

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. AND SAMSUNG ELECTRONICS
AMERICA, INC.,

Petitioners,

v.

AQ CORPORATION,

Patent Owner.

CASE: IPR2026-00231

U.S. PATENT NO. 11,303,011

DECLARATION OF DR. DAVID S. RICKETTS

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I, Dr. David S. Ricketts, declare as follows:

1. I am over eighteen years of age, and I am competent to testify regarding the matters set forth in this declaration if called upon to do so.

2. I have been retained in this matter by K&L Gates LLP on behalf of Patent Owner, AQ Corp. (“AQ”).

3. I submit this declaration at the request of K&L Gates as counsel for Patent Owner in this proceeding. The opinions contained in this declaration are mine, and mine alone. No part of my compensation for my time in this proceeding is tied to, or contingent on, any opinion or outcome of this proceeding.

4. I understand that Samsung Electronics Co., Ltd. (“Samsung Electronics”) and Samsung Electronics America, Inc. (“Samsung Electronics America”) (collectively, “Samsung” or “Petitioner”) and their expert, Dr. David K. Choi, have submitted papers in this proceeding arguing that Claims 1-6 (the “Challenged Claims”) (Ex. 1002) are unpatentable under the United States Patent and Trademark Office’s *inter partes* review (“IPR”) standard of a preponderance of the evidence. I provide certain technical opinions regarding the scope and content of the prior art, including how those skilled in the art as of 2019 would have understood certain references, the industry as a whole, and what factors were driving innovation in this space.

5. In preparing this declaration, I have analyzed the '011 Patent (Ex. 1001), its file history (Ex. 1004), the Declaration of Dr. David Choi (Ex. 1002), six prior art references: Seong (Ex. 1006), 005Lee (Ex. 1008), Kang (Ex. 1012), Cho (Ex. 1010), Ahn (Ex.1007), 721Lee (Ex. 1011). I also considered the other documents or references cited in this declaration.

6. In forming the opinions expressed below, I have considered the documents listed above, the relevant legal standards as provided to me by my counsel, and my own knowledge and expertise. My opinions are offered from the perspective of a person of ordinary skill in the art, as that term is defined, as of November 27, 2019.

7. I understand that Dr. Choi has already provided his opinions in 1002; however, if he is permitted to offer additional opinions, I reserve my right to respond to those should I be asked.

I. QUALIFICATIONS AND BACKGROUND

8. My qualifications for forming the opinions given in this declaration are summarized here and are addressed more fully in my curriculum vitae ("CV"), which is submitted as Exhibit 2013. That exhibit also includes a list of my publications.

9. I received my B.S. and M.S. in Electrical Engineering in 1995 and 1997, respectively, from Worcester Polytechnic Institute in Worcester,

Massachusetts. I received my Ph.D. in Electrical Engineering from Harvard University in Cambridge, Massachusetts in 2006.

10. I am currently a Full Professor of Electrical and Computer Engineering at North Carolina State University. In my position I conduct research and teach undergraduate and graduate students in the area of electrical and computer engineering. The courses I teach include Power Systems, Power Management Integrated Circuit (“IC”) Design, Advanced Analog IC Design, Radio System Design, and Analog Circuit Laboratory. I also lead a research group that conducts research and design of electrical and electronic circuits, including power system circuits, millimeter wave and microwave circuits and systems, wireless power transfer circuits, power electronics and nano-electronic and nano-phonic devices. I lead research in power electronics and power conversion integrated circuits. I have served in my current position since 2012.

11. Prior to entering academia, I worked as an engineer in private industry holding several engineering and managerial positions where I developed and oversaw the development of electrical and electronic circuits, including those related to power transfer, power conversion, and semiconductor design in wired and wireless circuits and systems.

12. From 1995 to 1999, I held a position as an engineer and senior engineer at American Power Conversion, where I designed uninterruptable power supplies

(UPS), AC-DC converters, and DC-DC converters. The converters that I designed and developed were originally developed for solar power systems and microgrids, including to convert DC power sourced from renewable energy sources, including solar panels, to AC energy used to power homes. This technology also included functionality for transferring energy from the solar panels directly to the grid, as well as microgrid, at home solar installations and voltage and current inverters. During my time in industry, I also developed AC-DC and DC-DC converters, as well as battery chargers.

13. From 1999 to 2001, I held a position as a Principal Consultant at Renaissance Design, Inc., where I designed power management ICs for power converters, including DC-DC converters and DC-AC inverters.

14. From 2000 to 2002, I held a position as a Manager of New Product Development at ON Semiconductor Corp., where I was responsible for six product development teams, including market analysis, business development, system design, and integrated circuit design and testing. In that role I oversaw the development of over twenty power management ICs, also known as power ASICs, in bipolar, CMOS, and BiCMOS technologies. These ICs related to DC-DC power converters among other power electronic circuits.

15. From 2002 to 2003, I held the position of Advanced System Engineering Manager at ON Semiconductor Corp., where I directed a team of system engineers to develop multi-phase power management ICs.

16. In 2006, I received my Ph.D. on the topic of advanced oscillator topologies. My work on integrated circuit oscillators was included in the 2008 McGraw-Hill Yearbook of Science and Technology and discussed in Nature, the pre-eminent science journal. In addition, my work on advanced materials for circuits included the first Si-Ge shell-core nanowire oscillator on plastic.

17. As shown in my CV, I have published two books, at least 50 academic journal papers, and 78 conference papers related to power transfer electronics and circuits, radio frequency (“RF”) systems, magnetic circuits and materials, analog circuits, RF circuits and nanoscale devices. Ex. 2013.

18. I am the recipient of the National Science Foundation CAREER award for work in emerging magnetic devices known as spin-torque oscillators. I also received the Defense Advanced Research Projects Young Faculty Award for my work in emerging magnetic devices.

19. My current CV contains more information on my background and experience.

20. No part of my compensation is contingent upon the outcome of this IPR or any district court litigation between the parties. I have no other interests in this IPR, any litigation between the parties, or with any of the parties.

21. Because of my background, training, and experience, I am qualified as an expert in the technical areas relevant to the '011 patent, and I am a “person of ordinary skill in the art” (“POSITA”).

II. LEGAL STANDARD

22. Although I am not a lawyer, I have been advised on what I have been told are some of the relevant legal principles by AQ’s counsel and have used them as a basis for my opinions.

A. Claims and their understanding

23. I have been informed and understand that terms in the patent claims must be read as they would have been understood by a POSITA at the time of the claimed invention.

24. I understand that a POSITA is a person to which the claimed subject matter pertains with the capability of understanding the scientific and engineering principles applicable to the pertinent art. I understand that the following factors may be considered in determining the level of ordinary skill:

- the type of problems encountered in the art;
- prior art solutions to those problems;

- the speed with which innovations are made;
- the sophistication of the technology; and
- the educational level of active workers in the field.

I also understand that not every factor may be present and that one or more factors may predominate others.

25. I understand that the claims within a patent set forth what the inventors have presented as their inventions. I understand that claims can be independent or dependent form, meaning that they depend from the identified independent claims and add requirements to those claims.

B. Specification

26. I understand that there are other parts of a patent, including the abstract, the figures of a patent, the background of the invention, the summary of the invention, and the detailed description of the invention. I understand that these portions often are collectively referred to as the “specification” of a patent. I understand that technically the claims are part of the specification, but that referring to the “specification” typically means referring to the written description of the inventions rather than the claims. I understand that the specification informs the understanding of the claims by, for example, describing the claimed invention and providing preferred examples of the claimed invention.

27. I have also been informed and understand that terms of a claim should be understood in the context of the claim as a whole. I also understand that the specification of the patent is relevant to the meaning of a claim term. I further understand that the claims must be read in light of the specification.

C. Prosecution History

28. I understand that the correspondence back and forth between the representative of the applicant, and the U.S. Patent and Trademark Office, leading up to the issuance of a patent is called the “file history” or “prosecution history.” It has been explained to me that, in the process of obtaining a claim of a patent, the inventors and the examiner may make statements explaining their understanding of the scope of their claimed invention. It has also been explained to me that for a statement by the inventors to narrow the scope of a claimed invention, the statement must clearly and unambiguously limit the scope of an invention. I understand this is called “prosecution disclaimer” or “prosecution disavowal.” I understand that the claim language, specification, and file history are referred to as “intrinsic evidence” or “the intrinsic record.”

D. Burden of Proof

29. I understand that, unlike at the district court, patents subject to IPR, such as this proceeding, are not presumed to be valid, such that a lower burden of proof is used to judge the patentability of challenged claims. Unlike the district

court’s “clear and convincing” burden, here, a “preponderance of the evidence” burden exists.

E. Anticipation

30. I understand that a patent claim is invalid as “anticipated” by a single “prior art” reference if the reference discloses every single element of the claim with sufficient precision and detail to establish that the subject matter of the claim existed in the prior art. In particular, I understand that it is not sufficient to establish that all of the elements are collectively disclosed within the four corners of a particular document. Instead, the operative question is whether a person of ordinary skill would have understood the elements as being arranged as in the claim itself. I also understand that a prior art reference cannot “anticipate” a patent claim unless that reference enables one of ordinary skill in the art to make and use what is disclosed without undue experimentation. Thus, if the reference does not enable one of ordinary skill to make or use each and every claim limitation, then the claim cannot be “anticipated” by the reference.¹

31. I understand that a prior art reference can disclose a given claim element actually or inherently.

¹ I understand that the Petition and Dr. Choi are not advancing any anticipation-based theories of unpatentability.

32. In the case of actual disclosure, I understand that a person of ordinary skill would need to have understood that the disclosure corresponds to the claim element in question. I also understand that such disclosure may be implicit rather than explicit. For example, prior art need not use the same words as the claimed invention. However, I understand that ambiguous references do not anticipate.

33. In the case of alleged “inherent” anticipation, I understand that the claim element in question must necessarily be present when practicing the described technology even though the prior art reference itself contains no express description of the element in question. In particular, I understand that “possibilities or probabilities” are not sufficient to establish inherency. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. Instead, the essence of inherency is that one of ordinary skill in the art would recognize that a reference unavoidably teaches the property in question.

F. Obviousness

34. I understand that a patent claim may describe an invention that was new (i.e., not anticipated by any prior art reference), but nevertheless be invalid for “obviousness” if the differences between the patented subject matter and the prior

art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the invention was made.²

i. Motivation to Combine

35. I further understand that an invention is not obvious just by demonstrating that each of its elements was, independently, known in the prior art. To prove that an invention is obvious, I understand that it can be important to point to a reason or reasons, such as a teaching, suggestion, or motivation, that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed invention does; however, I further understand that a teaching, suggestion, or motivation need not be explicitly set forth in a reference itself. I understand that this is because inventions in most (if not all) instances rely upon building blocks already known, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known; therefore, it can be important to point to such a reason or reasons. I understand that in identifying such a reason, the analysis need not require precise teachings in the prior art directed to the specific subject matter of the challenged claim. However, I further understand there must be some reason articulated that supports why a POSITA (defined below) would have

² I understand that the Petition and Dr. Choi are advancing three “obviousness” theories with Grounds 1 to 3.

made the proposed modification, and that the reason must be rooted in the prior art time.

36. I understand that it will often be necessary for a court, the PTAB, or a finder of fact to look to interrelated teachings of multiple patents and the background knowledge possessed by a person having ordinary skill in the art in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. I understand that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. I understand that the combination of familiar elements according to known methods may be obvious when it does no more than yield predictable results.

37. I also understand that a claim is not invalid as obvious if it is more than the predictable use of prior art elements according to their established functions.

38. Further, I understand that while predictability is a touchstone of obviousness, the concept of a “predictable result” under the law refers not only to the expectation that prior art elements are capable of being combined, but also that the combination would have arrived at the challenged claims.

39. I also understand that if the prior art “teaches away” from combining known elements in the manner claimed by the invention at issue, discovering a successful way to combine them is less likely to be obvious. In particular, I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant, or would understand based on the reference that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant. Likewise, I understand that similar subject matter may not be sufficient motivation for a person of skill in the art to combine references if the references have conflicting elements.

40. Further, I understand that even if a reference does not necessarily “teach away,” the reference’s statements regarding preferences are relevant to a finding regarding whether a person of ordinary skill would have had reason to combine that reference with another reference.

ii. Reasonable Expectation of Success

41. I understand that an invention is not rendered obvious simply on the basis of two or more different disclosures that collectively disclose all of the claimed elements. In other words, an invention is not obvious just because all of the elements that comprise the invention may have been known in the prior art. Instead, a person

of ordinary skill in the art must have had both a reason to pursue the proposed combination and a reasonable expectation of success in pursuing the possibility that turns out to succeed and is claimed. In particular, I understand that knowledge of a goal does not itself render achievement of that goal obvious.

42. I also understand that determining whether or not a claimed invention would have been obvious requires assessing facts related to (1) the scope and content of the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the art, and (4) any objective evidence (“secondary considerations”) of non-obviousness. I understand that this is known as consideration of the “Graham Factors.”

iii. Hindsight

43. I also understand that one must be cautious and resist the temptation to rely on hindsight reasoning when attempting to combine references to suggest that a claim may be obvious. It is important to analyze validity based on the perspective of one of skilled in the art at the time of the invention, which for this case I have been asked to assume is November 27, 2019, and which I understand is the date Dr. Choi and the Petition use as the priority date of the '011 Patent. I understand that objective indicia (or “secondary considerations”) of non-obviousness or obviousness may be particularly probative and helpful in avoiding hindsight. I have not been asked to analyze any secondary considerations as part of this declaration.

III. LEVEL OF ORDINARY SKILL IN THE ART

44. I understand that Dr. Choi opines that a POSITA in the field of power electronics or battery charging in 2019 would have had a bachelor's degree in electrical engineering or a similar field and 2-3 years of experience in antenna design, wireless charging, and/or contactless wireless communication. I understand that Dr. Choi has further opined that additional education could offset less experience and vice versa, and a POSITA could have also obtained similar knowledge and experience through other means. At this point in time, I have not been asked to provide an opinion on the level of skill; as a result, I have applied the level set forth in Dr. Choi's opinion. My opinions, however, would not be affected if a POSITA is defined as someone who has slightly more or slightly less experience than described above.

45. My analysis and opinions below are given from the perspective of a POSITA in this technological field in the relevant time frame, unless stated otherwise.

46. I satisfied the definition of a POSITA before the filing date of the application leading to the '011 Patent. I consider myself to be an expert in the relevant field of technology for the '011 Patent, and capable of analyzing the prior art and responding to Dr. Choi's opinions from the perspective of a POSITA.

IV. BACKGROUND TECHNOLOGY

47. The asserted prior art and the '011 Patent describe antenna structures, such as magnetic secure transmission (“MST”), Near Field Communication (“NFC”), and wireless power transmission (“WPT”). All three antennas are forms of near-field communication. Near-field antennas are typically designed as small loops or coils that operate in the reactive near-field region, where energy is stored rather than radiated. Unlike conventional far-field antennas that emit propagating electromagnetic waves, these antennas primarily generate localized magnetic fields through alternating current flowing in the conductor. The resulting magnetic flux can couple inductively to nearby devices, making them well-suited for short range communication and sensing applications. The strength and shape of the magnetic field depend on factors such as coil geometry, number of turns, current amplitude, and operating frequency. Because magnetic field strength decays rapidly with distance (approximately proportional to $1/r^3$), these antennas are inherently short-range but offer advantages such as reduced interference, precise spatial coupling, and improved performance near conductive materials. They are commonly used in technologies like RFID (NFC), wireless charging, and magnetic secure transmission of payment information.

48. MST is a near-field magnetic stripe transmission system where a current pulse in an MST antenna creates a magnetic field that can then be sensed by

a magnetic reader. Unlike NFC and WPT, MST is not based on a sinusoidal carrier, it is rather based on changing magnetic field strengths. These changing magnetic field strengths can, for example, mimic the swiping of a physical card with a magnetic strip. *See, e.g.*, U.S. Patent App. Pub. No. 2016/0180120. MST typically³ operates at frequencies of single digit kHz.

49. NFC is a short-range wireless communication technology whose behavior is best understood through its radio-frequency (RF) characteristics rather than through conventional radiative communication models. Operating mostly in the globally available industrial, scientific, and medical (“ISM”) band at 13.56 MHz, NFC occupies a frequency regime where the wavelength (~22 m) is orders of magnitude larger than the physical dimensions of the devices involved. As a result, NFC systems function entirely within the reactive near-field region, where electromagnetic interactions are dominated by quasi-static magnetic fields rather than propagating waves. NFC communications are based on RF communications

³ The '011 Patent states that MST may use a frequency of 85-100 kHz (*see* Ex. 1001, 4:23-27); however, in general, MST systems are understood to operate at frequencies in the single-digit kHz range, and my opinions here reflect that general understanding of a POSITA.

that use modulated sinusoidal signals such as amplitude shift keying to convey information over a wireless link.

50. WPT is a near-field RF-based system that transmits power through near field magnetic coupling of two coils. Using resonance, higher efficiency transmission can be obtained. WPT is based on Faraday's law, which induces a voltage from a time varying magnetic field. WPT uses a sinusoidal waveform to efficiently transfer power. While different WPT systems use a range of frequencies, 10-100s kHz is a typical frequency range for mobile devices, such as cell phones. The "Qi" wireless standard for WPT uses 87-205 kHz and can transmit 5W or more. WPT operates at frequencies at least an order of magnitude (and often two or three orders of magnitude) less than NFC. WPT operates at frequencies that are typically an order of magnitude or more than MST.

51. MST, NFC, and WPT are functionally different systems (i.e., different functional antenna patterns), each defined by different operating parameters, requirements, and antenna functionality. Some structures, such as antenna coils, may be appropriate for use in more than one type of system, but the systems themselves are separate. The asserted prior art does not teach or contemplate a system that operates both as MST and NFC, or as MST and WPT; rather, each system operates independently. If an antenna structure is used for MST it is not simultaneously used for NFC or WPT. Conversely, if that same antenna structure is

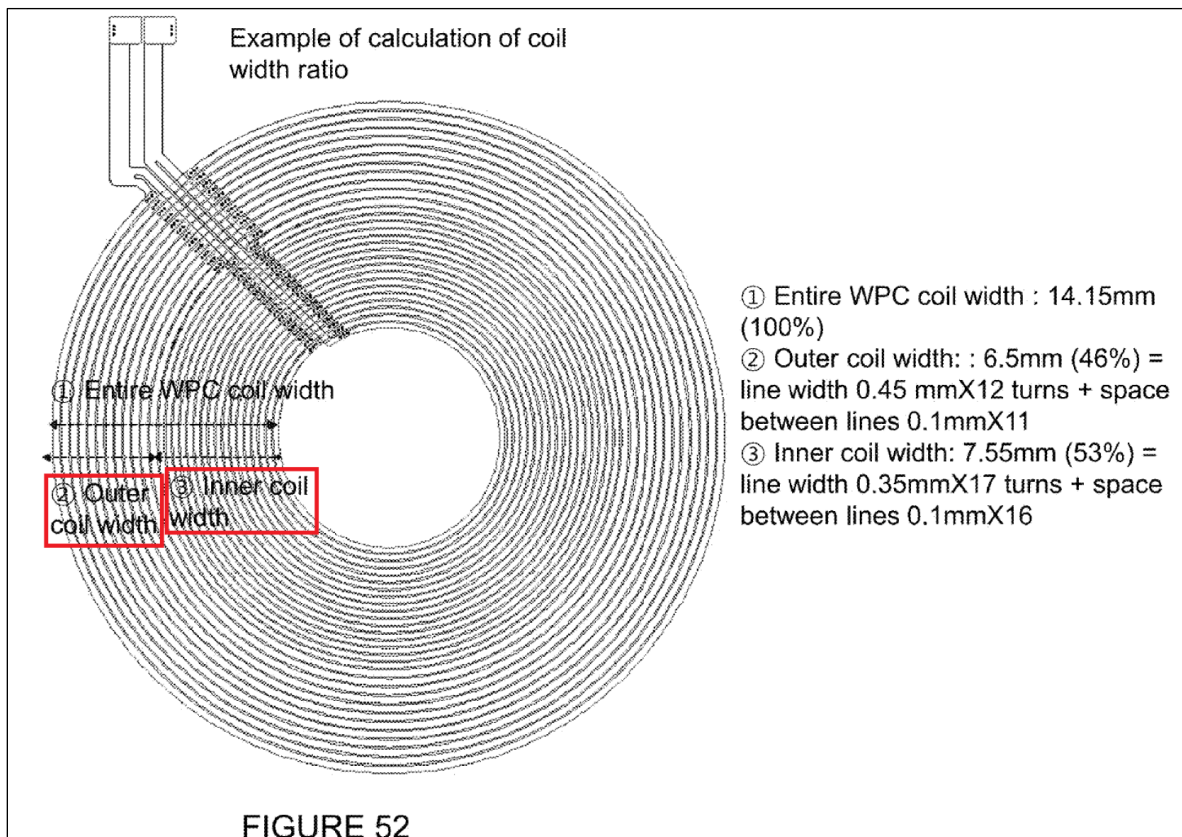
used in a different system for NFC, it is not used for MST or WPT within that same system. In other words, a particular antenna structure is not used for two different functions in the same device, but rather is used to perform only a single function (e.g., one of NFC, MST, or WPT).

52. Finally, while connecting two portions of the same coil in series is a trivial task (simply connecting the inner-most end of any “outer” coil with the outer-most end of an “inner” coil makes a larger coil), connecting an inner and outer coil in parallel is a more complex task, requiring specific geometries on an opposite surface to be accounted for to provide the parallel wiring. Any allegation that selecting parallel versus series is simply a “design choice” is an inappropriate simplification of complex circuit design. I disagree that providing a parallel connection where a previously articulated series connection existed is a matter of “design choice.”

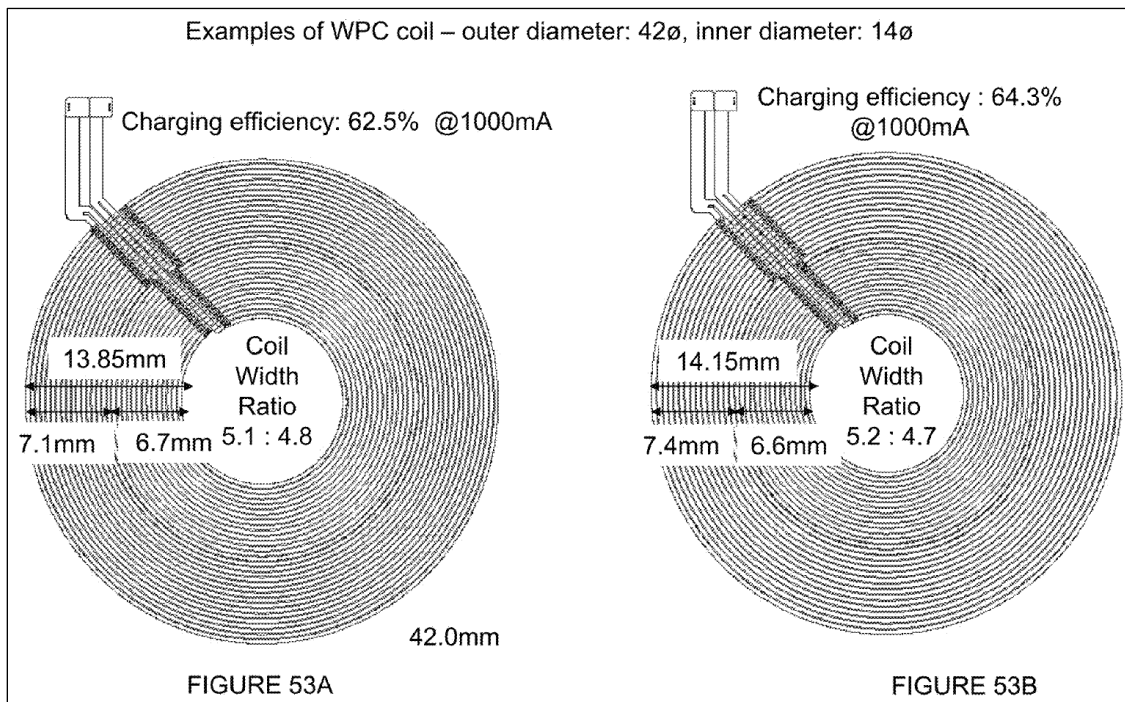
V. SUMMARY OF THE '011 PATENT

53. The '011 Patent relates to a smartphone antenna module having a particular structural antenna architecture for smartphones. Ex. 1001, Abstract. The '011 Patent addresses the competing constraints of charging efficiency, limited form factor, and coexistence with other known near-field antennas. Ex. 1001, 1:22-38, 42:27-33, Fig. 55. To address these problems, the '011 Patent provides an antenna formed on a flexible printed circuit board in which an inner coil and an outer coil are

implemented as two portions of a single functional antenna pattern (e.g., WPC) on a single major surface of the substrate, but more specifically requires that these two coils are electrically connected in parallel. Ex. 1001, 42:13-32, Cl. 1, Figs. 51-55. Importantly, the inner coil and the outer coil are not separate coils or routed on different layers, as shown below in Figure 52, rather they are two portions of the same antenna pattern.

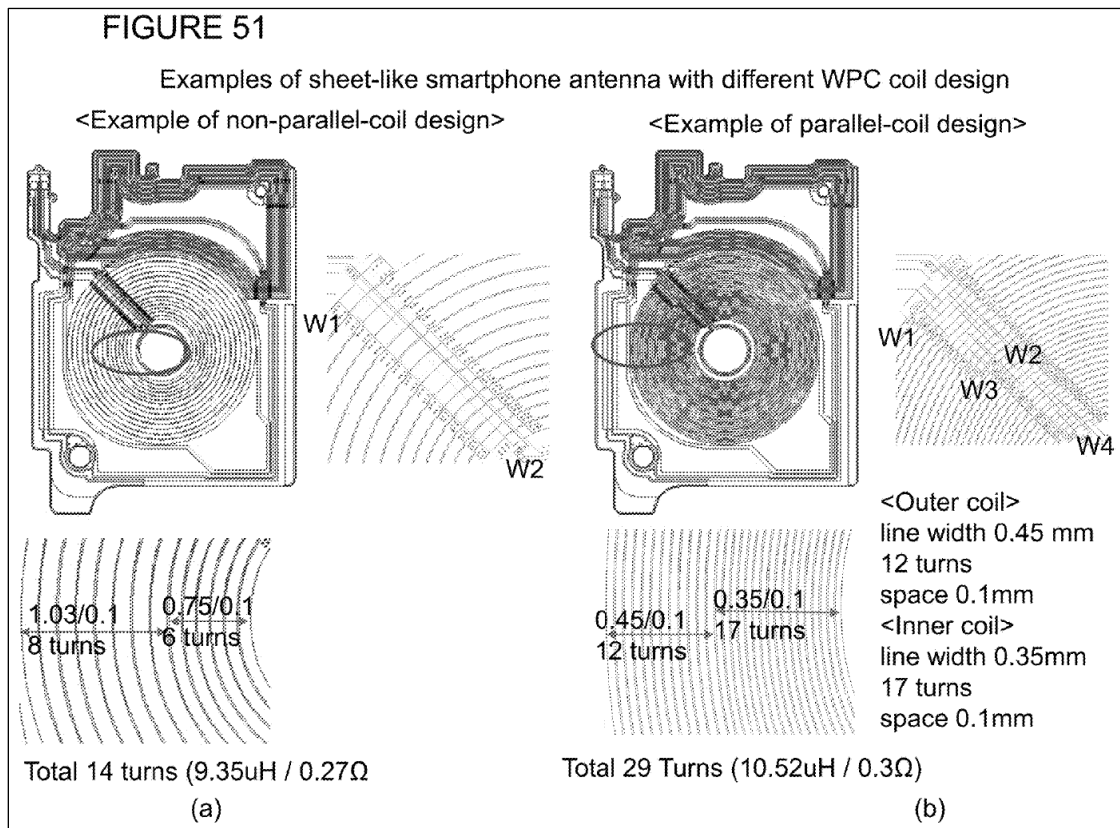


Ex. 1001, Fig. 52 (annotated to indicate outer coil and inner coil).



Ex. 1001, Figs. 53A-53B.

54. The '011 Patent further shows that a high inductance can be achieved even with narrower conductors using the same-surface parallel-coil design, and even higher than a same-surface serial connected structure as considered by the asserted prior art. *See* Ex. 1001, Fig. 51.



Ex. 1001, Fig. 51.

55. By integrating the inner and outer coils into a single same-surface antenna pattern and tailoring their geometry to function as parallel current paths, the '011 Patent discloses and claims a unique, structure-driven solution to wireless charging that departs from prior approaches relying on layer-to-layer parallelization and separate coil structures.

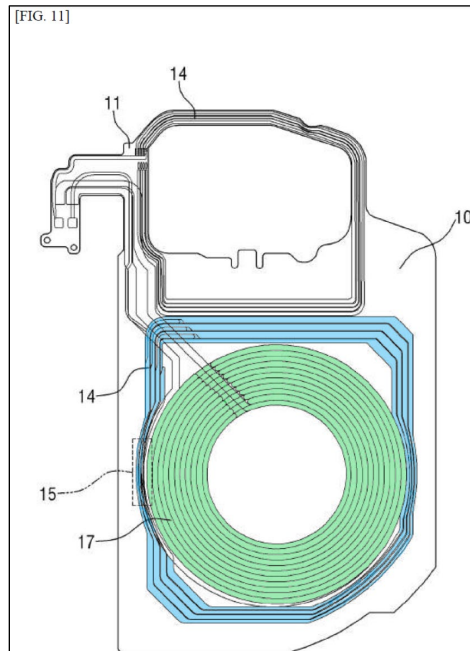
VI. SUMMARY OF THE ART

A. Seong (Exhibit 1006)

56. Seong describes a composite antenna structure. Ex. 1006, ¶ 1. Specifically, the various antenna patterns described by Seong includes “NFC pattern,

an MST pattern, and a WPC pattern are all formed at once on a single substrate.”

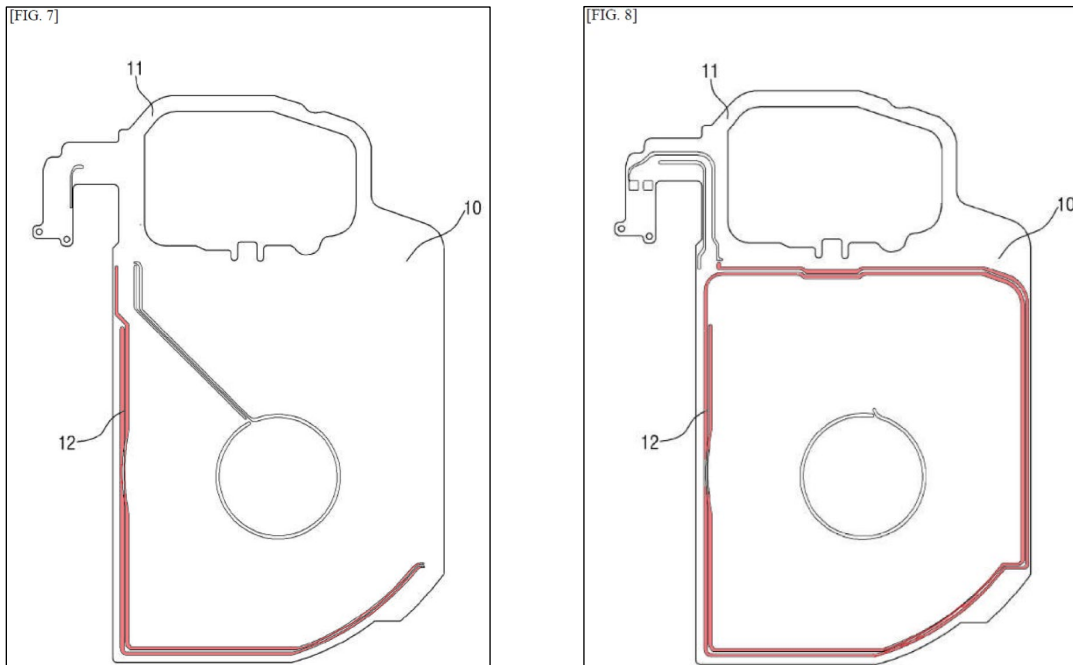
Ex. 1006, ¶ 1. For example, as shown in Figure 11 below, “an MST pattern and a WPC pattern [are] formed on the top surface of the substrate.” Ex. 1006, ¶ 40, Fig. 11.



Ex. 1006, Fig. 11 (MST pattern on top surface of substrate shown in blue; WPC pattern on top surface of substrate shown in green).

57. A stated objective of Seong is to efficiently arrange these different antennas on one substrate while minimizing mutual interference between the distinct antennas and reducing thickness of the overall structure. Ex. 1006, ¶¶ 25-27. Seong does not specify the type of electrical connections between antenna patterns, but consistently describes antennas of the same antenna pattern being formed on opposite sides of a substrate. For example, as shown in Figure 7 below, the “NFC

pattern 12 [is] formed on the top surface of the substrate 10 and FIG. 8 is a drawing showing the NFC pattern 12 formed on the bottom surface thereof.” Ex. 1006, ¶ 64, Figs. 7-8.



Ex. 1006, Fig. 7 (left, NFC pattern formed on top surface of substrate shown in red), Fig. 8 (right, NFC pattern formed on bottom surface of substrate shown in red); *see also* Ex. 1006, ¶ 68, Figs. 9, 10 (illustrating “the MST pattern 14 formed on the top surface of the substrate 10, and FIG. 10 is a drawing showing the MST pattern 14 formed on the bottom surface”).

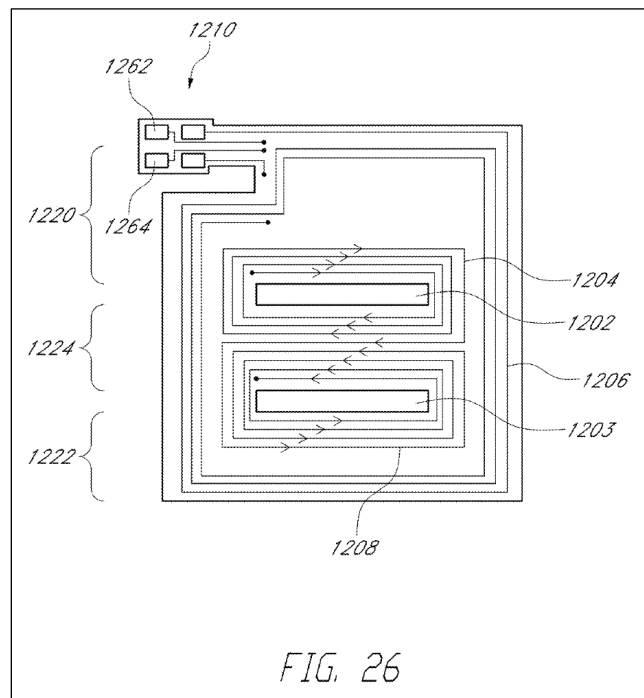
B. Kang (Exhibit 1012)

58. Kang is directed to smartphone antenna modules formed on flexible printed circuit boards that integrate multiple antenna patterns serving distinct functions, such as NFC, MST, and wireless charging, within a compact, layered

structure. Ex. 1012, ¶¶ [0002], [0198]-[0203]. Kang focuses primarily on mechanical layout, magnetic sheet integration, and routing techniques to enable coexistence of multiple antennas within the interior of a smartphone. Ex. 1012, ¶¶ [0198]-[0203].

59. Kang describes antenna modules that include multiple distinct antenna patterns or coils, arranged around through-holes or across multiple PCB surfaces, with magnetic sheets (e.g., ferrite or nanocrystal layers) positioned to guide magnetic flux and reduce interference. Ex. 1012, ¶¶ [0210]-[0211], ¶ [0224], Fig. 26.

60. As shown in Figure 26, the patterns described in Kang are associated with different antenna functions (e.g., NFC (coil B 1206), MST (coil A 1202, coil C 1208), or wireless charging). Ex. 1012, ¶¶ [0003], [0019].



Ex. 1012, Fig. 26.

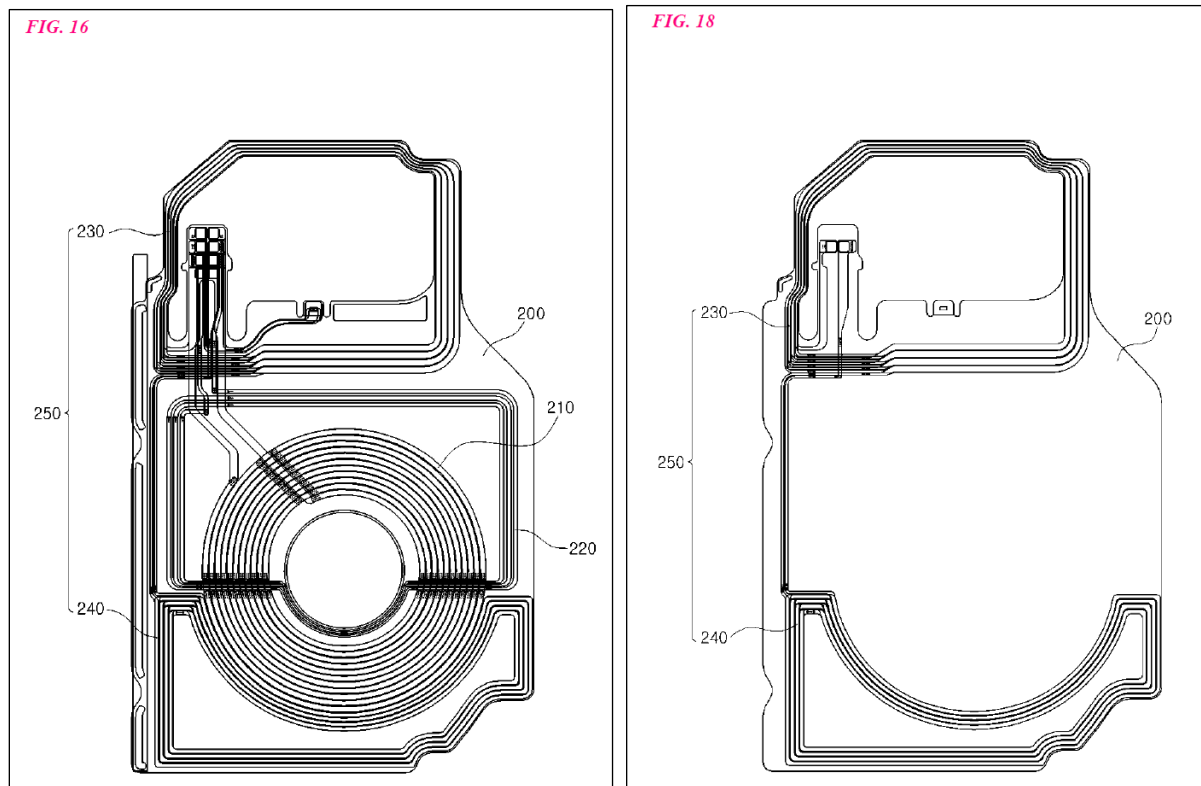
C. Cho (Exhibit 1010)

61. Cho is directed to antenna structures for mobile devices, with an emphasis on arranging multiple antenna patterns on a shared substrate while managing electromagnetic interference and space constraints. Ex. 1010 ¶¶ [0002]-[0003]. Cho focuses on antenna pattern placement, pattern geometry, and the use of magnetic materials to improve antenna performance in compact devices such as smartphones. Ex. 1010 ¶¶ [0004]-[0005].

62. In Cho, different antenna patterns (e.g., NFC or wireless power coils) are implemented as distinct antenna patterns, each designed to serve a particular function and frequency band. Ex. 1010 ¶¶ [0056]-[0057]. Although Cho may describe coils with multiple turns or complex geometries (*see, e.g.*, Ex. 1010, Fig. 4), it does not describe an architecture in which inner and outer coils of a single antenna pattern are intentionally electrically connected in parallel to function as parallel current paths. Instead, Cho reflects a design approach in which antenna functionality is preserved through separation and layout control, rather than through electrical connection of coil portions within one antenna pattern. Ex. 1010, ¶¶ [0053]-[0056], [0072].

63. As shown below, Figure 16 of Cho depicts a wireless communication device including multiple wireless communication coils, including a “second

wireless communication coil.” Ex. 1010, Fig. 16. Figure 18 is a drawing illustrating that second wireless communication coil shown in Figure 16. Ex. 1010, ¶ [0089]. As shown in Figure 18, the second wireless communication coil comprises a first coil portion and a second coil portion that are spatially separated. Ex. 1010, Fig. 18. In sum, and at most, Cho discloses putting two separate communication patterns in parallel connection.



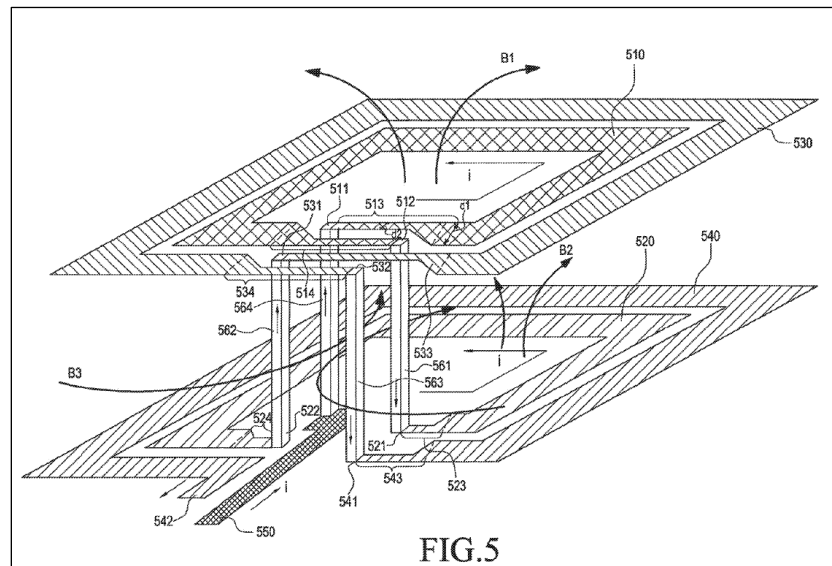
Ex. 1010, ¶¶ [0089]-[0090], Figs. 16 (left), 18 (right).

D. 721Lee (Ex. 1011)

64. 721Lee describes electronic devices that include multi-layer coil structures designed to increase inductance and magnetic field strength for magnetic

secure transmission (i.e., MST) and, in some embodiments, wireless charging and NFC. Ex. 1011, ¶¶ [0005]-[0011]. 721Lee focuses on a “spiral type coil” architecture in which multiple coils disposed on different layers (e.g., first and second layers, or first through third layers) are electrically connected in series via vertical conductors (via sets). Ex. 1011, ¶¶ [011]-[0013], [0108]-[0121].

65. As shown in Figure 5 below, 721Lee discloses a parallel connection on two sides of a substrate.

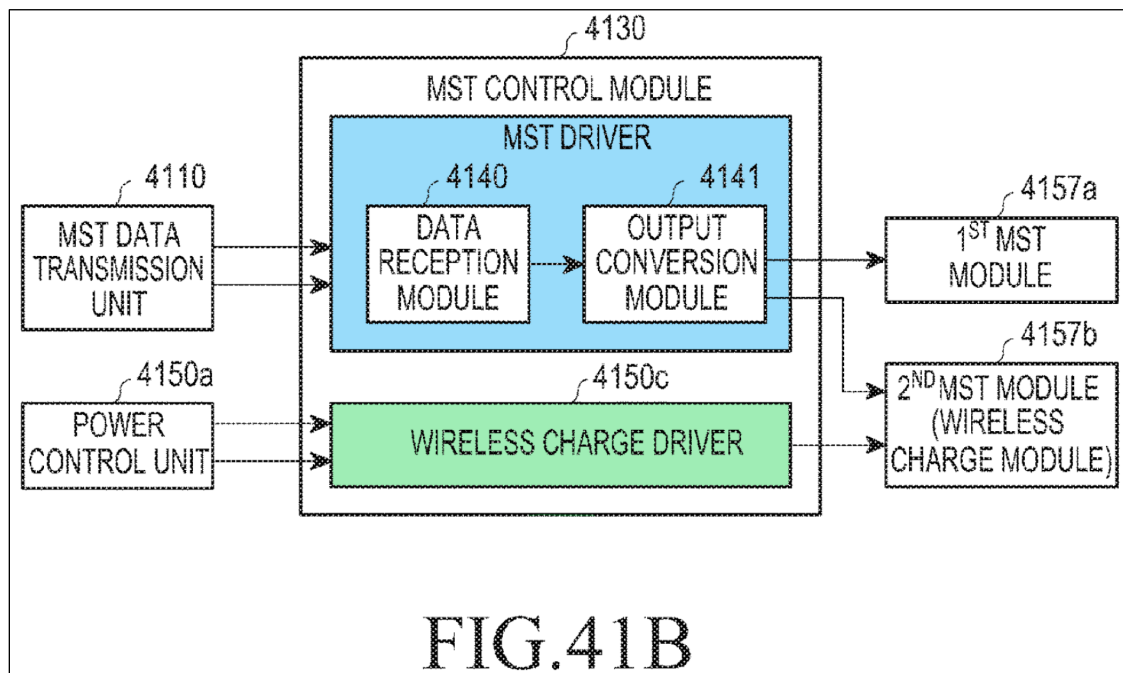


Ex. 1011, Fig. 5.

E. 005Lee (Ex. 1008)

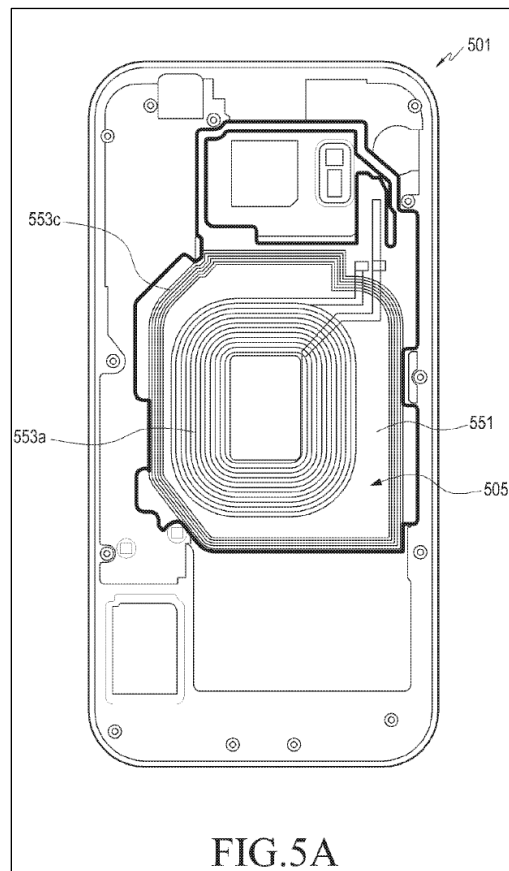
66. 005Lee describes electronic devices that include conductive coil structures configured to generate controlled magnetic fields for MST, NFC communication, and wireless charging. Ex. 1008, 1:51-67. 005Lee also discloses that the distinct coils may be arranged as separate conductive patterns disposed on a

flexible printed circuit board or within a device housing, and that the coils are selectively driven by separate control circuitry (e.g., an MST driver and wireless charge driver) to transmit transaction data and wireless power, respectively. Ex. 1008, Figs. 5A, 5B, 41B (annotated below).



Ex. 1008, Fig. 41B (annotated to indicate MST driver in blue and wireless charge driver in green).

67. As shown in Figure 5A below, 005Lee depicts multiple different conductive coil patterns of differing size and geometry arranged on a substrate. Ex. 1008, 16:60-17:23, 17:29-31, Fig. 5A, 5B.



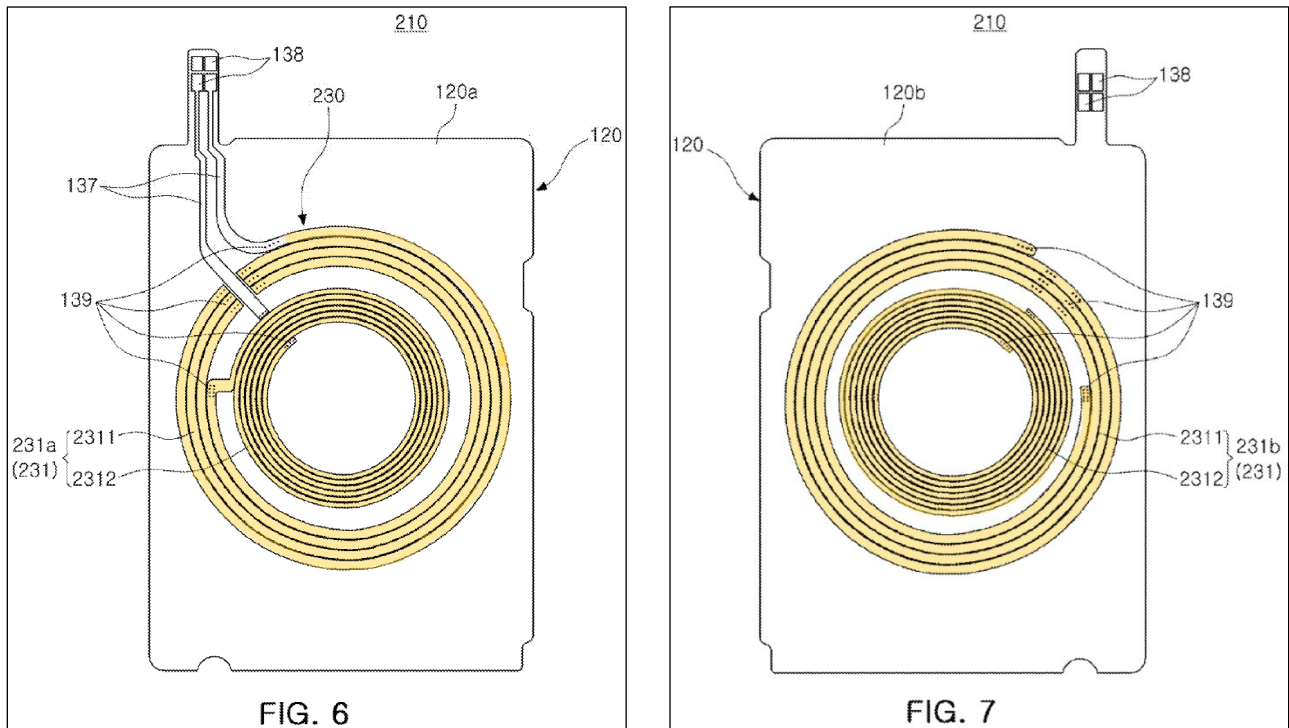
Ex. 1008, Figs. 5A-5B.

F. Ahn (Exhibit 1007)

68. Ahn describes antenna patterns formed on substrates, including spiral coil antennas used in wireless communication and wireless power applications. Ex. 1007, ¶¶ [0003]-[0004]. Ahn focuses on antenna pattern geometry, trace width variation, and layer arrangement to improve performance characteristics such as efficiency and signal quality. *See, e.g.*, Ex. 1007, ¶¶ [0004], [0006]-[0011].

69. As shown in Figures 6 and 7 below, Ahn describes that “a coil wiring 230 of the coil assembly 210, a second section 2312 of the first spiral wiring 231a

formed on the first surface 120a of the substrate 120 and a second section 2312 of the spiral wiring 231b formed on the second surface 120b of the substrate 120 may be connected to each other in series.” Ex. 1007, ¶ [0107].



Ex. 1007, Figs. 6 (left, spiral wiring 231a (yellow) on front surface 120a of substrate 120), 7 (right, spiral wiring 231b (yellow) on second surface 120b of substrate 120).

70. Ahn also discloses embodiments in which multiple distinct spiral wirings are disposed on different surfaces or layers of a substrate, and it discusses that such wirings may be electrically connected in series or in parallel. Ex. 1007, Figs., 8, 9.

71. These disclosures are directed to layer-to-layer or surface-to-surface configurations, where coils on opposite sides of a substrate are connected through interlayer conductors or vias. Ex. 1007, ¶¶ [0113], [0120].

72. In describing spiral wirings with inner and outer portions, Ahn focuses on geometric characteristics (such as varying line widths or turn density) and on routing strategies across layers. Ahn's spiral wirings do not include, and Ahn does not otherwise disclose, inner and outer portions of a single same-surface antenna pattern that are electrically connected in parallel as distinct coil elements.

73. Accordingly, Ahn's approach to antenna design relies on multi-layer implementations and interlayer connections, rather than on parallel electrical connections between inner and outer coils formed on the same surface.

VII. SUMMARY OF OPINIONS

74. I understand that Dr. Choi advances Grounds 1 to 3 and in them alleges that Claims 1-6 of the '011 Patent are obvious. I disagree with Dr. Choi.

75. In Ground 1, Dr. Choi opines that Claims 1-6 of the '011 Patent are obvious over the combination of Seong, Kang, and Cho. It is my opinion that Ground 1 fails to render the Challenged Claims obvious. None of the cited references, Seong, Kang, or Cho, teach or disclose any inner coil and outer coil being electrically connected in parallel as required by Claim 1. Further, Dr. Choi has not

established a motivation to combine Seong, Kang, and Cho to arrive at the claimed coil structure.

76. In Ground 2, Dr. Choi opines that dependent Claims 1-6 are obvious over the combination of Ahn and 721Lee. It is my opinion that Ground 2 fails to render the Challenged Claims obvious. Neither of the cited references, Ahn or 721Lee, teach or disclose an inner coil and outer coil being electrically connected in parallel as required by Claim 1. Further, Dr. Choi has not established a motivation to combine Ahn and 721Lee to arrive at the claimed coil structure.

77. In Ground 3, Dr. Choi opines that Claims 1-6 are obvious over a combination of 005Lee, Seong, and Cho. It is my opinion that Ground 3 fails to render the Challenged Claims obvious. None of the cited references, 005Lee, Seong, and Cho, teach or disclose an inner coil and outer coil being electrically connected in parallel as required by Claim 1. Further, Dr. Choi has not established a motivation to combine 005Lee, Seong, and Cho to arrive at the claimed coil structure.

VIII. OPINIONS

A. Ground 1: Dr. Choi Fails to Establish that the Combination of Seong, Kang, Cho Renders Obvious Claims 1-6

78. Dr. Choi opines that Claims 1-6 of the '011 Patent are obvious over the combination of Seong, Kang, and Cho. I disagree with Dr. Choi's opinion at least for the reasons set forth below.

79. First, Dr. Choi’s proposed modification of Seong in view of Kang and Cho fails to render obvious Claim 1 because it does not teach or suggest claim element 1[n], which requires “a first antenna pattern formed on the first major surface and comprising an inner coil formed on the first inner ring portion and an outer coil on the first outer ring portion” where “the inner coil and the outer coil are electrically connected in parallel” Ex. 1001, Claim 1; *see* Section VIII.A.I.

80. Second, Dr. Choi fails to establish that a POSITA would have been motivated to modify Seong in view of Kang to achieve the claims of the ’011 Patent. Dr. Choi does not attempt to explain why a POSITA would have been motivated to electrically connect the same antenna patterns in parallel (as required by Claim 1), but only asserts that “a POSA would have been motivated to electrically connect Seong’s WPC and MST patterns in parallel.” Ex. 1002, ¶ 94. Indeed, a POSITA would not have been motivated to modify Seong in view of Kang as proposed, because, at least in part, Kang discloses parallel electrical connections of different types of antennas, and is agnostic to parallel connections of antennas that are of the *same* antenna pattern. *See* Section VIII.A.II.

i. Ground 1 fails to render obvious claim element 1[n]

- a. The primary reference, Seong, does not disclose “the inner coil and the outer coil are electrically connected in parallel.”

81. As a threshold matter, Dr. Choi’s analysis appears to be based on an incorrect reading of Claim 1: Dr. Choi improperly reads Claim limitation 1[n] in isolation from the remainder of Claim 1’s limitations. Claim 1 requires “a first antenna pattern formed on the first major surface and comprising an inner coil formed on the first inner ring portion and an outer coil on the first outer ring portion” (Claim 1[d]). A proper reading of Claim 1 requires that the inner coil (of the first antenna pattern recited in Claim 1[d]) and the outer coil (of the first antenna pattern recited in Claim 1[d]) are electrically connected in parallel (Claim 1[n]). Ex. 1001, Claim 1. Claim 1 does not merely require that any two coils of any type of antenna patterns are electrically connected in parallel; rather Claim 1 requires that two coils, an inner and outer coil, of the same antenna pattern, on the same surface, are electrically connected in parallel. Dr. Choi’s interpretation of Claim 1 to the contrary renders his analysis incorrect.

82. Because of Dr. Choi’s misinterpretation of Claim 1, Dr. Choi incorrectly identifies two distinct coil patterns disclosed in Seong: the MST and WPC patterns. These are not two patterns of the same functional coil; they are antenna patterns of distinct and separate functional circuits (MST and WPC). Dr.

Choi ignores that in doing so, Seong's functionality is reduced—as the proposed antenna pattern cannot serve as both the WPC and MST pattern, as those are different systems, operating at different frequencies, with different protocols. Despite Dr. Choi's focus on separate and functionally distinct coil patterns (MST and WPC), I agree with Dr. Choi's conclusion that Seong does not disclose how coils are electrically connected.

83. Claim element 1[n] requires “wherein the inner coil and the outer coil are electrically connected in parallel” Ex. 1001, Claim 1. Dr. Choi does not identify any disclosure in Seong supporting that the inner coil and outer coil are electrically connected in parallel. Ex. 1002, ¶ 162. Rather, as Dr. Choi admits “Seong does not, however, teach how the MST and WPC patterns are electrically connected[,]” much less how the inner coil and the outer coil of the *same antenna pattern* are electrically connected in parallel. Ex. 1002, ¶ 162. Notably, Seong does not disclose that the MST and WPC patterns are connected at all. In this regard, not only does Seong not disclose how they are connected (as Dr. Choi confirms), but Seong does not even teach that they are connected at all.

84. Specifically, it is my opinion that Seong does not disclose an inner coil and an outer coil of the same antenna pattern, nor does Seong disclose the claimed parallel electrical connection between such coils that are part of a single antenna

structure. And Dr. Choi identifies no other disclosure that remedies Seong's deficiencies.

- b. Kang does not disclose "wherein the inner coil and the outer coil are electrically connected in parallel."

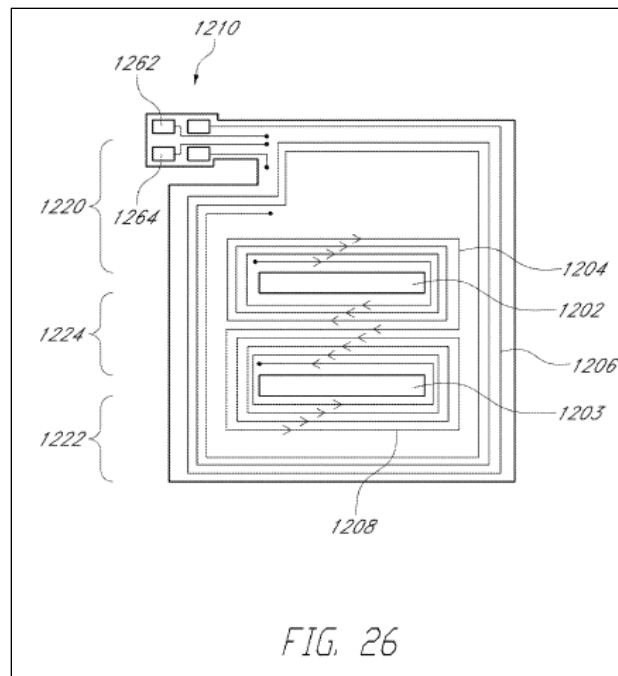
85. Dr. Choi relies on Kang for "teach[ing] electrically connecting inner and outer coils in parallel" and concludes that "[i]t would have been obvious to electrically connect Seong's WPC and MST patterns in parallel in view of Kang. Ex. 1002, ¶ 162. I disagree with Dr. Choi.

86. As discussed above, Dr. Choi's analysis is premised on a misunderstanding of Claim 1. Even if a POSITA would have found it obvious to electrically connect Seong's WPC and MST patterns in parallel based on Kang's disclosure (and I disagree that a POSITA would have that understanding), his proposed combination still does not render obvious Claim 1, which requires that the inner and outer coils of the *same* antenna pattern are electrically connected in parallel. These two patterns that Dr. Choi relies on, WPC and MST, are two distinct functional antenna patterns.

87. Kang does not teach, and Dr. Choi does not rely on Kang for teaching, inner and outer coils of a single functional antenna pattern connected in any way. Accordingly, Dr. Choi's analysis confirms that such disclosure does not exist in any

reference relied upon by Dr. Choi, as I understand it is Petitioner's burden to identify this teaching in the prior art it relies on.

88. But, even with a proper reading of Claim 1, Kang does not disclose the claimed inner and outer coils of a single antenna pattern electrically connected in parallel. Instead, while Kang may describe different functional antenna patterns on the same substrate surface, it does not teach connection of different functional types. For example, as shown below, Fig. 26 depicts coil A (1204), coil B (1206), and coil C (1208).



Ex. 1012, Fig. 26; *id.* ¶ 218. Kang also describes that coil A (1204) and coil C (1208), which are of the same functional type yet located adjacent to one another,

and do not comprise an inner and outer coil, can be connected in series. Ex. 1012, ¶ [0237].

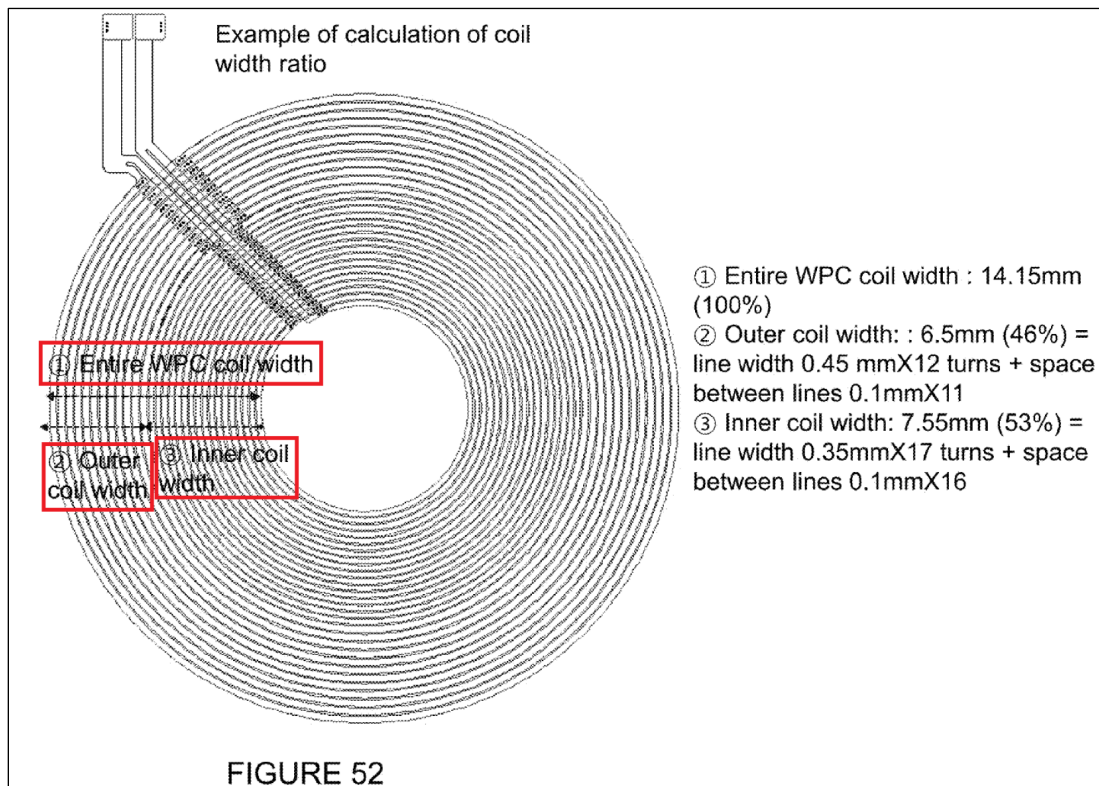
89. Kang also describes how “[i]n embodiments shown in FIGS. 28 and 21, coil A 1204, coil C 1208 and coil D 1210 are electrically connected to each other in series.” Ex. 1012, ¶ [0231]. Although *Kang* explains that “to provide a proper length of antennas, the connections may be modified to parallel connections,” (Ex. 1012, ¶ [0236]), this is referring to the connections between coils A and C (two different *adjacent* functional patterns) or coils B and E (two other different *adjacent* functional patterns), respectively. *See id.* ¶ [0237] (“For example, coil A and coil C [adjacent coils] may be connected to each other in parallel as shown in FIG. 24B. Coil A and coil D [coils on opposite surfaces of a substrate] may be connected to each other in parallel. Similarly, coil B and coil E [adjacent coils] may be connected to each other in parallel. Coil B and coil F [coils stacked atop each other] may be connected to each other in parallel.”). The parallel connections described in Kang are not parallel connections between any inner and outer coil of the same antenna pattern on the same surface. Rather, the parallel connections described in Kang are limited to connections between different antenna patterns, or connections that do not have an inner coil and outer coil configuration.

90. Dr. Choi indiscriminately relies on the word “parallel” in Kang to conclude that it would have been obvious to modify Seong in view of the above-

mentioned specific teachings of Kang. But Kang is inapplicable to the claimed coil structure because Kang does not disclose an inner coil and an outer coil (of the same functional antenna pattern on the same surface) that are electrically connected in parallel, rather Kang merely teaches the existence of parallel wiring.

91. Not only does Kang fail to disclose the claimed structure, but Kang cannot provide the motivation to modify Seong. Seong does not disclose that two different functional antenna patterns (MST and WPC) are connected at all, let alone how the MST and WPC patterns are connected. Claim 1 is not directed to electrically connecting different antenna patterns (e.g., MST and WPC coils). Instead, Claim 1 requires that an inner coil and an outer coil of an antenna pattern formed on the same major surface are electrically connected in parallel. Dr. Choi's short analysis of Claim 1[n] ignores this critical distinction, and he proceeds as though Claim 1 is satisfied by electrically connecting different antenna patterns (i.e., MST and WPC coils) regardless of whether they are of the same antenna pattern. Ex. 1002, ¶ 162.

92. The '011 Patent is clear that the claimed "inner coil" and "outer coil" refer to two portions of the same type of antenna pattern formed (i.e., inner WPC coil and outer WPC coil) on the same surface. Ex. 1001, Fig. 52. For example, the relevant inner coil and outer coil comprise the "Entire *WPC* coil" as shown below in Figure 52. Ex. 1001, Fig. 52 (emphasis added).



Ex. 1001, Fig. 52 (annotated).

93. The '011 Patent consistently describes the inner coil and outer coil as two components of a WPC coil that are electrically connected in parallel. *See, e.g.*, Ex. 1001, Figs. 51, 52, 53A-53C. But, even if the coils are not confined to the same exact type of antenna, it is undeniable that they are of the same antenna pattern. Ex. 1001, Cl. 1 (“a first antenna pattern formed on the first major surface and comprising an inner coil formed on the first inner ring portion and an outer coil on the first outer ring portion”). Dr. Choi does not even suggest that the MST and WPC coils of Seong are of the same pattern (they are not).

94. As discussed above, Kang does not supply this missing structure. Kang's references to coils that may be connected in series or parallel are generic and untethered to the particular claimed coil geometry, let alone the specific geometry required by Claim 1. As a result, a POSITA would not have been motivated to connect Seong's MST and WPC coils in parallel in view of Kang's generic parallel connection disclosure, much less to modify Seong's distinct MST and WPC coils into an inner coil and outer coil of the same antenna pattern as required by Claim 1. Doing so would render one functionality (i.e., MST or WPC) inoperable. In addition, there is simply no evidence advanced by Dr. Choi, nor in Kang and/or Seong, that connecting the two functional antenna patterns he identifies, MST and WPC, would be possible, desired, or would provide any benefit.

95. Thus, it is my opinion that a POSITA would not have understood Seong and Kang as disclosing an antenna module wherein the inner coil and the outer coil are electrically connected in parallel.

96. For the reasons discussed above, I disagree with Dr. Choi's opinions.

ii. A POSITA would not have been motivated to combine Seong, Kang, and Cho

a. Dr. Choi does not establish that a POSITA would have been motivated to modify Seong in view of Kang

97. Dr. Choi opines that Seong as modified by Kang would have been a combination obvious to a POSITA. Ex. 1002, ¶¶ 89, 162. I disagree with Dr. Choi's opinion.

98. Dr. Choi asserts that a POSITA would have been motivated to combine Seong, Kang, and Cho because they each relate to antenna modules in smartphones and share a general goal of space efficiency. Ex. 1002, ¶ 89. Dr. Choi further asserts that a POSITA would have understood that "parallel connections may be more secure, and thus preferable for high-security, close-distance transactions, such as NFC payment transactions." Ex. 1002, ¶ 94. I disagree. Dr. Choi cites to no evidence supporting his assertion that parallel connections may be more secure. He identifies no portion of Cho or any other asserted prior art reference to suggest that the alleged benefit would have motivated a POSITA to combine Seong, Kang, and Cho in the manner proposed (indeed, among the references Dr. Choi discusses, only the '011 Patent provided this specific parallel electrical connection between an inner and outer coil located on the same surface of a substrate). This is because his assertion is not supported by disclosure in the asserted prior art.

99. As an initial matter, there is simply no evidence advanced by Dr. Choi that connecting the two antenna patterns he identifies, MST and WPC would be possible, desired, or would provide any benefit. The alleged “improvements” he identifies (Ex. 1002, ¶ 94) have absolutely nothing to do with the connection of the two distinct antenna types he attempts to connect. Secure transmission is not mentioned in Seong, Kang, or Cho and combining MST and WPC would not increase any security of transmission. In addition, Dr. Choi’s opinion that benefits of improved performance would be obtained is merely a conclusory statement. Dr. Choi states, “Operating the two coils in parallel offers improved flexibility and performance, for example, by providing a larger active area over which to perform wireless charging and/or to improve coil efficiency by reducing parasitic series resistance in a parallel combined coil”; however, Dr. Choi provides no analysis or citation to support this, nor how this purported benefit is tied to the teachings of Seong, Kang, or Cho.

100. For example, MST and WPC operate under different physical constructs (*see supra* Section IV). MST uses a pulse driven current in a coil to create magnetic fields that mimic a magnetic stripe on a credit card, for example. In contrast, WPC uses a continuous sinusoidal signal to induce a voltage in a proximately located coil through Faraday’s law to transfer power. A POSITA would understand that WPC uses resonance to create efficient power transfer, which is only

possible in a continuous sinusoidal based system. Resonance would be counterproductive to MST, as it operates on a pulse based function. Introducing resonance into an MST system would disturb the pulse sequence that MST seeks to create.

101. MST and WPC also impose fundamentally different antenna tuning and impedance requirements. MST generates a magnetic field through pulses that is only sensed by a near-field reader. WPC, on the other hand, must deliver power efficiently to power external devices. This requires WPC to generate larger magnetic fields that couple to external devices efficiently.

102. Finally, MST and WPC serve decidedly different functions. For example, WPC delivers power, while MST delivers information for financial transactions.

103. In my opinion, Dr. Choi's reasoning does not articulate a motivation to arrive at the claimed antenna architecture. It assumes that a POSITA would select an abstract electrical configuration (i.e., a "parallel" connection) and apply it wholesale to different functional antenna patterns. This argument is akin to saying a circuit has electrical connections, and an electrical connection is known, so all circuits are therefore rendered obvious. In fact, a POSITA would understand that it is the *way* circuits are configured, connected, and structured that yields the desired function and performance.

104. Dr. Choi does not address two critical aspects of Claim 1. First, the claim requires that the inner and outer coils are portions of a single antenna pattern, not coils belonging to separate antenna systems. Second, the '011 patent makes clear that the “inner coil” and “outer coil” are portions of the same antenna pattern (e.g., an entire WPC coil) rather than separate antennas repurposed or electrically combined after the fact. *See, e.g.*, Ex. 1001, Claim 1, Fig. 52. As a result, I disagree that a POSITA would have been motivated to connect the two electrically isolated coils of *Seong*, let alone connect those two coils in parallel.

B. Ground 2: Dr. Choi Fails to Establish that the Combination of Ahn and 721Lee Renders Obvious Claims 1-6

i. Ground 2 fails to render obvious claim element 1[n]

- a. The primary reference, Ahn, does not disclose “the inner coil and the outer coil are electrically connected in parallel.”

105. Dr. Choi opines that Claims 1-6 of the '011 Patent are obvious over 721Lee and Ahn. I disagree with Dr. Choi's opinion.

106. As discussed above with respect to Ground 1, the '011 Patent requires an inner coil and an outer coil that are formed as part of a single antenna pattern on the same substrate surface, and the inner and outer coils are electrically connected in parallel. Ex. 1001, Claim 1. Dr. Choi concedes that Ahn discloses “first and second spiral wirings disposed *on opposite surfaces of the substrate* in parallel.” Ex. 1002, ¶ 251.

107. Because of Ahn’s fundamental differences in design, Ahn does not disclose an inner coil and an outer coil that are electrically connected in parallel as required by claim 1[n], let alone such coils formed as part of a single antenna pattern on the same “first major surface” of a substrate as required by Claim 1. *See* Ex. 1001, Cl. 1. While Ahn discloses that the first and second spiral wirings may be connected to each other in series or in parallel, this still does not meet the claimed limitation.

108. Ahn’s “series” or “parallel” language concerns a different relationship entirely: Ahn describes first and second spiral wirings disposed on *opposite surfaces of the substrate* (Ex. 1007, ¶ [0071]) and electrically connected through interlayer conductors (Ex. 1007, ¶¶ [0071]-[0074]), noting that these opposing-surface spirals may be treated as disposed “in parallel with each other on the opposite surfaces of the substrate 120, respectively” (i.e., layered conductors). Ex. 1007, ¶ [0074].

109. Ahn also explains that the spiral wirings include a first section forming an outer portion and a second section forming an inner portion, with different line widths, and then states: “the spiral wirings ... may include two wirings having different widths and connected to each other in *series*.” Ex. 1007, ¶¶ [0076]-[0077]. That disclosure is incompatible with Dr. Choi’s attempt to treat Claim 1[n] as satisfied by Ahn’s generic mention of “parallel.”

110. It is my opinion that Ahn does not disclose an inner coil and an outer coil of the same antenna pattern, nor does it disclose any parallel electrical connection between such inner and outer coils of a single antenna structure on a first surface of a substrate.

- b. 721Lee does not disclose “wherein the inner coil and the outer coil are electrically connected in parallel.”

111. Dr. Choi points to 721Lee’s generic disclosure that “two coils ... may be connected in parallel” (Ex. 1002, ¶ 253) to assert that “a POSA reading Ahn and 721Lee would have understood electrically connecting coils in series or in parallel was a design choice and would have been motivated to try connecting Ahn’s inner and outer coils in parallel.” Ex. 1002, ¶ 254. I disagree with Dr. Choi and again believe this is an oversimplification of the claims of the ’011 Patent.

112. 721Lee’s generic “parallel” disclosure relates to multi-layer coil structures connected through vias (i.e., connecting coils on different layers in parallel). Ex. 1011, ¶ [0152]. Specifically, 721Lee explains that “[a] coil 1220 with 2 turns may be disposed on a second layer (2-layer), and the two coils 1210 and 1220 may be connected in parallel. Such a structure may be named a parallel type coil.” Ex. 1011, ¶ [0152]. The parallel type coil described in 721Lee falls short of disclosing the parallel electrical connection required by Claim 1 because 721Lee

only described the parallel electrical connection between coils on separate layers, not two coils of the same antenna pattern on the same surface.

113. Moreover, 721Lee is directed to increasing inductance and strengthening magnetic fields for MST wireless charging in a limited area by using coils on *multiple surfaces*. Ex. 1011, ¶¶ [0011]-[0014], [0154]-[0159]. 721Lee teaches a “spiral” structure formed on two or more separate layers to achieve a higher recognition success rate. This “spiral” structure is shown to be better performing than a series connection between two coils on different layers or a parallel connection between two coils on different layers. Ex. 1011, ¶¶ [0154]-[0159], Tables 1 and 2, Fig. 13. Fundamentally, 721Lee is a different design direction than the claimed requirement that the inner coil and outer coil are electrically connected in parallel within Claim 1’s first antenna pattern on the same surface. Where 721Lee mentions parallel connections in other contexts (e.g., “sub coils” connected in parallel), those discussions again relate to sub-coils buried *between* layers and reliant on via connections, not the claimed inner/outer parallel configuration. Ex. 1011, ¶ [0134]. Accordingly, 721Lee does not remedy the deficiencies of Ahn. 721Lee, at most, describes parallel connections between coils on different layers, and 721Lee even identifies why general parallel coupling can lead to lower performance than “spiral” or series structures (Ex. 1011, ¶¶ [0154]-[0159], Tables 1 and 2, Fig. 13.),

which suggests one would not have been motivated to use this “parallel” disclosure that 721Lee discourages.

114. Therefore, 721Lee does not disclose the claimed inner coil and outer coil in parallel electrical connection as required by Claim 1.

- ii. A POSITA would not have been motivated to combine Ahn and 721Lee
 - i. The Petition fails to articulate why a POSA would select and combine the cited teachings to arrive at the claimed architecture

115. Dr. Choi opines that Ahn as modified by 721Lee would have been a combination obvious to a POSITA. Ex. 1002, ¶ 254. I disagree with Dr. Choi’s opinion.

116. Dr. Choi asserts that a POSITA would have been motivated to combine Ahn and 721Lee because each relate to the general goal of space efficiency (*see, e.g.,* Ex. 1002, ¶ 182), and because “electrically connecting coils in series or in parallel was a design choice.” Ex. 1002, ¶ 89. This fails on the surface because all electrical circuits consist of either series or parallel connection, but clearly not every circuit is rendered obvious by the fact that a POSITA knows that series and parallel electrical connections are possible.

117. Dr. Choi explains that “[b]oth references teach antenna patterns on both sides of a substrate in a smartphone, including WPC, NFC, and MST antennas.” Ex.

1002, ¶ 182. But Dr. Choi’s explanation is insufficient because Claim 1 requires a parallel electrical connection between the same antenna patterns formed on the same surface of a substrate. Ex. 1001, Claim 1. Specifically, Claim 1 requires a specific, claimed architecture: a first antenna pattern formed on the first major surface and comprising an inner coil formed on the first inner ring portion and an outer coil on the first outer ring portion” (Claim 1[d]) “wherein the inner coil and the outer coil are electrically connected in parallel” (Claim 1[n]). Ex. 1001, Cl. 1. The claim also requires a second antenna pattern formed on the second major surface, the second antenna pattern being an NFC antenna pattern. This multi-faceted structure provides for unique benefits, and hurdles that must be accommodated.

118. Ahn’s technical contribution is to optimize loss and efficiency by varying trace widths between inner and outer portions of a spiral and managing routing/lead wires through disconnected regions, not by teaching that inner/outer portions should be paralleled. Ex. 1007, ¶¶ [0076]-[0083], [0093]-[0100], [0072]-[0074]. 721Lee’s technical contribution relates to multi-layer coil structures and via-set arrangements to increase inductance and field strength, not on an inner coil and outer coil of a single antenna pattern being electrically connected in parallel. Ex. 1011, ¶¶ [0011]-[0014], [0154]-[0156].

119. Because Dr. Choi does not articulate anything, other than the existence of parallel connections, that would motivate the proposed modifications to Ahn’s

structure, I disagree with Dr. Choi that a POSITA would have been motivated to modify Ahn in view of 721Lee. 721Lee discourages the use of parallel and serial connections, and proposes a novel “spiral” configuration. Dr. Choi errs in his citation of 721Lee in providing a motivation. Dr. Choi admits that 721Lee teaches that the parallel connection is the worst performing: “721Lee teaches antennas coils electrically connected in parallel have a lower recognition rate at higher distances than antennas with coils that are electrically connected in series....” Ex. 1002, ¶ 254. Dr. Choi attempts to import a generic benefit associated with this performance that mirrors the alleged “benefit” he proposes for all his theories of unpatentability: “parallel connected coils may be more secure, and thus preferable for high-security applications, including NFC and payment transactions.” Ex. 1002, ¶ [254]. 721Lee does not disclose any aspect of higher security, and Dr. Choi does not perform any analysis or provide any citations to support this purported security benefit.

120. Even if a POSITA would have been motivated to make such a modification, Dr. Choi’s proposed combination does not teach the inner coil and outer coil electrically connected in parallel as required by Claim 1.

C. **Ground 3: Dr. Choi Fails to Establish that the Combination of 005Lee, Seong, and Cho Renders Obvious Claims 1-6**

i. **Ground 3 fails to render obvious claim element 1[n]**

121. Dr. Choi opines that Claims 1-6 of the '011 Patent are obvious over the combination of 005Lee, Seong, and Cho. Ex. 1002, ¶¶ 182. I disagree with Dr. Choi's opinion.

122. For his analysis of claim limitation 1[n], Dr. Choi cross-references his motivation to combine analysis, and then introduces Cho as allegedly teaching an inner and outer coil electrically connected in parallel. Ex. 1002, ¶¶ 332-334. However, Dr. Choi's reliance on Cho suffers from the same fundamental flaw that pervades his analysis in Grounds 1 and 2: Dr. Choi, again, misreads Claim 1 as permitting any two coils—regardless of antenna pattern—to satisfy the “inner coil” and “outer coil” limitations so long as they may be connected in parallel. Ex. 1002, ¶¶ 332-334; *id.* at Section X.C.I, incorporated herein. That reading is incorrect.

123. Dr. Choi's error is particularly apparent here where Dr. Choi asserts that “[i]t would have been obvious to incorporate Cho's parallel electrical connection teachings with the combined 005Lee-Seong teachings to electrically connect 005Lee's *MST* and *wireless charge coils* (inner and outer coils) in parallel.” Ex. 1002, 334. 005Lee discloses separate functional antenna patterns (e.g., NFC, MST, and wireless charging coils) that may be arranged on a flexible PCB, and that

are selectively driven by separate control circuitry (e.g., an MST driver and wireless charge driver) to transmit transaction data and wireless power, respectively. Ex. 1008, 16:60-17:23, 17:29-31, Fig. 5A, 5B Fig. 41B. While these functional antenna patterns may be operated individually or in combination, 005Lee does not disclose an inner coil and an outer coil that together form a single antenna pattern on the same surface.

124. Dr. Choi's assertion is fundamentally flawed because it improperly treats distinct antenna patterns as though they satisfy Claim 1's requirement for an inner coil and an outer coil of the same antenna pattern, where those antenna structures are not even electrically connected in the prior art. Ex. 1001, Claim 1. Importantly, Dr. Choi does not, nor could he, identify any disclosure in Seong, 005Lee, or Cho stating that an MST antenna and a wireless charging antenna are of the same antenna pattern, are arranged as an inner coil and an outer coil, or collectively form a single antenna structure. Nor does Dr. Choi identify any disclosure in 005Lee or Cho where the same antenna patterns are formed on the same surface of a substrate. Merely labeling these distinct antennas as "inner" and "outer" coils does not supply the missing structure required by the claim.

125. For these reasons, and those outlined in my analysis of Ground 1 and Ground 2, I disagree with Dr. Choi's opinions that the combination of Seong, 005Lee, and Cho render Claim 1 obvious.

ii. A POSITA would not have been motivated to combine 005Lee, Seong, and Cho

- i. The Petition fails to articulate why a POSA would select and combine the cited teachings to arrive at the claimed architecture

126. Dr. Choi opines that 005Lee as modified by Cho would have been a combination obvious to a POSITA. Ex. 1002, ¶ 277. I disagree with Dr. Choi's opinion.

127. The only disclosure Dr. Choi identifies from Cho is Cho's "wireless communication coil" comprises a "first coil portion" and a "second coil portion[,]" which "may be connected in series or in parallel." Ex. 1002, ¶ 333. This generic disclosure is not enough, as discussed above with respect to Ground 1. *See* Section VIII.A, incorporated herein.

128. Claim 1 is explicit that the "inner coil" and "outer coil" are portions of a single antenna pattern formed on the same major surface of the substrate. Ex. 1001, Claim 1[d], 1[n]. Claim 1 requires (i) a specific antenna pattern (inner and outer ring portions of one antenna pattern) and (ii) a specific electrical relationship (parallel connection between those portions). None of 005Lee, Seong, or Cho disclose either requirement as discussed above.

129. Accordingly, because Dr. Choi identifies only a generic disclosure in Cho untethered to Claim 1's specific inner coil and outer coil architecture, and

because none of 005Lee, Seong, or Cho disclose, or suggest modifying, to a single antenna pattern having inner and outer coils electrically connected in parallel on the same surface, Dr. Choi has not articulated why a POSITA would have been motivated to select and combine these teachings to arrive at the claimed invention.

IX. RESERVATION OF RIGHTS

130. I reserve the right to amend or supplement this declaration as this case proceeds and any additional information comes to light.

131. I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true. I also declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001. I declare under the penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Dated: April 29, 2026

David Ricketts

Dr. David S. Ricketts