

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC
Petitioner

v.

K.MIZRA LLC
Patent Owner

Case No. IPR2026-00254
Patent 8,144,717

**DECLARATION OF DAVID H. WILLIAMS IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,144,717**

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Petition for *Inter Partes* Review of U.S. Patent No. 8,144,717

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- g. [1.7]: “at least part of the stations is configured to become active to transmit association grants as responses to received ones of the association request messages, but only after switching to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.” 35
2. Claim 7: “A wireless communication network according to claim 1, wherein each station from said at least part of the stations is configured to transmit discovery advertisement messages including an identification of the station from said at least part of the stations, the stations that transmit association request messages being configured to address the association request messages using identifications from the discovery advertisement messages.” 37
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f.	[14.6] wherein each association grant is transmitted only from the association unit or from an intermediate station, the latter only after said intermediate station has switched to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.	55
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4. Claim 5: “A wireless communication network according to claim 2, wherein the dual function station comprises a first and second unit, each with at least a respective antenna, coupled via a mechanically flexible connection, the first unit being configured to transmit first ones of the association request messages and to receive first ones of the association grants, the second unit being configured to receive second ones of the association request messages and to the transmit second ones of the association grants in response to the first ones of the association request messages.” 79
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 - b. [15.2]: “transmitting a secondary association grant originating from the association unit in response to the secondary association request message;” 82

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- c. [15.3]: “enabling the dual function station to transmit the association grants only upon receiving the secondary association grant.” 82
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1.	Claim 6: “A wireless communication network according to claim 2, wherein the dual function station is configured to operate using respective, mutually distinct first and second frequency channels, using the first frequency channel for transmitting association request messages and receiving association grants, and using the second frequency channel for receiving association request messages and transmitting association grants.”	85
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Exhibit No.	Description
1001	U.S. Patent No. 8,144,717, issued March 27, 2012
1002	File History of U.S. Patent Application No. 12/159,753
1003	PCT Publication No. WO 2007/078193, published on July 12, 2007
1004	EP 05078044.4, filed on December 30, 2005
1005	U.S. Patent Application Publication No. 2006/0215588, published on September 28, 2006 to Chang-June C.J. Yoon (“Yoon”)
1006	U.S. Patent Application Publication No. 2004/0018839, published on January 29, 2004 to O. Andric <i>et al.</i> (“Andric”)
1007	U.S. Patent Application Publication No. 2006/0274671, published on December 7, 2006 to R. Budampati <i>et al.</i> (“Budampati”)
1008	U.S. Patent No. 7,729,285, issued June 1, 2010 to Chang-June C.J. Yoon (“Yoon ’285”)
1010	<i>Curriculum Vitae</i> of David Williams

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I, David H. Williams, hereby state as follows:

I. INTRODUCTION

1. I have been retained by Google LLC (“Petitioner”) as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Counsel for Petitioners (“Counsel”) to consider whether certain references teach or suggest the features recited in Claims 1-20 (“the Challenged Claims”) of U.S. Patent No. 8,144,717 (“the ’717 Patent”) (EX1001). My opinions and the bases for my opinions are set forth below.

3. I am being compensated at my ordinary and customary consulting rate for my work, which is \$485 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

4. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

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5. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as EX1010. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

6. I have over 30 years of experience in wireless location services, including experience implementing Wireless 911 (E911) systems and designing, implementing, and managing numerous location-based service (LBS) applications such as family tracking and fleet and asset management. I am currently the President of the company E911-LBS Consulting, and I have been with the company since 2002. As the President of E911-LBS Consulting, I provide services across the entire wireless value chain, particularly with respect to technology and business strategic planning and product design and development associated with LBS, Global Positioning Satellite (GPS) systems, E911, Real-Time Location Systems (RTLS), Radio Frequency Identification (RFID), beacon, and other location determination and sensing technologies and services.

7. I have extensive expertise in all aspects of LBS delivery across the wireless location ecosystem including enabling network, map data, geospatial platform, chipset, data management, device, and location determination

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infrastructure and integration providers. I am an expert in all related aspects of LBS, including data privacy and security management.

8. For example, I managed the development and launch of several consumer-oriented LBS applications including mobile social networking, family tracking and local search for a major wireless carrier (AT&T). This work included the development of corporate-wide location data privacy policies and their systemic implementation for all LBS customers. My work in both data privacy and mobile social networking resulted in my co-inventing a patent in this field. I also have several other patents related to mobile location and associated applications and architectures.

9. I also have significant experience related to E911 systems. For example, in 2003-2004, I consulted with AT&T Wireless on their implementation of E911 systems. Specifically, I led the development of implementation and monitoring of systems in AT&T Wireless Western Region as part of their deployment of TDOA (Time Difference of Arrival) non-GPS E911 network location infrastructure to meet the wireless E911 location requirements mandated by the FCC. In 2004-2005, I worked with NAVTEQ, a key provider of LBS and E911 location map data, in developing their application developer ecosystem and website, providing developers with access to all of NAVTEQ's product and technical

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resources for developing location-related applications, including data products involving 911 GIS (Geographical Information Systems).

10. I have authored multiple books on wireless location, including:

- The Definitive Guide to GPS, RFID, Wi-Fi, and Other Wireless Location-Based Services (2005 and 2009 versions);
- The Definitive Guide to Wireless E911; and
- The Definitive Guide to Mobile Positioning and Location Management (coauthor).

11. I received a B.S. degree, in Electrical Engineering, from Purdue University in 1983. I received an MBA degree, in Information Systems Management, from The University of Texas at Austin in 1987.

III. INFORMATION CONSIDERED

12. In preparation for this declaration, I have considered the materials discussed in this declaration, including, for example, the '717 Patent, the references cited by the '717 Patent, the prosecution histories of the '717 Patent and applications from which it derives (including the references cited therein), various background articles and materials referenced in this declaration, and the prior art references identified in this declaration. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

13. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

14. I have been informed that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I have been informed that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

15. I have been informed that certain patent claim terms may be interpreted as “means-plus-function” claim terms. I have been informed that terminology is part of the U.S. Patent Law in 35 USC §112, paragraph 6 (pre-AIA) / 35 USC § 112(f) (post-AIA), which states the following: “An element in a claim for a combination may be expressed as a means or step for performing a specified function without the

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recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.”

B. Perspective of One of Ordinary Skill in the Art

16. I have been informed that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I have been informed that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Anticipation

17. I have been informed that a claim is not patentable if it is anticipated. I have been informed that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a prior art reference, arranged as in the claim, when considered from the perspective of a person of ordinary skill in the relevant art. I have been informed that when the structure recited in a reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. I have been informed that extrinsic evidence may be used

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to explain but not expand the meaning of terms and phrases used in the reference relied upon as anticipatory of the claimed subject matter.

D. Obviousness

18. I have been informed that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

19. I have been informed that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long- felt but unmet need, failure of others, copying by others, and skepticism of experts).

20. I have been informed that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I have been informed that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I have been informed that a POSITA is presumed to know the relevant prior art. I have

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been informed that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

21. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I have been informed that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the Patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the Patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other

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market forces, where the variations are predictable to a POSITA;

- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

22. I have been informed that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I have been informed, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

23. It is my opinion that the Challenged Claims of the '717 Patent are unpatentable under 35 U.S.C. §103 on the following grounds:

Ground	Reference(s)	Basis	Claims
1	U.S. Patent Application Publication No. 2006/0215588 to Yoon (“Yoon”) (EX1005)	102/103	1, 7-11, 14
2	Yoon in view of U.S. Patent Application Publication No. 2004/0018839 to Andric (“Andric”) (EX1006)	103	2-5, 12, 13, 15-19
3	Yoon in view of Andric and U.S. Patent Application Publication No. 2006/0274671 to Budampati (“Budampati”) (EX1007)	103	6, 20

VI. TECHNOLOGY BACKGROUND

24. The '717 Patent is directed to a wireless communication network including a plurality of sensor stations, beacon frame transmitters, and an “association unit”. EX1001, 4:54-57.

25. The wireless communication network establishes routes between the stations and the association unit using association request messages and association grant messages. *Id.*, 3:21-32; 6:20-24.

26. Established routes are then used for messaging. *Id.*, 3:17-21. Each route is established when an association request from a station is granted. *Id.*, 3:21-22. The communication routes form a tree structure. *Id.*, 4:61-65. *See id.*, Fig. 1.

27. Stations that have an established route to the association unit are authorized to grant associated status to other stations. *Id.*, 3:32-38. *See also id.*, 4:54-65; 5:31-6:2.

28. Figure 1 (reproduced below) shows an association unit (red), plural beacon frame transmitters (green), plural sensor stations, and example routes (blue) established for the beacon frame transmitters and the sensor stations.

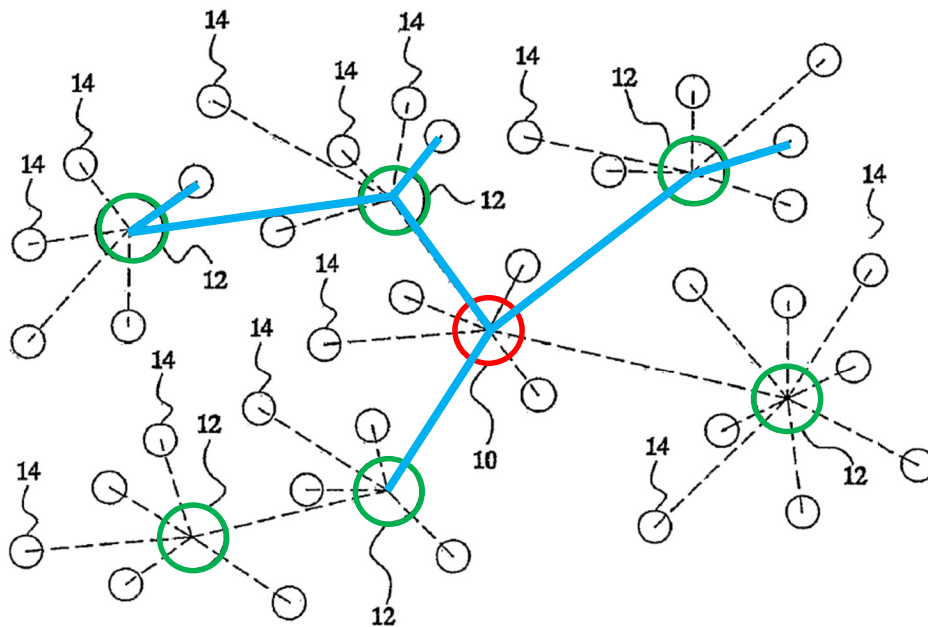


Fig.1

Fig. 1 of the '717 Patent (Annotated)

VII. THE CHALLENGED '717 Patent

29. The '717 Patent contains 20 claims. I have been asked to opine on the validity of Claims 1-20.

VIII. THE '717 PATENT PROSECUTION HISTORY

30. I have reviewed the file history of the '717 Patent. The Challenged Claims were allowed in the first action during prosecution. EX1002, pp.7-15. Reasons for allowance stated that “none of the prior art cited alone or in combination provides the motivation to teach if the source of the association grant is not the association unit, the operating route between the source of the association grant and the association unit previously established for the source of the association grant in response to association request messages and/or the association grants for intermediate stations, in which network the association unit is configured to transmit association grants as responses to received ones of the association request messages; at least part of the stations is configured to become active to transmit association grants as responses to received ones of the association request messages, but only after switching to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.” EX1002, p.13.

IX. LEVEL OF ORDINARY SKILL IN THE ART

31. A person of ordinary skill in the art (“POSITA”) pertinent to the ’717 Patent would have had a bachelor’s degree in electrical engineering, computer engineering, or a related discipline, knowledge of wireless networking as of this time, and at least two years of experience working in a field involving wireless networks and wireless network routing. A person with a different degree could still qualify if they have additional experience that compensates for the different educational backgrounds. A person with less experience working in a field involving wireless networks and wireless network routing could still qualify if the person has additional education that compensates for their lesser experience.

X. PRIORITY DATE

32. I have been informed that the “priority date” or “earliest effective filing date” of a patent is the date on which it is filed, or the date on which an earlier-filed U.S. or international patent application was filed if the patentee claims the benefit of priority to that earlier-filed U.S. or international patent application.

33. The ’717 Patent issued from U.S. Patent Application No. 12/159,753, filed on December 2, 2008, which is a U.S. National Stage of PCT/NL2007/000001, filed on January 2, 2007 (published as WO 2007/078193 (EX1003)), and claims priority to EP 05078044.4, filed on December 30, 2005 (EX1004). For purposes of this declaration, I have assumed that the ’717 Patent is entitled to a priority date of

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December 30, 2005, and I have not evaluated or formed an opinion on whether the claims of the '717 Patent are actually entitled to that date.

XI. CLAIM CONSTRUCTION

34. For purposes of my analysis in this IPR proceeding, I have been informed that terms that appear in the claims of the '717 Patent should be interpreted according to their plain and ordinary meaning under the *Phillips* standard. In determining the ordinary and customary meaning, I have been informed that the words of a claim are first given their plain meaning that those words would have had to a POSITA at the time of the alleged invention. I also have been informed that the claims, specification, and file history may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. I have been informed that even treatises and dictionaries may be used under limited circumstances to determine the meaning attributed by a POSITA to a claim term at the time of filing.

35. I also understand that, for terms that evoke a means plus function construction, “the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.” 37 C.F.R. §42.104(b)(3). I understand from counsel that construing a means-plus-function claim term is a two-step process that includes (1)

identifying the claimed function and (2) then determining what structure, if any, disclosed in the specification corresponds to the claimed function.

XII. OVERVIEW OF THE PRIOR ART REFERENCES

A. Yoon (EX1005)

36. Yoon discloses a wireless communication network including a plurality of nodes (stations) and a main node (i.e., C2 node) forming a tree-like topology. EX1005, ¶[0023].

37. Yoon's wireless communication network establishes routes between nodes (i.e., sensor nodes, relay nodes) and the C2 node via a join tree process that associates nodes to the network C2 node using JOIN_REQUEST messages and JOIN_ACK messages. *Id.*, ¶[0066]. *See id.*, ¶¶[0058]-[0066], Fig. 3.

38. Established routes are used for messaging or further downstream associations, as updated routes are maintained in network formation databases. *Id.*, ¶¶[0055], [0060], [0064]-[0066]. *See id.*, Fig. 4 (540), Fig. 5 (553, 554). Only Yoon's associated nodes having established routes to the C2 node can grant associated status to other nodes via JOIN_ACK messages. *Id.*, ¶¶[0038], [0064]-[0066].

39. Figure 1 (reproduced below) shows a C2 node (red), a plurality of relay nodes (green), a plurality of sensor nodes, and example routes (highlighted in blue)

established for the relay nodes and the sensor nodes. Yoon's nodes store route information in a network formation database (e.g., at each node). *Id.*, ¶¶[0060], [0064].

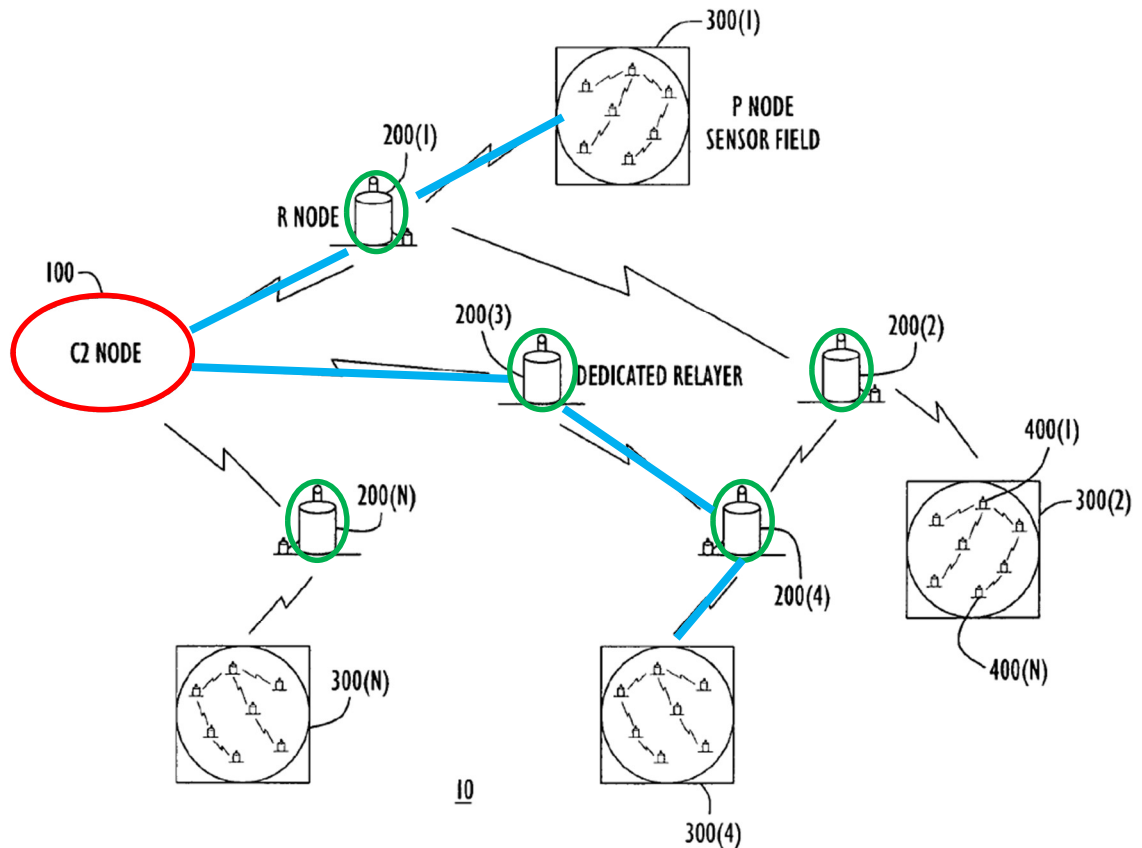


FIG. 1

Fig. 1 of Yoon (Annotated)

B. Andric (EX1006)

40. Andric discloses wireless networks that use a communication protocol to form an ad hoc, self-organizing network; i.e., a network with a random topology

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in which the network organization and maintenance occur without human intervention. EX1006, ¶¶[0004], [0066].

41. Andric discloses forming a wireless network using a control node configured to manage network topology (e.g., joining and leaving of network nodes and mobile nodes). EX1006, ¶¶[0180], [0181].

42. Andric's network nodes become associated with the network using CONNECTION REQUESTS transmitted to the control node, and receiving CONNECTION RESPONSES from the control node. Network nodes which are associated can then associate other nodes to the network by sending NODE ID REQUESTS to the control node, and receiving NODE ID RESPONSES. *Id.*, ¶¶[0088]-[0090]. *See id.*, ¶¶[0086]-[0095].

C. Budampati (EX1007)

43. Budampati discloses a wireless network with redundantly connected nodes using several addressing methods. EX1007, ¶[0004].

44. Budampati discloses adding new devices to a wireless network to form an ad hoc wireless network. *Id.*, ¶[0029]. *See also id.*, Fig. 3.

45. Budampati discloses a node discovery process to initiate network formation. *Id.*

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Claims 1, 7-11, and 14 are Anticipated by and/or Rendered Obvious over Yoon (EX1005) (Ground 1)

46. In my opinion, the Challenged Claims are unpatentable over the prior art.

47. The following sections provide reference to where the elements of Claims 1, 7-11, and 14 are anticipated by/obvious over the prior art.

48. To the extent there are any minor differences between Yoon and limitations of the Challenged Claims, they would have been obvious. To the extent any expert testimony is interpretive of Yoon, any minor differences would have been obvious to a POSITA to be taught by Yoon. Thus, the Challenged Claims are anticipated or obvious over Yoon.

1. Claim 1 (Preamble): “A wireless communication network that comprises an association unit and a plurality of stations,”

49. To the extent the Preamble is limiting, Yoon discloses/suggests the Preamble.

50. Yoon discloses a wireless communication network. Yoon’s “FIG. 1 illustrates a wireless unmanned ground sensor (UGS) network 10 that is an example of the type of wireless sensor network in which the techniques described herein may be useful.” EX1005, ¶[0023]. *See id.*, Fig. 1.

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51. Yoon's wireless communication network includes an association unit (i.e., a Command & Control "C2 node") and a plurality of stations (i.e., relay nodes and sensor nodes "used to send sensor data back to the C2 node.") *Id.*, ¶¶[0023]-[0024].

52. "The C2 node is also referred to herein as the main node, hub node or 'root' node in the sense that all other nodes feed data back to the C2 node." EX1005, ¶[0023], Fig. 1. Yoon refers to sensor nodes as P nodes and relay nodes as R nodes. *Id.*, ¶[0024].

53. The '717 Patent describes "association unit 10 at its root and beacon frame transmitters 12 at its nodes. Each beacon frame transmitter 12 is coupled in a star topology to a number of the sensor stations 14." EX1001, 4:62-65.

54. The '717 Patent refers to all node/sensor components as "stations". *Id.*, 6:7-11. *See also id.*, 3:27-38, 4:27-32, 4:61-5:10, 9:63-66, 13:64-14:3, Fig. 2. *See also* EX1005, ¶¶[0023], [0066], [0104] ("a plurality of nodes that transmit and receive information between each other and ultimately to a main node in a tree-like configuration").

55. Yoon's "nodes" are disclosed having structure to the same extent as "stations" in the '717 Patent, including a processor, and a transmitter/receiver. *See* EX1001, 4:66-5:18, Fig. 2; EX1005, ¶¶[0029]-[0030], Fig. 2.

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56. Yoon's nodes perform the same functions as stations in the '717 Patent. See EX1001, 6:3-59; EX1005, ¶¶[0023]-[0028].

57. For example, Yoon's C2 node functions as an "association unit", Yoon's R nodes are beacon frame transmitters, and Yoon's P nodes are sensor stations.

58. To the extent "association unit" is interpreted under pre-AIA 35 U.S.C. §112(6), it functions to transmit association grants in response to association request messages. The corresponding structure in the '717 Patent includes at least the structure of the Figure 2 station. EX1001, 4:66-5:10.

59. The '717 Patent indicates that the association unit is a station (i.e., like a beacon frame transmitter and a sensor station). *Id.*, 3:19 ("association station"); 6:7-11. See *id.*, 6:3-19.

60. Figure 2 shows a station including "a receiver circuit 20, a transmitter circuit 22, a processor circuit 24, a memory 26" where "receiver circuit 20 and transmitter circuit 22 include an antenna". *Id.*, 5:1-7. See *id.*, 4:66-5:10. The '717 Patent states that the association unit uses memory to store routes. *Id.*, 3:25-27; 5:54-57; 10:7-9. The association unit exchanges data and requests with other stations via wireless communication. *Id.*, 5:15-16.

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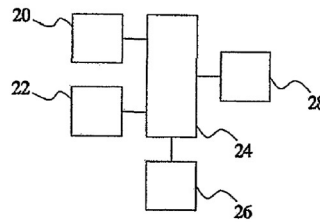


Fig.2

Fig. 2 of the '717 Patent

61. Thus, the association unit structure includes components of stations shown in Figure 2, including at least memory, a receiver circuit, a transmitter circuit, and a processor circuit. *Id.*, 6:3-19.

62. Yoon discloses its C2 node as performing the same functions and having corresponding structure comparable to the '717 Patent's association unit.

63. Yoon's C2 node transmits association grants (i.e., JOIN_ACK messages) as responses to received ones of the association request messages (i.e., JOIN_REQUEST messages). EX1005, ¶¶[0061]-[0066]. *See id.*, ¶[0104]. *See* Element [1.6], *infra*. Yoon's C2 node is "a Command & Control vehicle . . . for processing." EX1005, ¶[0023]. Each of Yoon's nodes, including the C2 node, "maintains a network formation database" and thus includes memory to store routes. *Id.*, ¶[0060]. *See id.*, ¶¶[0027], [0066]. Yoon's C2 node receives "sensor data" from all other nodes in the network and provides "RF timing". *Id.*, ¶¶[0023]-[0026]. The

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C2 node also issues network formation commands, wake-up commands, and LNE messages. *Id.*, ¶[0031].

64. Yoon's C2 node has memory (e.g., for storing data in the network formation database), a receiver circuit (for receiving/collecting data from other nodes), a transmitter circuit (for transmitting commands/messages), and a processor for processing received data.

65. To the extent any corresponding structure of the C2 node is not expressly disclosed by Yoon, it would have been obvious that Yoon's C2 node includes structure including at least memory, a receiver circuit, a transmitter circuit, and a processor because Yoon expressly discloses nodes (including the C2 node) configured to transmit and receive messages (EX1005, ¶¶[0010]-[0011]), store data (*id.*, ¶¶[0055], [0060], [0064]), and process data (*id.*, [0023], [0060]).

66. Yoon also discloses R nodes including similar components such as memory, a receiver circuit, a transmitter circuit, and a processor circuit. *See id.*, ¶¶[0029]-[0030]; Fig. 2. Yoon expressly teaches that R nodes include a general purpose processor (GPP), a digital signal processor (DSP), a radio transceiver, and other components. *See id.*, Fig. 2.

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67. It would have been obvious to a POSITA that Yoon's C2 node similarly includes at least memory, a transmitter/receiver (or transceiver), and a processor for performing the disclosed functions of Yoon's wireless network routing protocol.

a. [1.1]: “each station being configured to start up in a not-associated state and to transmit association request messages in the not-associated state,”

68. Yoon discloses/suggests Element [1.1].

69. Each of Yoon's stations are configured to start up in a not-associated state (i.e., a “sleep” state or “isolated” state). EX1005, ¶¶[0031], [0038].

70. Yoon's nodes are initially deployed in a “sleep” state until they receive a wake-up signal transmitted from the C2 node. *Id.* “In response to the node receiving a wake-up signal, the node enters the Isolated state 310.” *Id.*, ¶[0038], Fig. 3. Yoon's “sleep” state and “isolated” state can be considered “not-associated” states because they are distinguished from a distinct “associated” state. *Id.*, ¶[0038] (i.e., “The R nodes can take on one of three states: Sleep 300, Isolated 310 and Associated 320.”). *See also id.*, ¶[0036], Fig. 3.

71. Each of Yoon's nodes are configured to transmit association request messages in the “not-associated” state (i.e., “isolated” state).

72. Yoon's JOIN_REQUEST messages correspond to association request messages. EX1005, ¶[0038].

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73. Yoon's nodes in the "isolated" state are configured to execute a join tree process to join Yoon's network and transition to the "associated" state. *Id.* In the join tree process, "the Isolated node transmits a join request (JOIN_REQUEST) packet to an upstream node (already Associated)." *Id.* See *id.*, ¶¶[0038]-[0039], [0058]-[0066].

b. [1.2]: "each station being configured to switch to an associated state upon reception of an association grant in response to one of its association request messages,"

74. Yoon discloses/suggests Element [1.2].

75. Each of Yoon's stations are configured to switch to an "associated" state upon reception of an association grant in response to one of its association request messages.

76. Yoon's nodes are configured to switch from the "isolated" state to the "associated" state upon reception of a JOIN_ACK message (i.e., an association grant) in response to a JOIN_REQUEST message (i.e., an association request message) sent from the node in the "isolated" state. EX1005, ¶[0038]. See also *id.*, ¶¶[0062]-[0066]. See Element [1.1], *supra*.

77. Yoon's JOIN_ACK message is an association grant because the JOIN_ACK message causes an "isolated" node to become an "associated" node.

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EX1005, ¶¶[0064], [0066]. *See also* EX1001, 7:40-60; 9:3-10:3, Figs. 3 and 4 (“third states” 33 and 43 are associated states).

c. [1.3]: “the association request message and/or the association grant in response thereto establishing an operating route associated with the station for exchanging operating messages with the association unit during subsequent operation,”

78. Yoon discloses/suggests Element [1.3].

79. Yoon’s association request (i.e., JOIN_REQUEST message) and/or the association grant (i.e., JOIN_ACK message) in response thereto establishes an operating route associated with the station for exchanging operating messages with the association unit during subsequent operation.

80. Yoon discloses the JOIN_REQUEST message and/or the JOIN_ACK message (transmitted in response to the JOIN_REQUEST message) establishing an operating route associated with a node.

81. Yoon establishes operating routes for nodes by updating a network formation database (e.g., maintained at each node) to store route information once a node receives a JOIN_ACK message and is associated. EX1005, ¶¶[0060], [0064].

82. Yoon establishes an operating route for a node based on the node having transmitted a JOIN_REQUEST message and the node receiving in response a JOIN_ACK message from an upstream node. *Id.*, ¶¶[0062]-[0064].

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83. Yoon's network formation database stores route information including upstream node addresses, C2 node addresses, cost-to-C2 (number of hops to C2 or minimum energy to C2), and the number of sub-tree members (the number of downstream nodes). *Id.*, ¶[0060].

84. When a new node is associated with Yoon's network, the network formation database is updated with the new route information to establish an operating route to the upstream node leading back to the C2 node. EX1005, ¶¶[0063]-[0064].

85. Yoon also establishes individual operating routes (e.g., one-hop routes) for each downstream node by having the downstream node store the address of its upstream node and the address of the C2 node such that the downstream nodes can exchange operating messages with the C2 node (e.g., by forwarding sensor derived data) during subsequent operation along the routes from the downstream node back to the C2 node. *Id.*, ¶[0066]. *See id.*, ¶¶[0023]-[0025]. Additionally, Yoon's C2 node stores full operating route information (e.g., multi-hop routes) to every downstream node. *Id.*, ¶[0027]. Updated and/or new route information for associated nodes is transmitted to the C2 node to manage and update the network topology. *Id.*, ¶[0066].

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86. Figure 4 of Yoon “shows a flow diagram of the join tree process 500 to illustrate how a network is formed using the LNI [*local node information*] techniques.” EX1005, ¶[0061]. *See also id.*, ¶[0065].

87. Yoon discloses an established operating route in the same manner as described by the '717 Patent. The '717 Patent indicates that an operating route is established by “storing information that defines the route” in memory. EX1001, 3:24-25. *See id.*, 5:38-39.

88. The '717 Patent also states that each station “stores at least information that is selective for the beacon frame transmitter 12 at the start of its route to association unit 10” and “each beacon frame transmitter 12 stores at least information that is selective for the next beacon frame transmitter 12 in the route or for association unit 10.” *Id.*, 5:40-46. *See id.*, 5:35-63.

89. Thus, the '717 Patent describes stations storing route information for their upstream station (i.e., the next beacon frame transmitter in the route) (e.g., one-hop routes). The '717 Patent also describes the association unit storing routes from the association unit to the downstream stations (e.g., multi-hop routes). *Id.*, 3:21-32.

90. Yoon discloses that the C2 node stores all operating routes to downstream nodes as “the C2 node knows the complete tree topology for the UGS network.” EX1005, ¶[0066].

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91. Yoon also discloses that each node stores at least information selective for an upstream node at the start of its route (back to the C2 node). *Id.*, ¶¶[0060], [0064].

92. Yoon's nodes' network formation databases store at least an upstream node address, selective for the next upstream node in its route back to the C2 node. *Id.*

93. Thus, Yoon discloses establishing operating routes as both (1) full routes from the C2 node to downstream nodes (stored at the C2 node) (e.g., multi-hop routes) and (2) individual hops for routes from a downstream node to its next upstream node (stored at each node's network formation database) (e.g., one-hop routes). *See id.*, ¶¶[0060]-[0066].

94. The '717 Patent's stations store route information (e.g., to the next beacon frame transmitter) to forward messages from the stations to the association unit. EX1001, 5:67-6:2.

95. Yoon operates in the same way, storing one-hop route information for the next upstream node in a full route so messages can be transmitted from P nodes up to the C2 node. *See* EX1005, ¶[0066].

96. Yoon's one-hop routes from one node to another node defined in a single network formation database of a specific station constitute established

operating routes (e.g., from a downstream node to its upstream node), while the overall route formed by the network formation database of multiple nodes up to the C2 node also constitutes an established operating route (e.g., from one downstream node to the C2 node).

d. [1.4]: “the operating route associated with the station running through a source of the association grant in response to said one of the association request messages and,”

97. Yoon discloses/suggests Element [1.4].

98. Yoon’s operating routes are associated with the station and run through a source of the association grant.

99. Yoon’s operating routes for a node relate directly to that particular node (i.e., because that node stores route information in its network formation database) and the node that provided the JOIN_ACK message to that node (i.e., stored as the upstream node address in the network formation database). EX1005, ¶¶[0064]-[0065].

100. Yoon’s operating routes are stored in a “network formation database” maintained at each node and stored at the C2 node. *See* Element [1.3], *supra*.

101. Each node’s network formation database stores route information including at least an upstream node address. EX1005, ¶[0060].

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102. Yoon also discloses that the upstream node address identifies a node that is the source of the JOIN_ACK request as a selected upstream node. *Id.*, ¶[0063].

103. Yoon’s “upstream node address” refers to an address of the source node that transmitted the JOIN_ACK message (i.e., “source of the association grant”). EX1005, ¶¶[0063]-[0064].

104. Any downstream node within a route in Yoon’s network stores the address of a selected upstream node that provided that downstream node with the JOIN_ACK message. EX1005, ¶¶[0063]-[0064]. *See id.*, ¶¶[0060]-[0066].

105. Yoon’s network formation database (and stored operating route) also includes the C2 node address and the cost-to-C2 as a number of hops to the C2 node. *Id.*, ¶[0060].

106. Nodes storing route information in their network formation database know their operating route to a selected upstream node, while the selected upstream nodes know their routes to a secondary upstream node, running through a chain of upstream nodes as sources of JOIN_ACK messages to reach the C2 node. *Id.*, ¶¶[0066], [0069]. *See also id.*, ¶¶[0092]-[0095].

107. Yoon’s C2 node stores the entire topology and route information of the network. EX1005, ¶¶[0027], [0066].

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108. Yoon's network stores information for the operating route "running through" the source of the JOIN_ACK message, (i.e., the upstream node corresponding to the "source of the association grant") where the JOIN_ACK message is transmitted to the node at the endpoint of the route (e.g., a downstream node) in response to said one of the JOIN_REQUEST messages from the node at the endpoint.

- e. **[1.5]: "if the source of the association grant is not the association unit, the operating route between the source of the association grant and the association unit previously established for the source of the association grant in response to association request messages and/or the association grants for intermediate stations,"**

109. Yoon discloses/suggests Element [1.5].

110. Yoon discloses the recited "operating route" of Element [1.5]; in Yoon, if the source of the association grant is not the association unit, the operating route between the source of the association grant and the association unit is previously established for the source of the association grant in response to association request messages and/or association grants for intermediate stations.

111. That is, in Yoon an upstream, intermediate node that is not the C2 node (e.g., an intermediate R node between the C2 node and a downstream node) can transmit a JOIN_ACK message (i.e., the "source of the association grant") to a downstream node. The operating route for that particular intermediate node to the

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C2 node was previously established by the prior association of that intermediate node with the C2 node via an earlier JOIN_ACK message. EX1005, ¶¶[0062]-[0064]. *See id.*, ¶¶[0038], [0058]-[0066], [0104].

112. The operating route back to the C2 node (the “association unit”) is therefore established before the intermediate node transmits a JOIN_ACK message (i.e., as the “source of the association grant”) to a downstream node. *Id.*, ¶[0064]. *See* Element [1.3], *supra*.

113. Yoon’s intermediate nodes (e.g., nodes between the C2 node and a downstream node that wishes to join the network) are associated with Yoon’s network the same way as downstream nodes (e.g., R nodes, P nodes). EX1005, ¶¶[0038], [0104]. *See id.*, ¶¶[0060]-[0066].

114. Once intermediate nodes are associated and routes are established, those intermediate nodes can respond to JOIN_REQUEST messages transmitted from “isolated” downstream nodes to continually grow the network and establish routes for downstream nodes to the C2 node. EX1005, ¶[0038]. *See also id.*, ¶¶[0064], [0104].

115. Yoon’s “isolated” nodes become “associated” with the network by transmitting a JOIN_REQUEST message to an upstream (i.e., intermediate) node

(“already Associated”) and receiving a JOIN_ACK message from the upstream node. *Id.*

116. Yoon’s upstream, “already Associated” nodes form a complete route from the joining downstream node to the C2 node. *Id.* See Element [1.4], *supra*. See also *id.*, ¶¶[0064], [0104].

117. Yoon’s network generally describes this process for associating all nodes. See EX1005, ¶¶[0058]-[0066].

118. In this process, Yoon’s downstream nodes receive information (via a local node information (LNI) message) for the previously established operating route from an upstream intermediate node that is not the C2 node. EX1005, ¶¶[0061]-[0064].

119. The data received by a downstream node (e.g., in Yoon’s LNI message) includes data for the previously established operating route for an intermediate upstream node. EX1005, ¶¶[0040]-[0048].

120. Yoon discloses that newly associated nodes can associate other downstream nodes (i.e., via receiving JOIN_REQUEST messages and transmitting JOIN_ACK messages) in the same way to extend the previously established route by establishing a new route to the other downstream nodes. *Id.*, ¶¶[0063]-[0066].

**f. [1.6]: “in which network the association unit is
configured to transmit association grants as responses to
received ones of the association request messages;”**

121. Yoon discloses/suggests Element [1.6].

122. Yoon’s network includes an association unit configured to transmit association grants as responses to received ones of the association request messages within the network.

123. Yoon’s C2 node (i.e., association unit) is configured to transmit JOIN_ACK messages (“association grants”) as responses to received ones of JOIN_REQUEST messages (“association request messages”), for example, when Yoon’s network is initially being set up. EX1005, ¶[0061].

124. At initial network formation, Yoon’s C2 node is an “upstream node” transmitting JOIN_ACK messages in response to JOIN_REQUEST messages from other downstream nodes. *Id.* Once Yoon’s C2 node begins network formation, the C2 node is configured as an “associated” node: to receive JOIN_REQUEST messages and issue JOIN_ACK messages to downstream nodes. *See id.*, ¶¶[0038], [0063]-[0066].

125. Yoon discloses that the upstream node can be the C2 node. Thus, Yoon’s C2 node, as an association unit, is configured to transmit association grants

as responses to received ones of the association request messages within the network.

g. [1.7]: “at least part of the stations is configured to become active to transmit association grants as responses to received ones of the association request messages, but only after switching to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.”

126. Yoon discloses/suggests Element [1.7].

127. Yoon discloses that at least part of its stations are configured to become active to transmit association grants as responses to received ones of the association request messages, but only after switching to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.

128. Yoon discloses that downstream nodes (e.g., a first tier of nodes downstream from the C2 node) that are associated with the network by receiving JOIN_ACK messages directly from the C2 node are configured to transmit JOIN_ACK messages as responses to other JOIN_REQUEST messages from downstream nodes only after the downstream nodes have switched to the

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“associated” state upon receiving a first JOIN_ACK message. EX1005, ¶[0038]. *See also id.*, ¶¶[0062]-[0066].

129. Yoon discloses that the further downstream nodes (e.g., a second tier of nodes downstream from the first tier of nodes), once associated based on receiving JOIN_ACK messages from associated upstream nodes (e.g., upstream nodes in the first tier—indirectly based on JOIN_ACK messages from the C2 node), are configured to transmit further JOIN_ACK messages in response to JOIN_REQUEST messages from even further downstream nodes (e.g., a third tier of downstream nodes). *Id.* This is because Yoon’s downstream nodes in “associated” states “can behave like an upstream node with respect to other unassociated nodes.” *Id.*, ¶[0038]. *See id.*, ¶¶[0038]-[0057], [0104].

130. At least part of Yoon’s nodes are configured to become active to transmit JOIN_ACK messages only after the at least part of the nodes have themselves become associated directly or indirectly based on a JOIN_ACK message from the C2 node.

131. Yoon’s “join tree process” operates this way because Yoon’s network includes “a plurality of nodes that transmit and receive information between each other and ultimately to a main node in a treelike configuration”. EX1005, ¶[0106]. *See id.*, ¶¶[0104]-[0106].

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132. Because Yoon's C2 node initiates network organization, all downstream nodes switch to the "associated" state either directly or indirectly based on a first JOIN_ACK message from the C2 node and subsequent JOIN_ACK messages from associated intermediate nodes. *Id.*, ¶[0027]. *See id.*, ¶¶[0025]-[0028], [0060].

133. Yoon's network formation therefore works in the same way as is disclosed in the '717 Patent. *See* EX1001, 3:27-32 ("a wave of association that radiates from nodes to nodes starting from the association unit.").

2. Claim 7: "A wireless communication network according to claim 1, wherein each station from said at least part of the stations is configured to transmit discovery advertisement messages including an identification of the station from said at least part of the stations, the stations that transmit association request messages being configured to address the association request messages using identifications from the discovery advertisement messages."

134. Yoon discloses/suggests Claim 7. *See* Claim 1, *supra*.

135. Yoon discloses each station being configured to transmit discovery advertisement messages including an identification of the station.

136. Yoon's stations are configured to address the association request messages (i.e., JOIN_REQUEST messages) using identifications from the discovery advertisement messages.

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137. Yoon discloses nodes (e.g., upstream nodes) configured to transmit LNI messages (i.e., discovery advertisement messages) to provide identification information. *See* EX1005, ¶¶[0034]-[0036].

138. Yoon's LNI message is provided to accommodate additional node/network information: a sender's local clock, a source node ID, a C2 address, a number of hops to C2 node (or cost to C2 node), a battery life index, a number of downstream nodes, and a maximum number of hops to C2. EX1005, ¶¶[0040]-[0048]. At least the source node ID included in the LNI message constitutes an identification of the node transmitting the LNI message.

139. Yoon's nodes (e.g., downstream nodes) use the identification information (i.e., at least the source node ID) from the LNI messages to address JOIN_REQUEST messages transmitted to upstream nodes. EX1005, ¶¶[0038], [0048].

140. Yoon's "LNI message technique contains all the necessary information to form the network database efficiently at the link layer." EX1005, ¶[0055]. *See also id.*, ¶¶[0061]-[0062].

141. Yoon's "Isolated node uses the LNI it receives from candidate upstream nodes to select the best upstream node to join based on the measure of data routing responsibility of the respective candidate upstream nodes." EX1005, ¶[0066].

3. **Claim 8: “A wireless communication network according to claim 7, wherein each station in said at least part of the stations is configured to indicate, in the discovery advertisement messages, whether the station is enabled to transmit association grants, the stations that transmit association requests being configured to transmit association requests addressed to stations from said at least part of the stations only if the addressed station has indicated in at least one of the discovery advertisement messages that it is enabled to transmit association grants.”**

142. Yoon discloses/suggests Claim 8. *See* Claim 7, *supra*. Yoon discloses stations configured to indicate in the discovery advertisement messages whether the station is enabled to transmit association grants (i.e., JOIN_ACK messages).

143. Yoon’s Associated nodes transmit discovery advertisement messages as LNI messages to Isolated (e.g., non-Associated) nodes. *See* claim 7, *supra*.

144. Yoon’s “Associated node transmits LNI messages periodically to be received by other Isolated nodes to enable those Isolated nodes to join to the existing UGS network, and consequently become Associated.” EX1005, ¶[0038].

145. The LNI message includes local node information including a sender’s local clock, a source node ID, a C2 address, a number of hops to the C2 node (or a cost to C2 node), a battery life index, a number of downstream nodes, and a maximum number of hops to the C2 node. *Id.*, ¶¶[0040]-[0047].

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146. At least the source node ID, the number of downstream nodes, and/or the number of hops to the C2 node indicate that the source node, or the sender of the LNI message, is enabled to transmit association grants.

147. This information included in the LNI message indicates that a node is enabled to transmit association grants because this information informs a downstream node that the upstream node is a candidate node such that the downstream node can transmit JOIN_REQUEST messages to a selected candidate node to successfully receive JOIN_ACK messages. EX1005, ¶¶[0038], [0048].

148. Yoon discloses that downstream nodes “will receive LNI messages from one or several upstream nodes that are in the Associated State.” EX1005, ¶[0048].

149. The one or several upstream nodes are “candidate nodes” to the downstream node. *Id.* The downstream node receiving the LNI messages “can select among the candidate upstream nodes the upstream node that has the fewest downstream nodes.” *Id.* The fewest number of downstream nodes acts as an indication that the upstream node is enabled to accommodate more downstream nodes and thus transmit JOIN_ACK messages. *See id.*, ¶[0048] (“the Number of Downstream Nodes of a node is a measure or indication of the level or degree of data routing (forwarding) responsibility of that node.”). *See also id.*, ¶¶[0049]-

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[0054]. Thus, at least the number of downstream nodes is used to determine which of the candidate upstream nodes is enabled to transmit JOIN_ACK messages to the downstream node to allow the downstream node to join the network. *Id.*

150. Yoon's LNI messages transmitted by an upstream node and received at a downstream node initiates the join tree process for an "isolated" node (e.g., the downstream node). EX1005, ¶[0061]. *See id.*, ¶¶[0058]-[0064].

151. Thus, the LNI message itself and at least the indications within the LNI message of the source node ID, the number of downstream nodes, and/or the number of hops to the C2 node are indications that the upstream node is enabled to transmit JOIN_ACK messages in response to JOIN_REQUEST messages. *See id.*, ¶¶[0075]-[0078]. *See also id.*, ¶¶[0058]-[0064].

152. The downstream node will know an upstream node is enabled to transmit a JOIN_ACK message by virtue of receiving the LNI message, including indications in the LNI message indicating that the upstream node is "associated" and/or has appropriate routing responsibility. EX1005, ¶¶[0061], [0068].

153. The '717 Patent describes transmission of the discovery advertisement messages is used to "avoid waste of energy or bandwidth on association requests that cannot be granted." EX1001, 4:7-11.

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154. Yoon uses LNI messages (including at least an indication for number of downstream nodes) for candidate upstream nodes in the same way, to avoid use of nodes with low battery power and wasting energy transmitting additional LNI messages. EX1005, ¶[0061]. *See id.*, ¶¶[0060]-[0066]. *See also id.*, ¶¶[0048]-[0057].

155. Yoon discloses that the stations that transmit association requests (i.e., downstream nodes) are configured to transmit association requests (i.e., JOIN_REQUEST messages) addressed to stations from said at least part of the stations (i.e., upstream nodes) only if the addressed station has indicated in at least one of the discovery advertisement messages that it is enabled to transmit association grants (i.e., JOIN_ACK messages).

156. Yoon discloses that downstream nodes select at least one of candidate upstream nodes only if the downstream node has received an LNI message from the upstream node indicating that the upstream node is enabled to transmit JOIN_ACK messages. EX1005, ¶[0062]. *See id.*, ¶¶[0061]-[0064].

157. Yoon's downstream nodes "will receive an LNI message from each of its candidate upstream nodes", including an indication of the upstream node's source ID and the number of downstream nodes for the upstream node, indicating that the candidate upstream nodes can transmit JOIN_ACK messages. *Id.*, ¶[0061]. *See id.*, ¶¶[0063]-[0064]. Yoon's downstream nodes select one of the candidate upstream

nodes to use for joining the network and the downstream nodes are configured to transmit a JOIN_REQUEST message addressed to the selected upstream node. *Id.*, ¶[0062]. *See id.*, ¶¶[0060]-[0066].

4. **Claim 9: “A wireless communication network according to claim 1, wherein said at least part of the stations are configured to transmit route information toward the association unit after transmitting an association grant, the route information defining the associated route for the station to which the association grant has been sent.”**

158. Yoon discloses/suggests Claim 9. *See* Claim 1, *supra*.

159. Yoon’s stations are configured to transmit route information toward the association unit (i.e., C2 node) after transmitting an association grant (i.e., JOIN_ACK message).

160. Yoon’s route information defines the associated route for the station to which the association grant (i.e., JOIN_ACK message) has been sent.

161. Yoon discloses that if the network detects a change in a sub-tree system, the upstream node transmits a message to its upstream node, wherein the message contains updated topology information with respect to the change in its sub-tree, and so on. Eventually, the updated topology information reaches the C2 node. Thus, the C2 node knows the complete tree topology for the UGS network. This routing process simplifies maintenance of the routing table.

EX1005, ¶[0066].

162. Yoon's stations, "[a]fter transmitting the JOIN_ACK message to a downstream node, are configured to send route information (i.e., updated topology information) back to the C2 node. *Id.*

163. The route information defines the associated route for the newly added downstream node to which the JOIN_ACK message has been sent because the C2 node "knows the complete tree topology" with the updated information in the network formation database. *Id.*, ¶¶[0065]-[0066].

5. **Claim 10: "A wireless communication network according to claim 9, wherein said at least part of the stations is configured to forward at least part of the route information towards the association unit, to store at least a further part of the route information and to route subsequent messages from the association unit to the station for which the route information was sent according to said stored at least further part."**

164. Yoon discloses/suggests Claim 10. *See* Claim 9, *supra*.

165. Once route information is stored at Yoon's C2 node, the C2 node can use the route information to route subsequent messages from the C2 node to the downstream nodes.

166. "The C2 node 100 needs to know the path or network route to every R node 200(1) to 200(N)." EX1005, ¶[0027]. *See also id.*, ¶[0069]. This functionality

is also enabled by Yoon's network formation database. *Id.*, ¶[0060]. *See* Claim 9, *supra*.

167. Yoon's C2 node maintains a network formation database including the topology of the network and routes to each R node and P node.

168. This information is forwarded as tree information through upstream nodes until it reaches the C2 node where the information can be stored in the C2 node network formation database. EX1005, ¶[0066]. This information allows the C2 node to route further messages, including LNI messages, to downstream nodes. *Id.*

6. Claim 11 (Preamble): "A station for use in a wireless communication network,"

169. Yoon discloses/suggests the Preamble. *See* Claim 1 (Preamble), *supra*.

170. Yoon discloses a station for use in a wireless communication network.

171. Yoon discloses stations including at least P nodes and R nodes in a wireless unmanned ground sensor (UGS) communication network. EX1005, ¶[0023].

172. Yoon's P nodes "form a multi-hop network using short-range radios. Each sensor network also includes long-range-radio-equipped recognition sensors (referred to as R nodes) used to send sensor data back to the C2 node." *Id.*, ¶[0024].

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173. Each of Yoon's P nodes and R nodes constitute a station for use in Yoon's wireless communication network. *See* Claim 1 (Preamble), *supra*.

a. [11.1]: “the station comprising a transmitter arrangement, a receiver arrangement and a processor circuit coupled to the transmitter arrangement and the receiver arrangement,”

174. Yoon discloses/suggests Element [11.1].

175. Yoon's stations include a transmitter arrangement, a receiver arrangement, and a processor circuit.

176. Yoon's R nodes include an “ultra low-power receiver (receiver 240 in FIG. 2)”. EX1005, ¶[0036].

177. Figure 2 of Yoon shows a block diagram of components of an R node. The R node includes “a radio transceiver 240” and a “general purpose processor (GPP) 210 and a digital signal processor (DSP) 220.” *Id.*, ¶[0029], Fig. 2.

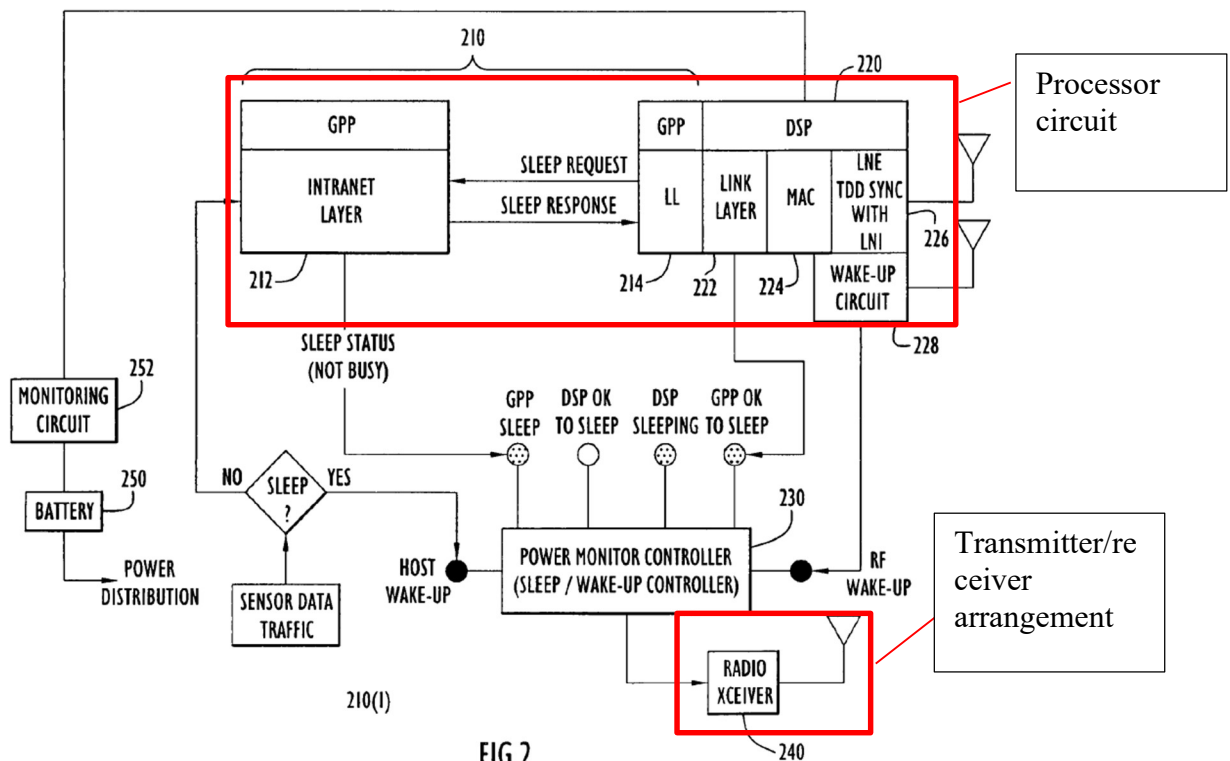


Fig. 2 of Yoon (Annotated)

178. Yoon's R nodes include radio transceiver 240. *Id.*, ¶¶[0029], [0036]. Yoon's transceiver constitutes a transmitter arrangement and a receiver arrangement to send and receive data. *Id.*

179. The '717 Patent itself discloses a generic "receiver circuit 20" and a generic "transmitter circuit 22". EX1001, 5:1-10.

180. The specification of the '717 Patent does not expressly disclose structure for the transmitter arrangement or receiver arrangement. Figure 2 of the

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'717 patent shows transmitter circuit 22 and receiver circuit 20 as generic blocks. See EX1001, Fig. 2 (reproduced below).

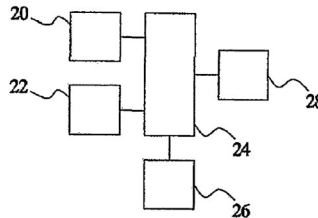


Fig.2

181. The '717 Patent describes the only functions of the transmitter 22 as transmitting discovery messages, association request messages, and association grant messages. EX1001, 7:9-11, 8:25-28, 8:57-59, 9:44-49.

182. The '717 Patent describes the only functions of the receiver 20 as receiving beacon frames and association grant messages. *Id.*, 7:12-16, 7:40-51, 8:28-32, 9:3-13.

183. Yoon's transceiver discloses a transmitter arrangement and a receiver arrangement at least to the same degree as disclosed in the '717 Patent.

184. Yoon's issued patent (U.S. Patent No. 7,729,285, issued June 1, 2010 ("Yoon '285") (EX1008)) discloses and claims "[a] wireless network node device, comprising: a receiver configured to receive signals from other nodes in a network; a transmitter configured to transmit signals to other nodes in the network;". EX1008, Claim 17, 18:22-26.

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185. Yoon '285 provides evidence that Yoon discloses a transmitter arrangement and a receiver arrangement used within its nodes.

186. As shown in Figure 2 of Yoon, the GPP and DSP are coupled to the radio transceiver 240. EX1005, ¶[0087], Fig. 2.

187. Yoon's processor circuit is coupled to the transmitter arrangement and the receiver arrangement.

b. [11.2]: “the processor circuit being configured to start up in a not-associated state and to cause the transmitter arrangement to transmit association request messages in the not-associated state,”

188. Yoon discloses/suggests Element [11.2].

189. Yoon's processor circuit (i.e., including a GPP and DSP) is configured to start up in a not-associated state (i.e., sleep state or isolated state) and configured to cause the transmitter arrangement (i.e., transceiver 240) to transmit association request messages (i.e., JOIN_REQUEST messages) in the not-associated state. *See* Element [1.1], *supra*.

190. Yoon discloses the GPP and DSP being configured to start up in the “isolated” state, after wake-up. EX1005, ¶[0029].

191. Yoon's “sleep” state and “isolated” state are both “not-associated” states. *Id.*, ¶[0036].

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192. Yoon's nodes start up in the Sleep state and enter the Isolated state after receiving a wake-up signal. Thus, Yoon's nodes include a processor circuit configured to start up in a not-associated state. *Id.*, ¶[0031]. *See also id.*, ¶[0038].

193. Yoon's nodes in the "isolated" state are caused (via the transmitter arrangement) to transmit association request messages: "the Isolated node transmits a join request (JOIN_REQUEST) packet to an upstream node (already Associated)." EX1005, ¶[0038]. *See id.*, ¶¶[0038]-[0039], [0058]-[0066]. *See* Element [1.1], *supra*.

c. [11.3]: "the processor circuit being configured to switch to an associated state upon reception at the receiver arrangement of an association grant in response to one of the association request messages,"

194. Yoon discloses/suggests Element [11.3].

195. Yoon's processor circuit is configured to switch the node to an associated state (i.e., "Associated") upon reception at the receiver arrangement of an association grant (i.e., JOIN_ACK message) in response to one of the association request messages (i.e., JOIN_REQUEST message). *See* Element [1.2], *supra*.

d. [11.4]: "the processor circuit being configured to establish an associated route for communication with an association unit during subsequent communication of operating messages to an association unit, the associated route including a source of the association grant, and,"

196. Yoon discloses/suggests Element [11.4].

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197. Yoon's processor circuit is configured to establish an associated route for communication with an association unit (i.e., C2 nodes) during subsequent communication of operating messages to an association unit.

198. Yoon's associated route includes a source (i.e., upstream node) of the association grant (i.e., JOIN_ACK message). *See* Element [1.3], *supra*.

199. An "associated route" as claimed in the '717 Patent is the same as an "operating route" as claimed.

200. The term "operating route" is only found in Claims 1, 2, and 11 (Element [11.5], *infra*). *See* EX1001, 14:28-67; 15:61-16:16.

201. The term "associated route" is only found in Claims 9 and 11 (Element [11.4]) and the Abstract. *See* EX1001, Abs. 11.3, 18; 15:48-53; 15:61-16:16.

202. The specification of the '717 Patent does not differentiate between an "operating route" and an "associated route".

203. In fact, Claim 11 uses the term "the operating route" in Element [11.5] without antecedent basis, where the term "an associated route" is used in Element [11.4].

204. Thus, Petitioner asserts that the terms "operating route" and "associated route" are used interchangeably.

- e. **[11.5]: “if the source of the association grant is not the association unit, the operating route between the source of the association grant and the association unit previously established for the source of the association grant in response to association request messages and/or the association grants for intermediate stations,”**

205. Yoon discloses/suggests Element [11.5]. *See* Element [1.5], *supra*.

- f. **[11.6]: “the processor circuit being configured to cause the transmitter arrangement to initiate and transmit association grants in response to association request messages, but only after switching to the associated state.”**

206. Yoon discloses/suggests Element [11.6].

207. Yoon’s processor circuit is configured to cause the transmitter of the node to initiate and transmit association grants (i.e., JOIN_ACK messages) in response to association request messages (i.e., JOIN_REQUEST messages), but only after the node has switched to the associated state (i.e., “Associated”). *See* Element [1.7], *supra*.

- 7. **Claim 14 (Preamble): “A method of operating a wireless communication network that comprises an association unit and a plurality of stations, the method comprising”**

208. Yoon discloses/suggests the Preamble. Yoon discloses a method of operating a wireless communication network that comprises an association unit (i.e., C2 node) and a plurality of stations (i.e., R nodes, P nodes).

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209. Yoon discloses a method of network formation with an “on-demand” approach for a routing protocol in a UGS network that achieves balanced energy consumption among all participating nodes. EX1005, ¶¶[0009], [0015], [0023].

210. Yoon’s network includes an association unit (i.e., C2 node) (EX1005, ¶[0023]) and a plurality of stations (i.e., R nodes, P nodes) (EX1005, ¶[0024]). *See id.*, Fig. 1.

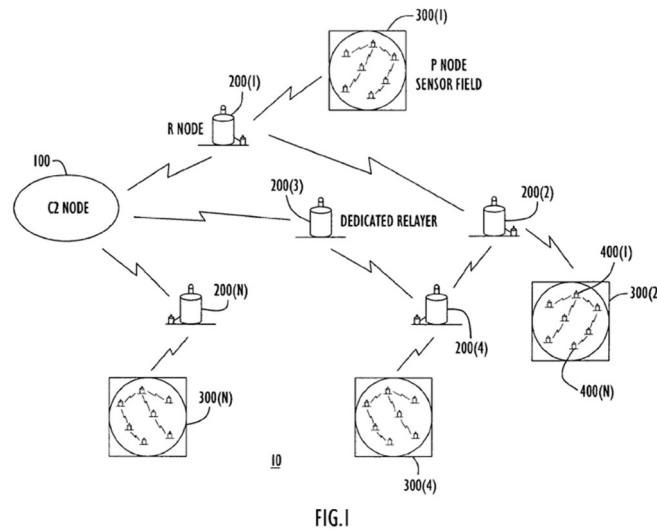


Fig. 1 of Yoon

a. [14.1]: “installing the stations in a not-associated state;”

211. Yoon discloses/suggests Element [14.1].

212. Yoon discloses nodes initially being in a “sleep” state or “isolated” state (i.e., a not-associated state). Yoon expressly discloses that when its R nodes “are initially deployed, they are configured by a relay and enter the Sleep state”.

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EX1005, ¶[0031]. *See also id.*, ¶[0097] (“The UGS network is initially in the sleep state”).

213. It would have been obvious to a POSITA that the nodes in Yoon’s network are installed while shutdown, and then the nodes start up in the “sleep” state because Yoon discloses that at least its R nodes are deployed and enter the “sleep” state (i.e., not associated state). *See* Elements [1.1], [11.2], *supra*. EX1005, ¶[0031]. A POSITA would have understood that Yoon’s nodes would have been installed when shutdown and then enter the “sleep” state once configured. *Id.*

b. [14.2]: “transmitting association request messages from stations in the not-associated state;”

214. Yoon discloses/suggests Element [14.2]. *See* Elements [1.1], [11.2], *supra*.

c. [14.3]: “transmitting the association grants in response to the association request messages,”

215. Yoon discloses/suggests Element [14.3]. *See* Elements [1.2], [11.3], *supra*.

d. [14.4]: “switching each station to an associated state when the station has received an association grant in response to one of its association request messages;”

216. Yoon discloses/suggests Element [14.4]. *See* Elements [1.2], [11.3], *supra*.

- e. **[14.5] storing route information defining a route between the station that has switched to the associated state and the association unit, the route including the station that has sent the associated grant and, if the source of the association grant is not the association unit, the operating route between the source of the association grant and the association unit previously established for the source of the association grant in response to association request messages and/or the association grants for intermediate stations;**

217. Yoon discloses/suggests Element [14.5]. *See* Elements [1.3], [1.4], [1.5], [11.4], [11.5], *supra*.

- f. **[14.6] wherein each association grant is transmitted only from the association unit or from an intermediate station, the latter only after said intermediate station has switched to the associated state upon an association grant from the association unit or one of the at least part of the stations switched to the associated state directly or indirectly based on an association grant from the association unit.**

218. Yoon discloses/suggests Element [14.6]. *See* Elements [1.6], [1.7], [11.6], *supra*.

B. Claims 2-5, 12, 13, and 15-19 are Rendered Obvious Over Yoon (EX1005) in view of Andric (EX1006) (Ground 2)

- 1. Claim 2: “A wireless communication network according to claim 1, wherein said part of the stations comprises at least one dual function station, said dual function station being configured to transmit association grants only after receiving a secondary association grant, the dual function station being configured to transmit one or more secondary association request messages to the association unit along its operating route when in the associated state, only the association unit being configured to originate the secondary association grant in response to the secondary association request message.”**

219. Yoon and Andric disclose/suggest Claim 2. *See* Claim 1, §XIII.A.1., *supra*.

At Least One Dual Function Station

220. Yoon discloses that “said part of the stations comprises at least one dual function station”.

221. The ’717 Patent describes a dual function station as a station having capabilities of both beacon frame transmitters (i.e., relay nodes, R nodes) and sensor stations (i.e., P nodes). EX1001, 4:18-31. *See also id.*, 12:29-64.

222. The example of a dual function station in the ’717 Patent is described as including “two unit[s] 60, 62 as shown in FIG. 2, plus a message exchange memory 64 coupled between the processor circuits 24 of the two units.” *Id.*, 12:30-32. *See id.*, 12:29-42.

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223. Figure 6 includes a “mechanically flexible connection 66”. *Id.*, 12:38, Fig. 6. Figure 2 of the '717 Patent shows a single station while Figure 6 shows a “beacon frame transmitter” having two units described as a dual function station. *See* Figs. 2, 6 (reproduced below).

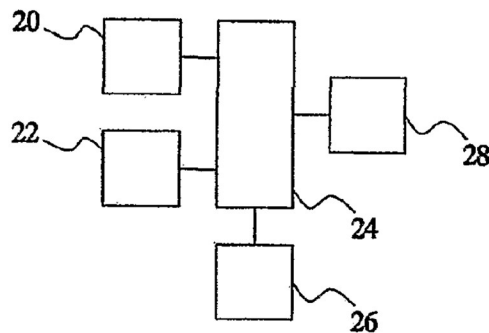


Fig.2

Fig. 2 of the '717 Patent (Station)

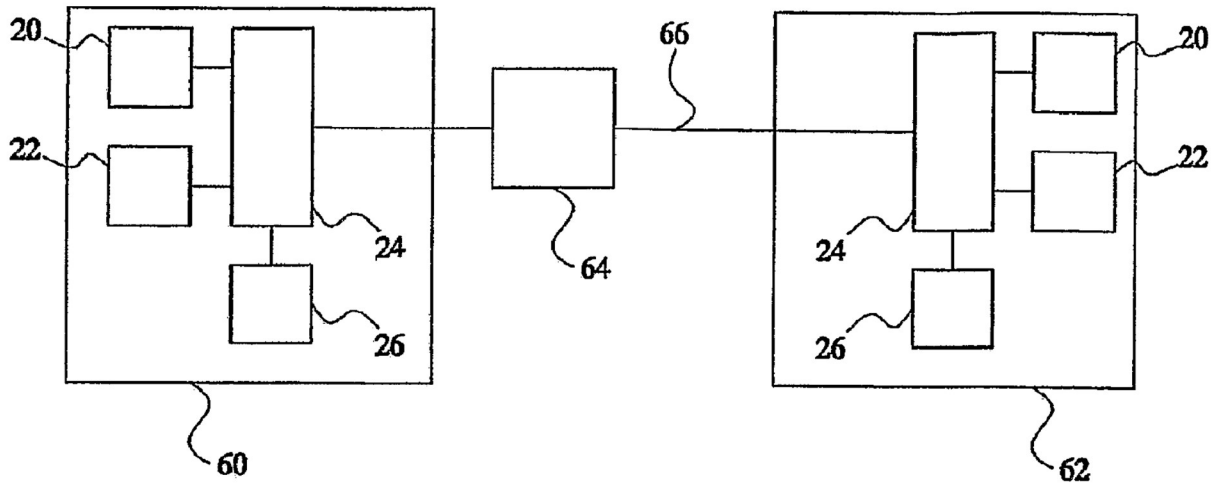


Fig.6

Fig. 6 of the '717 Patent (“Beacon Frame Transmitter” – Dual Function Station)

224. The corresponding disclosure for the dual function station in the '717 Patent does disclose structural requirements for the dual function station relating to the subject matter of Claim 2. EX1001, 4:12-26.

225. The '717 Patent indicates that the dual function station encompasses “separate units that each have an antenna” and include “a mechanically flexible connection” between the separate units. *Id.*, 4:28-29. *See id.*, 4:27-31. *See also id.*, 12:29-64, Fig. 6.

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226. The '717 Patent indicates that the dual function station “may use shared circuits” (*id.*, 13:56-57), however there is no requirement that the dual function station use shared circuits. Claim 2 encompasses a dual function station including the “separate units” and “mechanically flexible connection”, and can be a single station configured to perform the claimed functions using “separate units.”

227. Claim 5 (*infra*) is directed to a Claim 2 dual function station embodiment including “separate units” and a “mechanically flexible connection.”

228. Yoon discloses dual function stations as R nodes with locally attached P nodes. EX1005, ¶[0025].

229. A POSITA would have understood that R nodes with locally attached P nodes include “separate units” or “shared circuits” for the nodes to the same extent as disclosed in the '717 Patent and encompassed by Claim 2. Thus, Yoon discloses dual function stations at least to the same extent as the '717 Patent.

230. Yoon discloses R nodes that include locally attached sensors (i.e., locally attached P nodes), thus being a dual function station. EX1005, ¶[0025].

231. Yoon’s Figure 1 differentiates dedicated R nodes from dual function nodes that include locally attached sensors. *See id.*, Fig. 1 (showing a “dedicated relay” (outlined in red) with no locally attached sensor and other R nodes with locally attached sensors (outlined in green)—reproduced below).

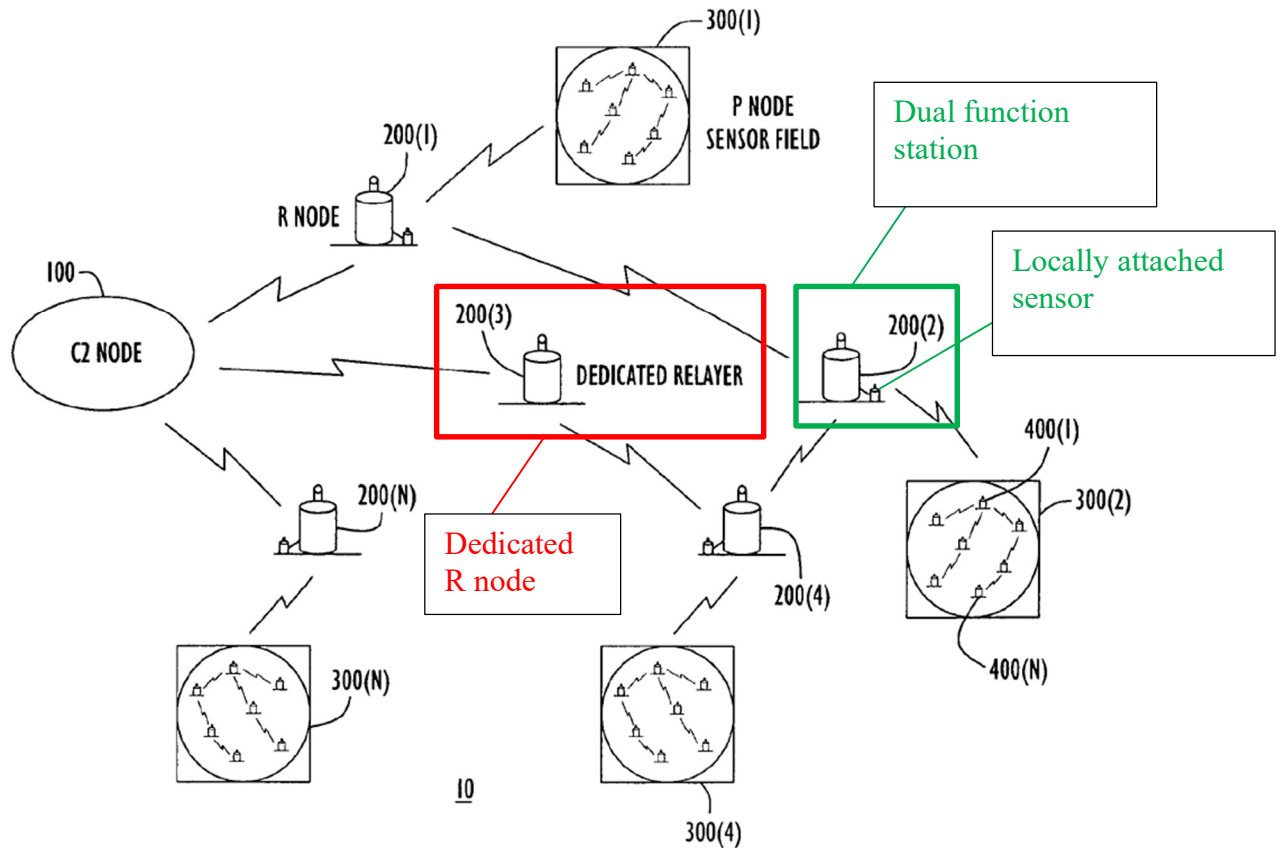


FIG. 1

Fig. 1 of Yoon (Annotated)

***Configured to Transmit Association Grants Only After Receiving a Secondary
Association Grant***

232. Yoon discloses dual function stations configured to transmit association grants only after receiving a secondary association grant in response to a secondary association request. Yoon's nodes (including dual function nodes) are configured to

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transmit association grants only after becoming associated. EX1005, ¶[0038]. *See also id.*, ¶¶[0062]-[0066]. *See* §VII.A.1.b., *supra*.

233. Yoon's secondary association requests and grants are implicit in Yoon's JOIN_REQUEST messages and JOIN_ACK messages because Yoon's dual function stations are configured to transmit association grants (i.e., JOIN_ACK messages) to join new downstream nodes to the network only after receiving a JOIN_ACK message themselves (*see also* discussion of Andric, *infra*). EX1005, ¶[0038]. *See also id.*, ¶¶[0010], [0062]-[0066].

234. Thus, by requesting association via a JOIN_REQUEST message, Yoon's dual function stations transmit a secondary association request. Yoon's dual function stations also receive secondary association grants from the C2 node (i.e., association unit) by receiving JOIN_ACK messages to associate the dual function station and permit transmission of further JOIN_ACK messages to join new devices.

235. Yoon does not expressly disclose that a dual function station (i.e., dual function R nodes with locally attached P nodes) use secondary association requests/grants for the C2 node to manage/limit association of downstream nodes, or that node ID requests/responses are included to control network topology and performance.

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236. Andric (EX1006) is a wireless network topology management system like Yoon, and discloses network nodes (NNs) as stations of a wireless network that transmit association grants (i.e., CONNECTION RESPONSES) only after receiving a secondary association grant (i.e. NODE ID RESPONSE). Andric's NNs transmit secondary association request messages (i.e., NODE ID REQUESTS) to a cluster head (i.e., association unit) along the NN's operating route when the NN is in the "associated" state to associate new downstream nodes and/or sensors. *See* EX1006, ¶¶[0076], [0090]-[0095], [0180]-[0184], [0212].

237. Only Andric's association unit (i.e., cluster head) is configured to originate the secondary association grant (i.e., NODE ID RESPONSES) in response to the secondary association request message (i.e., NODE ID REQUESTS). *Id.*

238. The '717 Patent describes a purpose of "secondary association grants" as follows:

Association unit 10 may for example make issuance of the secondary grant message *dependent on information about the number of as yet unassociated stations* that the beacon frame transmitter 12 has discovered. *Thus, association unit 10 can control network topology.*

EX1001, 6:31-36. *See also id.*, 11:8-20.

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239. Andric describes the same purpose for transmitting NODE ID RESPONSES as grants to NODE ID REQUESTS (e.g., based on information of the number of unassociated stations) such that Andric’s system (and cluster head—i.e., association unit) can manage network topology. *See* EX1006, ¶¶[0090]-[0095], [0211].

240. Andric limits the number of nodes a network can associate based on a number of node IDs available “or some other defined limit”. *Id.*, ¶[0089]. Andric’s cluster head only sends NODE ID RESPONSES when node IDs are available, thus being dependent on information about the number of unassociated nodes. *Id.*, ¶¶[0092]-[0093].

241. Specifically, Andric discloses a “multi hop cluster setup procedure” shown in Figure 4 (reproduced below).

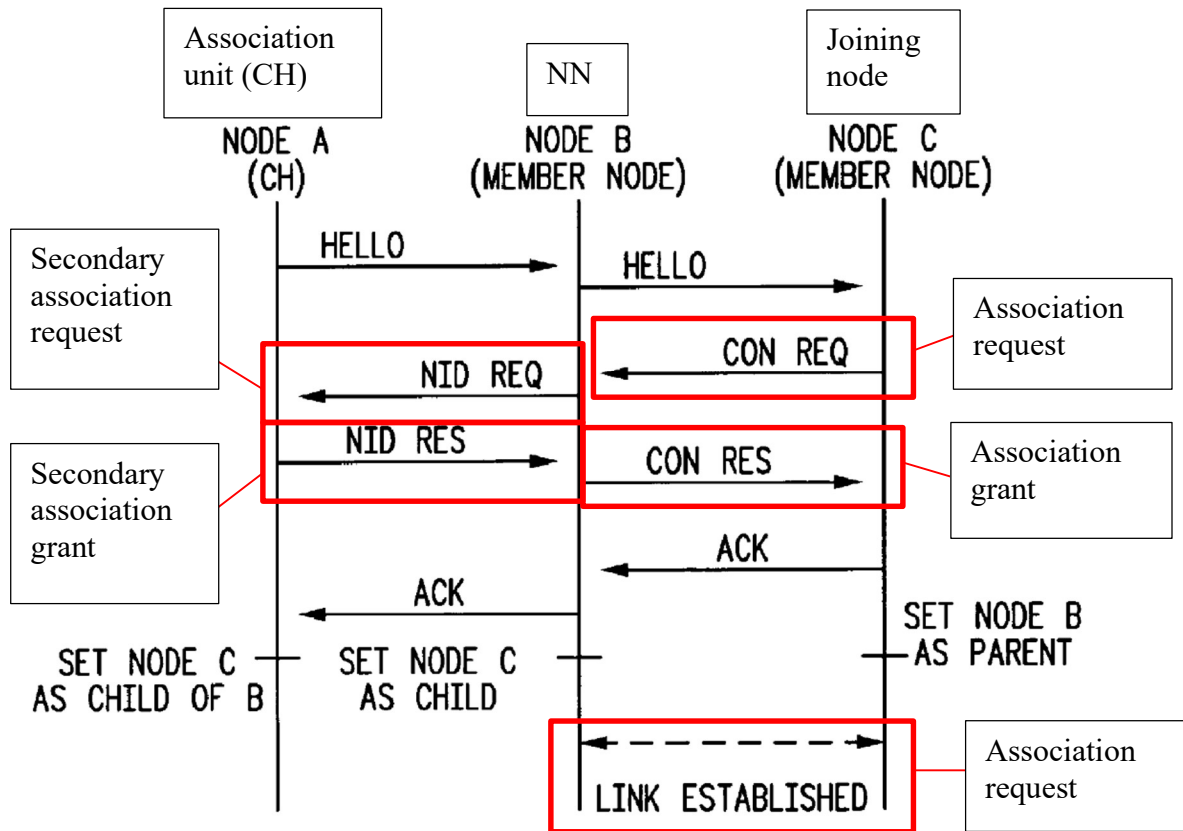


FIG. 4

Fig. 4 of Andric (Annotated)

242. Andric discloses its NN transmitting a secondary association request in response to receiving an association request (i.e., CONNECTION REQUEST) from the joining node. The '717 Patent discloses preferably transmitting secondary association requests from beacon frame transmitters to the association unit in response to receiving an association request from a not-associated node, as disclosed in Andric. EX1001, 11:8-12. *See id.*, 11:8-20. *See* EX1006, ¶[0090], Fig. 4.

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243. Andric's NNs are configured to transmit the NODE ID REQUESTS to the cluster head along the NN's operating route when the NNs are in the "associated" state (i.e., after the NN has established a link with the cluster head). EX1006, ¶¶[0088], [0090].

244. Only Andric's cluster head is configured to originate the NODE ID RESPONSE in response to the NODE ID REQUEST. *Id. See id.*, ¶[0088] ("the cluster head has the responsibility to assign and manage unique node IDs to its member nodes.").

245. Andric's NODE ID REQUESTS and NODE ID RESPONSES are used in the same manner to accomplish the same goals as the '717 Patent, including controlling network topology to limit the number of nodes that can join the network to limit the number of hops to minimize energy usage, network bandwidth, "network delay", and interference. *See* EX1006, ¶¶[0004], [0075], [0088], [0090], [0210] ("reducing the number of hops required to get a message to its intended target may also provide the additional benefit of reduced message interference by reducing the number of message re-transmissions along the path.").

246. It would have been obvious to include Andric's secondary association request/grant functions in Yoon's stations (i.e., R nodes and/or dual function R/P nodes) so that Yoon's C2 node can also manage/limit association of downstream

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nodes to improve bandwidth usage, network delay, and interference. It would have been obvious to include Andric's node ID requests/responses with Yoon's R nodes with locally attached P nodes (i.e., dual function stations) and C2 node to allow Yoon's C2 node to control network topology to improve network performance. *See* EX1006, ¶[0210].

247. Yoon would have provided a POSITA motivation to combine Andric's NODE ID REQUESTS/RESPONSES for managing/limiting the number of downstream nodes that are "associated" with the network in order to conserve battery life of devices already "associated" with the network. EX1005, ¶¶[0033] ("energy efficient protocols at various levels (i.e. physical layer, link layer, network layer, etc.) are important for the UGS network."), [0048] ("the node having more downstream nodes could deplete its battery sooner."). *See id.*, ¶¶[0048]-[0057], [0074].

248. Andric's NODE ID REQUESTS/RESPONSES would have allowed Yoon's network to limit the number of downstream nodes for upstream R nodes to conserve battery of upstream R nodes, and/or to evenly distribute downstream nodes using NODE ID REQUESTS/RESPONSES to normalize and distribute battery usage among the already "associated" R nodes. *See* EX1005, ¶¶[0048], [0056], [0107]. *See also* EX1006, ¶¶[0077], [0211].

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249. Yoon would have motivated a POSITA to include Andric's NODE ID REQUESTS/RESPONSES in Yoon's network because of Yoon's expressed desire to increase routing and topology knowledge of the C2 node. This enhanced knowledge of the C2 node would have allowed the C2 node to ensure improved battery power and node efficiency for R nodes and P nodes, for example, by further controlling network size and minimizing bandwidth usage/interference. EX1005, ¶¶[0009], [0061], [0066].

250. Allowing Yoon's C2 node to manage/limit association of downstream nodes would have benefitted network formation and tree structure of nodes resulting in improved network efficiency, such that Yoon's network could limit downstream nodes for certain upstream nodes (e.g., R nodes) to further improve battery power and efficiency of nodes within its network. *See id.*, ¶¶[0048], [0061].

251. A POSITA would have understood that Yoon's C2 node could have been configured to limit association of new downstream nodes by transmitting NODE ID RESPONSES only from the C2 node such that R nodes that receive the NODE ID RESPONSES can transmit JOIN_ACK messages to associate new downstream nodes. This functionality would have also allowed Yoon's C2 node an opportunity to reject association of a new downstream node by rejecting the NODE ID REQUEST and foregoing sending a NODE ID RESPONSE.

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252. Andric also recognizes the importance of using node IDs within a cluster architecture. EX1006, ¶[0088] (“The node ID may be unique within a cluster and the cluster head has the responsibility to assign and manage unique node IDs to its member nodes.”). *See also id.*, ¶¶[0092]-[0093], [0103], [0211].

253. A POSITA would have recognized in Yoon that cluster architectures benefit from techniques which maximize battery power, and thus a POSITA would have been motivated to include Andric’s NODE ID messaging to accommodate dynamic clustering architectures. EX1005, ¶[0008] (“it is important that the routing protocol accommodate dynamic clustering architectures to prevent cluster heads from depleting their power, and hence extending the lifetime of the network.”).

254. Adding Andric’s node id requests/responses to Yoon’s C2 node and dual function nodes (i.e., R nodes with locally attached P nodes) would have involved combining prior art elements of node ID requests/responses and node association in Andric according to known methods disclosed in Yoon for forming ad hoc networks with node association. Such a combination would have yielded predictable results of allowing Yoon’s C2 node full control over network topology by approving (via a node ID response) which nodes can join the network.

255. A POSITA would have had a reasonable expectation of success given that Andric and Yoon are both directed to formation of ad hoc networks using a

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network tree formation protocol and Yoon recognizes problems with cluster tree networks which Andric's disclosure addresses. *See* EX1005, ¶¶[0006], [0009]-[0012]. *See also* EX1006, ¶¶[0004], [0081]-[0096].

2. **Claim 3: “A wireless communication network according to claim 2, wherein the dual function station is configured to transmit information to the association unit indicating from which of the stations said dual function station has received transmissions, the association unit being configured to select whether to grant the secondary association request dependent on said information.”**

256. Yoon and Andric disclose/suggest Claim 3. *See* Claim 2, *supra*.

257. Yoon discloses wherein said part of the stations comprises at least one dual function station. *See* Claim 2, *supra*.

258. Yoon and Andric disclose/suggest a dual function station configured to transmit information to the association unit indicating from which of the stations the dual function station has received transmissions.

259. The association unit is configured to select whether to grant the secondary association request (i.e., the NODE ID RESPONSE) dependent on said information.

260. Andric discloses that a mobile node (MN) (i.e., downstream node, joining node) “may communicate connection status information about itself, such as whether it is a MN that has never joined, a MN that is re-joining (re-associating)

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itself with the network, etc.” EX1006, ¶[0190]. The MNs transmit status information to the cluster head (via a connecting node/NN, i.e., a dual function station) including “a code corresponding to the appropriate status of the MN.” *Id.*

261. Andric discloses that the status information “may convey that a static address needs to be assigned to the MN if a control node is responsible for assigning static addresses to MNs of the network.” *Id.*

262. Thus, where the MN status information indicates a static address is needed, Andric’s cluster head can select whether to send the NODE ID RESPONSE dependent on the status information received from the MN via a connecting node. *See id.*, ¶¶[0093], [0190].

263. Andric’s status information includes connection status information about a MN (i.e., downstream node) that indicates from which node (i.e., which MN) the dual function station (i.e., Andric’s connecting node/NN) has received transmissions. *See* EX1006, ¶¶[0186]-[0194]. This is because Andric’s MNs communicate status information and identifying information (e.g., an address) of the MN for identification and storage in a database. *Id.*, ¶¶[0195]-[0196]. *See also id.*, ¶[0206].

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264. This status information is shared with Andric's cluster head (i.e., association unit) so that the cluster head is aware of the information regarding the status of the MN. EX1006, ¶¶[0190], [0192]. *See id.*, Fig. 66 ("src field").

265. Andric's MN communicates status information as part of the "connection request" (CONNECTION REQUEST message). *Id.*

266. Andric's cluster head is configured to select whether to grant the NODE ID RESPONSE (and provide an address) dependent on the received status information. For example, Andric discloses that where a node is a new MN (newly joining node) and Andric's cluster head determines there are no node IDs left or "the cluster has reached some other defined limit," the cluster head can reject connection requests from new nodes. EX1006, ¶¶[0093], [0192]. Andric's cluster head selects whether to transmit a NODE ID RESPONSE depending on the status of a node. *See id.*, ¶¶[0190]-[0192]. Where the status of the MN is that it was previously associated and it is trying to reassociate, a static address can be assigned such that the same static address is retained so that the cluster head does not need to update the identity of the MN in the database, but only the NN through which the MN is connecting. *Id.*, ¶¶[0190], [0195]-[0196]. Thus, Andric's cluster head can select whether to assign a new node ID or use a previously assigned node ID based on the status of the MN. *Id.*, ¶¶[0093], [0189]-[0190]. *See id.*, ¶¶[0189]-[0199].

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267. Once the status information is received at the cluster head, the cluster head can select whether to provide the connecting node (i.e., dual function node) with a NODE ID RESPONSE to allow the connecting node to associate the MN dependent on said connection status information. *Id.*, ¶¶[0093], [0190], [0195]-[0196].

268. It would have been obvious to combine Andric's functionality of NODE ID REQUESTS and NODE ID RESPONSES, as well as transmission and reception of node status information, to Yoon's network formation method. *See* Claim 2, *supra*. Yoon's C2 node (similar to Andric's cluster head) would have benefited from knowing the status of downstream nodes wishing to associate with Yoon's network because Yoon expresses concern about node status, especially battery life. EX1005, ¶¶[0008], [0034], [0057]. Yoon discloses that downstream nodes can communicate status information (e.g., battery life of downstream nodes) similar to Andric. *Id.*, ¶[0057]. However, Yoon does not expressly describe the C2 node using battery life or other status information (e.g., previously joined or re-associating nodes) to select whether or not to allow the downstream node to be joined by an intermediate node.

269. It would have been obvious to include Andric's status information including whether a node has been previously associated or is newly associated with

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Yoon's battery life information in messages to Yoon's C2 node for selecting whether to send addresses to downstream nodes based on node status information. *Id.*

270. Yoon expressly states that at least battery life information can be transmitted to the C2 node. *Id.*, ¶[0057]. Yoon also provides motivation to use techniques that save node battery reserve and that limit use of nodes that have low battery life. *Id.*, ¶[0061] (“This mechanism attempts to discourage nodes with low remaining battery power from participating in the routing process”). Yoon also describes a similar association and re-association procedure as Andric where new upstream nodes are selected. *Id.*, ¶¶[0068]-[0076]. A POSITA would have been further motivated to include an improved mechanism to re-join nodes in Yoon's network (e.g., in Yoon's repair process). A POSITA would have recognized that this can be accomplished by joining new or re-joined downstream nodes based on their status using Andric's static addresses supplied by the C2 nodes.

271. A POSITA reading Andric would have been motivated to use Andric's static addressing technique in Yoon's network for associating downstream nodes. Andric's static addressing is advantageous because it reduces the requirement “to obtain new logical information” and thus “translates to immediate savings in battery life for the mobile node, as well as for NNs in proximity.” EX1006, ¶[0077]. A POSITA would have been motivated to include Andric's static addressing in Yoon

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to further save battery life of both upstream and downstream nodes in Yoon's network, particularly when relying on Yoon's repair process. *See* EX1005, ¶¶[0004], [0007]-[0008], [0068]-[0080].

272. Combining Andric's static addressing and joining of nodes based on said status information would have constituted combining a known technique described in Andric with Yoon's network and downstream node join process to similarly improve Yoon's network to provide an additional method of reducing communications and improving battery life for both Yoon's upstream and downstream nodes.

273. A POSITA would have had a reasonable expectation of success in using Andric's newly joined node status or previously joined node status and Andric's static addressing as Andric expressly states this method leads to node battery savings (*see* EX1006, ¶[0077]) and such status information could have been included in Yoon's existing status messages while adding a simple static addressing scheme for downstream nodes using Yoon's existing network formation database. EX1005, ¶[0057]. This would have allowed Yoon's network to more accurately keep track of node battery level by storing status information in the C2 node's network formation database, reducing required messaging and allowing for less costly re-associating of nodes during Yoon's repair process. This would have also provided enhanced

control of network topology by the C2 node, because the C2 node could determine whether to allow devices to associate with the network dependent on their status.

274. It would have been obvious to apply Andric's functionality of granting NODE ID RESPONSES based on a node status to Yoon's network to allow Yoon's C2 node to further manage network topology and allow R nodes to add new downstream nodes to the network based on status (e.g., battery level or previously/newly joining) of downstream nodes. *See* EX1006, ¶¶[0190], [0196], [0212]. *See* Claim 2, *supra*.

3. Claim 4: “A wireless communication network according to claim 3, wherein the stations are configured to transmit discovery messages before switching to the associated state, said transmissions comprising at least the discovery messages.”

275. Yoon and Andric disclose/suggest Claim 4. *See* Claim 3, *supra*.

276. Yoon discloses stations configured to transmit discovery messages (i.e., wake-up messages, LNI messages, and/or responses to LNI messages as JOIN_REQUEST messages) before switching to the associated state (i.e., while in the “isolated” state).

277. Yoon and Andric disclose that the transmissions received by the dual function stations (i.e., upstream nodes) (“said transmissions”, *see* Claim 3, *supra*) include at least a node address of the “isolated” node included in the

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JOIN_REQUEST message. Yoon discloses that nodes in the “isolated” state transmit JOIN_REQUEST messages including node address information to upstream nodes before the “isolated” node is switched to the “associated” state and before any routes are established for the downstream node. EX1005, ¶¶[0036], [0062], [0065]. *See id.*, ¶[0038].

278. The ’717 Patent discloses the purpose of the “discovery stage” (i.e., discovery messaging) is to enable stations “first to discover addresses of available other stations to which association requests can be sent, or stations that may send association requests before a route is established.” EX1001, 4:4-7.

279. The ’717 Patent also states that “[t]he discovery stage and the association stage may overlap” and in fact indicates that discovery messages “can double as association requests 54a.” *Id.*, 6:51-52, 14:17-21. *See also id.*, 6:56-59, 7:5-11, 7:52-60, 14:1-3, Fig. 3.

280. Yoon’s network uses wake-up messages and LNI messages in a discovery process for downstream nodes. EX1005, ¶¶[0010], [0038]. The wake-up signal is transmitted to change downstream nodes from the “sleep” state to the “isolated” state so the “isolated” nodes can receive LNI messages. *Id. See id.*, ¶[0028] (“Two wake-up sequences are available (C2-initiated and sensor-initiated).”). Once an LNI message is received by a downstream node to discover

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“isolated” nodes, the “isolated” nodes can transmit JOIN_REQUESTS in response to completing the discovery process. *Id. See id.*, ¶[0010] (“a node may periodically transmit LNI messages ... so that it may alert other “Isolated” nodes about its existence.”).

281. A POSITA would have understood that a discovery process can include initial discovery messages received and discovery messages transmitted in response so the network is aware of available nodes. *See id.*, ¶[0036]. Yoon’s downstream nodes would have no ability to discover the network and available upstream nodes unless those nodes had first received wake-up signals and LNI messages. *Id.*, ¶[0038]. *See also id.*, ¶[0066].

282. Yoon’s JOIN_REQUEST messages include node address information of the “isolated” nodes and enables the “isolated” nodes to discover addresses of available upstream nodes to which JOIN_REQUEST messages can be sent. As disclosed in the ’717 Patent, Yoon overlaps the discovery stage and the association stage by including the node address information in the JOIN_REQUEST messages for discovery of available downstream nodes (i.e., “isolated” nodes) by upstream nodes receiving the JOIN_REQUEST messages including the node address. *See* EX1005, ¶¶[0036], [0065].

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283. A POSITA would have understood that the “information” from the JOIN_REQUEST message includes the downstream node address. *Id.*, ¶[0065], Fig. 5 (553).

284. Thus, Yoon’s “discovery message” doubles as an “association request” as part of the discovery process. *See* EX1001, 6:37-42.

285. Andric discloses that “said transmissions” include at least the discovery messages (doubling as JOIN_REQUEST messages, or CONNECTION REQUEST messages in Andric). Andric discloses that the dual function stations (i.e., NNs) are configured to transmit information (i.e., status information) to the association unit (i.e., C2 node, cluster head) indicating from which of the stations (i.e., MNs) said dual function station has received transmissions including at least the discovery messages. *See* Claim 3, *supra*. Andric’s CONNECTION REQUESTS, like Yoon’s JOIN_REQUEST messages, include at least node address information (i.e., a Source Device ID) of the transmitting node. EX1006, ¶¶[0151], [0191].

286. Andric’s CONNECTION REQUESTS are also transmitted as responses in a discovery process (i.e., via HELLO messages). *Id.*, ¶[0087]. Andric’s HELLO messages are similar to Yoon’s LNI messages. *See id.*, ¶¶[0087]-[0091]. *See* EX1005, [0038]-[0057].

287. A POSITA would have understood that Yoon's JOIN_REQUEST messages and Andric's CONNECTION REQUESTS constitute discovery messages in response to wake-up/LNI messages in a discovery process to allow the network to discover available "not-associated" downstream nodes.

4. **Claim 5: "A wireless communication network according to claim 2, wherein the dual function station comprises a first and second unit, each with at least a respective antenna, coupled via a mechanically flexible connection, the first unit being configured to transmit first ones of the association request messages and to receive first ones of the association grants, the second unit being configured to receive second ones of the association request messages and to the transmit second ones of the association grants in response to the first ones of the association request messages."**

288. Yoon and Andric disclose/suggest Claim 5.

289. Yoon discloses/suggests a dual function station including a first unit (i.e., locally attached sensor, P node) and a second unit (i.e., R node) each with a respective antenna and coupled via a flexible connection (i.e., RS-232 link). *See* Claim 2, *supra*.

290. Yoon's "R node 200(i) may use locally attached sensors to further enhance the information that was received. Such a P node will be connected to an R node radio via an RS-232 link." EX1005, ¶[0025].

291. Yoon discloses that its R nodes can include locally attached sensors, thus being a dual function station. *See also id.*, Fig. 1. *See* Claim 2, *supra*.

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292. The '717 Patent indicates that “use of a flexible connection has the advantage that the different units may be located ‘around a corner’ from each other, so that one unit has contact with a space to which the other has no contact.” EX1001, 13:58-61.

293. Yoon discloses that “a P node will be connected to an R node radio via an RS-232 link.” EX1005, ¶[0025].

294. A POSITA would have understood that P nodes and R nodes “connected” via an RS-232 link are connected by a physical cable using the RS-232 communication standard. It would have been obvious to a POSITA that Yoon’s locally attached P nodes are connected to R nodes with a mechanically flexible connection (e.g., a cable) that uses the RS-232 communication standard. Yoon’s RS-232 link, including a flexible cable, would permit an R node to be located “around a corner” from a locally attached P node.

295. Yoon discloses that the first unit (i.e., P node) and the second unit (i.e., R node) each include a respective antenna.

296. Figure 2 of Yoon expressly discloses that its stations include an antenna (i.e., at radio transceiver 240). *See* EX1005, ¶¶[0029]-[0030], Fig. 2.

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297. Each of the P nodes and R nodes are wireless radios, and a POSITA would have understood that Yoon's wireless radios each include an antenna for wireless communication. *See* EX1005, ¶[0024]. *See also id.*, ¶[0036].

298. Yoon's P nodes are configured to transmit first ones of JOIN_REQUEST messages and to receive first ones of JOIN_ACK messages. EX1005, ¶¶[0038], [0059]-[0064].

299. Yoon's R nodes are configured to receive second ones of JOIN_REQUEST messages (e.g., from a downstream P node or R node) and are configured to transmit second ones of JOIN_ACK messages in response to the first ones of JOIN_REQUEST messages. *Id.*

5. **Claim 12: “A station according to claim 11, wherein the processor circuit is configured, when switched to the associated state, to cause the transmitter arrangement to transmit a secondary association request message to the association unit, and to cause the transmitter arrangement to transmit the association grants only after receiving a secondary association grant in response to said secondary association request message.”**

300. Yoon and Andric disclose/suggest Claim 12. *See* Claim 11, §XIII.A.6., *supra*. *See* Claim 2, *supra*.

6. **Claim 13: “A station according to claim 11, wherein the processor circuit is configured to send information to the association unit indicating from which one of the stations said dual function station has received messages prior to receiving the secondary association grant.”**

301. Yoon and Andric disclose/suggest Claim 13. *See* Claim 11, §XIII.A.6., *supra*. *See* Claim 3, *supra*.

7. **Claim 15 (Preamble): “A method according to claim 14, wherein the intermediate station is a dual function station, the method comprising”**

302. Yoon discloses/suggests the Preamble. Yoon discloses a dual function station. *See* Claim 2, *supra*.

- a. **[15.1]: “transmitting a secondary association request message from the dual function station when the dual function is in the associated state;”**

303. Yoon and Andric disclose/suggest Element [15.1]. *See* Claim 2, *supra*.

- b. **[15.2]: “transmitting a secondary association grant originating from the association unit in response to the secondary association request message;”**

304. Yoon and Andric disclose/suggest Element [15.2]. *See* Claim 2, *supra*.

- c. **[15.3]: “enabling the dual function station to transmit the association grants only upon receiving the secondary association grant.”**

305. Yoon and Andric disclose/suggest Element [15.2]. *See* Claim 2, *supra*.

8. **Claim 16 (Preamble): “A method according to claim 15, comprising”**

306. Yoon and Andric disclose/suggest the Preamble. *See* Claim 15, *supra*.

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- a. **[16.1]: “transmitting information from the intermediate station to the association unit about from which one of the stations the intermediated station has received transmissions;”**

307. Yoon and Andric disclose/suggest Element [16.1]. *See* Claim 3, *supra*.

- b. **[16.2]: “selecting, in the association unit, whether to grant the secondary association request dependent on said information.”**

308. Yoon and Andric disclose/suggest Element [16.2]. *See* Claim 3, *supra*.

- 9. **Claim 17: “A method according to claim 16, further comprising transmitting discovery messages from the stations before switching to the associated state, said transmissions comprising the discovery messages.”**

309. Yoon and Andric disclose/suggest Claim 17. *See* Claim 4, *supra*. *See* Claim 16, *supra*.

- 10. **Claim 18 (Preamble) “A method according to claim 15, further comprising the steps of:”**

310. Yoon and Andric disclose/suggest the Preamble. *See* Claim 15, *supra*.

- a. **[18.1]: “transmitting discovery advertisement messages from at least part of the stations, including an identification of the station that has transmitted the discovery advertisement message;”**

311. Yoon and Andric disclose/suggest Element [18.1]. *See* Claims 7 and 8, §§VII.A.2.-VII.A.3., *supra*.

- b. [18.2]: “addressing the association request messages using identifications from the discovery advertisement messages.”**

312. Yoon and Andric disclose/suggest Element [18.2]. *See* Claims 7 and 8, §§VII.A.2.-VII.A.3., *supra*.

- 11. Claim 19 (Preamble): “A method according to claim 18, further comprising the steps of:”**

313. Yoon and Andric disclose/suggest the Preamble. *See* Claim 18, *supra*.

- a. [19.1]: “including an indication in the discovery advertisement messages, whether the station that transmits the discovery advertisement message is enabled to transmit association grants,”**

314. Yoon and Andric disclose/suggest Element [19.1]. *See* Claim 8, §VII.A.3., *supra*.

- b. [19.2]: “transmitting association requests addressed to stations only if the addressed station has indicated that it is enabled to transmit association grants.”**

315. Yoon and Andric disclose/suggest Element [19.2]. *See* Claim 8, §VII.A.3., *supra*.

C. Claims 6 and 20 are Rendered Obvious Over Yoon (EX1005) in view of Andric (EX1006) and Budampati (EX1007) (Ground 3)

- 1. Claim 6: “A wireless communication network according to claim 2, wherein the dual function station is configured to operate using respective, mutually distinct first and second frequency channels, using the first frequency channel for transmitting association request messages and receiving association grants, and using the second frequency channel for receiving association request messages and transmitting association grants.”**

316. Yoon, Andric, and Budampati disclose/suggest Claim 6.

317. Yoon discloses a dual function station configured to operate using respective, mutually distinct first and second frequency channels. *See* Claim 2, Claim 5, §§XIII.B.1., XIII.B.4., *supra*.

318. Yoon’s “UGS network 10 uses two distinct channels: (1) a wake-up channel, and (2) a normal communication channel.” EX1005, ¶[0036].

319. Yoon does not expressly disclose using the first frequency channel for transmitting association request messages and receiving association grants, and using the second frequency channel for receiving association request messages and transmitting association grants.

320. Budampati discloses nodes operating using mutually distinct frequency channels, using a first frequency channel for transmitting association request

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messages, and receiving association grants and using a second frequency channel for receiving association request messages and transmitting association grants.

321. Budampati's network includes leaf nodes that can perform first and second transmissions. "The first transmission may be performed on a first communication channel and the second transmission may [be] performed on a second channel." EX1007, ¶[0057]. *See id.*, ¶¶[0057]-[0062].

322. It would have been obvious to implement Budampati's separate channel transmissions with Yoon's distinct channels in order to limit interference of Yoon's JOIN_REQUEST messages and JOIN_ACK messages being transmitted (e.g., simultaneously between various devices) throughout Yoon's network. A POSITA would have understood that reducing messaging interference is an advantage for any wireless network, and that transmission of JOIN_REQUEST messages and JOIN_ACK messages on separate, distinct channels for Yoon's "normal communication channel" would reduce interference within the network further improving battery life of networked nodes. *See* EX1005, ¶[0036].

323. A POSITA would have been motivated to combine Budampati's separate channel transmissions with Yoon's nodes to allow for simultaneous transmission of JOIN_REQUEST and JOIN_ACK messages for low-power (e.g.,

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energy constrained) devices, where interference could have drained battery power.

EX1007, ¶¶[0018], [0068]. *See* EX1005, ¶¶[0004]-[0008], [0036].

324. A POSITA would have had a reasonable expectation of success given that Yoon already provides for separate, distinct channels for other message types (e.g., synchronization). EX1005, ¶¶[0036], [0038].

325. Separating Yoon’s “normal communication” channel into multiple separate channels to transmit JOIN_REQUEST messages and JOIN_ACK messages on different channels would have been a trivial implementation of known techniques of communication channel/bandwidth management to improve communication, reduce interference between Yoon’s nodes, and improve signaling within the overall network transmissions. A POSITA would have understood that separating Yoon’s “normal communication” channel into distinct channels for transmission of JOIN_REQUEST messages and receiving JOIN_ACK messages (e.g., from a downstream node reference) would have been a simple implementation of full-duplex communication, as is well known in the wireless communication arts.

2. **Claim 20: “A method according to claim 15, further comprising switching the intermediate station to operate at a first and second, mutually different transmission frequency after switching to the associated state, for directly or indirectly communicating with the association unit and for communicating with its associated stations respectively.”**

326. Yoon, Andric, and Budampati disclose/suggest Claim 20. *See* Claim 15, §XIII.B.7., *supra*. *See* Claim 6, *supra*.

XIV. SECONDARY CONSIDERATIONS

327. As discussed herein, all elements of the Challenged Claims were known in the art, and any differences would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art.

328. I am not aware of any secondary considerations that would alter my opinion.

329. Any purported evidence of secondary considerations that Patent Owner may present in this proceeding would be insufficient to overcome the strong evidence that the Challenged Claims are obvious.

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XV. CONCLUSION

330. For the reasons set forth above, it is my opinion that all elements of the Challenged Claims of the '717 Patent are disclosed or suggested by the prior art. In my opinion, the Challenged Claims of the '717 Patent would have been obvious over the prior art.

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

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

Date: February 20, 2026



David H. Williams