

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMAXTEC INC. and
SMAXTEC ANIMAL CARE GMBH,
Petitioners

v.

ST REPRODUCTIVE TECHNOLOGIES, LLC,
Patent Owner.

Case IPR2024-01067
Patent No. 10,231,644

DECLARATION OF EDWIN C. KAN, PH.D.

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I. INTRODUCTION

1. My name is Dr. Edwin C. Kan. I have been retained by ST Reproductive Technologies, LLC (the “Patent Owner” or “ST Repro”) as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office. I was retained in this matter by ST Repro to review U.S. Patent No. 10,231,644 (the “’644 Patent”) and provide analysis, opinions, and observations in relation to the ’644 Patent and IPR2024-01067.

2. I am being compensated at my standard rate of \$400 per hour. My compensation is not contingent in any way on the outcome of this matter, substance of my testimony, or any of the positions I have taken, as provided below. Although I am being compensated at my standard consulting rate for the time I spend on this matter, I have no personal financial interest in any of the entities involved in this proceeding.

3. For this declaration, I have been asked to review and respond to statements made in the Petition filed in IPR2024-01067 and to the opinions provided in the Declaration of Professor Darrin J. Young (Ex. 1002) filed in connection with the Petition. I understand Professor Young is the expert witness engaged on behalf of Petitioners. I have also been asked to consider and provide my opinions regarding the references Petitioners assert against the ’644 Patent, and to compare those references to the claims of the ’644 Patent that have been challenged in the Petition.

My opinions and the basis for those opinions are outlined below. The testimony I may provide about scientific principles relating to my analysis and opinions includes subjects relating to, for example, boluses, sensors, transmitters, and the use of radiofrequency devices in animals.

4. I reserve the right to revise or supplement my opinions if additional information makes either appropriate, or if Petitioners or Professor Young revise or supplement their allegations or opinions.

II. QUALIFICATIONS AND BACKGROUND

5. My qualifications are stated more fully in my curriculum vitae, which is attached as Exhibit 2002 and incorporated by reference within this declaration. The following is a brief summary of my qualifications.

6. I received a Bachelor of Science (B.S.) degree in Electrical Engineering from National Taiwan University in 1984. I then received a Master of Science (M.S.) degree in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign in 1988. I further received a Doctorate (Ph.D.) in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign in 1992, with my thesis titled “Numerical models for the simulation of nonstationary effects in submicron semiconductor devices.”

7. In January 1992, I joined Dawn Technologies in Sunnyvale, California as a Principal Computer-Aided Design (“CAD”) Engineer, developing advanced

electronic and optical device simulators and technology CAD frameworks. In 1994, I began working at Stanford University in Palo Alto, California as a Research Associate in the Center for Integrated Systems, where I performed research on technology CAD and numerical methods.

8. In 1997, I joined the School of Electrical and Computer Engineering at Cornell University in Ithaca, New York, where I have held various roles since. Specifically, from 1997 to 2002, I was an Assistant Professor, where I performed research on CMOS circuits and technology. The application areas include flash memory, molecular sensors, transmission lines, and autonomous microsystems.

9. During the summers of 2000 and 2001, I also worked at the IBM Thomas J. Watson Research Center (then, known as the Thomas J. Watson Lab) in Yorktown Heights, New York as a member of the Faculty Partner Program. The Thomas J. Watson Research Center is the global headquarters for IBM Research, the largest industrial research organization in the world. In this program, I performed research in CMOS technology development, including the modeling of subthreshold leakage currents due to band-to-band tunneling, and asymmetric source-drain transistor structures. I also participated in IBM's RF CMOS research, aiming at ultra-low-power design principles.

10. From 2002 to 2009, I was an Associate Professor in Cornell University's School of Electrical and Computer Engineering. During that time, my

work still focused on CMOS technology development and circuit designs. I have expanded my research to carbon-based nanostructures, including both nanotubes and fullerenes. I have also studied microsystem integration in insect cyborgs where complete control and communication modules were fitted on a moth for conceptual demonstration. I have investigated non-conventional communication modules such as Bragg pulse radios, nonlinear transmission lines, and nonvolatile computing in the baseband processing.

11. In 2004 and 2005, while on sabbatical leave from Cornell University, I was a Visiting Researcher with Intel Research in Santa Clara, California and a Visiting Professor with the Stanford University Electrical Engineering Department. At Intel Research, I worked on phase-change memories, molecular sensors and carbon nanostructures integration in CMOS. As a Visiting Professor with Stanford University, I participated in research of CMOS technology development and radio-frequency IC designs, in particular modules by Bi-CMOS processes.

12. In 2009, I became a Professor in Cornell University's School of Electrical and Computer Engineering, and I presently serve in that role. In this role, I have taught courses in radio-frequency identification (RFID), RF systems, digital VLSI design, CMOS fabrication, numerical methods and software engineering. I have also conducted research in RFID, in particular for precision localization and multiplexing protocols, RF systems for low data rate and ultra-low-power

consumption, RF sensors, animal vital-sign sensing, and biomedical diagnosis. From 2010 to 2013, I also served as the Director of Graduate Studies for the School of Electrical and Computer Engineering, where I was responsible for graduate admission and supervised annual reviews of graduate students.

13. I have worked with many collaborators for animal sensing, both for veterinary medicine and biomedical animal models. I have worked with farm animals, pets, and wild lives from small betta fish to large sea elephants. I have worked with dairy farms on respiratory and digestive sensing using the wearable radio biosensors invented in my group. I have given invited talks in conferences on radio biosensors and RFID networks.

14. I have author or co-authored more than 300 journal and conference papers, including approximately 150 papers on topics related to radio frequency sensing, actuators, sensor systems, biosensors, antennas, near-field radio frequency, RFID tag tracking, animal monitoring, and wireless protocols.

15. I have worked on more than 50 sponsored research projects, including approximately 25 projects in the areas of radio frequency sensing, sensor systems, biosensors, antennas, near-field radio frequency, RFID tag tracking, and wireless protocols.

16. I am the inventor or co-inventor on 15 issued U.S. patents, one U.S. patent application, and five U.S. provisional patent applications. A full list of my

patents and patent applications is included in Exhibit 2002. I was honored by Cornell University in 2003 and 2006 with the Cornell Inventor Award.

17. I have worked on both hardware and software in a complete sensor system, conducting design, fabrication, signal processing, machine-learning based analysis, human studies and animal testing. Additional details about my education, work experience, awards and honors, and publications that may be relevant to the opinions I have formed in this declaration are set forth in my CV (Ex. 2002).

III. MATERIALS CONSIDERED

18. My opinions are based on my years of education, research, and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this declaration and those listed in the table of exhibits below:

Exhibit No.	Description
1001	U.S. Patent No. 10,231,644
1002	Declaration of Professor Darrin J. Young
1003	CV of Professor Darrin J. Young
1004	Int'l Appl. No. PCT/US2007/020918, Pub. No. WO 2008/108816 ("Harvey")
1005	U.S. Patent Appl. Pub. No. 2009/0187392 ("Riskey")
1006	U.S. Patent Appl. Pub. No. 2013/0197323 ("Rettedal")
1007	Japanese Patent Appl. No. 2004-215061 A ("Kunda")

1008	U.S. Patent No. 6,371,927 B1 (“Brune”)
1009	U.S. Patent Appl. Pub. No. 2009/0030279 A1 (“Zander”)
1010	Prosecution History of U.S. Patent No. 10,231,644
1011	U.S. Patent No. 5,482,008 (“Stafford”)
1012	U.S. Patent No. 8,640,712 B2 (“Ardrey, Jr.”)
1013	“RUM_023 Administration of a Rumen Bolus”, UQ Animal Ethics Committee – Standard Operating Procedure
1014	U.S. Patent 9,413,585 B2 (“Schulzrinne”)
1015	U.S. Patent 10,594,335 (“Zrilic”)
1016	U.S. Patent Appln. Pub. No. 2023/0274893 A1 (“Andree”)
1017	2024-05-15 Preliminary Pretrial Conference Order (D.I. 034)
1018	2024-04-23 Plaintiff’s First Amended Complaint (D.I. 025)
1019	U.S. Patent Appln. Pub. No. 2003/0096637 A1 (“Keller”)
1020	Excerpt of Oxford Advanced Learner’s Dictionary of Current English, 9th ed. (2015)
1021	U.S. Patent No. 11,755,484 B2 (“Gray”)
1022	Int’l Appl. No. PCT/AU88/00225, Pub. No. WO 89/00024 (“Platt”)
1023	U.S. Appl. Pub. No. 2015/0277885 (“Kimoto”)
2003	U.S. Appl. Pub. No. 2010/0302039 (“Goto”)

IV. LEGAL PRINCIPLES APPLIED

A. Person of Ordinary Skill in the Art

19. Some of my opinions refer to the perspective of one of ordinary skill in the art (“POSA”) at the time of the invention. I understand Petitioners and Professor Young define a POSA as having, as of the claimed priority date, “at least a bachelor’s degree in electrical engineering or a related or equivalent field, and three or more years of experience researching, developing, designing and/or evaluating sensor systems for humans or other animals. However, additional years of education in the above-referenced fields may compensate for fewer years of experience.” Pet. at 5; Ex. 1002, ¶ 35. At ST Repro’s request, I have adopted and applied that definition herein solely for purposes of this proceeding, with the understanding that neither ST Repro nor I have undertaken an analysis of its accuracy, and that we both reserve the right to revisit its accuracy at a later date if necessary.

20. Based on the above criteria and my level of skill and personal experience in the field as of the priority date of the ’644 Patent, I consider myself a POSA and an expert in this area. I am also familiar with the understanding and knowledge of a POSA as of the priority date. Thus, I understand the perspective of a POSA, which I have applied in my analysis.

B. Claim Construction

21. I understand that the terms of a claim must be interpreted or “construed” and that, after such construction, the claims are then compared to the prior art for purposes of determining anticipation and/or obviousness.

22. I understand that patent claim terms are given their ordinary and customary meaning as would be understood by one of ordinary skill in the art. I further understand that the ordinary and customary meaning always applies unless a different meaning is clearly indicated by the patentee (such as by an express definition of a term in the patent specification or clear disclaimer of subject matter during prosecution).

23. Also, I understand that in determining the ordinary and customary meaning, the term should be read in light of “intrinsic” evidence, namely the patent specification and prosecution history. If intrinsic evidence is not sufficient to inform a person of skill of the ordinary and customary meaning of a term, “extrinsic” evidence may be consulted (e.g., a dictionary).

C. Anticipation

24. I have been informed and understand that a patent claim is invalid due to anticipation if a single prior art reference discloses every limitation of the claimed invention. I understand that a claim is anticipated only if each and every limitation

arranged as in the claim is found, either expressly or inherently described, in a single prior art reference.

25. I further understand that to anticipate the claimed invention, the prior art reference must be sufficiently “enabling,” that is, containing sufficient disclosures to enable a POSA to practice the subject matter based on the prior art reference without undue experimentation.

D. Obviousness

26. I understand that the prior art may render a patent claim “obvious.” I understand that obviousness is assessed from the view of a POSA at the time of invention. I understand that the prior art does not need to render obvious every possible embodiment within the scope of the claim. I further understand that in determining whether a patent claim is invalid because of obviousness, one must consider the scope and content of the prior art, the differences between the prior art and the claimed invention, and the level of ordinary skill in the art. To make these assessments, I understand that surrounding circumstances, like “objective indicia” or “secondary considerations” should be evaluated to the extent they exist.

27. I understand that an invention may be obvious because a skilled artisan pursues known options from a finite number of identified, predictable solutions, or because the claimed improvement is nothing more than the predictable use of prior art elements according to their established functions. I understand that a claim is

obvious if the POSA was motivated or had reason to combine the teachings of the prior art with a reasonable expectation of success. I also understand that obviousness does not require absolute predictability of success; only a reasonable expectation.

28. I further understand that obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. Obviousness must be established by providing a sufficient explanation of how the references may be combined, from the perspective of one with ordinary skill in the art, to arrive at the claimed invention, and why the proffered combination accounts for all the features of each claim.

29. In particular, I understand that an obviousness theory must explain why a POSA would have combined elements from specific references in the way the claimed invention does.

V. THE '644 PATENT

A. The Patent Specification

30. The title of the '644 Patent is "Calf Bolus." Ex. 1001. The patent was filed on June 12, 2015 and issued on March 19, 2019. *Id.* I have used June 12, 2015 as the date of the invention throughout this declaration.

31. The Abstract of the '644 Patent and Field of the Invention explain that the patent relates to an "animal monitoring device configured as a bolus for oral

administration to reside in the reticulorumen of a ruminant animal. The animal monitoring device includes a memory element, a processor in communication with the memory element and a computer code contained in the memory element. The computer code includes a power management module executable by the processor to regulate power use by the bolus.” Ex. 1001 at Abstract, 1:5-14.

32. The Background of the ’644 Patent also describes three significant problems in the prior art, namely:

[1] Conventional boluses orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth. [2] Additionally, boluses even when orally administered to adult ruminant animals may not have an operational lifespan long enough to monitor useful physiological parameters over the remaining productive lifespan of the ruminant animal. [3] Moreover, uncontrollable changes in the orientation of the bolus and correspondingly uncontrolled orientation of the bolus antenna in the reticulorumen of the ruminant animal may cause variable quality in radio signal transmission from the ruminant animal resulting in the loss of encoded physiological data.

Ex. 1001 at 1:18-30.

33. The patent then explains that a “broad object of the invention can be to provide a bolus which can reside in the reticulorumen of a ruminant animal having an operational lifespan corresponding to the entire lifespan or the productive lifespan of the ruminant animal.” *Id.* at 1:41-45. For example, one “aspect of this broad object

of the invention involves a power management module pre-programmed or re-programmable to reconfigure the operating parameters of the bolus during residence in the reticulorumen of a ruminant animal to collect only useful physiological data and encode and transmit such physiological data at intervals based upon the life stage of the ruminant animal.” *Id.* at 1:59-66. Further, a “broad object of the invention can be to provide an antenna having a structure that alters the magnetic field and electrical field generation in a manner that reduces the impact of uncontrollable changes in the orientation of the bolus and correspondingly the orientation of the antenna during residence of the bolus in the reticulorumen of the ruminant animal.” *Id.* at 2:10-16.

34. The claims of the patent describe a “method of monitoring physiological parameters of a ruminant animal” by generating a sensor signal from “one or more sensors contained in a bolus orally administered” to the animal. *See id.* at claims 5, 9. The sensor signal, which “varies based on a corresponding change” in the animal’s physiological parameters, is transformed into “encoded physiological data” and then stored in a “non-transitory computer readable media.” *Id.* The bolus also contains a “radio signal generator” that is enabled and then activated to transmit a “radio signal to carry said encoded physiological data.” *Id.* In most of the claims, the radio signal generator must be activated “at pre-determined intervals” to generate the radio signal carrying the encoded physiological data, and the radio signal has a

frequency of “between about 700 MHz to about 1 GHz.” *Id.* at claim 5. In other claims, the radio signal is transmitted with an “antenna having a pair of electrically conductive loops disposed a distance apart.” *Id.* at claim 9.

35. In my opinion, the claimed inventions conserve energy usage of a bolus, extending the battery life and the operational life of the bolus, such that the bolus can monitor the physiological parameters of a ruminant animal over its entire productive lifespan. This is particularly useful when monitoring a cow, which may have a productive lifespan of around 5-6 years, making power-savings critical for the bolus to remain operative while residing inside the cow’s reticulum the entire time. *See* EX. 1001 at 7:66-8:3

36. Professor Young quotes a portion of the specification referring to “conventional boluses.” Ex. 1002, ¶ 29 (citing Ex. 1001 at 1:18-30). I disagree to the extent Professor Young is suggesting that the methods claimed in the ’644 Patent consist of conventional components. The claims comprise specific components arranged in unconventional ways, as demonstrated by my comparison of the claims to Petitioners’ asserted art below.

37. Moreover, when the patent uses the word “conventional,” it is clearly describing prior art boluses only, and not any aspect of the claimed invention. The full context of the statement that Professor Young quotes, which is the first sentence of the “BACKGROUND OF THE INVENTION” section of the patent is as follows:

Conventional boluses orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals may not have a configuration capable of oral administration at birth.

Ex. 1001 at 1:18-21. This would not suggest to a POSA that the claimed methods are conventional in any way. In fact, as I explained above, the background describes significant problems with such prior art and then explains that the disclosed inventions solve those problems. See Ex. 1001 at 1:18-2:16.

B. The Challenged Claims

38. The Petition challenges claims 5-7, 9, 10, and 13 of the '644 Patent. I understand that claim 13 of the '644 Patent has been disclaimed by ST Repro. Therefore, I do not address claim 13 or Grounds 6 and 7, which challenge claim 13, in this declaration.

39. Claim 5 is reproduced below. In the left column, I include a shorthand identifier for each “claim element,” which I will refer to throughout this declaration.

5[Pre]	5. A method of monitoring physiological parameters of a ruminant animal, comprising:
5[A]	generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal,
5[B]	said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;

5[C]	encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said ruminant animal; and
5[D]	storing said encoded physiological data in a non-transitory computer readable media,
5[E]	enabling a radio signal generator located within said bolus;
5[F]	activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data; and
5[G]	generating said radio signal having a frequency of between about 700 MHz to about 1 GHz.

40. Claim 6 recites:

The method of claim 5, wherein said frequency is selected from the group consisting of: between about 700 MHz to about 800 MHz, 750 MHz to about 850 MHz, about 800 MHz to about 900 MHz, 850 MHz to about 950 MHz, 900 MHz to about 1 GHz.

41. Claim 7 recites:

The method of claim 6, wherein said bolus further comprises matching elements which adjusts said frequency of said radio signal to compensate for a change in said frequency of said radio signal due to passing through a mass of said ruminant animal.

42. Claim 9 is reproduced below. Again, I have included shorthand identifiers for claim elements.

9[Pre]	9. A method of monitoring physiological parameters of a ruminant animal, comprising:
9[A]	generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal,
9[B]	said sensor signal varies based on a corresponding change in one or more physiological parameters of said ruminant animal;
9[C]	encoding said sensor signal from said one or more sensors as encoded physiological data corresponding to said one or more physiological parameters of said ruminant animal;
9[D]	storing said encoded physiological data in a non-transitory computer readable media;
9[E]	enabling a radio signal generator located within said bolus;
9[F]	activating said radio signal generator to generate a radio signal to carry said encoded physiological data; and
9[G]	transmitting said radio signal with an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising transmitting said radio signal through said antenna.

43. Claim 10 recites:

The method of claim 9, wherein said pair of electrically conductive loops each comprise a loop of conductive sheet material having an inner annular edge and an outer annular edge which join opposed loop faces.

44. As I noted above, claims 6, 7, and 10 all depend from claims 5 or 9 and specify various additional limitations. Because the references asserted by Petitioners

and Professor Young do not anticipate or render obvious independent claims 5 or 9, and I understand that all limitations of an independent claim are required in its dependent claims, I have focused my analysis below on claims 5 and 9.

45. For all the reasons herein, I disagree with Professor Young's opinion that any of the challenged claims are anticipated or obvious.

VI. CLAIM INTERPRETATION

46. In accordance with the standards for interpreting patent claim terms discussed above in Section IV.B, I have interpreted the claims based on their ordinary and customary meaning as understood by a POSA in view of the '644 Patent and its prosecution history.

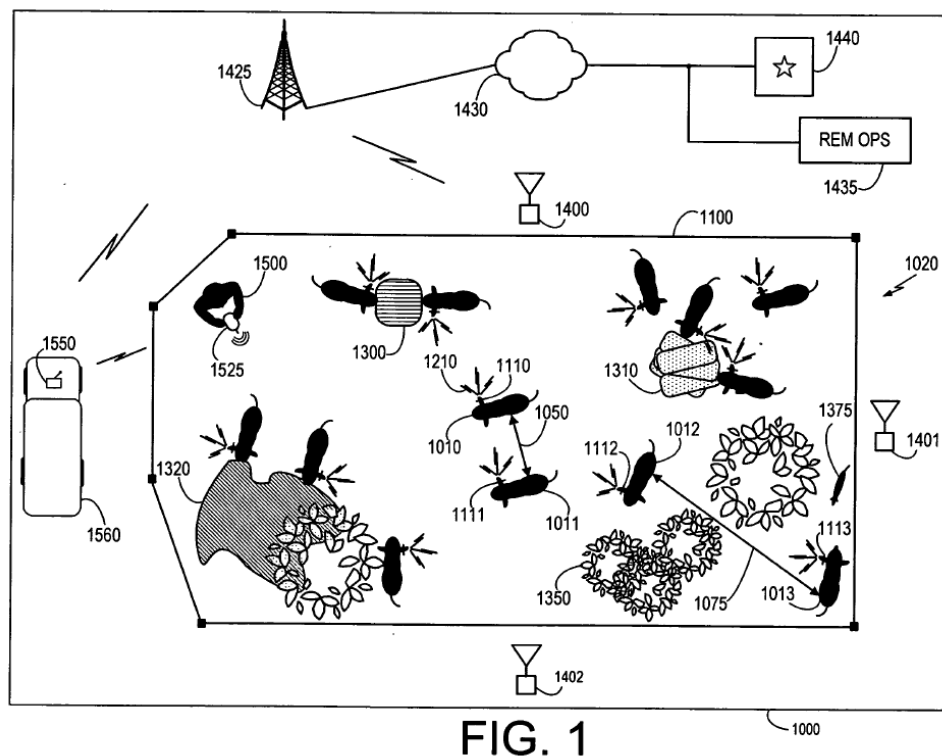
VII. SUMMARY OF THE ASSERTED ART

A. Harvey (Ex. 1004)

47. "Harvey" is a 78-page international patent publication titled "System and Method for Subject Management Using Intelligent RF Tag and Reader." Petitioners and Professor Young rely on Harvey in Grounds 1 and 3-5. For Ground 1, they argue that Harvey anticipates claims 5 and 6. For Ground 3, they argue that Harvey in combination with Risky renders obvious claims 5 and 6. For Ground 4, they argue that Harvey in combination with Rettedal renders obvious claim 7. For Ground 5, they argue that Harvey in combination with Kunda renders obvious claims 9 and 10. As I will explain below, it is my opinion that Harvey fails to disclose a method of monitoring physiological parameters of a ruminant animal that includes each and

every element of the challenged claims. Therefore, in my opinion, Harvey does not anticipate—or in combination with Risky, Rettedal, or Kunda render obvious—any of the challenged claims.

48. Harvey is generally directed to a “subject management system” using an “intelligent active tag” (“IAT”) that is “attached to a monitored subject.” Ex. 1004, Abstract, 1:1-2, 2:16-26, Figs. 1-3B. Figure 1 of Harvey provides an illustration of the subject management system, depicting an IAT (e.g., 1100, 1111, 1112, and 1113) attached to the ear of an animal subject (e.g., 1010, 1011, 1012, and 1013). Figure 1 is reproduced below:



Ex. 1004 at Fig. 1, 6:11-12; *see, e.g., id.* at 8:5-7, 11:8-10 (“[A]n active tag, such as IAT 1110, may be secured to monitored subject 1010 as a collar, bracelet, ring, or apparel, or as an ear tag, tail tag, or piercing stud.”), Fig. 3A (depicting an IAT affixed to an ear of cattle). The IAT includes a power source and transponder. Ex. 1004, 18:3-17, 18:34-19:9.

49. Petitioners and Professor Young rely on the “intelligent transponder (XPDR)” embodiment designated as 5000 in Harvey’s figures and specification. Pet., 18-27; Ex. 1002, ¶57-75; Ex. 1004 at 22:29-30. Figure 5 is reproduced below and depicts a block diagram of the embodiment:

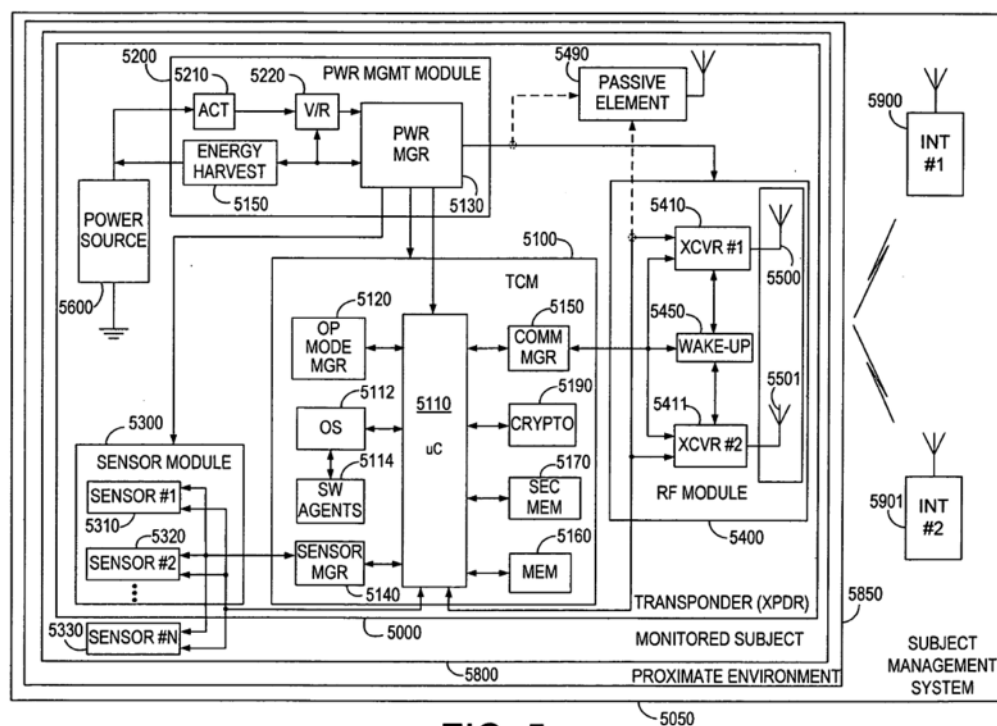


FIG. 5

Ex. 1004 at Fig. 5, 6:25-26, 22:29-30. The XPDR 5000 communicates with an interrogator (e.g., 5900). Ex. 1004, 22:35-36.

50. Petitioners and Professor Young repeatedly refer to the XPDR 5000 transponder as a component of “Harvey’s bolus,” but a POSA reading Harvey would understand that the XPDR 5000 embodiment is only suitable in an external format, such as an ear tag, not an internal bolus. There is one conclusory reference to a “bolus” configuration in the 78-page disclosure, but that reference is not related to XPDR 5000. Ex. 1004, 11:8-13. While addressing potential IAT implementations, Harvey states that “an active tag, such as IAT 1110, may be secured to monitored subject 1010 as a collar, bracelet, ring, or apparel, or as an ear tag, tail tag, or piercing stud,” or “may be restrained or moveable within monitored subject 1010, for example, as a digestive tract bolus device, or as a miniature transponder lodged or secured within the circulatory system, bone, or soft tissue.” EX1004, 11:9-13. But the XPDR 5000 embodiment that Petitioners and Professor Young rely on is never described as having an internal bolus configuration, nor would a POSA understand that the XPDR 5000 embodiment could be configured to operate in a bolus.

51. Every description of the XPDR 5000 transponder is as part of an external ear tag configuration. Harvey states that XPDR 5000 may be used as a “constituent element of multi-modal intelligent active tag 2000.” Ex. 1004 at 17:30-31, 22:29-30. As Harvey explains, “XPDR 5000 can be coupled to monitored subject 5800, for example, by intimate affixment, as described relative to FIG. 3.” Ex. 1004 at 22:30-33. Harvey further explains that a suitable tag for XPDR 5000 is “tag 2000

in FIGS. 2 and 3.” Figure 2, for example, illustrates the three possible “form factors” of active tag 2000. Figure 2 is reproduced below:

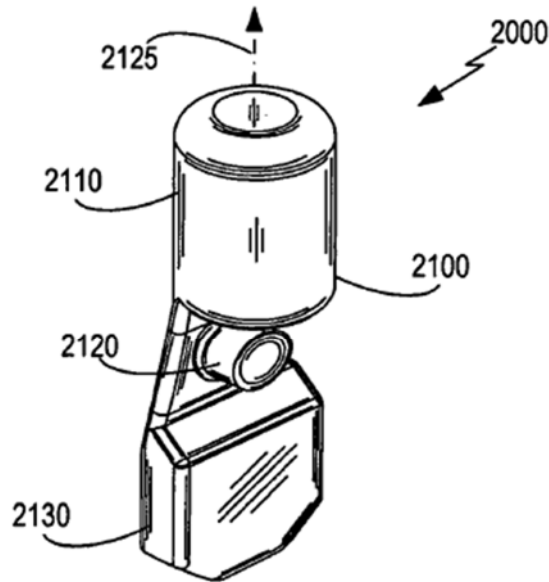


FIG. 2A

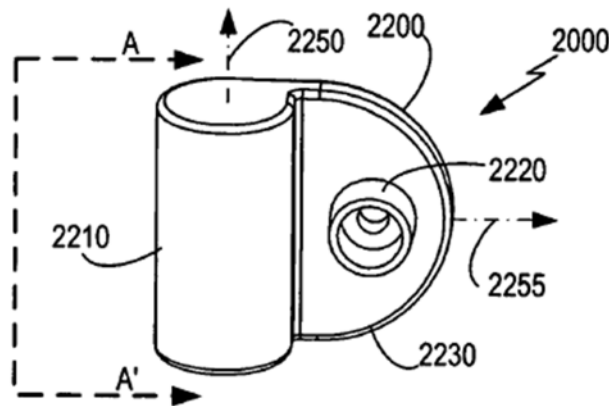


FIG. 2B

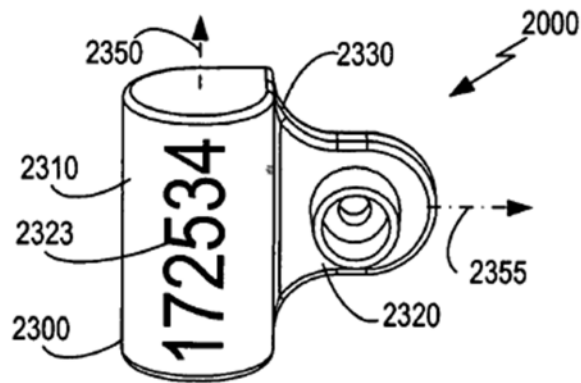


FIG. 2C

Ex. 1004 at Figs. 2A-2C, 17:29-30.

52. As detailed in Harvey, each form factor is an “ear tag” and includes an “affixment fitting” (e.g., 2120, 2220, and 2320) so the tag “may be affixed to the ear of monitored subject.” Ex. 1004 at 17:31-33, 18:3-17, Figs. 2A-2C (affixment fitting 2120, 2220, 2320). *See also id.* at 17:34-35 (“Tag 2000 also may be suitable for tag placement on another anatomical region of a subject member.”), 17:36-18:2 (“[T]he term intimate affixment may describe a manner by which tag 2000 may be coupled to monitored subject 1010 corpus, and in which at least a portion of tag 2000 may contact a portion of monitored subject 1010.”).

53. Figure 3 similarly illustrates the first form factor of tag 2000 “coupled to monitored subject 1010, by intimate affixment to a surface of cattle ear 3000,” exemplified by pinning to the ear, which “may facilitate sensing a monitored subject

parameter.” Ex. 1004 at 19:10-28. Specifically, Figure 3A is reproduced below and depicts the tag being affixed in an interior surface 3100 of cattle ear 3000:

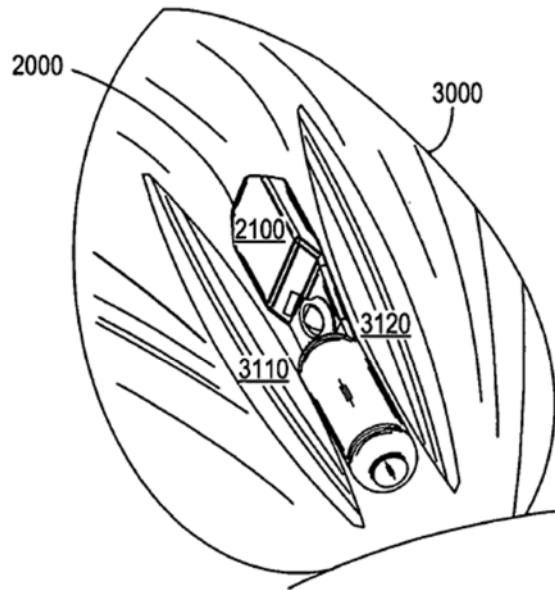


FIG. 3A

Ex. 1004 at Fig. 3A, 19:16-17. As Harvey explains, tag placement should be “a region affording visibility of the tag while avoiding permanent physical injury to the subject.” Ex. 1004 at 19:19-21. Figure 3B is reproduced below and further illustrates a cross section of the tag and tag placement depicted in Figure 3A:

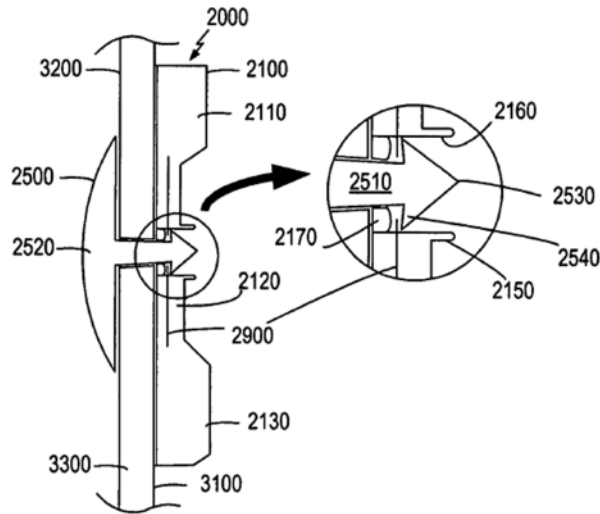


FIG. 3B

Ex. 1004 at Figs. 3B, 19:16-23.

54. Petitioners and Professor Young assert that the different figures in Harvey are “interchangeable examples of the same device” and “the descriptions in the specification apply equally to the devices illustrated in any and all of those drawings.” Pet., 11; Ex. 1002, ¶ 43. I disagree. A POSA would have understood that the exterior ear tag disclosed in Harvey, and relied on throughout the Petition and by Professor Young, has many design aspects that are not suitable for a bolus. For example, as I will explain below in Section VIII, many of the sensors included in the ear tag are not feasible in a bolus, such as the electrical sensors to measure EEG, ECG, or EMG waves, all of which need intimate contact to the designated skin electrodes, not in the environment of the digestive tract. For the antenna design, the ear tag can assume one side is the outer ear tissue and the other side is the free air,

where the antenna detuning can be mitigated readily with ground-plane techniques. In contrast, the bolus tag antenna has to consider not only the detuning uncertainty of the dielectric ambient consisting of the food intake and digestive juices but also the possible scattering through many layers of living tissues. For the radio transceivers, the ear tag can be readily accessed by operators or remotely charged by external radio energy harvesting, so the power consumption requirement is less stringent than the bolus transceivers where access is denied and energy harvesting much more difficult due to the energy coupling deep inside the living animal. Therefore, Harvey does not suggest that its embodiments and descriptions are interchangeable between the ear tag and the bolus tag, contrary to Petitioners' and Professor Young's unsubstantiated assertion.

B. Risky (Ex. 1005)

55. Risky is a U.S. patent application publication titled "System and Method for Monitoring a Health Condition of an Animal." As Petitioners and Professor Young acknowledged, Risky was presented to the Patent Office during prosecution of the '644 Patent, and the Examiner initialed the IDS to indicate that the reference was considered. See Pet. at 13; Ex. 1002, ¶ 48 ("Risky appears in the prosecution history of the '644 Patent in a September 23, 2015 IDS initialed by the examiner.") (citing Ex. 1010 at 174, 203).

56. For Ground 2, Petitioners and Professor Young argue that Risky anticipates claims 5 and 6. For Ground 3, they argue that Harvey in combination with Risky renders obvious claims 5 and 6. As I will explain below, Risky fails to disclose a method of monitoring physiological parameters of a ruminant animal that includes each and every element of the challenged claims. As I will explain below, it is my opinion that Risky does not anticipate, or in combination with Harvey render obvious, any of the challenged claims.

57. Risky generally relates to “systems and methods for monitoring a health condition of an animal.” Ex. 1005, Abstract, [0001], Figs. 1, 2. Unlike the invention in the ’644 Patent, Risky does not describe transmitting animal physiological data at “pre-determined intervals.” Instead, Risky describes transmitting a message at a “transmission frequency” that depends entirely on specific triggering “events,” such as “changing animal health conditions” or a change in the animal’s “location.” Ex. 1005, [0043], [0048]-[0049]. Risky explains that it is configured in this manner—i.e., to change frequencies based on events instead of at specified pre-determined intervals—so that such changes in the animal’s health or location may be recognized sooner. Ex. 1005, [0048], [0142].

58. According to Petitioners and Professor Young, Risky describes two embodiments that relate to transmission interval/frequency: (i) “burst” mode, and (ii) “on-line” mode. Ex. 1005, [0049], [0053]. Petitioners and Professor Young rely

on both modes to argue that Risky discloses “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data,” as required in claim 5. Pet., 36-37; Ex. 1002, ¶ 92-93. As I explain in more detail below for Ground 2, I disagree with Petitioners and Professor Young that these modes satisfy that claim limitation. See Section IX. For example, the “burst” mode in Risky uses a “transmission interval” that is not pre-determined, but is instead dependent on the animal’s health conditions and triggering events that affect the delay applied between transmissions. *Id.* The purported “interval” in the “on-line” mode relates to transmissions of bolus identifiers, not the “encoded physiological data” required by claim 5. *Id.*

59. I have reviewed the descriptions of Risky and Harvey, and how they are characterized in the Petition and Professor Young’s declaration. Based on my review, I do not see that Petitioners or Professor Young have identified any distinctions between Harvey and Risky and what they contend is disclosed by the references. Petitioners and Professor Young appear to apply the same analysis for both references.

C. Rettedal (Ex. 1006)

60. Rettedal is a U.S. patent application publication titled “Animal Monitoring System.” As Petitioners and Professor Young acknowledged, Rettedal was presented to the Patent Office during prosecution of the ’644 Patent, and the

Examiner initialed the IDS to indicate that the reference was considered. *See* Pet., 14; Ex. 1002, ¶ 52 (“Rettedal appears in the prosecution history of the ’644 Patent in a June 12, 2015 IDS initialed by the examiner.”) (citing Ex. 1010 at 163, 205).

61. Petitioners and Professor Young rely on Rettedal solely for claim 7. In particular, for Ground 4, they argue that Harvey in combination with Rettedal renders obvious claim 7. As I will explain below, it is my opinion that Rettedal in combination with Harvey does not render obvious claim 7.

62. Petitioners and Professor Young rely on Rettedal for only the “matching elements” limitation in claim 7. Pet., 48-49; Ex. 1002, ¶ 112-113. Petitioners and Professor Young rely solely on Harvey for the elements of claims 5 and 6, from which claim 7 depends, and they do not contend that Rettedal addresses Harvey’s deficiencies, presumably because Rettedal likewise fails to disclose or describe, at least, the “activating a radio signal generator at pre-determined intervals” requirement in claim 5. *See* Pet., 47-48; Ex. 1002, ¶ 111.

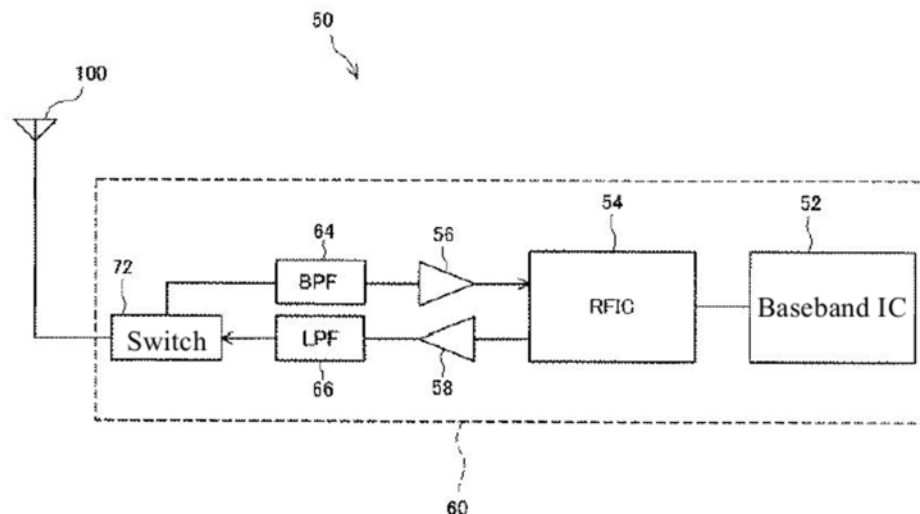
D. Kunda (Ex. 1007)

63. Kunda is a Japanese patent application publication titled “Folded Loop Antenna.” Petitioners and Professor Young rely on Kunda solely for the limitations related to an “antenna having a pair of electrically conductive loops” in claims 9 and 10. In particular, for Ground 5, they argue that Harvey in combination with Kunda renders obvious claims 9 and 10. As I will explain below, it is my opinion that Kunda

in combination with Harvey, does not render obvious claims 9 or 10. *See* Section XII. The choice of the loop antenna to take advantage of characteristics in antenna detuning and orientation insensitivity in the effective use case of a bolus tag would not have been obvious to a POSA. Antenna choices are particularly critical in wireless devices, as its characteristics may change due to the ambient conductors and dielectric, which has to be adjusted in the transceiver design. This has been further complicated by the ultra-low-power transceiver designs where the conventional active compensation circuits and adaptive frequency choices may not be feasible due to power considerations. For a bolus tag, the power consumption and the overall device geometry (including antennas) need an integrative consideration for an effective operation over a long span of time.

64. Kunda discloses fitting a loop antenna to two integrated circuits, where impedance matching in the signal chain is critical to avoid antenna reflection and severe self-jamming to the RFIC. Ex. 1007 at [0024], Fig. 1 (baseband IC 52 and RFIC 54).

Figure 1

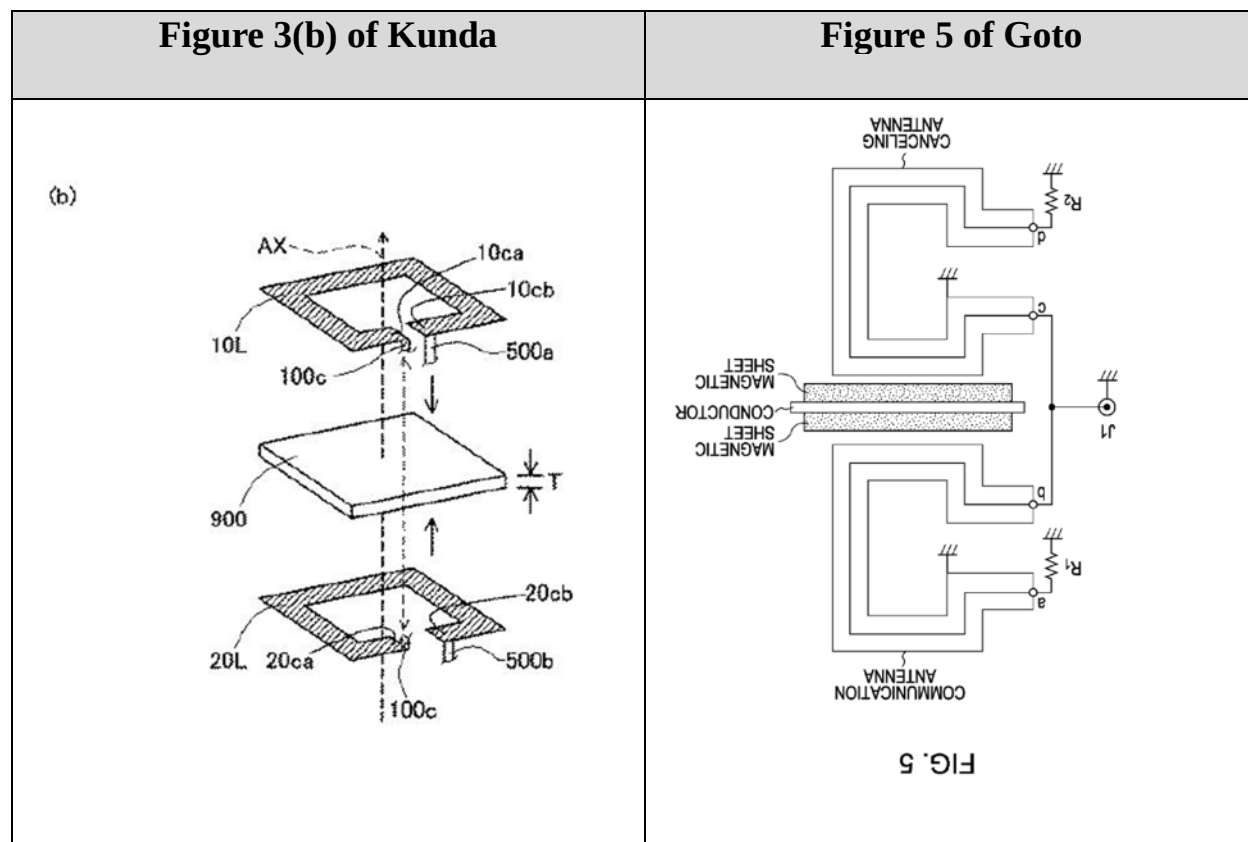


Ex. 1007 at Fig. 1. Kunda describes a use case of a general communication integrated circuit with a transmitter and receiver in a time-division half duplex, such as for use in mobile phones, where antenna reflection is the key design point. *See id.*; Ex. 1007 at [0001]-[0002], [0024]. Kunda provides no disclosures suggesting that its antenna could be applied in a bolus or other device designed to reside inside an animal body.

65. I have reviewed the descriptions in Kunda and Goto, which is a U.S. patent application publication titled “Communication Device, Antenna Device, and Communication System” (EX2003). Based on my review, Goto and Kunda are substantially similar in their teachings. Both describe a double-loop antenna directed to use cases in a general communication device. The loop antennas in Goto, Kunda, and ‘644 do share structural similarities. However, neither Goto nor Kunda discloses the ability to transmit signals from within a bolus or from within the body of an animal.

66. Similar to Kunda, Goto describes a communication device with a “first loop antenna” disposed on one surface a conductor plane and a “second loop antenna” disposed on the opposite surface of the conductor plane, such that the two “loop antennas” are “vertically symmetrical” to each other. EX2003, Abstract, [0001], [0131]; *see, also, id.*, [0042], [0048], [0113]-[0116], [0126], [0131], [0140], [0144], claims 1, 7. Goto discloses that the antennas “face each other within a short distance” and “have an equal relation with each other.” EX2003, [0116], [0128], Figs. 2, 4, 5.

67. The similarities of Kunda and Goto can be seen, for example, by the below side-by-side of their figures:



EX1007, Fig. 3(b); EX2003, Fig. 5 (rotated 180°). As shown above, Kunda's loop antennas 10L and 20L are substantially similar to Goto's communication antenna and cancelling antennas, and Kunda's substrate 900 is disposed between its two antennas in substantially the same way that Goto's conductor is disposed its two antennas.

VIII. GROUND 1: CLAIMS 5 AND 6 ARE NOT ANTICIPATED BY HARVEY

68. In my opinion, Harvey does not anticipate claims 5 and 6 of the '644 Patent.

A. Elements 5[A] and 5[E]: “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal” and “enabling a radio signal generator located within said bolus”

69. With respect to claim element 5[A], Petitioners and Professor Young do not establish that Harvey expressly discloses “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal.” Ex. 1001, claim 5. Specifically, they do not show that Harvey discloses “one or more sensors contained in a bolus.” Additionally, with respect to claim element 5[E], Petitioners and Professor Young do not establish that Harvey expressly discloses “enabling a radio signal generator located within said bolus.” Ex. 1001, claim 5. Specifically, they do not show that Harvey discloses “a radio signal generator located within said bolus.”

70. The '644 Patent explains that the claimed “bolus” is an internal device that “reside[s] in the reticulorumen of a ruminant animal”—as opposed to an external device, such as an ear tag. Ex. 1001, Abstract, 1:5-7 (“An animal monitoring device configured as a bolus for oral administration to reside in the reticulorumen of a ruminant animal.”); *see also id.* at 1:18-30 (“...orally administered to reside in the reticulorumen for monitoring of physiological parameters of ruminant animals...”), 3:36-38 (“[T]he term ‘reticulorumen (5)’ means the first chamber in the alimentary canal of a ruminant animal (3) composed of the rumen and reticulum.”), 7:44-46 (“[T]he power source (46) of a bolus (1) disposed in the reticulorumen (5) of the ruminant animal (3) cannot be recharged.”), 7:56-65 (“...operational within the reticulorumen (5) of the ruminant animal (3) for greater than three years and up to about ten years...”), 13:14-24. As I noted above in Section VII.A, Petitioners and Professor Young rely on a limited discussion of a potential bolus “implementation” in Harvey and impute that discussion onto Harvey’s different transponder embodiments. In doing so, Petitioners and Professor Young further assert that “Harvey’s cattle bolus” includes the recited elements. *See, e.g.,* Pet., 18-19, 23-25; Ex. 1002, ¶¶ 58, 67, 70. Harvey never discloses that the sensors or radio signal generators in its transponder embodiments are contained in a bolus that resides inside the reticulum of a ruminant animals, or that Harvey’s transponder would even be

suitable in a bolus. Further, a POSA would not understand Harvey to be making such a disclosure, as I will further discuss below.

1. Harvey's Limited Discussion of a "Bolus"

71. Petitioners and Professor Young rely on Harvey's single, conclusory reference to a "bolus" and assume that it applies to all other embodiments, examples, and implementations in Harvey. In doing so, they mix and match different teachings in Harvey and refer them as teaching "Harvey's cattle bolus." Petitioner and Professor Young do not provide a reason to combine those different teachings.

72. As I discussed above, Harvey describes a "subject management system" using an "IAT" and "interrogator." See Section VII.A. In addressing potential IAT "implementations," Harvey states that "an active tag" may be secured to an animal "as a collar, bracelet, ring, or apparel, or as an ear tag, tail tag, or piercing stud," or "may be restrained or moveable within monitored subject 1010, for example, as a digestive tract bolus device, or as a miniature transponder lodged or secured within the circulatory system, bone, or soft tissue." Ex. 1004, 11:9-13. Following that limited discussion, Harvey never again mentions or describes a "bolus" in connection with any of its different embodiments and components. Harvey's descriptions of its management system, the IATs, and other components, are focused solely on an implementation of an "ear tag" attached to the ear of cattle. See, e.g., Ex. 1004, 11:4-14, 22:29-30, Figs. 1-4; see Section VII.A. A POSA would

not have understood Harvey's other embodiments or components to apply to a bolus implementation, but instead would have understood them to be for an external ear tag, which I will further explain below.

2. Harvey Does Not Disclose Sensors or a Radio Signal Generator Contained in a Bolus

73. For elements 5[A] and 5[E], Petitioners and Professor Young assert that “Harvey’s bolus includes a transponder containing multiple sensors, as illustrated in Fig. 5,” and the “transponder within Harvey’s cattle bolus includes RF module 5400 which includes RF transceivers 5410 and 5411, depicted in Fig. 5.” Pet., 18-19, 23-25; Ex. 1002, ¶¶ 58, 67. Petitioners and Professor Young do not identify a disclosure in Harvey expressly stating that the transponder (i.e., XPDR 5000), the sensors (i.e., Sensor #1 5310 and Sensor #2 5320), the RF module (i.e., RF Module 5400), or the RF transceivers (i.e., XCVR #1 5410 and XCVR #2 5411) in Figure 5 are contained or would be capable of being contained in a bolus implementation. Instead, as I discussed above, Petitioners and Professor Young apply a single reference to a potential “bolus” implementation of an IAT to other embodiments of a transponder in Figure 5 that involves an ear tag in its design considerations. See Section VII.A. Petitioners and Professor Young do not explain how those embodiments are related to each other or explain why a POSA would understand that an internal bolus could be used for all embodiments and applications in the reference. Petitioners and Professor Young also do not assert that the components are inherently contained in

a bolus or assert that a POSA would have understood Harvey to be teaching these components to be included in a bolus implementation. Due to the design considerations of antenna detuning and extremely limited power supply, Harvey's teaching would not have been a suitable design to enable the bolus communication and sensing functions over a span of more than 5 years.

74. A POSA reading Harvey's description of the transponder depicted in Figure 5 would have understood it to be describing an "ear tag" device, and not a bolus, based on the sensors disclosed as part of the tag. *See e.g.*, Ex. 1004, 6:11-12, 8:5-7, 11:8-10, Figs. 1-3B. For example, Harvey's descriptions of the sensors in XPDR 5000 suggest that they are not—and cannot be—contained in a bolus that resides inside the reticulum of an animal. Petitioners and Professor Young assert that examples of "signal-producing sensors in Harvey's bolus" include at least "a heart-rate sensor," "a humidity sensor," and "electrical sensors to measure EEG, ECG, or EMG waves." Pet., 18; *see* Ex. 1002, ¶ 58. A POSA would have understood these sensors as described in Harvey to be used to measure physiological parameters from the *exterior* of an animal and that they are not feasible or practical in a bolus that resides *inside* the reticulum of an animal. Additionally, Petitioners and Professor Young cite to Harvey's disclosure of a "thermal sensor" for measuring "body temperatures." Pet., 18; *see* Ex. 1002, ¶ 58. When read in context with the other sensors described in Harvey, a POSA would have readily understood that Harvey is

describing thermal sensors that measure temperatures from outside the animal's body, including external "subject body temperature" and "an ambient" temperature," as Harvey described. *See* Ex. 1004, 40:25-28. Internal body temperatures measured inside the living body as an indication of fever are often more accurate than external body temperatures due to the less influence from ambient. However, reticulum is an exception to take internal body temperature due to the influence of the food/water intake as well as the chemical reactions, both of which will fluctuate the temperature readings for fever detection. Additionally, in its discussion of the thermal sensors, Harvey explains that the XPDR 5000 containing these sensors is "affixed to monitored subject," which Harvey describes is exemplified by pinning to the ear. *See* Section VII.A; *see e.g.*, Ex. 1004 at 19:10-28, 40:28-30. A POSA would have further understood from Harvey's explanation that these sensors are contained in an external ear tag, and not in a bolus measuring internal physiological parameters. A POSA would have also understood that temperature sensors are not necessarily the same when used in a bolus versus an ear tag, as there are differences in how they can be deployed.

75. As another example, Harvey discloses that the sensors in XPDR 5000 may also sense a "vocalized sound" or an "ambient sound," indicating that the sensors in this transponder are being used in a device attached the outside of the animal's body. Ex. 1004, 40:19-20. A POSA would therefore have understood that

Harvey's sensors are contained in a device affixed to the exterior of an animal, such as an ear tag.

76. In summary, I do not see evidence that Harvey discloses “one or more sensors contained in a bolus orally administered to said ruminant animal” or “a radio signal generator located within said bolus.” It is therefore my opinion that Harvey does not anticipate claims the challenged claims, and Ground 1 does not show the challenged claims to be unpatentable.

B. Element 5[F]: “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data”

77. Petitioner and Professor Young also do not establish that Harvey discloses “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data,” as required by element 5[F]. Claim 5 requires that the radio signal generator be activated to generate a radio signal at “pre-determined intervals,” as opposed to being activated at random times or in response to a triggering event, such as environmental conditions. *See* Ex. 1001, 1:59-66, claim 5. The '644 Patent further explains that the “pre-determined intervals” are a set and known period of time, e.g., every twenty-four hours, at which the radio signal generator transmits encoded physiological data. Ex. 1001, 10:31-43, 11:16-20 (consistently identifying intervals between transmission as periods of time, such as “twenty four hours,” a certain “time period,” and a “period of time”). This

claim element also requires that the specific radio signal that was transmitted at pre-determined intervals must “carry” the “encoded physiological data” of the animal, as opposed to providing mere identification information or pings. Ex. 1004, 4:39-41, 10:31-43, 11:16-27, claim 5. The external reader needs to be always on to listen for the signals or maintain accurate synchronization with the bolus sensor to minimize the loss of data packets. Synchronization needs to be maintained over the lifespan of the bolus sensor.

78. Despite these requirements for the “activating” step, Petitioners and Professor Young argue that Harvey’s “IAT transponder” (i.e., XPDR 5000) meets the “pre-determined intervals” limitation. I disagree. Petitioners and Professor Young argue that the XPDR 5000 “can transmit outbound messages in a ‘periodic’ manner using a ‘preselected tag transmission interval’ such as every two seconds,” and they cite an example implementation in Harvey where the XPDR 5000 “may initiate communication by transmitting an outbound IAT message to INT 5900 on a preselected tag transmission interval” of “about 2 seconds.” Pet., 26 (citing Ex. 1004, 26:6-11); see Ex. 1002, ¶ 72 (same). When reading Harvey as a whole, Harvey expressly discloses that these specific “transmissions” are part of a “collision avoidance protocol,” and the transmission is simply a “ping” to determine if the channel is clear and, critically, does not carry any “encoded physiological data” as required by the claims. Ex. 1004, 25:2-6 (“A non-limiting example of a selected

transmit operation can be a transponder ping operation, in which XPDR 5000 initiates communication by transmitting an outbound IAT message to INT 5900, which may identify XPDR 5000 to INT 5900. An outbound IAT message may be, but is not required to be, a TID or an SID corresponding to monitored subject 5800.”), 27:6-8. (“In an example implementation of a selected collision avoidance protocol, XPDR 5000 may initiate communication by transmitting an outbound IAT message to INT 5900 on a preselected tag transmission interval.”).

79. Based on Harvey’s description of the cited example implementation and Harvey’s preceding discussion of communication operations in the reference, the example implementation relates to the transponder “ping” messages, and not messages carrying “encoded physiological data” as claimed in the ’644 Patent. In paragraph [0067], Harvey introduces different communication operations and describes a selected transmit operation called a “transponder ping operation,” where XPDR 5000 “*initiates communication* by transmitting an outbound IAT message to INT 5900.” Ex. 1004, 25:2-4. Harvey explains that this operation may “identify XPDR 5000 to INT 5900” and may be “a TID or an SID.” Ex. 1004, 25:4-6. In paragraph [0069], Harvey discusses a scenario where communication contention and collision may occur due to multiple transponders initiating transmit operations to the same interrogator at the same time, and the use of a “selected collision avoidance protocol” to address such scenarios. Ex. 1004, 25:30-26:6. Harvey then describes an

example implementation of this protocol (the example cited in the Petition and by Professor Young) that, similar to the transponder ping operation, has XPDR 5000 “*initiate communication* by transmitting an outbound IAT message to INT 5900” to avoid collision with other transponders. Ex. 1004, 26:6-8 (emphasis added). When read in view of Harvey as a whole, a POSA would interpret this outbound message as a mere transponder ping, which may include a TID or an SID, but not encoded physiological data. A POSA would further understand based on this interpretation that XPDR 5000 transmits encoded physiological data only after communication with INT 5900 is established, i.e., only if and when the interrogator acknowledges one of the pings at an undetermined time.

80. Harvey does not disclose that the outbound message in the example implementation cited by Petitioners and Professor Young carries encoded physiological data. To the contrary, Harvey states that the only “messages” that may be sent as part of the ping in its collision avoidance protocols consist only of tag identifier (“TID”) or subject identifier (“SID”) information, which is not physiological data. See Ex. 1004, 14:22-26 (“IAT 1110 may be configured to broadcast a corresponding identifier including, without limitation, a TID or an SID[,] periodically, or aperiodically, and may use a selected collision avoidance protocol.”), 12:4-6 (“In general, monitored subject 1010 may be identified by a subject identifier (SID), which may include one or more of a name, an alias, or a identification number,

which may be globally-unique or non-globally-unique.”), 12:26-27 (“IAT 1110 may have corresponding tag identification (TID) data.”).

81. Additionally, Harvey’s description of a tag transmission interval of “about 2 seconds” also teaches a POSA that the transponder is either not transmitting an outbound message carrying encoded physiological data, as required by element 5[F], or not contained in a bolus orally administered to a ruminant animal, as required by element 5[E]. See Section VIII.A. A POSA would understand that the purpose of a bolus like the one disclosed in the ’644 Patent must remain operational over the entire productive lifespan of the animal, e.g., around 5-6 years for a cow. See, e.g., Ex. 1001, 7:66-8:3. As the ’644 Patent explains, and as a POSA would understand, the majority of power used by the bolus is in the operation of the radio signal generator. Ex. 1001, 10:37-43. Activating the radio signal generator to transmit sensed data at a rapid two-second rate makes little sense because that operation would use a substantial amount of energy and drain the battery life of the bolus. That would defeat the whole purpose of using a bolus like the invention claimed in the ’644 Patent. Instead, a two-second interval is more appropriate for an ear tag, where battery preservation is not as stringent as a bolus tag, e.g., an ear tag that is affixed to the exterior of the cow is more accessible than a bolus, which resides inside the reticulum of the cow. It is also more appropriate for transmissions containing, for example, location data or tracking data, rather than transmissions of

physiological data. As a comparison, 2-second intervals are common choices for location information within a cellular network when mobile devices can be in and out a specific cellular area.

82. Petitioners and Professor Young’s reliance on Harvey’s two-second transmission interval also directly contradicts their other positions regarding Harvey’s alleged purpose. Petitioners and Professor Young recognize that “[t]he ’644 Patent sought to solve the problem of extending the operational life of a bolus having limited battery capacity by regulating energy consumption.” Pet., 40; Ex. 1002, ¶ 98. According to Petitioners and Professor Young, “Harvey and Risky both recognized and solved that same problem—extending the operational life of a bolus,” and they described “boluses which save energy by controlling the operation of a radio signal generator that transmits sensor data.” Pet., 3, 40; Ex. 1002, ¶ 31, 95; *see also* Pet, 40 (“purpose is to reduce power consumption and prolong battery life”); Ex. 1002, ¶ 97 (same). If power conservation and extended battery life were truly Harvey’s aims, it makes little sense that Harvey would disclose a configuration that transmits physiological data every two seconds to a receiver, consuming a significant amount of energy in the process. For example, a two-second transmission interval would mean the radio signal generator transmits around 43,200 outbound messages of encoded physiological data per day. That configuration would substantially reduce the battery life and the operational lifespan of the bolus,

conflicting with Harvey's purpose as alleged by Petitioners and Professor Young. It would also be counterproductive to the power-saving features that they contend Harvey sought to address. For this reason, among others, a POSA would not interpret the cited two-second transmission intervals to be "pre-determined intervals" for transmitting radio signals that carry encoded physiological data.

83. On page 26 of the Petition and in paragraph 72 of Professor Young's declaration, Petitioners and Professor Young include several different arguments and citations for the "pre-determined intervals" element, but they do not explain how that information shows that Harvey discloses this element. For example, Petitioners and Professor Young make the conclusory assertion that the RF module and RF transceivers in Figure 5 of Harvey are "necessarily activated at the beginning of each transmission interval in order to transmit the IAT message containing the encoded physiological data." Pet., 26; Ex. 1002, ¶ 72. I understand that for Petitioners and Professor Young to show that is necessarily true, they need to establish that Harvey inherently discloses in the cited example implementation that the RF module and transceivers are activated at each transmission interval to transmit the encoded physiological data. I do not see any evidence cited by Petitioners or Professor Young to support their argument. They also do not explain why a POSA would have understood this element to be inherent in these citations. For example, they do not explain why a POSA would have understood the outbound IAT messages to

necessarily include “encoded physiological data” instead of, for example, a ping, a registration message, or identification data. As I explained above, based on the discussion of communication operations in preceding the example implementation relied on by Petitioners and Professor Young, it makes more sense that Harvey is describing a ping operation for initiating communication with the interrogator, and not necessarily sending physiological data. Thus, Petitioners and Professor Young have not established that Harvey discloses the step of “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data.”

84. Additionally, Petitioners and Professor Young argue that the “IAT transponder may be assigned its ‘selected tag transmission interval’ during manufacture or by self-assignment.” Pet., 26 (citing Ex. 1004, 27:14-21); *see* Ex. 1002, ¶ 72 (citing same). That Harvey states different ways to assign a tag transmission interval is immaterial to whether the reference discloses “pre-determined intervals to generate a radio signal to carry said encoded physiological data.” That disclosure provides no additional context or information related to the IAT transponder and the interval itself, such as the type of information being transmitted or the period of time between intervals. Petitioners and Professor Young do not explain how or why it does.

85. The other citations by Petitioners and Professor Young for this element are also not helpful. Petitioners and Professor Young string cite additional portions of Harvey in an attempt to show “pre-determined intervals,” but these purported disclosures do not actually describe transmission intervals, the transmission of encoded physiological data, or even the same embodiments in some instances. For example, Petitioners and Professor Young cite Harvey at 28:22-27, which describes a “predetermined transponder operation” mode. Pet., 26; Ex. 1002, ¶ 72. The word “predetermined” in that context is describing the overall “operational mode” of XPDR 5000 itself, and it does not refer to the transmission interval or the transmitter. A transmitter or transmission are not mentioned at all in that citation. Petitioners and Professor Young also cite Harvey at 65:32-66:2, which describes the transmission of a “REGISTRATION message.” Pet., 26; Ex. 1002, ¶ 72. It does not refer to the transmission of any encoded physiological data. That citation also relates to XPDR 7020, which is a different embodiment of a transponder, separate from XPDR 5000 relied on by Petitioners and Professor Young elsewhere. Ex. 1004, 65:32-66:2. This is another example of Petitioners and Professor Young relying on different embodiments in their attempt to show that Harvey discloses the required elements of the challenged claims.

86. For at least the above reasons, I do not see evidence that Harvey discloses “activating said radio signal generator at pre-determined intervals to

generate a radio signal to carry said encoded physiological data.” It is therefore my opinion that Harvey does not anticipate claims 5 and 6, and Ground 1 does not show the challenged claims to be unpatentable.

IX. GROUND 2: CLAIMS 5 AND 6 ARE NOT ANTICIPATED BY RISKEY

87. In my opinion, Risky does not anticipate claims 5 and 6 of the ’644 Patent.

88. Petitioners and Professor Young do not establish that Risky discloses “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data,” as required by element 5[F]. For this element, Petitioners and Professor Young rely on two embodiments in Risky that discuss a transmission interval/frequency: (i) “burst” mode, and (ii) “on-line” mode. Pet., 36-37; Ex. 1002, ¶¶ 92-93. Based on my review, Risky does not provide disclosures indicating that the transmission interval/frequency in either of these embodiments is “pre-determined.” Petitioners and Professor Young do not argue that this element was inherent.

89. With respect to “burst” mode, I disagree with Petitioners and Professor Young that Risky teaches activating said radio signal generator at predetermined intervals to generate a radio signal to carry said encoded physiological data. According to Petitioners and Professor Young, Risky teaches this element because “[f]or example, in ‘burst’ mode, the transmitter is activated at predetermined,

periodic intervals.” Pet., 36-37; Ex. 1002, ¶ 92. In discussing this embodiment, Risky states that “machine readable instructions 252 may specify a transmission interval, wherein processor 240 may transmit an animal characteristics message ... at each transmission interval.” Ex. 1005, [0049]. Nowhere does Risky state or suggest that the interval is pre-determined. Additionally, a POSA reading Risky would understand that the “transmission interval” in Risky is not pre-determined, but dependent on triggering events that affect the delay applied between transmissions. Specifically, when Risky refers to “intervals” between events and the “frequency” of events, they are always conditional on the occurrence of other events that affect the transmission delay, and not pre-determined. For example, Risky explains that machine-readable instructions 252 may define “conditions” under which processor 240 change sensor sampling frequency, polling frequency, or transmission frequency, e.g., based on a threshold animal temperature, health condition, or location. Ex. 1004, [0048]. Risky explains, “[f]or example, the processor 240 may increase a polling and/or transmission frequency when the animal is in the vicinity of a calving pen and/or hospital pen, and may decrease the polling and/or transmission frequency when the animal is moved out of the pen.” Ex. 1004, [0048]. As such, a POSA would understand that the transmission interval adapts to the varying conditions related to the animal, and it therefore cannot be “pre-determined.”

90. Moreover, Risky only describes a system that transmits messages at intervals in response to different triggering events that can occur at any given time, not at pre-determined intervals. As I discussed above, Risky purports to monitor animals by using a processor that adapts or varies the frequency of transmissions based on certain changes that occur, such as changes in the animal's health, location, or temperature. Risky's goal in linking transmission frequencies to changes was to send messages relating to those changes as soon as possible after they occurred. For example, Risky explains that its processor may increase a transmission frequency in response to changes in the animal's location so that the animal manager is aware of that condition sooner. Ex. 1005, [0048], [0142] (“[S]ome health conditions may require responsive action by an animal manager.”), [0020] (“The base station 40 and/or computing device 42 may be monitored by and/or in communication with an animal manager. As used herein, an animal manager may refer to any person, machine, and/or used to manage one or more animals. The animal manager may be in charge of and/or responsible for one or more animals monitored by the systems and methods disclosed herein.”). A POSA would understand from Risky's system goal that the transmitter sends messages at frequencies based on events corresponding to changes in animal conditions, instead of at a set pre-determined interval.

91. With respect to “on-line” mode, I disagree with Petitioners and Professor Young that Risky discloses activating the transmitter at pre-determined intervals to generate a radio signal to carry said encoded physiological data. According to Petitioners and Professor Young, in Risky’s “on-line” mode “the transmitter is activated at a predetermined ‘transmission frequency’—*i.e.*, transmission interval—specified by the device’s machine readable instructions.” Pet., 37 (citing Ex. 1005, [0055]; Ex. 1002, ¶ 93 (same)). Petitioners and Professor Young completely overlook that “transmission” alone does not meet the challenged claims. Per the challenged claims, the relevant signal sent at pre-determined intervals must carry the animal’s physiological data. That is not how Risky’s “on-line” mode operates. In “on-line” mode, Risky’s processor causes a communications unit, which comprises the transmitter, to transmit a “discovery message at a set interval” to a base station or transceiver. Ex. 1005, [0037] (“Communications unit 230 may comprise active data transmitter 232 and data receiver 234.”), [0053] (“In one embodiment, communications unit 230 may detect whether bolus 210 is within range of a receiver, such as a base station (not shown) or transceiver (not shown). Processor 240 may cause communications unit 230 to transmit a discovery message at a set interval.”). Risky explains that “[t]his simple message may be referred to as a ‘ping’ and may include one or more of the unique identifiers associated with a particular bolus 10 (e.g., a MAC, UAID, and/or UBID).” *Id.* That message may include a

unique ID, but it does not include “encoded physiological data” as required by the claim in the ’644 Patent. Risky further explains that the bolus may be configured for “on-line” mode, and the transmitter in turn may be activated to transmit animal characteristics messages, only “[u]pon receipt of a reply message” from the base state or transceiver. *Id.* In other words, the transmitter is activated based on threshold conditions that must be met first, and it is not activated at a pre-determined interval of time. Accordingly, Risky does not disclose “activating” step under either embodiment asserted by Petitioners and Professor Young.

92. For at least the above reasons, Petitioners and Professor Young do not establish that Risky discloses each and every element of the challenged claims. It is therefore my opinion that Risky does not anticipate claims 5 and 6, and Ground 2 does not show the challenged claims to be unpatentable.

X. GROUND 3: CLAIMS 5 AND 6 ARE NOT RENDERED OBVIOUS BY HARVEY IN COMBINATION WITH RISKEY

93. In my opinion, claims 5 and 6 of the ’644 Patent are not rendered obvious by a combination of Harvey and Risky.

A. General Comments on Petitioners’ “Obviousness” Ground

94. I understand that to show obviousness, Petitioners and Professor Young must specify differences between the claims and the prior art and must explain how and why a POSA would modify the prior art to meet the claim. I have reviewed the Petition and Professor Young’s declaration and have not seen an identification of

differences between the claims and Harvey or Risky. I also have not seen an explanation of how or why a POSA would modify Harvey in view of Risky, or vice versa, to include any missing or different elements. Petitioners and Professor Young do not specify any claim elements that are missing. Instead, they both offer a general combination asserting:

To the extent Patent Owner alleges that either Harvey or Risky fails to teach any claim element, that element is provided by the other reference. Further, to the extent the teachings of Harvey are substantively different than Risky for any given claim element, it would have been at least obvious to try Risky's implementation of that element in Harvey, or vice versa, given the overall similarity in their purpose, design and operation.

Pet., 42; Ex. 1002, ¶ 101. Petitioner and Professor Young do not identify a primary reference, the missing elements of that reference, or what teachings of the secondary reference should be applied. For example, while Petitioners and Professor Young's Ground 3 heading may suggest Harvey as a primary reference, I do not see that they identify any specific element missing in Harvey, the teachings in Risky that should be combined with Harvey for such element, or how and why a POSA would have modified Harvey in view of Risky to achieve claims 5 and 6.

95. In summary, I do not see that Petitioners or Professor Young identify any specific difference between Harvey, Risky, and the claims. I also do not see

that they have provided a reason to modify Harvey or Risky in combination with each other.

B. There Would Have Been No Reason to Combine Harvey and Risky

96. In my opinion, there would have been no reason to combine Harvey and Risky with each other. According to Petitioners and Professor Young, “Harvey and Risky teach the same kind of device which is used for the same purpose,” “Harvey and Risky both recognized and solved [the] same problem,” and “Harvey and Risky came up with the same solution to the problem.” Ex. 1002, ¶¶ 98, 100; Pet., 40-42; *see also* Ex. 1002, ¶¶ 96-97; Pet., 38-39. If that were true, a POSA would have no reason to combine the references because they do not teach anything new to each other. Specifically, a POSA would not modify Harvey based on Risky to solve any problem because, as Petitioners and Professor Young contend, Harvey already solved the same problem as Risky and in the same way. Likewise, a POSA would not turn to Harvey to modify Risky because, again, Harvey already purports to solve that same problem as Risky and in the same way.

97. In short, because Harvey and Risky provided the same solution for the same problem, a POSA would have understood that the two references add nothing new each other. Therefore, there would have been no motivation for a POSA to modify either reference in view of the other; a POSA would never have sought to combine them.

C. No Combination Is Shown to Meet All Elements of the Challenged Claims

98. As I discussed above, Petitioners and Professor Young have not identified any specific differences between the references such that a POSA would combine them. The only element addressed in Ground 3 is the requirement that boluses be “orally administered,” but Petitioners and Professor Young do not explain how the combination of Harvey and Risky somehow renders that requirement obvious. In any event, the alleged obviousness of “oral administration” does not address any of the deficiencies I have identified in Harvey and Risky.

99. As I discussed above in connection with Grounds 1 and 2, Petitioners and Professor Young do not establish that Harvey and Risky disclose a number of elements required by the challenges claims, including that neither reference discloses activating a radio signal generator at “pre-determined intervals” to carry “physiological data.” See Sections VIII, IX. Accordingly, no combination of those references would address the deficiencies I have identified, and nothing in Ground 3 suggests otherwise. Petitioners and Professor Young also do not assert that a POSA would have used the teachings in Risky to add a bolus functionality to Harvey’s ear tags to address the deficiencies that I have identified in Section VIII.A. Even under the most generous reading of Ground 3, Petitioners and Professor Young do not identify an obviousness combination at all. Therefore, Ground 3 adds nothing to Grounds 1 and 2.

100. Even if it is determined that Petitioners or Professor Young identified an actual combination of Harvey with Risky (which they have not for the reasons above), Petitioners and Professor Young have still not explained how a POSA would have combined any teaching from Risky into Harvey's external ear tag, or vice versa. Petitioners and Professor Young also do not explain why a POSA would have had as reasonable expectation of success in incorporating those teachings. Petitioners and Professor Young do not provide any evidence or explanation to support why a POSA would have had reasonable success in modifying these references in view of each other, much less explain what the modification would have been.

101. For at least the above reasons, Petitioners and Professor Young have not established that a combination of Harvey and Risky meets every element of claims 5 and 6. It is therefore my opinion that Ground 3 does not show the challenged claims to be unpatentable.

XI. GROUND 4: CLAIM 7 IS NOT RENDERED OBVIOUS BY HARVEY IN COMBINATION WITH RETTEDAL

102. In my opinion, claim 7 of the '644 Patent is not rendered obvious by the combination of Harvey in view of Rettedal.

103. Ground 4 fails for the same reasons as Ground 1. Claim 7 depends from claim 6, which depends from claim 5. Ex. 1001, claims 5-7. As I discussed for Ground 1, Harvey fails to disclose many of the elements recited in claim 5, including

at least “one or more sensors contained in a bolus,” “encoding said sensor signal,” “encoded physiological data,” “a radio signal generator located within said bolus,” and “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data.” See Section VII.B. Petitioners rely solely on Harvey for these elements in Ground 4, and they do not contend that Rettedal addresses Harvey’s deficiencies. See Pet., 47-49. Thus, Ground 4 necessarily falls with Ground 1.

104. To the extent it is determined that Petitioners and Professor Young identified an actual combination of the teachings in Harvey and Rettedal (which they have not), they nonetheless failed to explain how or why a POSA would have had as reasonable expectation of success in incorporating Rettedal’s teaching into Harvey’s tag. Impedance matching in the PCB is very different from impedance matching in the bolus, as the latter has a time-changing element due the intake of food and water. Similar to Ground 3, Petitioners and Professor Young make conclusory assertions that claim 7 includes “standard, predictable method steps using a bolus containing well-known, off-the-shelf sensors and radio communication components that would be familiar to any POSA,” and that “the technology and operation of such components was well-understood in the relevant time period.” Pet., 46-47; Ex. 1002, ¶ 109. Petitioners and Professor Young provide no evidence or adequate explanation

to support a reasonable expectation of success in modifying Harvey in view of Rettedal.

XII. GROUND 5: CLAIMS 9 AND 10 ARE NOT RENDERED OBVIOUS BY HARVEY IN COMBINATION WITH KUNDA

105. In my opinion, claims 9 and 10 of the '644 Patent are not rendered obvious of the combination of Harvey in view of Kunda.

106. Petitioners and Professor Young do not establish that Harvey discloses independent claim 9 for the same reasons that I explained above for claim 5. Section VIII. Claims 5 and 9 share many of the same elements, such as “generating a sensor signal from one or more sensors contained in a bolus orally administered to said ruminant animal” and “enabling a radio signal generator located within said bolus.” EX. 1001, claims 5, 9. As I explained above in Section VIII, Harvey does not disclose these elements, including “one or more sensors contained in a bolus” (see Section VIII.A) or “a radio signal generator located within said bolus” (see Section VIII.B). For claim 9, Petitioners and Professor Young rely solely on Harvey as the primary reference for these same elements, and they do not assert that Kunda addresses any of Harvey’s deficiencies in connection with these elements. See Pet., 55-56; Ex. 1002, ¶¶ 125, 129.

107. Rather, Petitioners and Professor Young rely on Kunda solely for its purported disclosure of “transmitting said radio signal with an antenna having a pair of electrically conductive loops disposed a distance apart and further comprising

transmitting said radio signal through said antenna.” See Pet., 56-66; Ex. 1002, ¶¶ 131-138. Petitioners and Professor Young have not shown Kunda teaches the choice of the loop antenna in the bolus sensor in view of what Harvey considered for the animal tag. Moreover, as Harvey did not focus its central design ideas and transceiver components on the bolus sensor (instead, most Harvey’s considerations surround the ear tag), it is not obvious that the loop antenna in Kunda’s teaching is the effective choice for the bolus sensor in Claim 9.

108. Ground 5 also challenges dependent claim 10, which depends from claim 9. Accordingly, for the same reasons that I explained above with respect to claim 9, Petitioners and Professor Young have not shown that Harvey in view of Kunda renders claim 10 obvious.

109. In any event, I disagree with Petitioners and Professor Young that a POSA would have been motivated to modify Harvey’s tag to incorporate Kunda’s antenna. As mentioned before, the optimal antenna choice out of the myriad of many conventional designs are a critical design for wireless units in view of not only the operational ambient for the possible detuning and orientation dependence but also the packaging limitation and antenna gains (which in turn affects the wireless link budget and the transceiver power consumption budget). Petitioners and Professor Young assert that the “motivation to add Kunda’s antenna to Harvey’s bolus is expressly provided in both references. For example, Harvey sought to produce a

bolus that would fit within the digestive tract of a monitored animal and emphasized the importance of compactness. Ex. 1004, 11:10-13 (goal of providing a ‘miniature transponder’); *see also id.*, 18:15-17 (recognizing importance of ‘more compact form factor’). Kunda addresses the same size considerations.” Ex. 1002, ¶ 115. I disagree. As I explained above in Section VIII.A, that is not an accurate characterization of Harvey’s limited discussion of a “bolus.”

110. A POSA would not have interpreted any statement in Harvey to be directed to “bolus” size concerns. Based on my review of Harvey, the reference does not address any concerns related to the size of a “bolus” or the size of other devices that must fit inside “the digestive tract of a monitored animal.” Rather, Harvey’s 78-page disclosure focuses on ear tags that are affixed to the exterior of an animal’s body, such as cattle ears. *See id.*; Ex. 1004, 19:10-20:12, Figs. 1, 3A-3B. As an example, Professor Young cites Harvey at 18:15-17 for its disclosure of a “more compact form factor.” In that disclosure, Harvey is specifically describing that “housing 2300 may have a more compact form factor.” *Id.* Harvey’s only embodiment of housing 2300 is in Figure 2(c), which depicts the housing with “affixment fitting 2320,” as shown below:

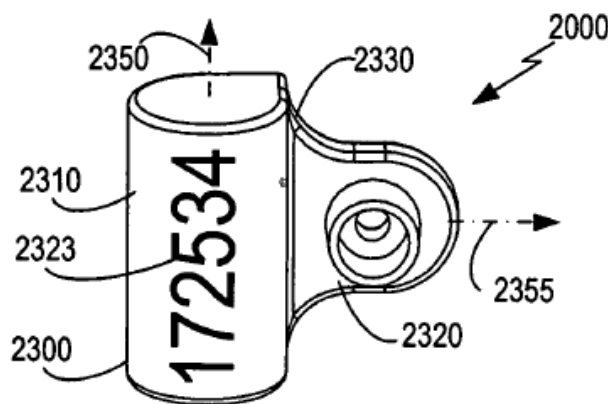


FIG. 2C

Ex. 1004, Fig. 2C. A POSA would have understood from these disclosures that housing 2300 is the housing of an exterior ear tag based on, for example, that affixment fitting 2320 is illustrated as a pin hole. Ex. 1004, Fig. 2(c). A POSA would have understood that fitting to be for “pinning” the ear tag to a cattle ear, as depicted in Figure 3A, for example. Ex. 1004, 19:13-16, Figs. 3A. For a bolus tag, a pin hole would not make any sense in the final packaging.

111. A POSA would not have understood that Kunda’s antenna is the effective choice in a bolus. Petitioners and Professor Young assert that Kunda’s antenna addresses the same “interference” problem solved by the ’644 Patent and the same “performance” and “bandwidth” benefits provided by the ’644 Patent. *See* Pet., 50-52; Ex. 1002, ¶¶ 115-118; Ex. 1001, 7:20-33. I disagree. Kunda does not describe an antenna capable of counteracting the unique electrical problems experienced when used in a bolus located *inside a body*. Specifically, Kunda

discloses fitting a loop antenna to two integrated circuits, where impedance matching in the signal chain is critical to avoid antenna reflection and severe self-jamming to the radio-frequency integration circuits. *See* Ex. 1007 at [0024], Fig. 1 (baseband IC 52 and RFIC 54). Kunda describes a use case of a general communication integrated circuit with a transmitter and receiver, such as for use in mobile phones, where antenna reflection is the key design point. *See id.*; Ex. 1007 at [0001]-[0002]. But Kunda provides no disclosures suggesting that its antenna could be applied in a device used inside an animal's reticulum, where, for example, impedance mismatching and antenna detuning are caused by internal factors, such as the properties of body tissue and complex food mixtures, resulting in significant performance loss, reduced battery life, attenuation, and polarization loss. A POSA would recognize those as necessary design focuses for an antenna in a bolus, which Kunda does not specifically address. A POSA would not be able to conclude from Kunda's disclosures that its antenna works in a bolus. There would thus be no motivation to combine Kunda with any of the alleged art.

112. With respect to Harvey, a POSA also would have understood Kunda to disclose an antenna that was incapable of being included in Harvey's tag device. According to Petitioners and Professor Young, "because Kunda's double-loop antenna saves space," a POSA would consider it "well-suited for use in Harvey's cattle bolus." Pet., 50; Ex. 1002, ¶ 115. I disagree. While Kunda contemplates a small

antenna, it does not disclose an antenna suitable for use in Harvey's device. As I explained above, Kunda describes fitting a loop antenna to two integrated circuits and a limited use case of a general communication integrated circuit. Based on my review, Harvey does not describe the same or a similar use case.

113. A POSA would have also considered it to be impractical to include Kunda's antenna in Harvey's device, where antennas are embedded in a printed circuit board. *See* Pet., 24; Ex. 1002, ¶ 116; Ex. 1004, 45:12-15 (antennas 5500 and 5501 for RF module 5400 are "embedded in a printed circuit board" or "mounted on a substrate, which may be a printed circuit board"). Kunda explains that "if the antenna is placed close to a printed circuit board or housing in order to reduce the size of the communication device, that will diminish the characteristics of the antenna." Ex. 1007 at [0005]. Kunda actually teaches away from using its antenna in smaller devices, expressly suggesting that helical antennas be used to meet the "demands for smaller antennas for use in portable wireless communication devices." Ex. 1007 at [0002]-[0003]. A POSA at the time would similarly understand helical antennas to be the better option for meeting antenna size demands. Even if space were a concern expressed in Harvey, there would have been no reason for a POSA at the time to use Kunda's double-loop antenna over, for example, a helical antenna as a means to conserve space with a reasonable expectation of success. Thus, in view of the references' disclosures and the general knowledge in the field, it is my opinion

that a POSA would not have been motivated to combine Kunda with Harvey or had a reasonable expectation success in doing so.

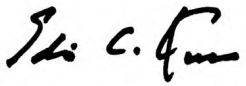
114. To the extent Petitioners and Professor Young are found to have identified an actual combination of the teachings in Harvey and Kunda (which they did not, as I explained above), they have nonetheless failed to explain how or why a POSA would have had as reasonable expectation of success in incorporating Kunda's antenna into Harvey's tag. Similar to Grounds 3 and 4, Petitioners and Professor Young make conclusory assertions that "Claims 9 and 10 consist of standard, predictable method steps using a bolus and antenna containing well-known, off-the-shelf sensors and simple conductive loops that would be familiar to any POSA," and that "the technology and operation of such components was well-understood in the relevant time period such that the combination of Harvey and Kunda would have had a high likelihood of success." Pet., 52-53; Ex. 1002, ¶ 119. Petitioners and Professor Young do not provide an explanation or evidence to support their assertion of a reasonable expectation of success in modifying Harvey in view Kunda.

XIII. CONCLUSION

115. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information or belief are believed to be true; and further that these statements were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both,
under Section 1001 of Title 18 of the United States Code.

Date: 10/22/2024

By: 
Edwin C. Kan, Ph.D.