

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 No. IPR2024-01067
U.S. Patent No. 10,231,644 B2

REPLY DECLARATION OF DARRIN YOUNG

PETITIONERS' EXHIBIT LIST

Exhibit	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 Appln. No. PCT/US2007/020918, Pub. No. WO 2008/108816 ("Harvey")
1005	U.S. Patent Appln. Pub. No. 2009/0187392 ("Risky")
1006	U.S. Patent Appln. Pub. No. 2013/0197323 ("Rettedal")
1007	Japanese Patent Appln. No. 2004-215061 A ("Kunda")
1008	U.S. Patent No. 6,371,927 B1 ("Brune")
1009	U.S. Patent Appln. Pub. No. 2009/0030279 A1 ("Zander")
1010	U.S. Patent No. 10,231,644 Prosecution History
1011	U.S. Patent No. 5,482,008 ("Stafford")
1012	U.S. Patent No. 8,640,712 B2 ("Ardrey, Jr.")

Exhibit	Description
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, 9 th ed. (2015)
1021	U.S. Patent No. 11,755,484 B2 (“Gray”)
1022	Int’l Appln. No. PCT/AU88/00225, Pub. No. WO 89/00024 (“Platt”)
1023	U.S. Appln. Pub. No. 2015/0277885 (“Kimoto”)
1024	Deposition Transcript of Professor Edwin C. Kan (July 22, 2025)

I. Introduction

1. I, Darrin J. Young, make this declaration in connection with the proceedings identified above.
2. I have been retained as an expert on behalf of smaXtec Inc. and smaXtec Animal Care GmbH (“smaXtec” or “Petitioner”) in connection with the proceedings identified above. I submit this Declaration on behalf of smaXtec in further support of its Petition for Inter Partes Review (“IPR”) and cancellation of Claims 5-7, 9, and 10, (“the Challenged Claims”) of U.S. Patent No. 10,231,644 (“the ’644 Patent”) (Ex. 1001).
3. I have previously submitted an expert declaration in this matter (Ex. 1002). I stand by that declaration. I incorporate by reference the contents of my first declaration and offer the below opinions as a supplement to my first declaration. I also respond here to certain points raised by the Patent Owner Response and the declaration of Edwin Kan (Ex. 2006). I am not attempting to respond to every point in those documents, and my silence on any issue should not be taken as agreement.
4. The opinions in this Declaration are based on my professional training and experience and my review of the exhibits discussed herein.
5. I am being compensated for my services in connection with the proceedings identified above at a rate of \$700 per hour (plus reimbursement

for expenses). My compensation is in no way contingent on the outcome of the proceedings identified above or on any of the opinions I provide below.

II. Ground 1: Patent Owner’s Challenges to the Harvey Anticipation Ground Lacks Merit

6. The Patent Owner Response argues that there is no connection between Harvey’s bolus and the transponder that Harvey identifies as XPDR 5000. I disagree. Harvey teaches a POSA that its intelligent active tag 1110 (“IAT 1110”) may be in the form of a bolus, among other options. Ex. 1004, 11:5-14. An IAT, as taught by Harvey, includes a power source and a transponder. Harvey directly states that XPDR 5000 is an appropriate transponder for IAT 1110. Ex. 1004, 70:22-23, 48:31-33. Thus, a POSA would have understood that Harvey discloses an embodiment that is IAT 1100 in the form of a bolus that includes XPDR 5000.

7. The XPDR 5000 transponder in Harvey is designed for use with sensors, Harvey indicates that sensors of a wide variety could be used. A POSA would have understood that there are many physiological attributes that can be measured or monitored in animal monitoring systems, including with XPDR 5000. *See, e.g.*, Ex. 1004, 41:1-15. Harvey notes that appropriate sensors for XPDR 5000 would be selected pragmatically based on a variety of factors including, “without limitation, intended transponder environment, transponder application, or expected transponder lifespan;

monitored subject lifespan; power availability, power renewability, or energy harvesting availability; sensor type, location, or sturdiness; data generation, data storage, or data offloading; telemetry burden; or cost.” Ex. 1004, 41:7-15.

8. Dr. Kan asserted that “the XPDR 5000 embodiment is only suitable in an external format, such as an ear tag, not an internal bolus.” Ex. 2006, ¶64. This is not true. As I state above, Harvey explains that IAT 1110 may be in form of a bolus, and can include XPDR 5000. Dr. Kan cites a number of disclosures about the ear tag 2000, relying on Harvey’s statement that XPDR 5000 *can* or *may be* used in that form. Ex. 2006, ¶65-67. None of those disclosures undercut Harvey’s statement that XPDR 5000 can be used in forms other than an ear tag, such as a bolus.

9. Dr. Kan also asserts that some of the sensor types or other design options that Harvey relates to the XPDR 5000 would not be suitable for a bolus. Ex. 2006, ¶68. But as I note above, Harvey contemplates that not all sensor types would be suitable with a bolus, but that appropriate sensors could be selected pragmatically based on a number of factors, including “transponder environment” and “transponder application,” such as whether IAT was an ear tag or bolus. Ex. 1004, 41:7-15. I agree that a POSA would have been able to choose suitable sensors for use with Harvey’s XPDR 5000

transponder in a bolus without difficulty. I note also that the Challenged Claims do not require or exclude any particular sensor type.

10. Dr. Kan and the Patent Owner response argue that Harvey does not disclose encoding of sensor signals as encoded physiological data (claim element 5[C]), and that there is likewise no disclosure of the storing (claim element 5[D]) and/or no transmitting (claim element 5[F]) of that encoded data. I disagree. As I detailed in my opening declaration, Harvey discloses a number of processors and methods that a POSA would have understood as directed to digital data. Ex. 1002, ¶62. That use of digital data would require an analog-to-digital conversion (“ADC”) to convert the sensor signal to digital physiological data, which is encoded physiological data. *Id.*, ¶63.

11. A POSA reading Harvey in 2015 would have been motivated to store and transmit digital physiological data. It would be obvious to a POSA at the relevant time of the alleged invention to have that encoding done before memory storage, as digital data is considerably more robust than analog signals. Analog signals are known to be sensitive to noise, interference and distortion as they are propagated through an electrical system. Dr. Kan alleges that ADC consumes significant power, and thus a POSA would have been reluctant to include it on an animal sensor. But as I note, Harvey

discloses a number of digital transmission methods, which would require the data to be encoded in digital form somewhere in the transponder.

12. A POSA reading Harvey or Risky would not have expected the data to be stored in EEPROM in an analog form. An EEPROM is built by employing floating gate transistors. A floating gate transistor's threshold voltage is programmed in a binary form (high threshold voltage and low threshold voltage) as a means to store digital data represented in the form of 1s and 0s. Therefore, a floating gate transistor serves as a memory cell, which is a digital storage element in memory such as EEPROM.

13. When Dr. Kan states that an EEPROM can be used to store analog data, he refers to neuromorphic computing systems or neuromorphic computing applications, which can use floating-gate transistors to store analog information as neural synapses, mimicking a biological neural learning process or an artificial intelligence (AI)-based computational process. Ex. 2006, ¶146. This is an unrelated usage of EEPROM that a POSA would not have considered when reading the teaching of the patent and the cited prior art references.

14. Harvey discusses a number of other ways that the analog sensor signal is encoded. For example, Harvey teaches that the sensors in XPDR 5000 (i.e., SENSOR #1 5310) may rely on a temperature difference between a

monitored subject's body temperature and a predetermined temperature. Ex. 1004, 40:30-33 ("SENSOR # 1 5310 may provide a sensed thermal parametric signal over a predetermined range of body temperatures, or may produce a sensed thermal parametric signal when a predetermined temperature threshold is met or surpassed, as may indicate hyper- or hypothermia of monitored subject 5800."). Here Harvey teaches that the sensor may be programmed to output monitored subject's body temperature only when the body temperature is outside a predefined range. A POSA would have understood that when the monitored subject's body temperature is within the predefined range, the sensor would output a predefined value or state, indicating that the monitored subject is in a healthy condition.

15. Harvey characterizes its examples using temperature sensors as "non-limiting." Ex. 1004, 40:25-28. A POSA would have understood that there are a number of different physiological parameters that could be encoded in the same way as temperature, such as pulse rate, pH and the like. A POSA would have understood that a predefined healthy range could be applied to these parameters as well, and the sensor programmed to output a predefined value or state when the subject is within the predefined healthy range.

16. Harvey discloses element 5[F]: “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data.” Harvey explains that “an outbound IAT message” is transmitted at a preselected tag transmission interval. Ex. 1004, 26:6-11. Dr. Kan alleges that this teaching is only for collision avoidance protocols and the message would not contain physiological data. Harvey explains, however, that an IAT message may include “an SID, a TID, subject data, subject dynamic information, a predetermined monitored subject state, or a predetermined subject state alert.” Ex. 1004, 14:7-9. Nothing in Harvey’s discussion of the collision avoidance protocol suggests that subject data or dynamic information (i.e., physiological data) should be excluded from that IAT message.

17. Dr. Kan also misconstrues element 5[F]: “activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data” to require that there be a single message sent with encoded physiological data at pre-determined intervals. However, the plain language of the claim is that the radio signal generator is activated at predetermined intervals in order to send physiological data. The claim language allows the radio signal generator to be activated at predetermined intervals, with encoded physiological data then sent thereafter.

18. Harvey explains that a preselected tag transmission interval may be assigned during manufacture. Ex. 1002, ¶72 (citing Ex. 1004, 26:6-11, 27:14-21, 28:22-27, 32:12-19, 65:32-66:2, 66:19-22, Fig. 9.). Therefore, the radio signal generator is activated at pre-determined intervals.

19. At Dr. Kan's deposition, he suggested that a "predetermined" interval is different from a "preselected" or "selected" interval, based on his assumption that the former is not meant to be changed once it is set, whereas the latter is. Ex. 1024 (Kan Depo. Tr.) at 108:21-109:22. I am not aware of any such distinction between those terms based on my experience, or based on anything disclosed in the '644 patent.

20. Dr. Kan also suggests multiple times that Harvey's exemplary interval of two seconds would be inappropriate as the constant interval in a bolus. *See, e.g.*, Ex. 2006, ¶140 (noting that a full day of messages at two second intervals would lead to "around 43,200 outbound messages"). But Harvey explains that two seconds was merely an example that XPDR 5000 may use. Ex. 1004, 26:8-11 ("may be exemplified by"). A POSA would have been able to choose an appropriate interval based on factors such as the needs of the animal, the tag form, and power requirements. A POSA would have also understood that the interval need not be the same all day and every day.

III. Ground 2: Patent Owner's Challenges to the Risky Anticipation Ground Lacks Merit

21. As with Harvey, Dr. Kan and the Patent Owner allege that the Risky reference fails to disclose encoding of sensor signals as encoded physiological data (claim element 5[C]), and that there is likewise no disclosure of the storing (claim element 5[D]) and/or no transmitting (claim element 5[F]) of that encoded data. I disagree. As I explained in my opening report that Risky discloses a number of processors, data structures and methods that a POSA would have understood as directed to digital data. Ex. 1002, ¶¶85-90. That use of digital data would require an ADC to convert the sensor signal to digital physiological data, which is encoded physiological data. *Id.*, ¶87.

22. Risky discloses the use of EEPROM memory storage for animal physiological data. Ex. 1005, [0049, 0052]. As I explain above (¶ 10-13), a POSA would have understood this to be a disclosure of the use of digital data, which is an encoded physiological data. The Patent Owner argued that Risky's teachings about EEPROM are limited to storing an identifier value (UBID value). Resp., 34-35. That is not what Risky teaches. Risky discloses that "[i]n one embodiment, the bolus memory unit 250 may comprise read-only storage 254. Read-only storage 254 may be a Programmable Read-Only Memory (PROM), Erasable Programmable Read-

Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), or the like.” Ex. 1005, [0052]. The purpose of the memory unit 250 is to store physiological data about the subject animal in addition to other necessary data for operating the bolus. A POSA would have understood Risky’s teaching to use EEPROM to store the encoded animal’s physiological data because EEPROM provides a POSA with flexibility to electrically erase the data already stored in the memory and reprogram the memory to store new data. As a result, large memory size can be avoided to save space and cost. Later in paragraph [0052], Risky teaches that a UBID value may be stored on the read-only storage, but a POSA would have understood that the UBID value as something that can be stored there in addition to, not instead of, the physiological data of the animal.

23. There are additional teachings in Risky that a POSA would have understood to be a disclosure of digital data. For example, when Risky discloses “compressing the data” and “reduce the amount of data transmitted to the base station”, a POSA would have understood this to be an application of digital data. Ex. 1005, [0044]. Only when a value represented in a digital format is compressed does it result in a reduction in the amount of data (i.e. bits). Note that Risky’s discussion of compressing the data is in reference

to “measurement data obtained from one or more sensor 220.” Ex. 1005, [0043-0044], Fig. 2. Therefore, the physiological signal obtained from the sensor is represented in a digital form, which is an encoded physiological data. That same encoded physiological data is stored in memory unit 250 (e.g. EEPROM) and transmitted by the communication module 230:

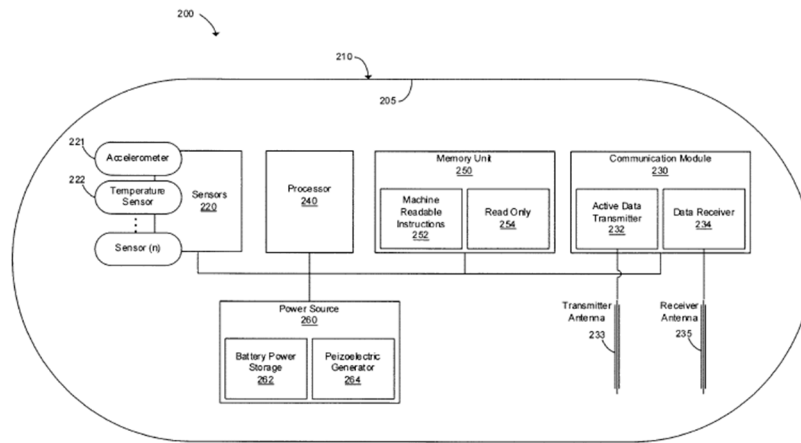


Figure 2

Ex. 1005 at Fig. 2. Elsewhere, Risky teaches the use of calibration data as part of the machine readable instructions, which are digital. Ex. 1005 at [0041, 0057]. Risky teaches the calibration data can be applied to the calibrate sensor readings. Ex. 1005 at [0041] (teaching that “machine readable instructions 252 may configure processor 240 to apply calibration data stored within memory unit 250 to readings returned by sensors 220.”). A POSA would have understood that applying digital calibration data to calibrate sensor data would be performed digitally, further confirming that

the sensor reading, which is the measurement data discussed by Risky in paragraph [0043], is digital.

24. Risky teaches additional encoding techniques besides analog to digital conversion. For example, Risky discloses a temperature sensor 222 that is a thermistor. Ex. 1005, [0035]. The thermistor's resistance value changes as the animal's body temperature changes. As a POSA would have understood, the thermistor's resistance value (which is the sensor signal) needs to be converted (encoded) into a voltage or current signal to be processed by the microprocessor. The voltage or current signal is therefore encoded physiological data that corresponds to a physiological parameter (body temperature) of the animal.

25. Risky discloses at least two instances of activating said radio signal generator at pre-determined intervals to generate a radio signal to carry said encoded physiological data (claim element 5[F]). Risky discloses a "burst mode" where sensor readings are transmitted in periodic bursts. Ex. 1005, [0049]. Risky explains:

In this mode, machine readable instructions 252 may specify a transmission interval, wherein processor 240 may transmit an animal characteristics message comprising some or all of the measurements stored in memory unit 250 at each transmission interval.

Riskey's burst mode thus meets claim element 5[F] as the interval is predetermined as part of the machine readable instructions.

26. Dr. Kan misreads Riskey when he argues that Riskey's machine readable instructions must be dependent on triggering events. Dr. Kan makes the mistake of reading a specific embodiment as a requirement for an unrelated example. Paragraph [0049] of Riskey states the following:

In another mode of operation, processor 240 may not immediately transmit the sensor readings polled from sensors 220, but instead store them on memory unit 250. *In this mode, machine readable instructions 252 may specify a transmission interval [sic: "interval"]*, wherein processor 240 may transmit an animal characteristics message comprising some or all of the measurements stored in memory unit 250 at each transmission interval. This operational mode may be referred to as "burst" mode since sensor 220 readings are transmitted as periodic bursts rather than when sensor polling takes place.

Ex. 1005, [0049] (emphasis added). There is no suggestion in this paragraph that the burst mode "transmission interval" should be adjustable or dependent on triggering events. However, Dr. Kan points to a different non-limiting embodiment in paragraph [0048]. Ex. 1005, [0048] ("In one embodiment, machine readable instructions 252 may define conditions under which the polling frequency associated with one or more sensors 220 may

change”). A POSA would not have read that separate embodiment to conclude that every time Risky refers to machine readable instructions, it requires those instructions to change under certain conditions. A POSA would have read the burst mode teaching to mean what it says: the machine readable instructions specify a transmission interval. Ex. 1005, [0049]. In other words, the transmission interval is predetermined.

27. Risky also discloses an “on-line” mode, and explains that when in this on-line mode, the bolus may transmit animal characteristics messages at transmission frequency specified by machine readable instructions 252. Ex. 1005, [0053-0055]. Dr. Kan attempts to distinguish this teaching from the claim limitation because the bolus only enters “on-line” mode in response to certain triggering events, such as when the animal is in the vicinity of a receiver station. Ex. 2006, ¶162. But Dr. Kan’s argument does not undercut the fact that while in an on-line mode, the system sends data at predetermined intervals. The claims do not require the bolus to always be in a mode where the data is sent at predetermined intervals.

28. Dr. Kan also alleges that Risky does not meet the claim requirement that a sensor signal varies based on changes in physiological parameters. Ex. 2006, ¶167-174. This argument is frivolous. The very purpose of an animal monitoring system with sensors is that the sensors signals will vary

based on changes in physiological parameters. Employing sensors that did not change their signal based on changing physiological parameters would defeat the entire purpose of the systems that are the subject of references like the '644 patent, Harvey, and Risky. A POSA would have understood that when Risky discusses detection of various physiological characteristics, it is doing so for the purpose of determining if the characteristics change. Ex. 1005, [0035]. For some physiological characteristics such as temperature, the detected characteristic itself is a determination of changes in a sensor signal over a time period. *Id.* at [0044]. At deposition, Dr. Kan confirmed that one of the purposes of monitoring the vital signs of an animal is to see if vital signs change over time. Ex. 1024, 35:18-36:22. He also confirmed that the way this would be done is that the sensor's signal would change over time. *Id.*, 36:23-37:5.

IV. Ground 3: Patent Owner's Challenges to the Harvey/Risky Obviousness Ground Lacks Merit

29. Dr. Kan and the Patent Owner argue that the Petition does not adequately discuss the obviousness of Claims 5 and 6 over Harvey in light of Risky.

30. As explained in my declarations, each of Harvey and Risky discloses each of the elements of Claims 5 and 6. To the extent that the Patent Owner or the Board feels that any elements are missing, they are present in the

various embodiments of Harvey and Risky. A POSA would have been motivated to combine Harvey and Risky for the reasons I explained in my opening declaration. Ex. 1002, ¶¶96-100.

31. In particular, I believe that a POSA would have considered the detailed architecture of Harvey's XPDR 5000 transponder for its use in the bolus described by Risky. Ex. 1004, Fig. 5 and accompanying descriptions; Ex. 1005, Figs. 1 and 2 and accompanying descriptions. A POSA would have been motivated to look to Risky for additional information about the physical design considerations of the bolus device into which Harvey's XPDR can be incorporated. Likewise, a POSA would have understood that Risky teaches the storing and transmitting of encoded physiological data, as evidenced by its disclosures relating to data compression of the measurement data, which could be incorporated into Harvey's XPDR 5000 to save power.

V. Ground 4: Patent Owner's Challenges to the Harvey/Rettedal Obviousness Ground Lacks Merit

32. Dr. Kan disagrees with the assertion that the Rettedal reference teaches the elements of claim 7. Claim 7 requires that matching elements are used to adjust (also known as "tune") the frequency of the radio signal generated by the radio signal generator in the bolus (as initially claimed in claim 5). The purpose of this adjustment of the frequency of the radio signal

is to compensate for changes in the frequency caused by the signal passing through the animal's body mass. In particular, it is desirable to adjust the frequency of the radio signal so that it is more closely matched to the center frequency of the antenna. The term "matching elements" here refers to electronic components such as capacitors and resistors. This plain reading of the claim is consistent with the specification of the '644 patent. *See, e.g.*, Ex. 1001, 5:11-6:40.

33. The Rettedal reference likewise teaches using matching elements to adjust the frequency of the generated radio signal, for the same purpose. *See* Ex. 1002, ¶108, 110. Accordingly, Rettedal discloses the elements of Claim 7.

34. Dr. Kan and the Patent Owner allege that Claim 7 should not be read according to its plain language. They argue that instead Claim 7 should be read to require that the center frequency *of the antenna* be changed to match the generated radio signal, rather than the other way around. *See, e.g.*, Ex. 2006, ¶191 (stating that "a POSA would understand that the claims involve impedance matching to shift the center frequency of the antenna, and not, for example, to cause the radio signal generator to generate a signal at a different frequency."). That is not what the claim language states. Claim 7 does not mention the antenna at all. It claims adjusting "said frequency of

said radio signal,” which is a reference to the frequency of the radio signal generated by the radio signal generator in Claim 5, from which Claims 6 and 7 depend.

35. Dr. Kan justifies this flipping of the claim language by arguing that the specific claim elements identified in the '644 patent specification are not able to adjust the frequency of the generated radio signal. He believes those matching elements are passive elements, and thus cannot adjust the frequency. In other words, he believes the claim to be impossible as written. Ex. 1024 (Kan Depo. Tr.) at 201:16-202:22; 208:10-209:20. I do not believe the claim is impossible. A radio frequency signal generator can be implemented by using a local oscillator. The local oscillator frequency can be adjusted by varying the value of passive components, for example capacitors, inductors, or resistors, as a part of a matching network electrically coupled to the local oscillator. Accordingly, a POSA reading the '644 patent or the Rettedal reference would have been able to follow their teachings to adjust or tune the generated radio signal.

36. Even if Dr. Kan is correct (which I disagree), and a POSA would have not been able to adjust the frequency of the generated radio signal using passive matching elements, I do not believe his conclusion is justified. I do

not believe a POSA would have interpreted Claim 7 to insert the idea of changing the center frequency of the antenna.

VI. Ground 5: Patent Owner’s Challenges to the Harvey/Kunda Obviousness Ground Lacks Merit

37. Dr. Kan and Patent Owner allege that there would be no motivation to combine Harvey with Kunda because Harvey does not, in their opinion, require that the bolus be small or compact in size. Ex. 2006, ¶206. I disagree. A POSA designing Harvey’s XPDR 5000 transponder into a “digestive tract bolus” for a ruminant animal such as cattle would have understood that the bolus would need to be compact in size to be administered to the animal.

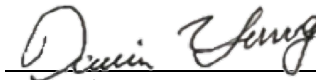
38. Dr. Kan and Patent Owner allege that the Kunda reference teaches away from using its antenna with a transponder like the one disclosed in Harvey. Ex. 2006, ¶206. They have mistakenly relied on Kunda’s description of prior art antennas, however, rather than its inventive antenna. For example, Dr. Kan’s citations to Kunda’s characterizations of its antenna are to paragraph [0005] of Kunda. Ex. 2006, ¶206 (discussing for example, that the antenna should not be placed near a printed circuit board) (citing Ex. 1007, [0005]). Paragraph [0006] of Kunda, which neither Dr. Kan nor the Patent Owner mentions, states in its entirety:

The present invention was achieved to resolve the above-mentioned problems in the prior art and, therefore, is intended to provide a small antenna with satisfactory characteristics.

Ex. 1007, [0006]. Thus Kunda expressly recommends its double-looped antenna for small devices. A POSA would have understood Harvey's bolus to be an appropriate use of Kunda's antenna.

39. I, Darrin Young, do hereby declare and state, 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. I declare under penalty of perjury that the foregoing is true and correct.

Dated: July 29, 2025


Darrin J. Young