Ex. 1017, claim 1.

52. Upon reviewing the PCT Application, in my opinion it is similarly deficient. The PCT Application recites hot-dipping of a second textile substrate only

in the claims and Abstract. Ex. 1018. However, the terms “seal” (or variations thereof) or “hot-dipping” never appear in the body of the specification. *Id.*, 1-5. Nor is a second textile substrate described or illustrated in the drawings. *Id.*

53. Accordingly, in my opinion, neither the PCT Application nor the Romanian Application include sufficient disclosure to show the inventor had possession of the claimed subject matter.

VII. TECHNOLOGY BACKGROUND AND THE STATE OF THE PRIOR ART

A. RFID technology

54. Radio-Frequency Identification (“RFID”) is a technology allowing identification of objects the transmission of radio waves at various frequencies. *Usta*, 1:11-12; *Shao*, 1385. An RFID system typically includes RFID tags affixed to corresponding objects to be identified, an RFID reader for communicating with the RFID tag, and a software application running on a host computer:

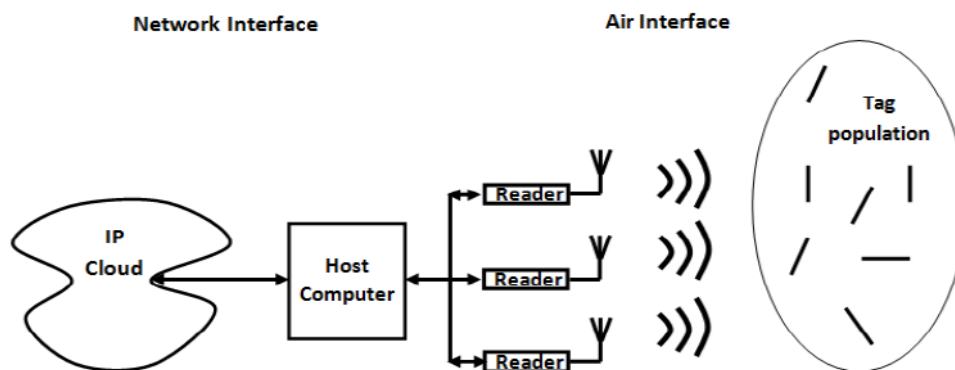


Fig. 1. General structure of a RFID system.

Moraru, Fig. 1, 410; *Moradi*, 248.

55. At the time of the '027 patent, RFID tags included an integrated circuit (also referred to as an “IC,” “transponder IC,” “tag IC,” “chip,” or “microchip”) that stores identification data (e.g., a unique identification code for the object) and implements the necessary power and communication functions. RFID tags also included an antenna, electrically or electromagnetically coupled to the integrated circuit, for transmitting and receiving radio waves. *Moradi*, 248. In RFID tags known as “passive” tags, the tag would not have its own battery. *Usta*, 1:18-26; *Moraru*, 411; *Moradi*, 248. Rather, the RFID tag antennas collected energy from electromagnetic waves emitted by the reader, thereby activating the chip. *Usta*, 1:18-26; *Moraru*, 411; *Moradi*, 248. The antenna harvests power, receives data from the reader, and transmits data by backscatter. *Moraru*, 410; *Moradi*, 248. The properties and performance of these RFID tags, such as the operating frequency and read range, depended significantly on the configuration of the antenna. *Moradi*, 248.

B. RFID tags for laundry environments

56. Long before the '027 patent's earliest claimed priority in 2017, RFID tags were used for textile applications. For example, a 2012 paper, *Moradi*, indicates that RFID tags had been integrated into clothing for purposes of monitoring children, elderly people, athletes, medical patients, or individuals that may require identification. *Moradi*, 248. RFID tags were thus adapted to be light-weight, flexible,

and seamlessly integrated within these textile materials. *Id.* These objectives were achieved in part by embroidering conductive threads into or onto a fabric to form the RFID tag antennas. *Id.*

57. RFID tags were used for other textile-related uses as well. For example, RFID tags had been integrated into linen products, such as hospital and hotel sheets or blankets, for tracking products in industrial laundry services. *Elbaz*, 3:1-12; *Moraru*, 412. These laundry environments presented uniquely harsh conditions, including immersion in water, exposure to high temperatures, exposure to harsh chemicals, and increased mechanical strain. *Moraru*, 412-413; *Pachoud*, [0017]; *Guibert*, § 4. To withstand these conditions, RFID tags had been adapted to include encapsulated transponders. *Pachoud*, [0027]; *Moraru*, 415. Because an encapsulation large enough to encompass the entire antenna would be prone to failure under high mechanical stress, generally only the transponders, which included the integrated circuit and a small near-field antenna with a limited range, were encapsulated. *Moraru*, 412-413; *Pachoud*, [0017], [0031]; *Stobbe*, [0005]; Ex. 1001, 1:44-59. It was known, however, to extend the range of the near-field antennas using separate larger far-field antennas formed of the electroconductive threads. *Moraru*, 412-413; *Pachoud*, [0037]; *Guibert*, § 4; Ex. 1001, 1:44-59. It was also known to use inductive coupling between the near- and far-field antennas, as physical connections were easily breakable under mechanical strain. *Pachoud*,

[0031], [0036]-[0039]; *Guibert*, § 4; Ex. 1001, 1:44-53. Indeed, the '027 patent expressly acknowledges that these features were known. Ex. 1001, 1:44-59.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

58. In rendering the opinions set forth in this declaration, I have been asked to consider the '027 patent's claims and the prior art through the eyes of a person of ordinary skill in the art (which I may also refer to as "one skilled in the art," "skilled artisan," "POSITA," "POSA" or similar variation). I have considered factors such as the educational level and years of experience of those working in the pertinent art, the types of problems encountered in the art, the teachings of the prior art, patents and publications of other persons or companies, and the sophistication of the technology.

59. Taking the factors described in the Legal Standards – Level of Ordinary Skill in the Art section into consideration, it is my opinion that a person of ordinary skill in the art ("POSITA") at the time of the alleged invention of the '027 patent would have had at least a bachelor's degree in electrical engineering, or a related field, at least two years of experience in design, development, and/or testing of RFID equipment, and familiarity with electronic textiles, or the equivalent. Additional education could substitute for professional experience and vice versa.

60. Based on my educational background and experience, I was at least a person of ordinary skill in the art at the earliest possible priority date of the '027 patent. My opinions would not change if a later priority date is assumed.

IX. CLAIM CONSTRUCTION

61. For purposes of this IPR proceeding, I apply the plain and ordinary meaning of claim terms in the '027 patent, consistent with the disclosure and prosecution history. In my opinion, no claim terms require explicit construction to resolve the proposed grounds at this time.

X. CLAIMS 1, 2, 3, AND 6 ARE UNPATENTABLE

62. As I outline below, in my opinion, the '027 claims recite a combination of well-known prior art elements that perform their known functions to produce predictable results.

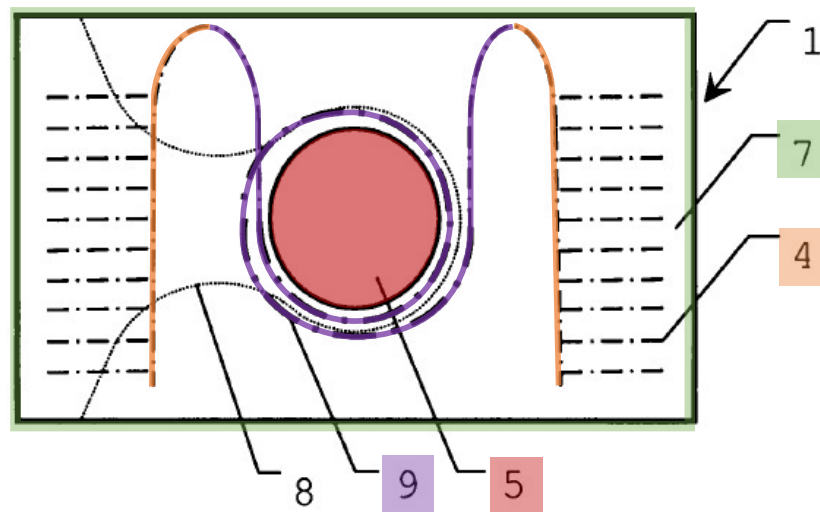
A. Ground 1: The Combination of *Pachoud*, *Astra*, and *Elbaz* Renders Obvious Claims 1, 2, 3, and 6

1. Overview of the Ground 1 Combination

a. *Pachoud*

63. *Pachoud* discloses an RFID tag for use in harsh professional laundry environments. *Pachoud*, [0021]-[0024]. The RFID tag is formed of an **RFID transponder** inductively coupled with a **UHF-SHF antenna**. *Id.*, [0024], [0026], [0036]. I see that the '027 patent describes aspects of *Pachoud*. Ex. 1001, 2:47-52. However, in my opinion, it does so incorrectly. For example, the '027 patent states

that *Pachoud*'s antenna is formed of a "metallic wire." Ex. 1001, 2:47-52. However, *Pachoud*'s antenna is in fact formed of an electroconductive thread, which is embroidered to a **textile substrate**. *Pachoud*, [0031], [0069], [0077]-[0078]. As I illustrate below with color-coded highlighting, the **antenna** includes a **loop-shaped section** surrounding the **transponder**, to achieve inductive coupling with the **RFID transponder**:



Id., Fig. 4b (annotated), [0042], [0065]. *Pachoud* further describes fully or partially enclosing the **transponder** and **antenna** to protect the tag from environmental impacts. *Id.*, [0024], [0026], [0043]-[0045], [0068]-[0070].

a. *Astra*

64. *Astra* discloses a "textile information carrier" including a **chip module** and an antenna module including an **antenna conductor**. *Astra*, [0025]. I understand this textile information carrier to be an RFID tag. For example, *Pachoud* indicates

the chip module and antenna module are used in association with an “information carrier” which would refer to RFID technology. Accordingly, the chip module refers to a functional RFID chip that would be coupled to an antenna to form a complete RFID transponder. The **antenna conductor** is formed of “one or more electrically conductive textile threads” that are “fixed completely and continuously on [a textile] **carrier 12** by embroidery technology.” *Id.* As I illustrate below with color-coded highlighting, the **chip module** (not shown) is inductively coupled to the antenna module via a **coupling coil** of the antenna conductor, having a plurality of windings:

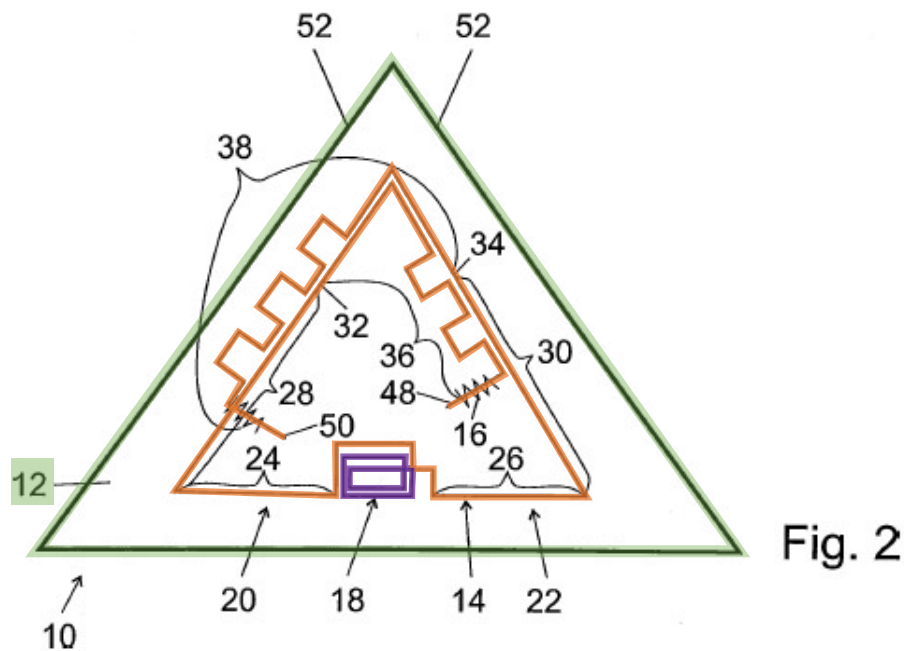


Fig. 2

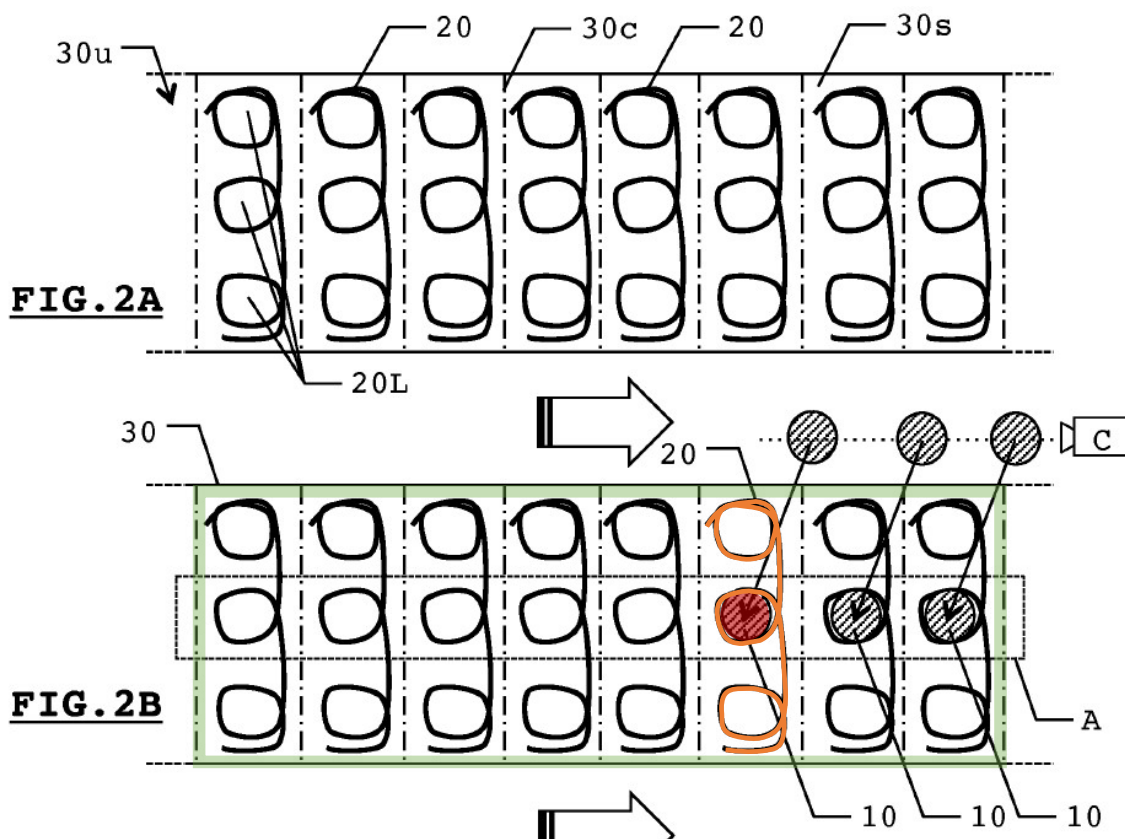
Astra, Fig. 2 (annotated), [0025], [0029].

a. Elbaz

65. *Elbaz* discloses an RFID tag for use in industrial laundry environments.

Elbaz, 1:10-2:2, 3:1-12, 30:7-15. *Elbaz* describes a method for manufacturing these

RFID tags using a **support material 30** formed of “cotton, nylon, viscose, a polyester or a synthetic material,” or other materials. *Id.*, 23:17-24:3. *Elbaz*’s tag includes an **antenna 20**, formed by embroidering or weaving conductive threads onto **support 30**. *Id.*, 25:3-9. As I illustrate below with color-coded highlighting, the antenna is formed to include a plurality of loops 20L:



Id., Figs. 2A, 2B (annotated), 23:8-25:2. An **RFID module 10** is placed within a central loop of the **antenna** to achieve inductive coupling with the **antenna**. *Id.*, 16:13-15, 22:12-23:6, 23:8-25:2, 25:17-26:29, 27:10-28:1.

b. The Combination of *Pachoud*, *Astra*, and *Elbaz*

68. Accordingly, in my opinion, Ground 1 renders obvious claims 1-3 and
er the earliest claimed priority date of the '027 patent.

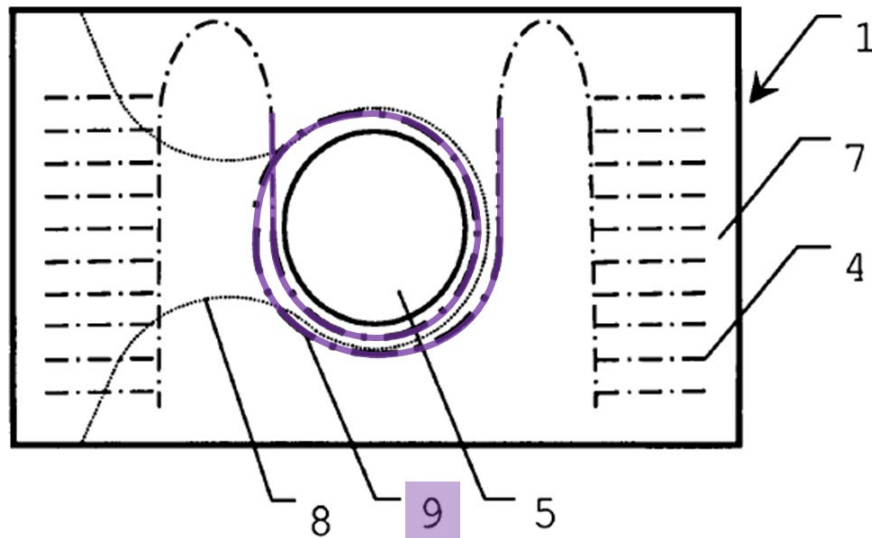
2. Motivation to Combine

69. In my opinion, a POSITA would have been motivated to combine *Pachoud*, *Astra*, and *Elbaz* and would have had a reasonable expectation of success in doing so. Like the '027 patent, each of *Pachoud*, *Astra*, and *Elbaz* are in the same field: textile RFID tags for applications in harsh environments.

70. The combination of *Pachoud* and *Astra* would merely reflect the combination of familiar elements according to known methods to yield predictable results. Both *Pachoud* and *Astra* provide textile-based RFID tags that share many common features. *Pachoud*, [0001]; *Astra*, [0025]. Both references include a transponder inductively coupled with an antenna formed of electroconductive thread embroidered to a textile substrate. *Pachoud*, [0031], [0069], [0077]-[0078]; *Astra*, [0025]. And in both references, the inductive coupling occurs through a loop-shaped portion of the antenna surrounding the transponder, as was typical. *Pachoud*, [0042], [0065]; *Astra*, [0018], [0019], [0025]. Accordingly, in my opinion, a POSITA at the time would have considered *Pachoud* and *Astra* combinable based on these similarities.

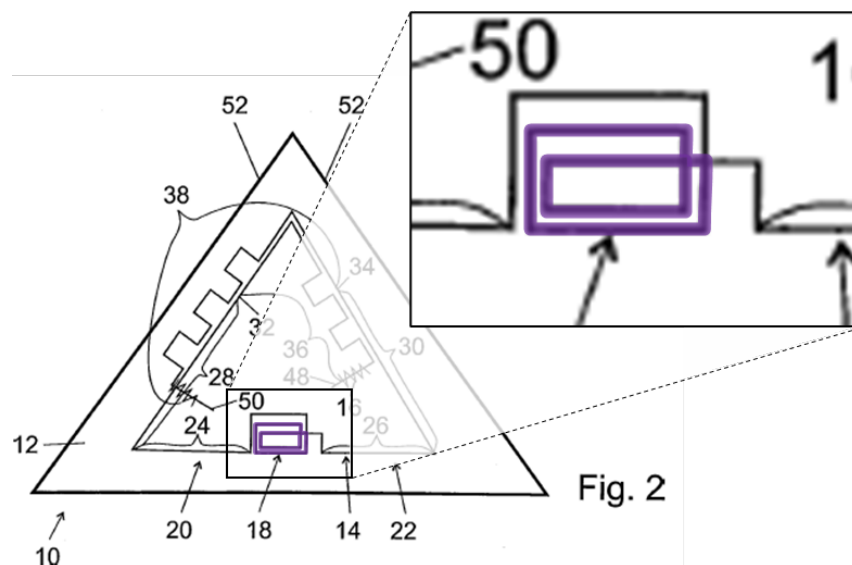
71. *Pachoud* teaches that the specific arrangement of its loop is flexible. For example, it offers multiple example configurations of its loop-shaped section, indicating it is not limited to any particular configuration. *Pachoud*, [0064], Figs. 4a, 4b, 4c. In one exemplary configuration, the **loop-shaped portion** of *Pachoud*'s

antenna includes nearly two full loops around the transponder, as highlighted in Fig. 4b of *Pachoud* below:

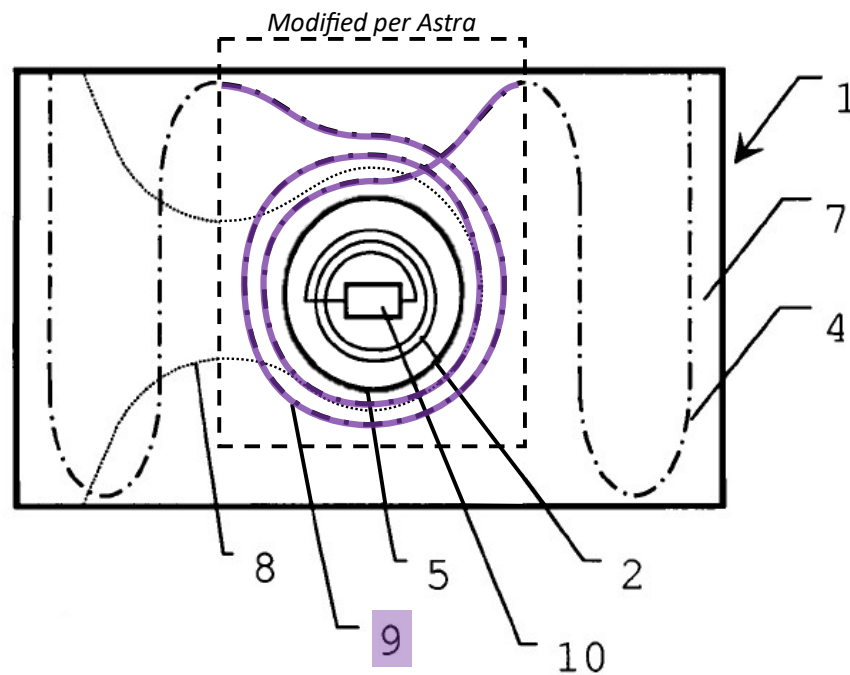


Pachoud, Fig. 4b (annotated).

72. *Astra* teaches yet another example configuration of the form of loops used in *Pachoud*, in this case, a loop-shaped portion having at least **two full loops**:



Astra, Fig. 2 (annotated; partially enlarged for detail). In my view, it would have been a simple modification to incorporate a **double loop** into the antenna of *Pachoud* in view of *Astra* to achieve a known result—increased inductive coupling between the antenna and RFID transponder, as explained further below. In the illustration below, I show that the combination of *Pachoud* and *Astra* would be straightforward to implement:



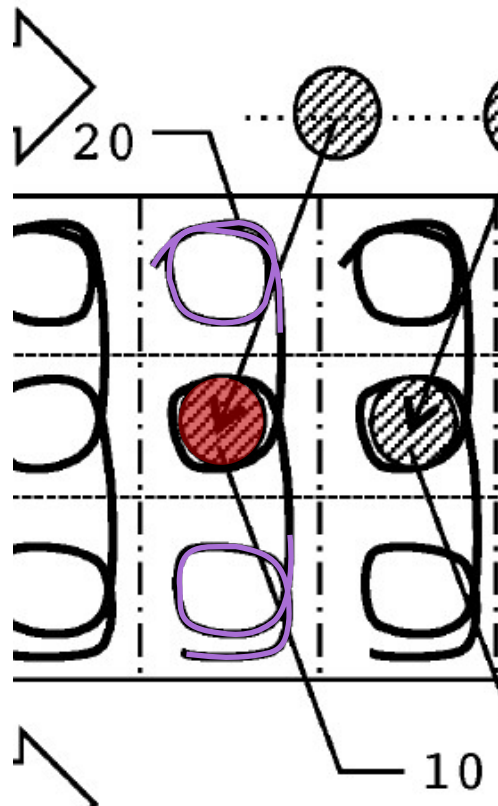
Pachoud, Fig. 4a (modified to include double loop of *Astra*). The highlighted purple section has two loops (like *Astra*), but has been modified from the original purple section of *Pachoud* element 9 which had 1.5 loops.

73. A POSITA would have understood that a larger number of loops surrounding the transponder would have increased the inductive coupling between

the antenna and RFID transponder. For example, *Pachoud* states that looping the antenna around the transponder increased the inductive coupling between the antenna and RFID transponder. *Id.*, [0042] (“In order to ensure a good coupling, ... the far-field antenna encircles the near-field antenna”), [0066], [0071]. And *Pachoud* teaches it would have been straightforward and obvious to implement alternate antenna configurations, such as that disclosed by *Astra*, to increase the inductive coupling. *Id.*, [0005] (antennas “can be designed in many different shapes and sizes to fit the desired form factor and purpose”), [0068] (adapting “the shape and alignment of the far field antenna ... is a routine task in these fields of the art.”); [0071] (a POSITA “will be capable of designing many other geometrical shapes of one or both of the antennas resulting in a coupling”). *Astra* also confirms that additional loops would have further increased the coupling. *Astra*, [0018]-[0019]. A better inductive coupling would typically promote better energy transfer between the transponder antenna and the far-field antenna, increasing the efficiency. *See Usta*, 5:4-11. Accordingly, in my opinion, combining *Pachoud* and *Astra* would have amounted to application of known techniques to achieve predictable results.

74. It is also my opinion that a POSITA would have been further motivated to combine *Elbaz*’s single loops in the extremities of the far-field antenna with the antenna of *Pachoud* and *Astra*. *Elbaz*, like *Pachoud* and *Astra*, discloses a textile-based RFID tag formed by embroidering or weaving conductive threads onto a

textile substrate. *Elbaz*, 1:10-2:2, 3:1-12, 25:3-9, 30:7-15. As I illustrate below with color-coded highlighting, the conductive antenna 20 includes a **plurality of loops 20L** in the extremities:



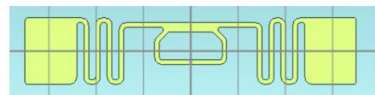
Elbaz, Fig. 2b (annotated), 23:8-25:2. As *Pachoud* notes, reducing the size of components is important in laundry applications to mitigate “mechanical interactions and impacts like pressure, bending, folding, hitting, etc.” *Pachoud*, [0028]. In my opinion, the specific shape of the far-field antenna is a design choice and a POSITA would have easily adapted it to achieve different antenna properties. And *Pachoud* confirms this understanding. *Id.*, [0068], [0005].

75. In my opinion, a POSITA would have been familiar with the principle that end-loading loops increase bandwidth while reducing antenna size. *Shao*, 1386. A POSITA would thus have implemented *Elbaz*'s approach in *Pachoud-Astra* to realize these benefits. *Pachoud* explicitly suggests "loop-...antennas" as an example of such variation, and *Pachoud* already teaches and suggests adopting loop-shaped portions in its design. *Pachoud*, [0042]. In my view, a POSITA would have been motivated to incorporate the loops in the extremities of *Elbaz*'s antenna to achieve the known benefit reduced size of the antenna and improved bandwidth. *Elbaz*, 23:13-14 ("To reduce its bulk ... [the] antenna, advantageously comprises a plurality of loops 20L."); *Shao*, 1386 ("end-loading loops improve impedance bandwidth ... [and] reduce[] the overall size of the antenna").

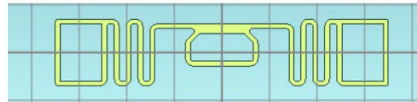
76. Simulation results confirm the desirable effect these loops can have on antenna properties, which a POSITA would have understood at the time of the '027 patent. The figures below show typical representative UHF RFID tag antenna designs a POSITA would have found obvious to consider, similar to the designs found in the prior art discussed throughout my declaration. *E.g.*, *Pachoud*, *Elbaz*, *Astra*, *Guibert*, *Shao*, *Usta*, *Moradi*, *Moraru*. Presented below these figures are the results of the simulations performed using these antenna designs. These simulations would have been straightforward for a POSITA to implement at the time. To perform the simulations, the design of the antenna of interest is imported into an antenna

simulation package, such as CST Studio Suite (or CST Microwave Studio, as the product was known before 2005), Ansys HFSS, OpenEMS, or various other simulation packages. These simulators can output the response of the antenna as a function of frequency. This response data can then be plotted using a program such as Matlab, Excel, or other computing software known at the time. A POSITA would have understood that design variations that shift the antenna's peak frequency can be inter-converted with changes in antenna size. Case 1 is an antenna end loaded with a solid patch; Case 2 is end loaded with a closed loop; Case 3 and Case 4 are end loaded with open loops, with the opening placed at different locations. The resonant frequencies, from lowest to highest, occur in this order: Case 1; Case 4; Case 2; Case 3. The lowest frequency antennas could be shrunk in size to bring their resonant frequency back to a higher target value. This would be desirable because it is necessary for RFID tags to operate in the specific frequency band prescribed by the relevant RFID standard, in this case the EPC Class 1 Generation 2 standard—the relevant standard at the time of the '027 patent. Thus, the antennas shown as the lowest in frequency in these simulations are the designs that would result in the greatest size reduction from the end loading. The '027 patent acknowledges that the ways to approach an ideal RFID tag include “designing a UHF/SHF antenna geometry to give it superior electromagnetic properties and at the same time to have as small a size as possible.” (Ex. 1001 2:39-41). The solid capacitive patch (Case 1)

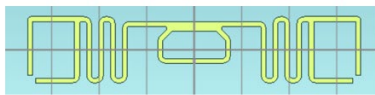
accordingly provides the most shrinkage, followed by the open loop with the gap closest to the antenna (Case 4). The closed loop (Case 2) and the other open loop (Case 3, with the opening far from the antenna) provide less shrinkage than Case 1 and Case 4.



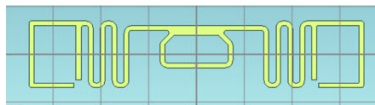
Case 1 – ER62 FS



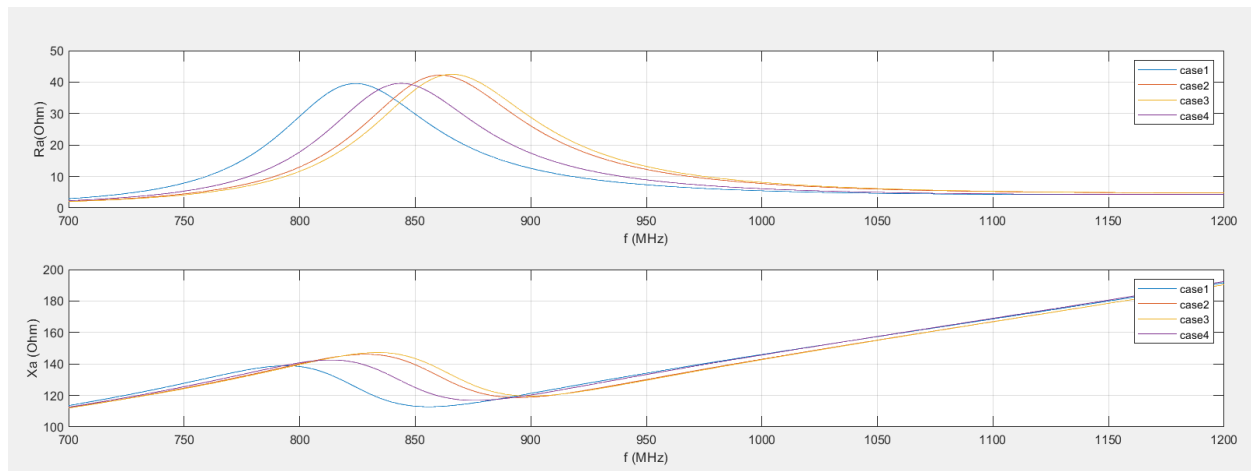
Case 2 – ER62 FS loop ends



Case 3 – ER62 FS open loop ends 1



Case 4 – ER62 FS open loop ends 2



Accordingly, as these data illustrate, varying the shape of the antenna by adding end loading loops can decrease the resonant frequency, as shown by Case 4. Instead of decreasing the resonant frequency, a POSITA at the time would have kept the

resonant frequency constant as required by the standard, but would have reduced the size of the Case 4 antenna, which is one of the stated goals of the '027 patent. A POSITA would have been motivated to modify *Pachoud-Astra* by incorporating *Elbaz*'s end loops as suggested by, for example, *Shao* and my simulations (which a POSITA would have performed) to shrink the antenna. *Shao*, 1386.

77. In addition to seeking to design an RFID tag considering of the above factors regarding the antenna shape, a POSITA would have been motivated to design an RFID tag that could withstand harsh environments encountered in, for example, industrial laundry facilities. Accordingly, in my opinion, a POSITA would have further been motivated to apply the fibrous mesh and thermoplastic material from *Elbaz* (*Elbaz*, 28:11-29:3, 37:10-38:3, Fig. 2) either in place of or in addition to the enclosure described in *Pachoud* to better protect the tag in harsh environments (*Pachoud*, [0024], [0026], [0043]-[0045], [0068]-[0070]). *Elbaz* states that, among other benefits, its mesh protects the RFID module “against possible shocks or mechanical constraints.” *Elbaz*, 28:11-29:3. The thermoplastic material further keeps the label substantially flat and provides improved resilience that would be encountered in harsh environments. *Id.*, 30:16-31:3. In my opinion, a POSITA would have been motivated to incorporate this sealing process of *Elbaz* to improve resilience of the tag in laundry environments, while retaining flexibility. *Elbaz*, 28:11-29:3

3. Independent Claim 1

a. [1.pre]: “An RFID tag (1) for use in harsh environments”

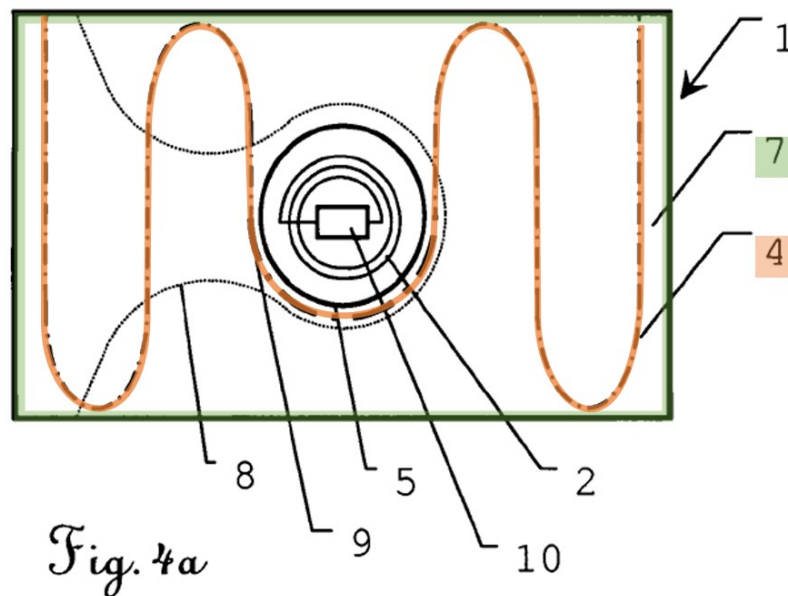
78. *Pachoud* discloses or renders obvious the preamble of claim 1. As an initial matter, the '027 patent admits that “the design of an RFID tag ... protected by the harsh environment of industrial laundries ... has been widely adopted” and thus was known in the art. Ex. 1001, 1:44-53. I agree. *Pachoud* is one such example, disclosing “an RFID laundry tag with resistance against harsh external conditions.” *Pachoud*, [0021].

b. [1.a]: “an UHF-SHF antenna (2) made from a continuous electroconductive textile thread, electrically insulated, embroidered on textile substrate”

79. In my opinion, *Pachoud* discloses or at least renders obvious [1.a] and *Pachoud* in view of *Astra* also renders obvious [1.a]. *Pachoud* discloses ***an USF-SHF antenna*** because it discloses a “textile item identification tag” including “at least one **far-field antenna**.” *Pachoud*, [0024]. *Pachoud*’s tag is expressly designed for operation in UHF or SHF frequency ranges. *Pachoud*, [0006], [0030], [0050], [0051].

80. The '027 patent addresses *Pachoud* specifically and admits *Pachoud*’s antenna is both “electrically insulated” and “attached to a textile support by ... embroidering.” Ex. 1001, 2:47-52. I agree. *Pachoud*’s far-field antenna is ***made***

from a continuous electroconductive textile thread, electrically insulated, embroidered on textile substrate because it is formed of “a thread that comprises conductive materials.” *Pachoud*, [0031]. A POSITA would have understood that this thread described in *Pachoud* is an “electroconductive textile thread.” As I illustrate with color-coded highlighting below, this **electroconductive thread** is continuously embroidered on a **tag material 7** to form the antenna:



Id., Fig. 4a (annotated), [0040] (“The far-field antenna is comprised in, or attached to, the textile item tag ... [by] couching, **embroidering**, sewing, soutache, weaving or stitching of a **yarn ... comprising a conductive material**”).

81. It is my opinion that a POSITA would have understood that *Pachoud*’s electroconductive thread is electrically insulated because *Pachoud* discloses a loop-shaped section of the antenna. *Id.*, [0042], Fig. 4b; § X.A.3.g (Ground 1, [1.d.ii]). A

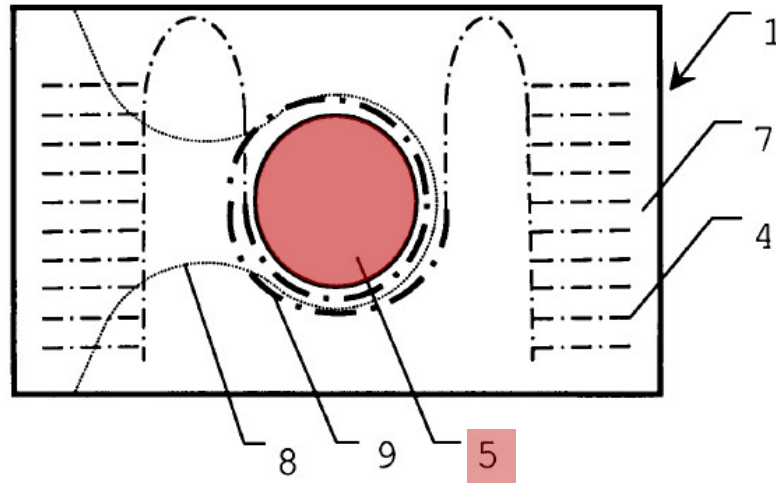
POSITA would understand that this loop includes an intersection point but does not form an electrical connection. *Pachoud*, [0042], Fig. 4b; § X.A.3.g (Ground 1, [1.d.ii]). According to basic principles of electromagnetics, to achieve inductive coupling with the transponder, the thread would need to be electrically insulated to avoid a short circuit at this crossing point. This understanding is confirmed by *Usta*, which explains that “[s]ince the dipole antenna (2) is coated with an insulating film material, a short circuit is prevented from occurring at the overlapping crossing part (23). Thus the electric current is allowed to flow along the entire dipole 20 antenna (2) such that it will completely surround the loop antenna (3).” *Usta*, 4:14-20.

82. Further, *Astra* more explicitly discloses an antenna that is electrically insulated, describing an antenna conductor formed of an “insulated braid.” *Astra*, [0025]. In my view, a POSITA would have been motivated to incorporate the electrically insulated conductor from *Astra* into *Pachoud* to form the double loop. §X.A.2 (Ground 1, Motivation to Combine). For example, a POSITA would have recognized the electrically insulated antenna conductor of *Astra* would avoid a short at the intersection point. See § X.A.3.g (Ground 1, [1.d.ii]). And such a short circuit would diminish the inductive coupling with the transponder. *Usta*, 4:14-20.

c. [1.b]: “an RFID transponder (3)”

83. The ’027 patent admits that RFID transponders were known in the art. Ex. 1001, 1:44-53. The ’027 patent even specifically admits such a responder is

disclosed in *Pachoud*. *Id.* I agree. Specifically, *Pachoud* discloses an **RFID transponder 5**:



Pachoud, Fig. 4b (annotated); see *id.*, [0024], [0036], [0050]. *Astra* and *Elbaz* also each disclose an RFID transponder. *Astra*, [0025]; *Elbaz*, 16:17-18:2; 20:14-21:1.

- d. [1.c.i]: “a substrate of textile material (4) on which the RFID transponder (3) and the UHF-SHF antenna (2) are placed”

84. In my opinion, *Pachoud* discloses or at least renders obvious [1.c.i] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [1.c.1]. *Pachoud* discloses ***a substrate of textile material on which the RFID transponder and the UHF-SHF antenna are placed*** because *Pachoud*’s RFID tag is formed of a “sheet-like material 7,” which may include “acetate, cotton, nylon, polyester and combinations thereof, in woven or non-woven form.” *Pachoud*, [0060]-[0061]. *Pachoud*’s RFID transponder is placed on the tag material 7. *Id.*, [0043], [0059], [0060], [0062] (“The RFID transponder can be directly glued or welded into the tag material 7”), [0068].

The far-field antenna is also placed on the textile tag material 7. *Id.*, [0040] (“The far-field antenna is comprised in, or attached to, the textile item tag”).

85. While it is my opinion that *Pachoud* alone teaches [1.c.i], *Astra* and *Elbaz* each disclose placing an enclosed transponder and antenna on a substrate of textile material. *Astra* discloses “an antenna module 10 comprising a carrier 12,” which is “a textile material.” *Astra*, [0025]. To form the antenna module, “the antenna conductor 14 is fixed completely and continuously on the carrier 12.” *Id.* The chip module is also arranged on the carrier 12. *Id.*

86. *Elbaz* discloses a support material 30 formed of “cotton, nylon, viscose, a polyester or a synthetic material,” or other materials. *Elbaz*, 23:8-25:2. *Elbaz* includes an antenna 20, formed by embroidering or weaving conductive threads onto support 30. *Id.*, 25:3-9. A radio-identification module 10 is also placed on an upper face of the support 30. *Id.*, 21:12-22:4.

87. As I explained above, a POSITA would have been motivated to affix the transponder to the textile substrate as in *Astra*’s and/or *Elbaz*’s ensure it stays in position relative to the antenna. §X.A.2 (Motivation to Combine).

e. [1.c.ii]: “the whole assembly being sealed by hot-dipping of a second textile substrate”

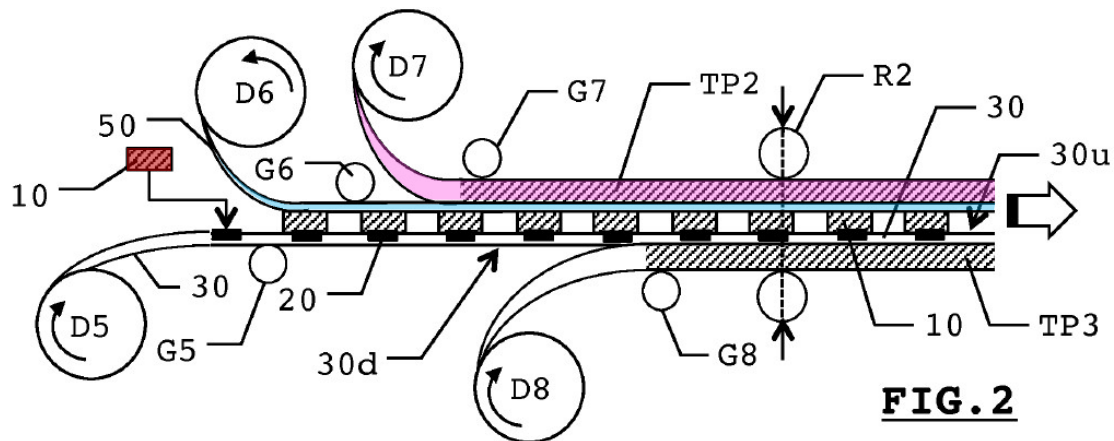
88. As I explained above, the specification of the ’027 patent provides no support for [1.c.ii]. § VI.C (Priority Date). The Romanian application uses the term

“hot gluing of a second substrate,” but as explained this is not the same as hot dipping and thus the priority claim is not valid. Ex. 1017, claim 1; § VI.C (Priority Date). But, even assuming that “hot-dipping” covered “hot gluing” of a second substrate, it is my opinion that *Pachoud* discloses or at least renders obvious [1.c.ii], and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [1.c.ii].

89. *Pachoud*’s entire ***assembly is sealed by hot-dipping of a second textile substrate*** because *Pachoud* discloses “a pouch-type enclosure (e.g., a strip, sachet or pocket, etc.) for receiving the RFID transponder.” *Pachoud*, [0043]. *Pachoud* envisions that its pouch is “formed out of the textile item tag material itself ...[or] another material, e.g. textile.” *Id.*, [0043]-[0044]. As explained for Fig. 4c, *Pachoud*’s pouch is formed by gluing the transponder between two sheets of the tag-material 7. *Id.*, [0068], Fig. 4c. And *Pachoud*’s pouch is formed through “a folded web, ***heat-sealed***, stitched, ultrasonically sealed, welded, adhesively bonded or otherwise attached along one side to provide a wall.” *Id.*, [0061] (emphasis added). As a POSITA would recognize, and as *Pachoud* explains, fully enclosing the RFID transponder and far-field antenna within the hot-sealed pouch, “can help protect[] it from environmental impacts.” *Id.*, [0044].

90. *Pachoud* does not use the specific term “hot-dipping.” However, in my opinion its “heat-sealed” enclosure at least renders obvious sealing the whole assembly by hot-dipping a second textile substrate because it discloses gluing and

heat-sealing the pouch enclosure with another textile material. Further, *Elbaz* expressly discloses “hot-dipping.” *Elbaz* discloses a method of assembling an RFID tag including an RFID module and a conductive antenna disposed on a dielectric carrier. *Elbaz*, Abstract. As illustrated in color-coded highlighting below, after depositing a **radio-identification module 10** on a support material 30, a **fibrous mesh 50** is applied, followed by heat-pressing of a **thermoplastic material TP2**:

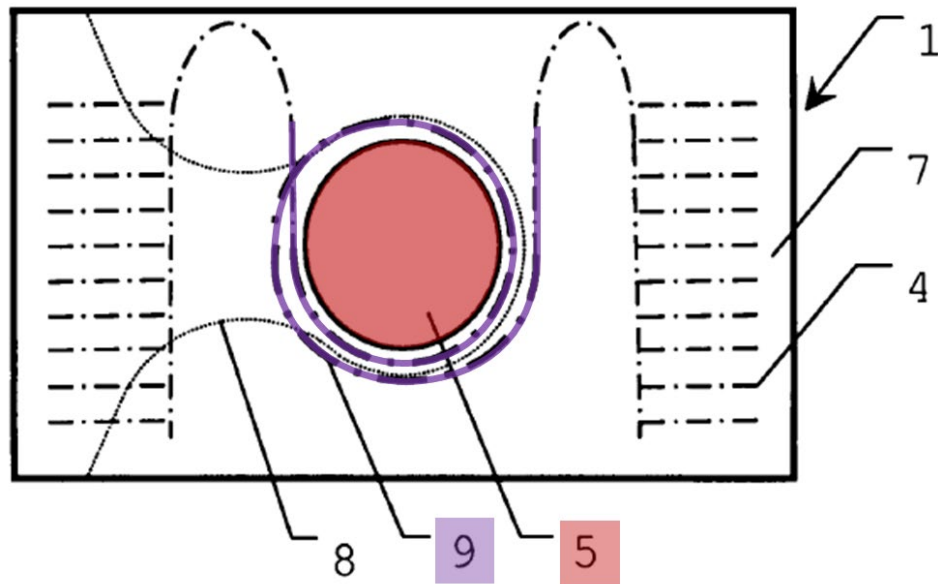


Elbaz, Fig. 2 (annotated), 28:11-29:3, 37:10-38:3. In my view, a POSITA would have understood *Elbaz*’s application of the mesh via hot-pressing of a thermoplastic material constitutes “hot-dipping of a second textile substrate” that seals the entire antenna assembly because the mesh is a second substrate. And this second substrate is applied via a heated thermoplastic material, and is used to seal the antenna assembly. Accordingly, a POSITA would understand this to be hot-dipping of a second substrate.

91. As I explained above, a POSITA would have been motivated to incorporate this sealing process of *Elbaz* to further improve the resilience of the tag in laundry environments, while retaining flexibility. § X.A.2 (Ground 1, Motivation to Combine).

- f. [1.d.i]: “wherein the UHF-SHF antenna (2) has a central zone formed by a double loop (5) by which it inductively couples with the encapsulated RFID transponder (3)”

92. In my opinion, *Pachoud* discloses or at least renders obvious [1.d.i] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [1.d.i]. As I understand it, *Pachoud* at least suggests that its *UHF-SHF antenna has a central zone formed by a double loop by which it inductively couples the encapsulated RFID transponder* because *Pachoud* discloses a central zone formed by a loop for inductive coupling with an RFID transponder. *Pachoud*’s far-field antenna “comprises a **loop-shaped section**, and the **RFID transponder** is at least partially surrounded by said **loop-shaped section**,” in order to “ensure a good coupling.” *Pachoud*, [0042]. This **loop-shaped section** is shown in color-coded highlighting below:



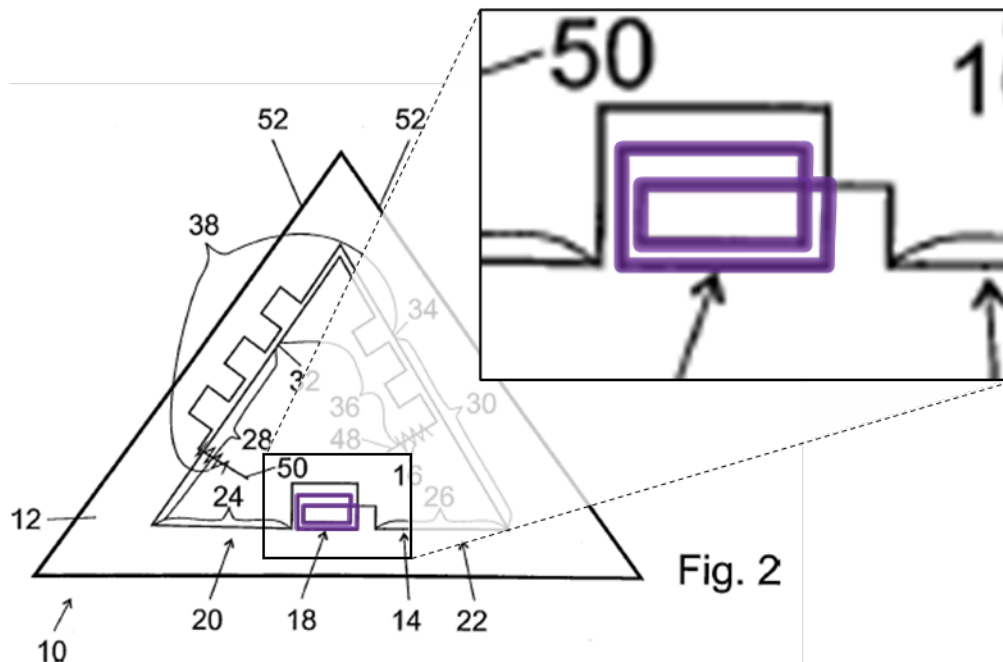
Id., Fig. 4b (annotated); *see also id.*, [0060].

93. *Pachoud*'s loop-shaped portion of Fig. 4b includes at least one complete loop, but suggests others were both possible and advantageous. *Id.*, Fig. 4b, [0042], [0071]. Accordingly, in my opinion, *Pachoud* suggests multiple loops and, in view of *Pachoud*'s suggestion, forming a loop-shaped section having two complete loops would have been an obvious design choice.

94. A POSITA would have been well-versed in the effects that looping the antenna around the transponder would have on the inductive coupling. As explained, the number of loops surrounding the transponder increases the inductive coupling between the antenna and RFID transponder. § X.A.2 (Ground 1, Motivation to Combine). At the very least, in view of the looping shown in *Pachoud* it would have

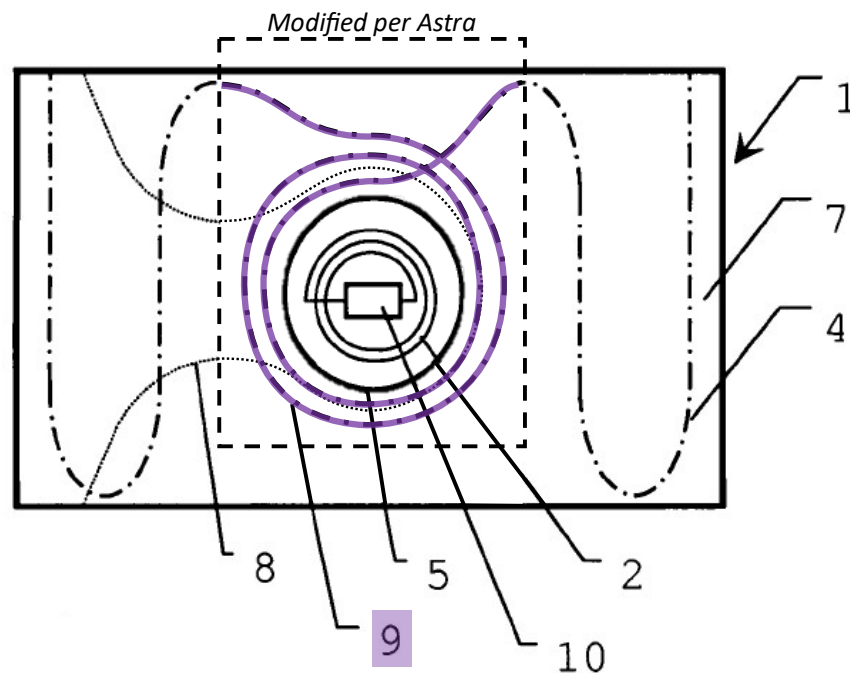
been obvious to try two complete loops to vary the strength of the inductive coupling with the transponder. *Id.*

95. While it is my opinion that *Pachoud* is sufficient to teach [1.d.i], *Astra* also expressly discloses a double loop. Specifically, *Astra* discloses a “coupling coil (18) ... [with] a plurality of windings.” *Astra*, [0029]. *Astra*’s windings, like those of *Pachoud*, are in a **central zone** of the antenna and **inductively couple [the antenna with] the encapsulated RFID transponder**. *Id.*, [0025] (indicating the chip module (RFID transponder) is arranged such “that the coupling loop is inductively coupled to a coupling coil 18 of the antenna conductor 14.”). As shown below in the expanded view of Fig. 2 (with color-coded highlighting added), this coupling coil expressly includes at least a **double loop**:



Id., Fig. 2 (annotated; partially enlarged for detail).

96. In my opinion, it would have been an easy endeavor for a POSITA to incorporate a double loop into the antenna of *Pachoud* in view of *Astra*, particularly in view of *Pachoud*'s express suggestion. In the figure below, I have modified Fig. 4a of *Pachoud* to show an example of what the *Pachoud-Astra* combination would look like:



Pachoud, Fig. 4a (modified to include an example double loop); § X.A.2 (Ground 1, Motivation to Combine). The modified portion is highlighted in a box with a dashed outline.

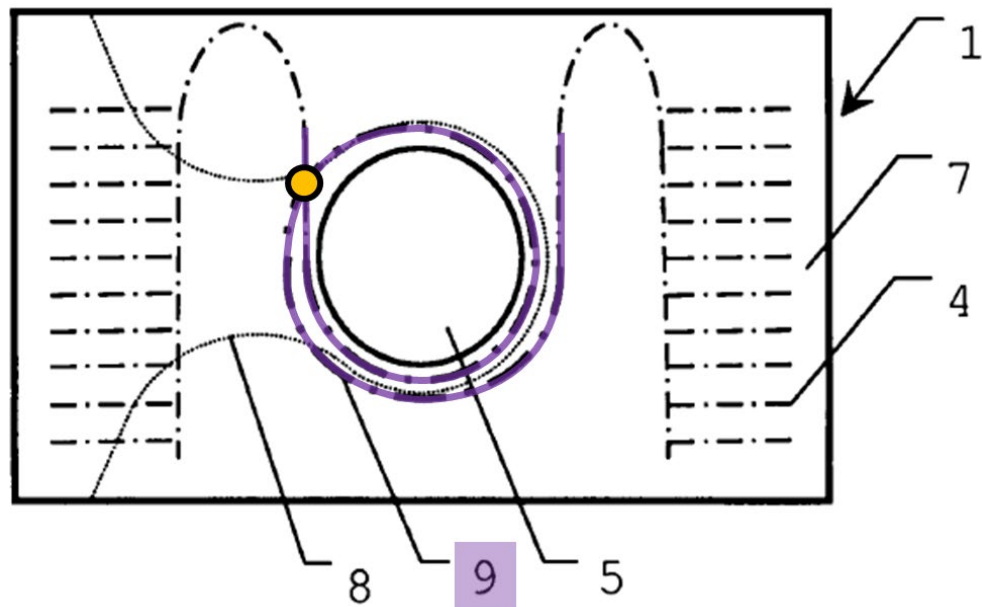
97. The loop shown in *Astra* includes a double loop but appears to include more than two loops (i.e., 2.5 loops). However, the combination still at least renders

a double loop obvious. As I explained above, the degree of coupling varies with the amount of looping around the transponder. § X.A.2 (Ground 1, Motivation to Combine). In my opinion, it would have at least been obvious to try two loops to achieve the desired coupling strength, especially in view of the disclosures of *Astra* and *Pachoud*'s flexile loop configurations. *Pachoud*, [0042], [0066], [0071].

98. Moreover, the additional partial loops are due at least in part to the relative position of the antenna and chip. In *Astra*, the additional “half” loops lead up to where the double loop portion begins. As shown in my modified version of Fig. 4a above, these leading portions are not necessary when combined with *Pachoud*.

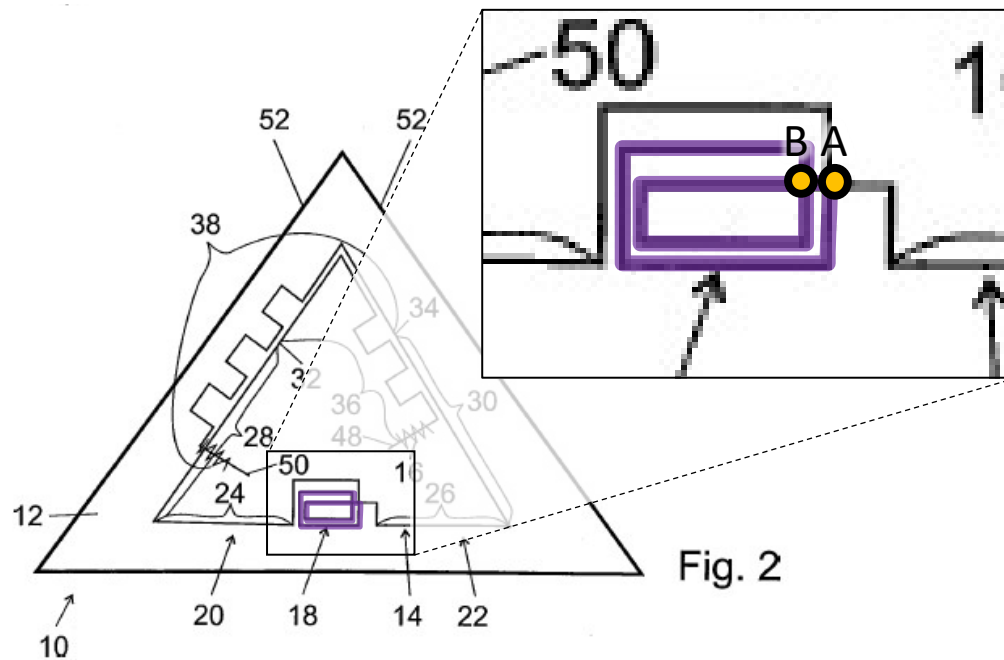
g. [1.d.ii]: “wherein the double loop (5) does not have electrical contacts at intersection points (A and B)”

99. In my opinion, *Pachoud* discloses or at least renders obvious [1.d.ii] and *Pachoud* in view of *Astra* also renders obvious [1.d.ii]. *Pachoud* discloses a **loop-shaped section 9** of the antenna including at least one complete loop that includes at least one **intersection point**:

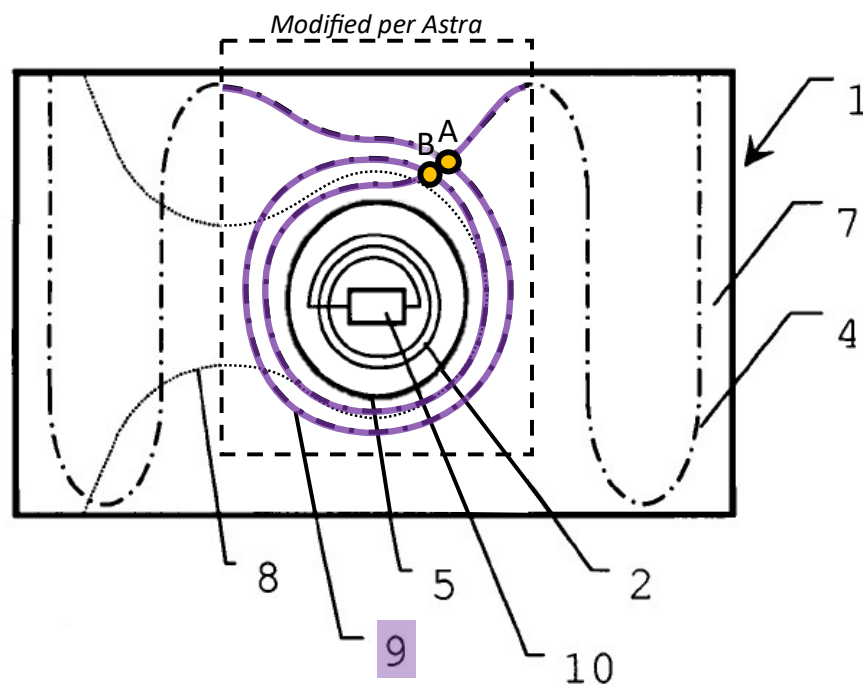


Pachoud, Fig. 4b (annotated); *see also id.*, [0042], [0060].

100. As I explained for [1.d.i], it would have been obvious to increase the number of loops in the loop-shaped portion to increase the connection strength with the RFID transponder. § X.A.3.f (Ground 1, [1.d.i]). The **double loop** of *Astra* includes at least two **intersection points**:



Astra, Fig. 2 (annotated; partially enlarged for detail). Accordingly, the *Pachoud-Astra* combination would likewise include multiple **intersection points** A and B, as shown in the modified version of Fig. 4a of *Pachoud*:



Pachoud, Fig. 4a (modified to show the double loop of *Astra*).

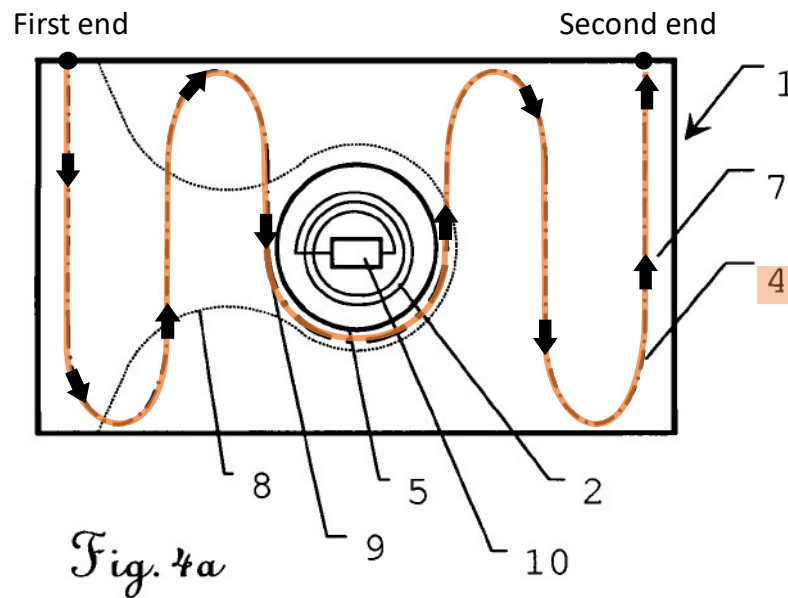
101. In my opinion, the combination of *Pachoud* and *Astra* at least renders obvious ***the double loop (5) does not have electrical contacts at intersection points.*** A POSITA would have recognized that the electroconductive thread forming the loop-shaped section in *Pachoud* would be insulated. § X.A.3.b (Ground 1, [1.a]). The '027 patent itself admits *Pachoud* includes an insulated antenna. Ex. 1001, 2:47-52. And *Astra* explicitly discloses an electrically insulated antenna conductor. *Astra*, [0025]. Thus, in my view, a POSITA would have understood that an electrically insulated conductor would prevent electrical contacts at intersection points. *Usta*, 5:13-15. Indeed, this insulation is the only manner described in the '027 patent for achieving electrical isolation at the crossing points. Ex. 1001, 3:22-29.

4. Claim 2

- a. [2.a]: “wherein the UHF-SHF antenna (2) is made of an electroconductive textile thread, electrically insulated, by continuous embroidering, starting from one end to the other”**

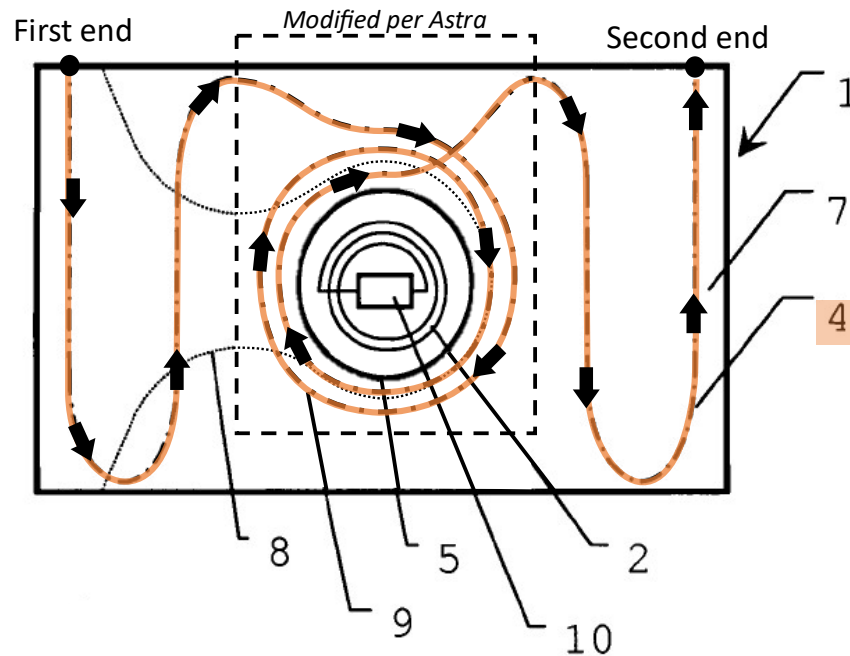
102. It is my opinion that *Pachoud* discloses or at least renders obvious [2.a] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [2.a]. As I explained for [1.a], *Pachoud* alone or in combination with *Astra* discloses or renders obvious a ***UHF-SHF antenna (2) is made of an electroconductive textile thread, electrically insulated, by continuous embroidering*** because the antenna is formed

of an electrically insulated electroconductive thread continuously embroidered on a tag material 7. § X.A.3.b (Ground 1, [1.a]). As shown below, the **electroconductive thread** in Pachoud is embroidered continuously **starting from one end to the other**—from a first end to a second end to form the antenna:



Pachoud, Fig. 4a (annotated).

103. *Pachoud-Astra* likewise includes continuous embroidery from a first end to a second end:



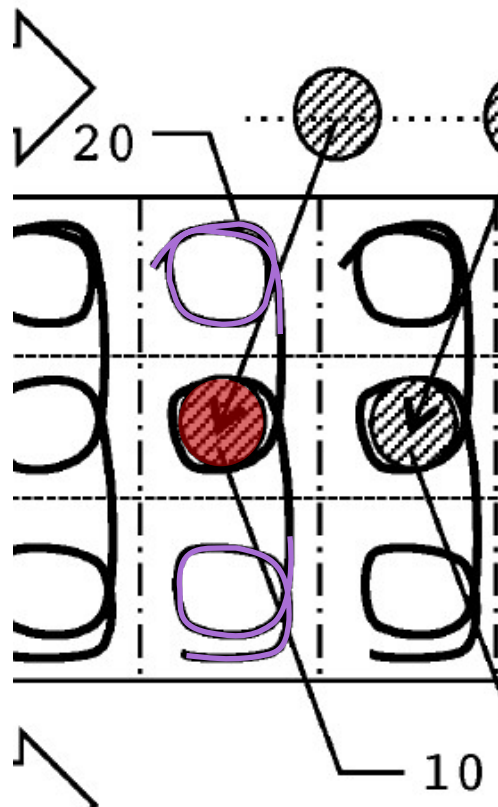
Pachoud, Fig. 4a (modified to include double loop of *Astra*). In my opinion, this continuous embroidery is expressly recited in *Astra*. *Astra*, [0025] (“[T]he antenna conductor 14 is fixed ... **continuously** on the carrier 12 by embroidery.”). *Elbaz* likewise discloses [2.a]. *Elbaz*, 11:14-17 (describing a “step of ... embroidering ... or weaving said first antenna on said first support”).

b. [2.b]: “wherein the UHF-SHF antenna (2) ... has simple loops in each extremity”

104. In my opinion, *Pachoud* discloses or at least renders obvious [2.b] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [2.b]. As I explained for [1.a], *Pachoud* discloses a **UHF-SHF antenna**. § X.A.3.b (Ground 1, [1.a]). *Pachoud* also at least suggests that its antenna **has simple loops in each extremity**. While the example antennas shown in Figs. 4a-4c and 5 do not explicitly show

simple loops in each extremity, incorporating such loops is well within the purview of a POSITA. *Pachoud* acknowledges that the specific shape of the far-filed antenna is a design choice and is easily adaptable by one of ordinary skill. *Pachoud*, [0068]. *Pachoud* also notes that antennas “can be designed in many different shapes and sizes to fit the desired form factor and purpose (spectral characteristics, antenna gain, directional characteristics, etc.).” *Id.*, [0005]. As I explained above, it was known that end loading loops reduce the size of the antenna and improve bandwidth. § X.A.2 (Ground 1, Motivation to Combine). And *Pachoud* already contemplates adding loops to the antenna. *Pachoud*, [0042], [0065]. Accordingly, in my opinion, it would have been an obvious design choice to include simple loops in the extremities in view of *Pachoud* alone.

105. However, to the extent *Pachoud* does not expressly disclose that its antenna *has simple loops in each extremity*, *Elbaz* does. *Elbaz* discloses a method of assembling an RFID tag including an RFID module and a conductive antenna disposed on a dielectric carrier. *Elbaz*, Abstract, Fig. 2A. The conductive antenna 20 includes a plurality of loops 20L, including a central loop encircling the **RFID module**, as well as **additional loops in the extremities**, as highlighted in the figure below:



Elbaz, Fig. 2b (annotated), 23:8-25:2.

106. In my view, a POSITA would have been motivated to incorporate loops 20L of *Elbaz* into the extremities of *Pachoud-Astra*'s antenna to achieve the known benefit of a reduced size and improved transmission characteristics of the antenna.

§ X.A.2 (Ground 1, Motivation to Combine).

- c. **[2.c]: “wherein the UHF-SHF antenna (2) ... has ... in the central area a double loop (5) consisting of a first loop with a smaller diameter, followed by a second concentric loop with a larger diameter”**

107. In my opinion, *Pachoud* discloses or at least renders obvious [2.c] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [2.c]. As I explained for

[1.d.i], *Pachoud* and *Astra* disclose or render obvious a ***UHF-SHF antenna [that] ... has ... in the central area a double loop.*** § X.A.3.f (Ground 1, [1.d.i]). *Astra* further discloses ***a first loop with a smaller diameter, followed by a second concentric loop with a larger diameter.*** *Astra* discloses “coupling coil (18) ... [with] a plurality of windings.” *Astra*, [0029]. These windings appear in a central zone of the antenna and are used to couple the chip module (e.g., an RFID transponder) to the antenna. *Id.*, [0025] (indicating the chip module is arranged such “that the coupling loop is inductively coupled to a coupling coil 18 of the antenna conductor 14.”). As shown in the highlighted version of Fig. 2 below, this coupling coil includes a **first loop** with a smaller diameter, followed by a **second concentric loop** with a larger diameter:

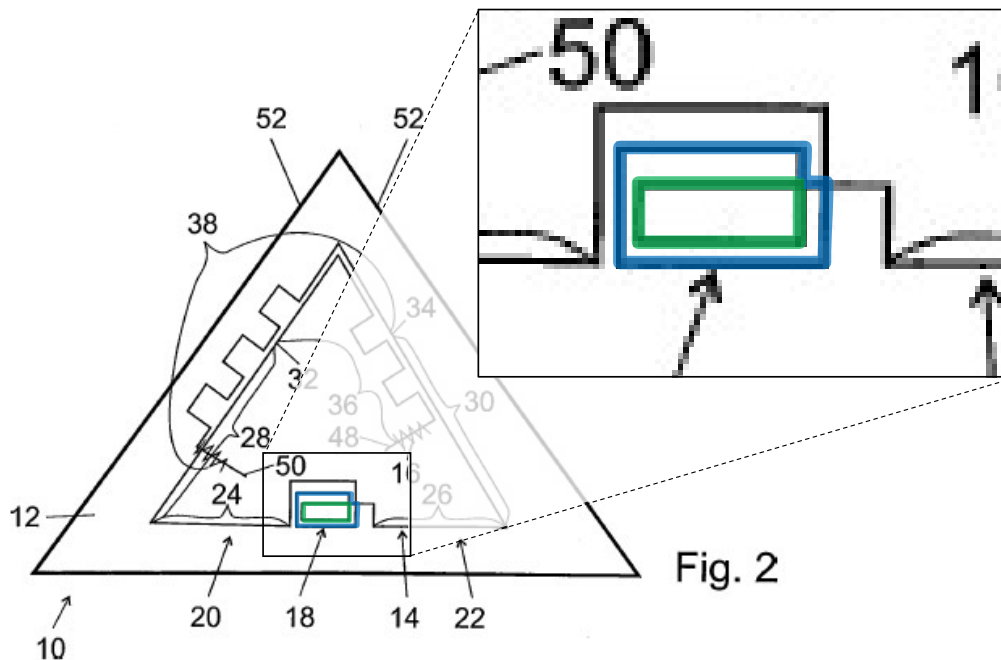
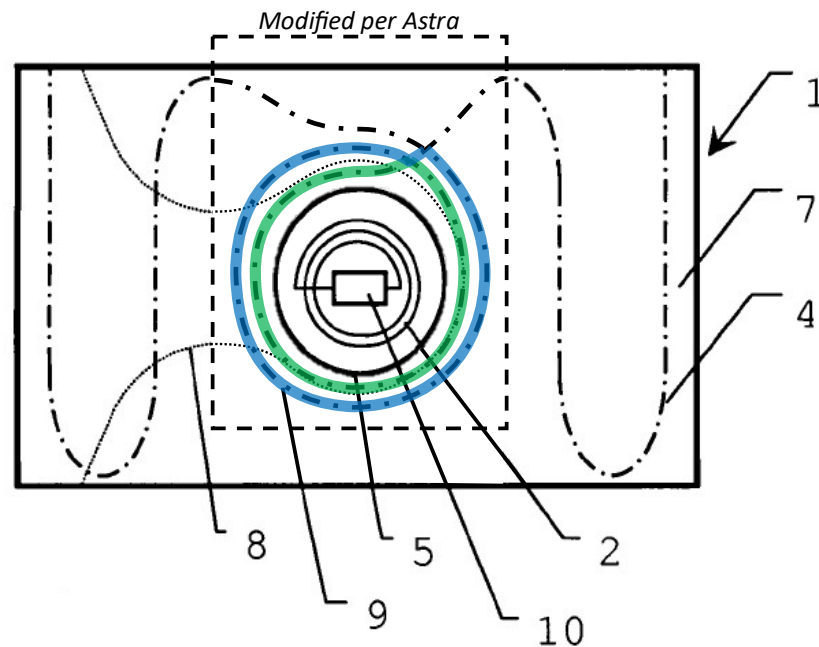


Fig. 2

Id., Fig. 2 (annotated; partially enlarged for detail).

108. The modification of *Pachoud* in view of *Astra* would similarly include a **first loop** with a smaller diameter, followed by a **second concentric loop** with a larger diameter, as shown in the modified version of Fig. 4a of *Pachoud* below:



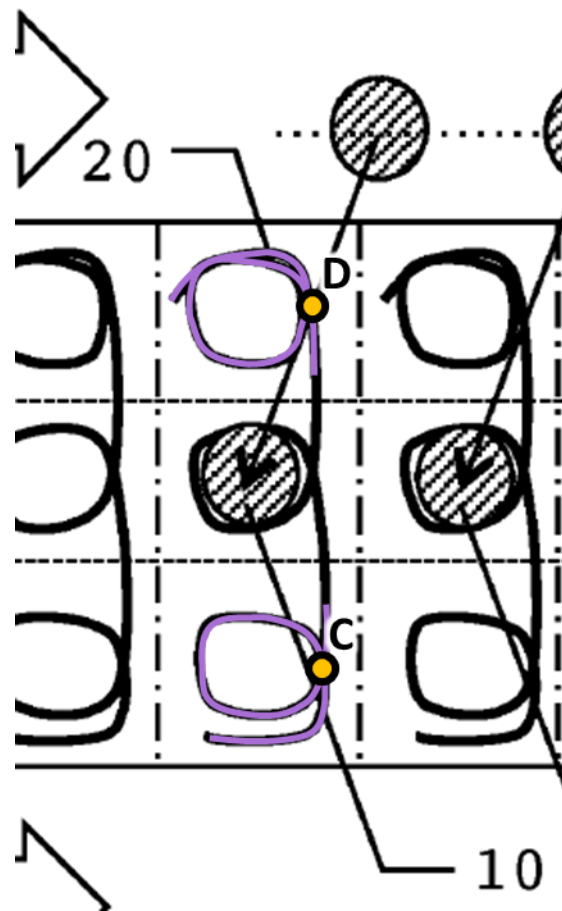
Pachoud, Fig. 4a (modified to show double loop of *Astra*).

5. Claim 3

- a. [3.a]: “wherein the UHF-SHF antenna (2) does not show electrical contacts in the crossing points (C and D) in the construction of simple loops located at the extremities”

109. It is my opinion that *Pachoud* discloses or at least renders obvious [3.a] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [3.a]. As I explained for [2.b], it would have been obvious to incorporate *Elbaz*’s *simple loops located at*

the extremities into *Pachoud*'s antenna. §X.A.4.b (Ground 1, [1.2.b]). Like the loop-shaped portion in *Pachoud* (see § X.A.3.g (Ground 1, [1.d.ii])), the simple loops in *Elbaz* include **crossing points (C and D)** in the construction of the **simple loops**, as shown below:



Elbaz, Fig. 2b (annotated), 23:8-25:2. *Pachoud* and *Astra* in view of *Elbaz* modified to include the simple loops would likewise include multiple intersection points C and D.

110. In my opinion, a POSITA would have recognized that the electroconductive thread forming the loop-shaped section in *Pachoud* would be

insulated, especially in view of *Astra*. § X.A.3.b (Ground 1, [1.a]). In my view, a POSITA would further have recognized that if the conductor forming the ***USF-SHF antenna*** is insulated, this would prevent electrical contacts at intersection points, and thus the antenna does ***not show electrical contacts in the crossing points***. § X.A.3.g (Ground 1, [1.d.ii]).

6. Claim 6

a. [6.a]: “wherein the harsh environments include temperatures between 8-90° C”

111. *Pachoud* discloses or at least renders obvious [6.a] and *Pachoud* in view of *Astra* and *Elbaz* also renders obvious [6.a]. *Pachoud* at least suggests ***the harsh environments include temperatures between 8-90° C*** because *Pachoud* discloses “an RFID laundry tag with resistance against harsh external conditions such as high temperatures.” *Pachoud*, [0021]. Specifically, *Pachoud* envisions a laundry tag capable of withstanding airdrying-machinery in which “high temperatures of up to 300° Celsius are used.” *Id.*, [0017]. Accordingly, *Pachoud* discloses an RFID tag for use in temperatures up to 300°C, and thus well suited for temperatures up to 90° C. In my opinion, a POSITA would understand *Pachoud*’s tag would likewise be suitable for lower temperatures of 8° C and fluctuations therebetween. At the time, a POSITA would have recognized these conditions were standard for textile RFID tags used in laundry operations. *Moraru*, 412 (listing

“specific industrial laundry environmental factors” including “washing temperatures of up to 90° C” and “high temperature variations – cold/warm (8° C /90° C)”).

112. In my opinion *Elbaz* similarly discloses this limitation. *Elbaz* envisions applications of its labels for industrial laundry environments and accordingly define a minimum melting temperature of its thermoplastic material of 180° C. *Elbaz*, 3:1-12, 30:7-15. As I explained, by forming an RFID tag that incorporates the fibrous mesh and thermoplastic material from *Elbaz* (*id.*, 28:11-29:3, 37:10-38:3, Fig. 2), the combination would result in an RFID tag configured for use in temperatures between 8-90° C. §X.A.2 (Ground 1, Motivation to Combine).

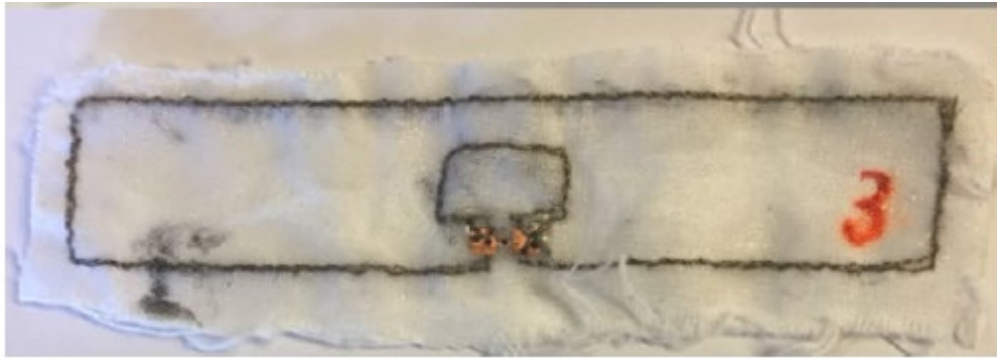
B. Ground 2: The Combination of *Pachoud*, *Astra*, and *Guibert* Renders Obvious Claims 1 and 6

1. Overview of the Ground 2 Combination

a. *Guibert*

113. *Guibert* is a publication exploring the effectiveness of coatings for wearable RFID tag applications. *Guibert*, Abstract. Like *Pachoud* and *Astra*, *Guibert* is in the same field of endeavor as the '027 patent.

114. The RFID tag of *Guibert* includes an antenna and an integrated circuit, formed by embroidering conductive thread onto a textile substrate:



Id., Fig. 1, §1. To protect against moisture during washing cycles, *Guibert* discloses applying a stretchable encapsulant onto the embroidered tags using a “dip coating” process at 100 °C. *Id.*, §2.

115. *Guibert* ultimately concludes “washing in a washing machine ... [is] damaging for the tags,” due to mainly to mechanical stress, adding that “further support material [would be] needed around the antenna-IC attachments, in order to make these tags truly washable.” *Id.*, §§4-5. Apart from these mechanical stress issues, *Guibert* found the tested encapsulant to be “a potential protective coating for textile-integrated wireless components” noting it “maintain[ed] ... excellent read ranges” and “was very effectively protecting the tags from moisture.” *Id.*, § 4.

b. The Combination of *Pachoud*, *Astra*, and *Guibert*

116. As I explained for Ground 1, *Pachoud* discloses an RFID tag that includes every feature of independent claim 1 except the claimed double loop. § X.A (Ground 1, Overview). But, as explained for Ground 1, this double loop would have been obvious, especially in view of *Astra*’s looping structure. *Id.*

117. Ground 1 further relied on *Elbaz* in part and in addition to the disclosures of *Pachoud* and *Astra* for disclosing hot gluing of a second substrate as teaching “hot-dipping” (Limitations [1.d.i-ii]). If this term were to require “dipping,” *Guibert* discloses hot-dipping. Ground 2 renders obvious claims 1 and 6 under **both** the proper priority date of October 29, 2019, and a priority date as of the filing of the PCT application on December 19, 2017. § VI.C (Priority Date).

2. Motivation to Combine

118. As I explained for Ground 1, a POSITA would have been motivated to combine *Pachoud* and *Astra*. § X.A.2 (Ground 1, Motivation to Combine). In my opinion, a POSITA would have also been motivated to combine *Guibert* with *Pachoud* and *Astra*. *Pachoud* discloses adapting a textile RFID tag for use in laundry environments. *Pachoud*, [0017]-[0023], [0027]. *Guibert* shares this same goal. *Guibert*, § 1. In my opinion, a POSITA would have implemented the dip-coating technique of *Guibert* in the RFID tag of *Pachoud* to further protect the tag’s components. Indeed, *Guibert* finds “the tested encapsulant can be considered a potential protective coating for textile-integrated wireless components, as they were able to maintain the excellent read ranges after 1 hour in water.” *Guibert*, §4. *Guibert* emphasizes that “the protective coating was very effectively protecting the tags from moisture.” *Id.*

119. While *Guibert* ultimately found “washing in a washing machine ... to be damaging for the tags,” it is my understanding from reviewing the findings that this failure was due to “mechanical stress” where “the antenna-IC interconnections were found to be easily breakable.” *Guibert*, §5. At the time, a POSITA would have recognized such issues would be mitigated in applying the dip coating to *Pachoud*’s already enclosed RFID tag. For example, *Pachoud* uses an additional textile material to enclose its tag. *Pachoud*, [0024], [0061], [0068]; § X.A.3.e (Ground 1, [1.c.ii]) In my opinion, a POSITA would have recognized this additional textile material protects against the mechanical stress found to be detrimental in *Guibert*. I understand that *Guibert* envisions this “further support material” around the antenna as a potential solution to the problems its coating encountered. *Guibert*, §4. And the weak antenna-IC interconnection noted in *Guibert* is precisely the issue addressed by inductively coupling the transponder and antenna in *Pachoud*. *Pachoud*, [0037]; *Moraru*, 412-413; Ex. 1001, 1:44-53.

120. In my view, a POSITA would have been motivated to dip-coat *Pachoud*’s textile identification tag using *Guibert*’s stretchable encapsulant to further protect the tag from moisture while maintaining excellent read ranges. *Guibert*, §4. Combining *Guibert* and *Pachoud* would, in my opinion, have thus been a straightforward application of known techniques to achieve proven results.

3. Independent Claim 1

a. [1.pre]: “An RFID tag (1) for use in harsh environments”

121. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.pre]. § X.A.3.a (Ground 1, [1.pre]).

b. [1.a]: “an UHF-SHF antenna (2) made from a continuous electroconductive textile thread, electrically insulated, embroidered on textile substrate”

122. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.a] and *Pachoud* in view of *Astra* also renders obvious [1.a]. § X.A.3.b (Ground 1, [1.a]).

c. [1.b]: “an RFID transponder (3)”

123. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.b] and *Pachoud* in view of *Astra* also renders obvious [1.b]. § X.A.3.c (Ground 1, [1.b]). The '027 patent acknowledges that RFID transponders were known in the art and admits they are disclosed in *Pachoud* specifically. Ex. 1001, 1:44-53. I agree with this assessment. In my opinion, *Pachoud* in view of *Astra* and *Guibert* also renders obvious [1.b]. *Guibert* is directed to “wearable RFID tags” that include components that transmit signals, including an **RFID transponder**. See generally *Guibert*.

d. [1.c.i]: “a substrate of textile material (4) on which the RFID transponder (3) and the UHF-SHF antenna (2) are placed”

124. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.c.i] and *Pachoud* in view of *Astra* also renders obvious [1.c.i]. § X.A.3.d (Ground 1, [1.c.i]). For similar reasons, it is my opinion that *Pachoud* in view of *Astra* and *Guibert* also renders [1.c.i] obvious.

125. *Pachoud* discloses placing an RFID transponder and a UHF-SHF antenna on a tag material. *Pachoud*, [0043], [0059], [0060], [0062]. Further, *Astra* and *Elbaz* each disclose placing an enclosed transponder and antenna on a substrate of textile material. *Astra* discloses “an antenna module 10 comprising a carrier 12,” which is “a textile material.” *Astra*, [0025]. To form the antenna module, “the antenna conductor 14 is fixed completely and continuously on the carrier 12.” *Id.* The chip module is also arranged on the carrier 12. *Id.*

e. [1.c.ii]: “the whole assembly being sealed by hot-dipping of a second textile substrate”

126. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.c.ii], and *Pachoud* in view of *Astra* also renders obvious [1.c.ii]. § X.A.3.e (Ground 1, [1.c.ii]). For similar reasons, in my opinion *Pachoud* in view of *Astra* and *Guibert* also renders obvious [1.c.ii].

127. The specification of the '027 patent provides no support for [1.c.ii]. VI.C (Priority Date). The Romanian application uses the term “hot gluing of a second substrate,” but as I explained this is not the same as hot dipping. Ex. 1017, claim 1; § VI.C (Priority Date). I have been told that the priority claim is therefore not valid. To the extent this term requires “dipping.” *Guibert* is prior art and expressly discloses such dipping.

128. *Guibert* discloses a method for fabricating “textile antennas ... for wearable RFID applications.” *Guibert*, Abstract. As with *Pachoud*, the RFID tag of *Guibert* includes an antenna and an integrated circuit formed by embroidering conductive thread onto a textile substrate. *Id.*, §1. To protect against moisture during washing cycles, *Guibert* applies a coating to the RFID tags. *Id.*, §2. In particular, *Guibert* discloses **dip coating** a stretchable encapsulant onto the embroidered tags at the high temperature of 100° C, which is hot-dipping. *Id.*

129. In my opinion, a POSITA would have been motivated to dip-coat the tag of *Pachoud* and *Astra* in *Guibert*'s stretchable encapsulant to obtain *Guibert*'s noted benefit of “very effective[] protecti[on] ... from moisture,” while “maintain[ing] ... excellent read ranges.” § X.B.2 (Ground 2, Motivation to Combine).

- f. [1.d.i]: “wherein the UHF-SHF antenna (2) has a central zone formed by a double loop (5) by which it inductively couples with the encapsulated RFID transponder (3)”**

130. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.d.i] and *Pachoud* in view of *Astra* also renders obvious [1.d.i]. § X.A.3.f (Ground 1, [1.d.i]). For similar reasons, in my opinion *Pachoud* in view of *Astra* and *Guibert* also renders obvious [1.d.i]. For example, it would have been obvious over *Pachoud* in view of *Astra* to use a double loop to increase the strength of the coupling with the RFID transponder. § X.A.3.f (Ground 1, [1.d.i]).

- g. [1.d.ii]: “wherein the double loop (5) does not have electrical contacts at intersection points (A and B)”**

131. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [1.d.ii] and *Pachoud* in view of *Astra* also discloses or renders obvious [1.d.ii]. § X.A.3.g (Ground 1, [1.d.ii]). For similar reasons, in my opinion *Pachoud* in view of *Astra* and *Guibert* also renders obvious [1.d.ii]. In my opinion, it would have been obvious in view of *Pachoud* in combination with *Astra* to use a double loop to increase the connection strength with the RFID transponder, and it would further have been obvious to insulate that loop to avoid electrical contacts and shorts at the intersection points. § X.A.3.g (Ground 1, [1.d.ii]).

4. Claim 6

a. [6.a]: “wherein the harsh environments include temperatures between 8-90° C”

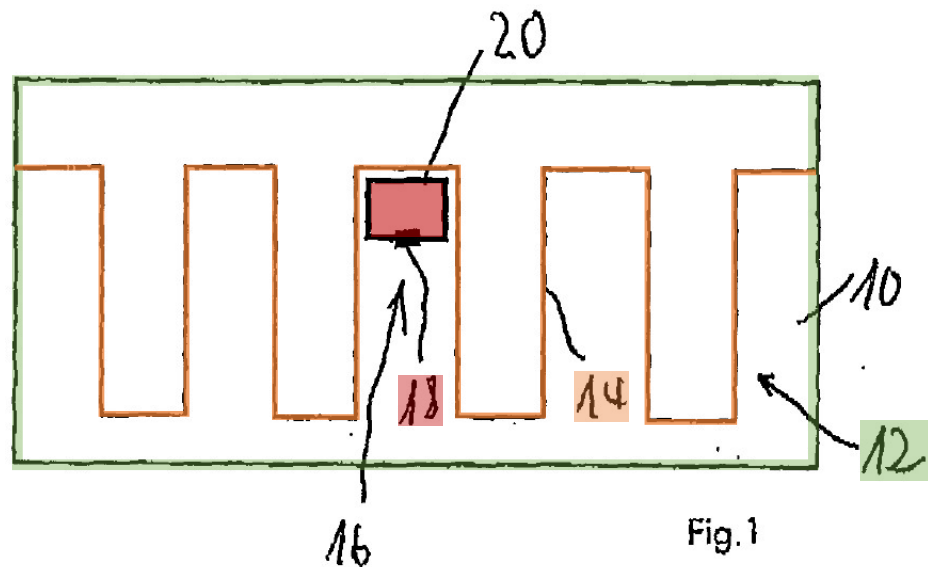
132. As I explained in Ground 1, *Pachoud* discloses or at least renders obvious [6.a]. § X.A.6.a (Ground 1, [6.a]). For similar reasons, in my opinion *Pachoud* in view of *Guibert* also renders obvious [6.a]. *Pachoud*’s tag is designed for temperature up to 300° C, which includes temps between 8-90° C. *Pachoud*, [0017]. *Guibert*’s tag is designed to undergo laundry conditions that include 40° C and were dried at temperatures up to 160° C during manufacturing and are used for “everyday” applications. *Guibert*, §§2-3. These temperatures thus span ranges between 8-90° C. *Id.*

C. Ground 3: The Combination of *Astra*, *Stobbe*, and *Elbaz* Renders Obvious Claims 1, 2, 3, and 6

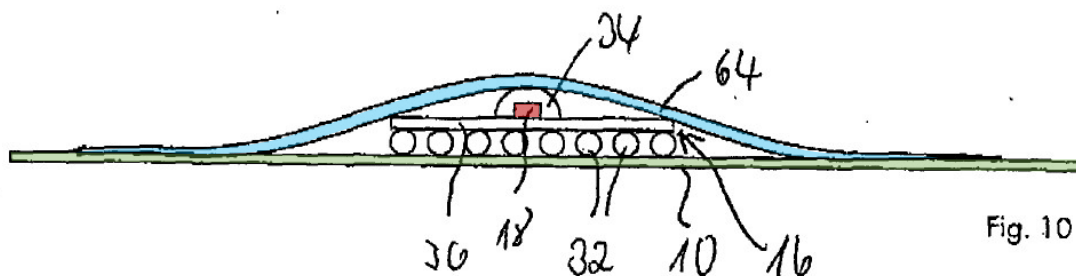
1. Overview of Ground 3

a. *Stobbe*

133. *Stobbe* is filed by the same applicant as *Astra* and similarly discloses a “textile information carrier” including a **chip module** and an **antenna** placed on a **textile label**. *Stobbe*, [0009]. As in *Pachoud* and *Astra*, the antenna is connected to the **chip module** via inductive coupling, as illustrated with color-coded highlights below:



Id., Fig. 1 (annotated), [0009]. Whereas *Astra* focuses mainly on improving the form of the antenna module (*Astra*, [0002]-[0003]), *Stobbe* aims to adapt the textile tag when used specifically in harsh laundry environments (*Stobbe*, [0005]-[0006]). For example, is indicated in the color-coded highlighting below, *Stobbe* discloses applying a **patch** over the **chip module** and **antenna** to form a seal with the **textile label** that can withstand harsh environments:



Stobbe, Fig. 10 (annotated), [0024].

b. The Combination of *Astra*, *Stobbe*, and *Elbaz*

134. In my opinion, *Astra* alone discloses or renders obvious each element of the independent claim with the exception of hot-dipping of a second textile substrate. However, as I explained, *Stobbe*'s application of a patch applied via adhesive using heat and pressure discloses this element. It would have been obvious to combine *Astra* and *Stobbe*, especially in view of *Astra*'s explicit reference to *Stobbe* as its starting point. Further, even setting the teachings of *Astra* in view of *Stobbe* aside, *Elbaz* discloses this hot-dipping and in my opinion it would have been obvious over *Astra* in view of *Stobbe* and *Elbaz*.

135. As explained below, Ground 3 renders obvious claims 1-3 and 6 under the earliest claimed priority date of the '027 patent.

2. Motivation to Combine

136. In my opinion, a POSITA would have been motivated to combine *Astra*, *Stobbe*, and *Elbaz*. I expect that a POSITA would have had a reasonable expectation of success in doing so given the teachings of the prior art. The references are analogous to the '027 patent because they are in the same field of endeavor: textile RFID tags for applications in harsh environments.

137. The combination of *Astra* and *Stobbe* is nothing more than the combination of familiar elements according to known methods to yield predictable results. Both *Astra* and *Stobbe* provide textile RFID tags including a chip module

and an antenna conductor affixed to a textile label. *Astra*, [0025]; *Stobbe*, [0066]. It is my opinion that a POSITA in possession of *Astra* would have turned to *Stobbe* for its benefits of further adapting the textile RFID tag for laundry environments. *Stobbe*, [0005]-[0006]. Indeed, *Stobbe* is explicitly referenced in *Astra* to disclose a relevant prior art textile device comprising an antenna and chip module, and both list the same applicant. *Astra*, [0002].

138. A POSITA would have also been motivated to combine *Elbaz* with *Astra* and *Stobbe*. A stated goal of *Astra* is to provide an antenna module having a compact design. *Astra*, [0003]. And as I explained above regarding the modification of *Pachoud* and *Astra* in view of *Elbaz*, a POSITA would have been similarly motivated to improve performance by including *Elbaz*'s end loops. § X.A.2 (Ground 1, Motivation to Combine). In my opinion, a POSITA would have been motivated to incorporate the loops in the extremities of *Elbaz*'s antenna to achieve the known benefits of reduced size while improving bandwidth, thus furthering this goal. See § X.A.2 (Ground 1, Motivation to Combine). For example, antenna conductor 14 of *Astra* includes "third sections 36, 38 partially hav[ing] a meander-shaped course." *Astra*, [0031]. I understand that this form of meander is precisely the antenna configuration that can be avoided by adding simple loops. *Shao*, 1386. This understanding is confirmed by *Elbaz*, which describes the advantages of its loops, which I confirmed a POSITA would have understood by presenting

simulations above. *Elbaz*, 23:13-14 (“To reduce its bulk ... [the] antenna[] advantageously comprises a plurality of loops 20L.”); § X.A.2 (Motivation to Combine). Given *Astra*’s insulated antenna, in my opinion that combining *Astra* and *Elbaz* would have amounted to a straightforward application of known techniques to achieve predictable results.

139. In my opinion, a POSITA would have been additionally motivated to combine *Astra* and *Stobbe* with *Elbaz* to improve the ability of its tags to survive harsh environments in laundry processes. For example, *Elbaz* states that, among other benefits, its mesh protects the RFID module “against possible shocks or mechanical constraints.” *Elbaz*, 28:21-29:3. My understanding is that the thermoplastic material further keeps the label substantially flat and provides improved resilience for harsh environments. *Id.*, 30:16-31:3. It advantageously provides a minimum melting temperature of its thermoplastic protective coating of 180° C. *Id.*, 30:13-15. In view of these teachings, a POSITA at the time would have been motivated to incorporate this sealing process of *Elbaz* to improve resilience of the tag in laundry environments, while retaining flexibility.

3. Independent Claim 1

a. [1.pre]: “An RFID tag (1) for use in harsh environments”

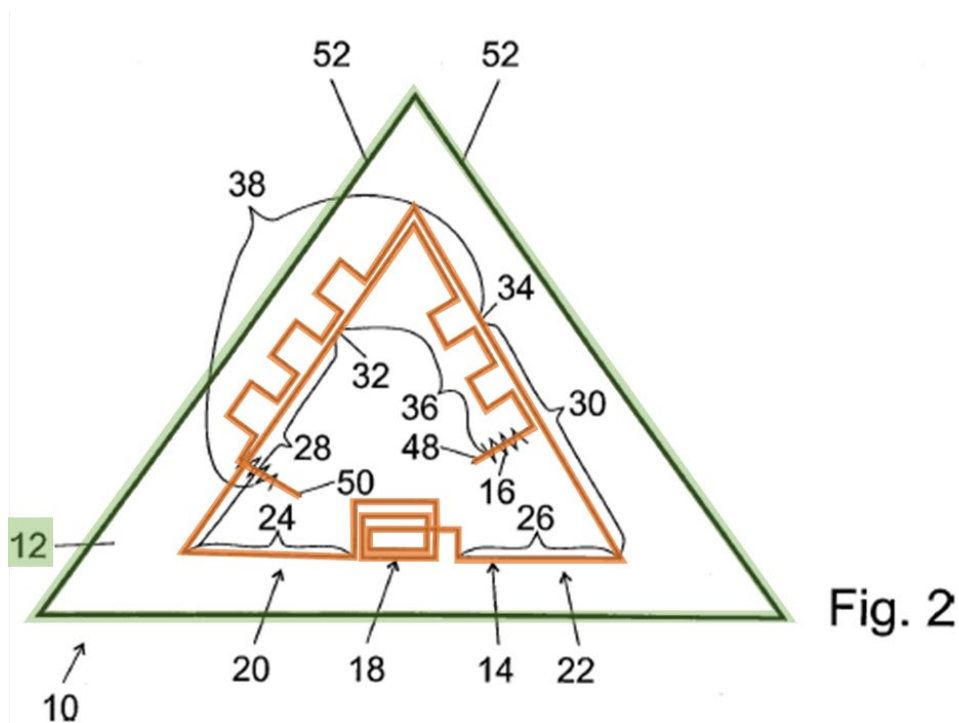
140. In my opinion, *Astra* discloses or at least renders obvious [1.pre] and *Astra* in view of *Stobbe* and *Elbaz* also renders obvious [1.pre]. *Astra* discloses “an antenna module [having] a compact design” with a minimal external interference on its resonance frequency. *Astra*, [0003]. In reading *Astra*, A POSITA would have recognized this antenna would be suitable for harsh environments. For example, *Astra* specifically refers to *Stobbe* at the outset and thus envisions use of its antenna module in the same technical field. *Astra*, [0002]. It is clear from *Astra* that its antenna module is intended for use in the tag of *Stobbe*. And *Stobbe* specifically raises the thermal and chemical influences on textiles during a laundry cycle as a problem to be addressed. *Stobbe*, [0005].

141. *Elbaz* provides a solution to the problems posed in harsh industrial laundry environments by applying a mesh and thermoplastic material over the RFID module and antenna. *Elbaz*, 3:1-12 (describing a tag and manufacturing process for withstanding “particularly harsh environments and/or conditions encountered in textile cleaning.”), 28:11-29:3, 30:7-15. Thus, in my opinion *Astra* alone or in view of *Stobbe* and *Elbaz* renders obvious this limitation.

b. [1.a]: “an UHF-SHF antenna (2) made from a continuous electroconductive textile thread,

electrically insulated, embroidered on textile substrate”

142. In my opinion, *Astra* discloses or at least renders obvious [1.a] and *Astra* in view of *Stobbe* and/or *Elbaz* also renders obvious [1.a]. For example, *Astra*’s antenna module includes an **antenna conductor 14** and a textile **carrier material 12**. *Astra*, [0025]. As I illustrate below with color-coded highlights, the **antenna conductor** of *Astra* is “an insulated braid” that may “comprise one or more electrically conductive textile threads” and is “fixed completely and continuously on the **carrier 12** by embroidery technology using **embroidery yarn 16**”:



Id., Fig. 2 (annotated) , [0025].

143. In my opinion, a POSITA would have recognized that *Astra*'s antenna would have been suitable for use in the UHF-SHF frequency range. For example, *Astra* teaches that the shape of the antenna conductor 14 can be varied to achieve different frequencies. *Astra*, [0011], [0017], [0028]. The textile identification tag of *Stobbe*, identified as the starting point for *Astra*'s antenna (*Astra*, [0002]), more specifically discloses applications in the UHF and SHF range. *Stobbe*, [0005]. When reviewing these references, a POSITA would have understood *Astra*'s chip module would have been suitable for the same frequency range. *Elbaz* confirms that such RFID tags are "generally operated on a [UHF] frequency band." *Elbaz*, 1:20-2:2.

c. [1.b]: "an RFID transponder (3)"

144. In my opinion, *Astra* al discloses or at least renders obvious [1.b] and *Astra* in view of *Elbaz* and *Stobbe* also renders obvious [1.b]. For example, *Astra* discloses a "chip module, which comprises a chip and a coupling loop." *Astra*, [0025]. *Astra* notes that the chip module is not included in Fig. 2 "for reasons of clarity," but explains that the chip module is "arranged on the carrier 12 in such a manner that the coupling loop is inductively coupled to a coupling coil 18 of the antenna conductor 14." *Id.* A POSITA would understand this chip module, comprising a chip and a coupling loop, to be an RFID transponder. *See* § VII.A.

145. While it is my opinion that *Astra*'s chip module is an RFID transponder despite the specific terms "RFID" and "transponder" not being used, *Elbaz* expressly

discloses an RFID transponder. For example, *Elbaz* discloses “a radio-frequency identification module of the RFID type” having “an electronic component connected to a second conductive antenna.” *Elbaz*, 3:14-19. This would refer to the RFID chip and near-field antenna. *See, e.g., Moradi*, 248. A POSITA would thus understand this RFID module, including an electronic component and an antenna, to be an RFID transponder (e.g., as described by *Moradi*).

146. The '027 patent also admits that RFID tags including RFID transponders are known in the art. Ex. 1001, 1:44-53. I agree.

d. **[1.c.i]: “a substrate of textile material (4) on which the RFID transponder (3) and the UHF-SHF antenna (2) are placed”**

147. In my opinion, *Astra* discloses or at least renders obvious [1.c.i]. For example, *Astra* discloses “an antenna module 10 comprising a carrier 12” which “can be a textile material.” *Astra*, [0025]. To form the antenna module, “the antenna conductor 14 is fixed completely and continuously on the carrier 12.” *Id.* The chip module is also arranged on the carrier 12. *Id.*

e. **[1.c.ii]: “the whole assembly being sealed by hot-dipping of a second textile substrate”**

148. The specification of the '027 patent provides no support for [1.c.ii]. § VI.C (Priority Date). The Romanian application uses the term “hot gluing of a second substrate,” but as I explained this is not the same as hot dipping. Ex. 1017,

claim 1; § VI.C (Priority Date). Even if hot-dipping encompasses hot gluing of a second substrate, *Astra* in view of *Stobbe* and/or *Elbaz* renders obvious this limitation.

149. *Stobbe* discloses a detection plate 16 including a chip module 16 and an antenna 12. *Stobbe*, [0066]. *Stobbe* explains that the detection plate may be “sealed with a coating ... [to] protect ... against mechanical and chemical influences.” *Stobbe*, [0033]-[0034]. For example, this may include placing a **patch 64**, including a coating and thermal adhesive, over the detection plate. *Id.*, [0078]. As illustrated in the highlighted version of Fig. 10, the **patch 64** is attached by pressure and heat to a textile label 10 to enclose the detection plate:

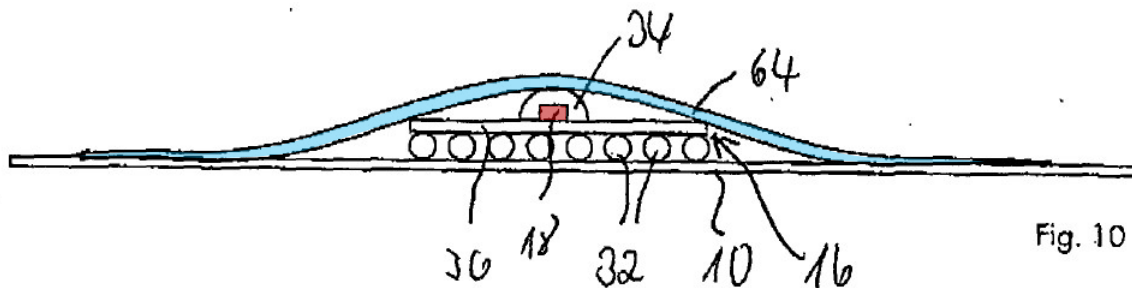


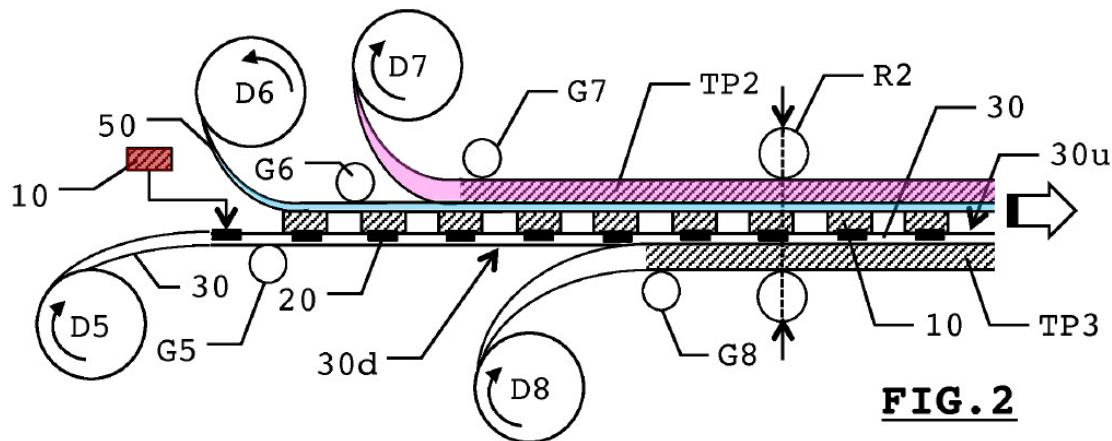
Fig. 10

Stobbe, Fig. 10 (annotated), [0078].

150. It is my opinion that a POSITA would have understood this patch applied via adhesive using heat and pressure to be “seal[ing] by hot-dipping of a second textile substrate” under any interpretation. A POSITA would have also been motivated to include the sealing patch of *Stobbe* to outfit the antenna module for

laundry applications, as confirmed by the explicit reference to *Stobbe* at the outset of *Astra*. *Astra*, [0002].

151. *Elbaz* also discloses this element, in my opinion. Specifically, *Elbaz* discloses depositing a **radio-identification module 10** on a support material 30, applying a **fibrous mesh 50**, and heat-pressing a **thermoplastic material TP2**, as shown in the color-coded highlights below:



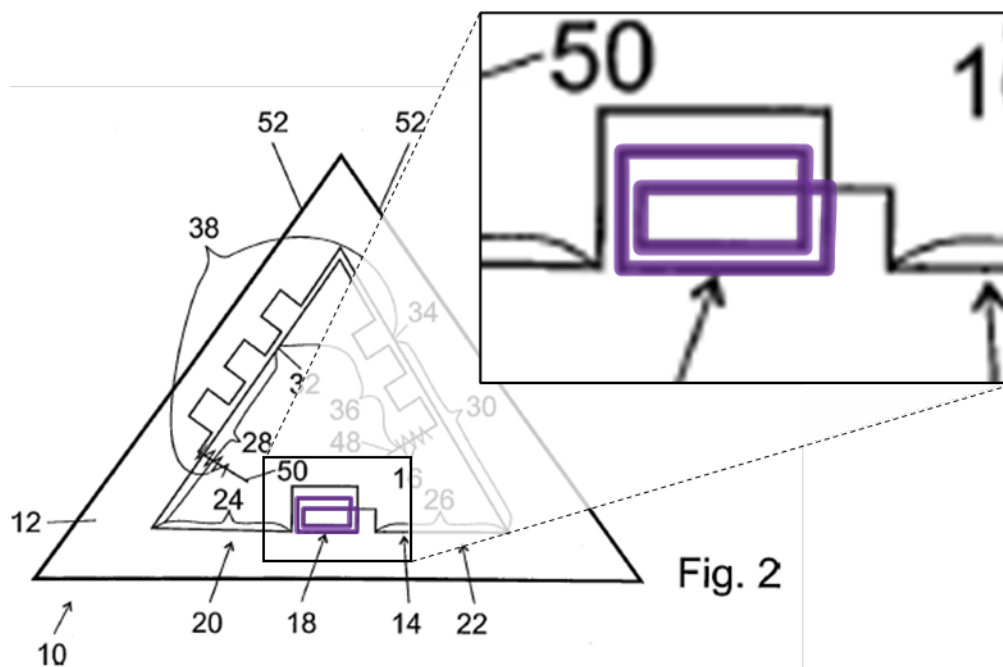
Elbaz, Fig. 2 (annotated), 28:11-29:3, 37:10-38:3.

152. A POSITA would have recognized the mesh applied via hot-pressing of a thermoplastic material constitutes hot-dipping of a second textile substrate to seal the antenna assembly. In my opinion a POSITA would also have been motivated to incorporate this sealing process of *Elbaz* to improve the resilience of *Astra*'s antenna module in laundry environments. § X.C.2 (Ground 3, Motivation to Combine).

- f. [1.d.i]: “wherein the UHF-SHF antenna (2) has a central zone formed by a double loop (5) by which it

**inductively couples with the encapsulated RFID
transponder (3)”**

153. It is my opinion that *Astra* discloses or at least renders obvious [1.d.i] and *Astra* in view of *Stobbe* and *Elbaz* also renders obvious [1.d.i]. For example, *Astra* discloses a central zone formed by a loop for inductive coupling with an RFID transponder. In particular, *Astra* discloses a “coupling coil (18) ... [with] a plurality of windings.” *Astra*, [0029]. These windings appear in a central zone of the antenna and are used to couple the chip module (i.e., the RFID transponder) to the antenna. *Id.*, [0025] (indicating the chip module is arranged such “that the coupling loop is inductively coupled to a coupling coil 18 of the antenna conductor 14.”). As I show in purple highlights in Fig. 2, this coupling coil includes a **double loop**:



Id., Fig. 2 (annotated; partially enlarged for detail). In my opinion, *Astra* in view of *Stobbe* and *Elbaz* thus discloses a double loop.

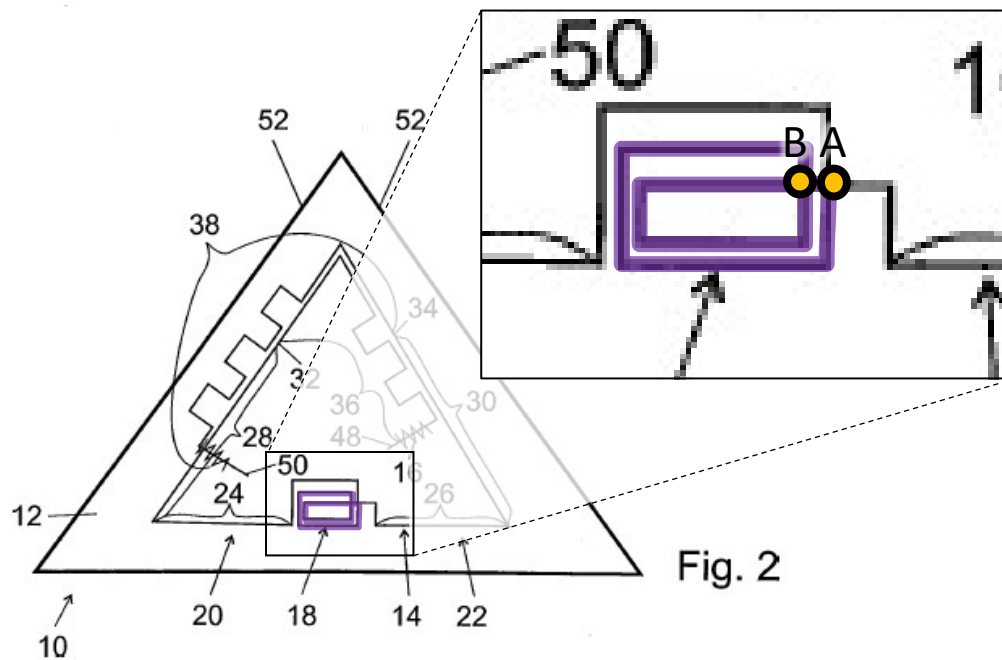
154. In my opinion, a POSITA would recognize the chip module of *Astra* would be used for laundry applications and thus would necessarily be encapsulated. However, *Stobbe* and *Elbaz* each disclose an encapsulated RFID transponder. The chip module 18 of *Stobbe* (specifically referenced in *Astra*) is coated with a “globtop material[,] provid[ing] protection against mechanical, thermal, and chemical influences.” *Stobbe*, [0070]. Similarly, the RFID module of *Elbaz* includes a protective resin covering the module’s components. *Elbaz*, 10:1-10, 13:10-17, 17:2-18:2, 18:3-9, 22:12-23:6. To the extent not already disclosed in *Astra*, a POSITA would have found it obvious to encapsulate the RFID transponder as described in *Stobbe* and/or *Elbaz* to protect the transponder against mechanical shocks. § X.B.2 (Ground 2, Motivation to Combine).

155. I also find that the distinction between a double loop and 2.5 loops is not a meaningful distinction, nor is the claim limited to exactly two full loops. § X.A.3.f (Ground 1, [1.d.i]).

g. [1.d.ii]: “wherein the double loop (5) does not have electrical contacts at intersection points (A and B)”

156. In my opinion *Astra* discloses or at least renders obvious [1.d.ii] and *Astra* in view of *Stobbe* and/or *Elbaz* also renders obvious [1.d.ii]. As I explained

for Ground 1, forming the double loop of *Astra* introduces multiple **intersection points** A and B, as highlighted in Fig. 2 to of *Astra* below:



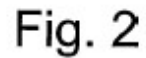
Astra, Fig. 2 (annotated; partially enlarged for detail). § X.A.3.g (Ground 1, [1.d.ii]).

In my opinion, a POSITA would have recognized that because the antenna conductor 14 is insulated, no electrical contact at intersection points A and B would be present. § X.A.3.g ([Ground 1, [1.d.ii]). Indeed any loop-shaped portion formed of a conductive thread would likely have these intersection points.

4. Claim 2

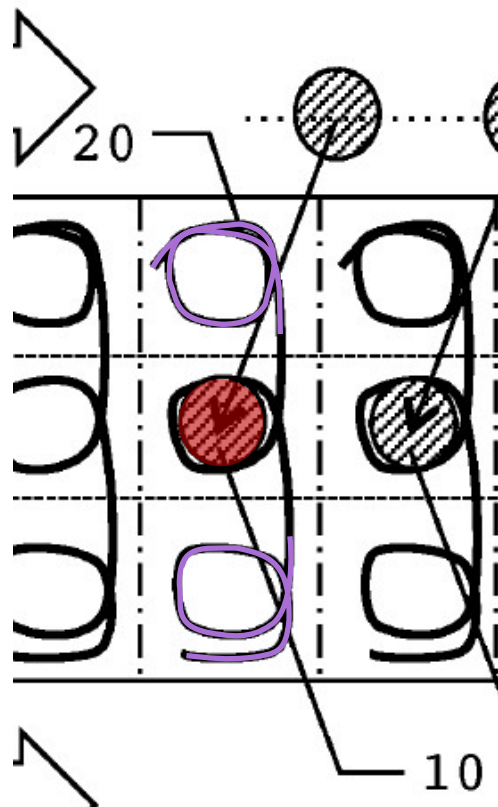
- a. [2.a]: “wherein the UHF-SHF antenna (2) is made of an electroconductive textile thread, electrically insulated, by continuous embroidering, starting from one end to the other”**

157. It is my view that *Astra* discloses or at least renders obvious [2.a] and *Astra* in view of *Stobbe* and *Elbaz* also renders obvious [2.a]. *Astra* discloses an antenna formed of an “insulated braid ... [of] electrically conductive textile threads ... fixed completely and continuously on the carrier 12 by embroidery technology using embroidery yarn 16.” *Astra*, Fig. 2, [0025] (noting only a limited portion of the embroidery is shown for clarity). Accordingly, in my opinion, a POSITA would have recognized the antenna conductor 14 disclosed in *Astra* is formed by continuously embroidering the **electroconductive thread** from a first end to a second end of the antenna. This arrangement is indicated in the highlighted figure below:



b. [2.b]: “wherein the UHF-SHF antenna (2) ... has simple loops in each extremity”

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Elbaz, Fig. 2b (annotated), 23:8-25:2. In my opinion it would have been obvious to incorporate loops 20L of *Elbaz* into the extremities of *Astra*'s antenna to achieve the known benefits of a reduced antenna size and improved bandwidth. § X.C.2 (Ground 3, Motivation to Combine).

- c. **[2.c]: “wherein the UHF-SHF antenna (2) ... has ... in the central area a double loop (5) consisting of a first loop with a smaller diameter, followed by a second concentric loop with a larger diameter”**

159. In my opinion, *Astra* discloses or at least renders obvious [2.c]. As I explained for Ground 1, [1.d.1], *Astra* discloses a “coupling coil (18) ... [with] a plurality of windings in a central zone of the antenna. *Astra*, [0025]; see § X.A.3.f

(Ground 1, [1.d.i]). As illustrated in the highlighted version of Fig. 2, this coupling coil includes a **first loop** with a smaller diameter, followed by a **second concentric loop** with a larger diameter:

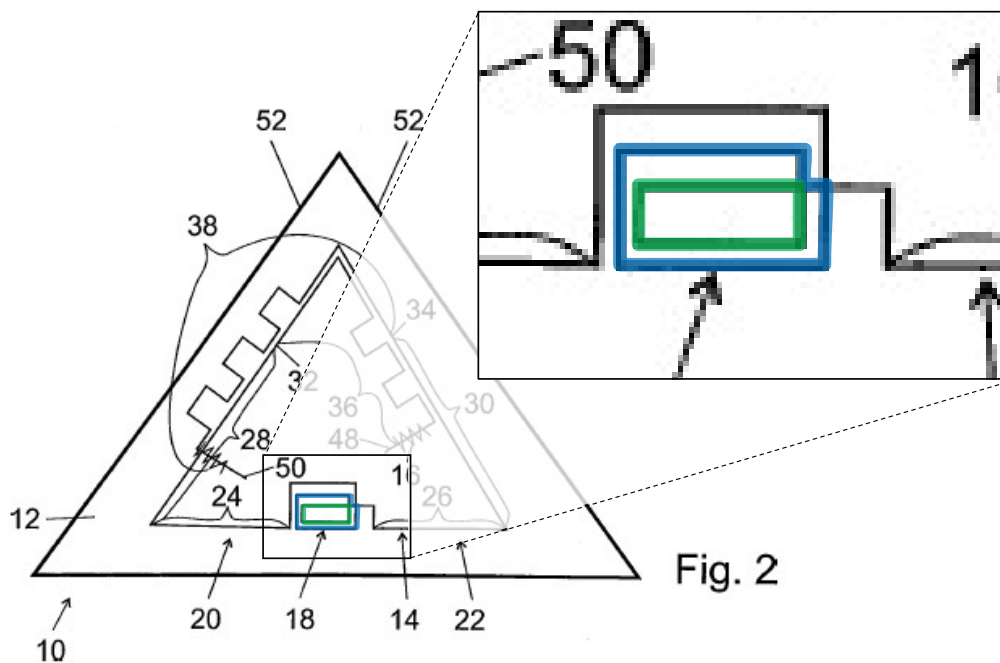


Fig. 2

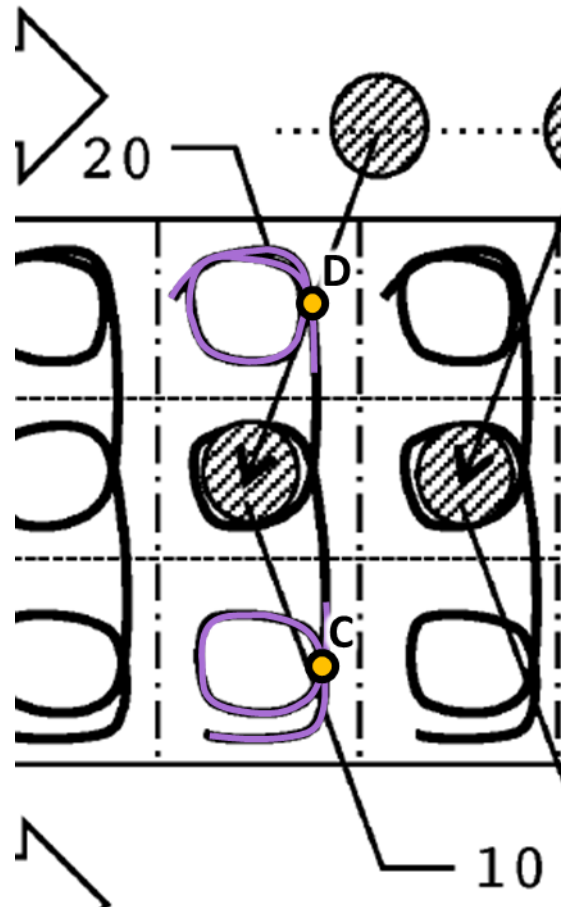
Id., Fig. 2 (annotated; partially enlarged for detail).

5. Claim 3

- a. [3.a]: “wherein the UHF-SHF antenna (2) does not show electrical contacts in the crossing points (C and D) in the construction of simple loops located at the extremities”

160. It is my opinion that *Astra* in view of *Stobbe* and *Elbaz* renders obvious [3.a]. As I explained for [2.b], it would have been obvious to incorporate *Elbaz*’s *simple loops located at the extremities* into *Astra*’s antenna. X.C.4.b (Ground 3, [2.b]). Like the loop-shaped portion in *Astra* (see § X.C.3.g (Ground 3, [1.d.ii])), the

simple loops in *Elbaz* include *crossing points (C and D) in the construction of the simple loops*, as I show in the highlighted figure below:



Elbaz, Fig. 2b (annotated), 23:8-25:2. *Astra* and *Stobbe* modified to include the simple loops of *Elbaz* would likewise include multiple intersection points C and D.

161. *Astra*'s antenna conductor 14 is formed using an electrically insulated thread. § X.C.3.b (Ground 3, [1.a]). It is my finding that a POSITA would have recognized that this insulation would prevent electrical contacts at intersection points of the simple loops. § X.A.3.g (Ground 3, [1.d.ii]).

6. Claim 6**a. [6.a]: “wherein the harsh environments include temperatures between 8-90° C”**

162. In my opinion, *Astra* in view of *Stobbe* and *Elbaz* renders obvious [6a]. For example, *Elbaz* discloses its labels would have been used in industrial laundry environments and accordingly defines a minimum melting temperature of its thermoplastic protective coating of 180° C. *Elbaz*, 30:7-15. Accordingly, the antenna module of *Astra* in view of *Stobbe* and *Elbaz* would have included the coating layer of *Elbaz* which would have been suitable for use in temperatures between 8-90° C. It would have been obvious to use *Elbaz*’s protective coatings to improve the ability of *Astra* and *Stobbe*’s tags to survive harsh laundry environments. § X.C.2 (Ground 3, Motivation to Combine).

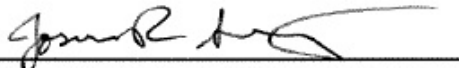
XI. CONCLUSION

163. For the reasons set forth above, in my opinion, a person of ordinary skill in the art would have found claims 1-3 and 6 of the ’027 patent obvious.

164. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

165. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: September 29, 2023

By: 
Joshua R. Smith, Ph.D.