IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re inter partes review of:

U.S. Patent 7,477,624 to Gan, et al

Filed: Herewith

For: Approach for Managing the Use of Communications Channels Based on Performance

Atty. Docket: 3559.001IPR2

Declaration of Dr. Zhi Ding in Support of Petition for Inter Partes Review of U.S. Patent No. 7,477,624

Mail Stop Inter Partes Review

Attn: Patent Trial and Appeal Board

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Commissioner:

I, Dr. Zhi Ding, declare as follows:

1. I have been retained on behalf of Marvell Semiconductor, Inc., MediaTek Inc., and MediaTek USA, Inc. for the above-captioned inter partes review proceeding. I understand that this proceeding involves U.S. Patent No. 7,477,624 to Gan, et al, titled “Approach for Managing the Use of Communications Channels Based on Performance” (“the ’624 patent”) and that the ’624 patent is currently assigned to Bandspeed, Inc.
2. I have reviewed and am familiar with the specification of the ’624 patent filed on April 3, 2006. I will cite to the specification using the following format: (’624 patent, 1:1-10). This example citation points to the ’624 patent specification at column 1, lines 1-10.

3. I have reviewed and am familiar with the file history of the ’624 patent. I have also reviewed the reexamination of U.S. Patent No. 7,027,418 (“the ’418 patent”). I understand that the ’624 patent is a continuation of the ’418 patent. I understand that the ’624 patent and the ’418 patent share a common specification.

4. I have reviewed and am familiar with the following prior art used in the Petition for Inter Partes Review of the ’624 patent and/or referenced below:

**U.S. Patent No. 6,760,319** to Gerten, et al (“Gerten”), titled “Fixed Frequency Interference Avoidance Enhancement.” (Exhibit 1003.)

**U.S. Patent No. 6,418,317** to Cuffaro, et al (“Cuffaro”), titled “Method and System for Managing Frequencies Allocated to a Base Station.” (Exhibit 1004.)

**U.S. Patent No. 6,115,407** to Gendel, et al (“Gendel”), titled “Frequency Hopping Communication Method and Apparatus for Modifying Frequency Hopping Sequence in Accordance with Counted Errors.” (Exhibit 1005.)

U.S. Patent No. 5,781,582 to Sage, et al (“Sage”), titled “Frequency Agile Transceiver with Multiple Frequency Synthesizers Per Transceiver.” (Exhibit 1007.)

5. I have also reviewed the pages cited below from the Microsoft Dictionary, Third Edition (Microsoft Press 1997), provided as Exh. 1010.

6. The ’624 patent describes “managing the use of communications channels based on channel performance” in a communications network. (’624 patent, 1:46-48.) I am familiar with the technology described in the ’624 patent as of its earliest possible priority date of January 25, 2001.

7. I have been asked to provide my technical review, analysis, insights, and opinions regarding the ’624 patent and the above-noted references that form the basis for the grounds of rejection set forth in the Petition for Inter Partes Review of the ’624 Patent.

I. Qualifications

8. I have 3 decades of experience in wireless communications and signal processing and have authored over 100 journal papers and 2 technical books on communication technologies.
9. I earned a Bachelor of Engineering degree from Nanjing Institute of Technology in Nanjing, China in 1982. I later received a Master of Applied Science degree from the University of Toronto in Toronto, Canada in 1987 and a Doctor of Philosophy degree from Cornell University in Ithaca, New York in 1990, both in Electrical Engineering.

10. I have been a professor of Electrical (and Computer) Engineering since 1990. For over two decades, I have taught classes that cover fundamentals of signal detection, communications, and systems. I am currently a professor in the Department of Electrical and Computer Engineering at University of California at Davis in Davis, California.

11. I have served as the steering committee chair of The Institute of Electrical and Electronics Engineers (IEEE) Transactions on Wireless Communications (1.2009 – 1.2011). I was elevated to Fellow of IEEE in 2002 by the IEEE Signal Processing Society. I have also served as the Technical Program Chair of the IEEE Globecom 2006 (the flagship conference of the IEEE Communications Society). In 2013, I received the IEEE Communications Society Wireless Communications Technical Committee Recognition Award. This annual award is presented to a person with a high degree of visibility and contribution in the field of “Wireless and
Mobile Communications Theory, Systems, and Networks” according to the WTC Award website http://bbcr.uwaterloo.ca/~wtc/awards.html.


13. My Curriculum Vitae is provided as Exhibit 1011, which contains further details on my education, experience, publications, and other qualifications to render an expert opinion. My work on this case is being billed at a rate of $475 per hour, with reimbursement for actual expenses. My compensation is not contingent upon the outcome of this inter partes review.

II. Level of Ordinary Skill in the Art

14. I understand that the person of ordinary skill in the art is viewed at the time of invention. Based on the disclosure of the ’624 patent, one of ordinary skill in the art would have a B.S. degree in Electrical and/or Computer Engineering, or an equivalent field, as well as at least 3-5 years of academic or industry experience in the communications field.

15. By equivalent field, I mean that the required levels of educational and industry experience are on a sliding scale relative to each other. For example, a
person of ordinary skill could have a more advanced educational degree with less industry experience.

16. In deciding the level of ordinary skill, I considered the following: the levels of education and experience of persons working in the field; the types of problems encountered in the field; and the historical development and the sophistication of the technology.

III. My Understanding of Claim Construction

17. I understand that, during an *inter partes* review, claims are to be given their broadest reasonable construction in light of the specification as would be read by a person of ordinary skill in the relevant art.

IV. My Understanding of Anticipation

18. I understand that a reference anticipates a claim if it discloses each and every element recited in the claim, arranged as in the claim, so as to enable one of ordinary skill in the art to make and use the claimed invention without the need for undue experimentation in light of the general knowledge available in the art.

V. My Understanding of Obviousness

19. I understand that a claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject mat-
ter as a whole would have been obvious at the time the invention was made to one of ordinary skill in the art.

20. I understand that to prove that prior art or a combination of prior art renders a claim obvious, it is necessary to (1) identify the particular references that, singly or in combination, make the claim obvious; (2) specifically identify which elements of the claim appear in each of the asserted references; and (3) explain how the prior art references could have been combined or modified in order to create the claimed invention.

21. I understand that certain objective indicia can be important evidence regarding whether a claim is obvious or nonobvious. Such indicia include: commercial success of products covered by the claim; a long-felt need for the claimed invention; failed attempts by others to make the claimed invention; copying of the claimed invention by others in the field; unexpected results achieved by the claimed invention as compared to the closest prior art; praise of the claimed invention by the infringer or others in the field; the taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at the time of the claimed invention; and the patentee proceeding contrary to the accepted wisdom of the prior art.

VI. Overview of the ’624 Patent
22. The ’624 patent relates to “managing the use of communications channels based on channel performance” in a communications network. (’624 patent, 1:46-48.) FIG. 2 of the ’624 patent depicts a communications network having a number of communications devices labeled master 210, slave 220, and slave 230. Each of the communications devices includes a memory, a processor that may execute the instructions stored in the memory, and a transceiver that is configured to transmit and receive communications with other devices of the communications network. (Id. at 9:53-59.)

23. The ’624 patent generally relates to use of frequency hopping, and in particular frequency hopping in the context of Bluetooth communications. The Background section of the ’624 patent describes that “[a] frequency hopping (FH) protocol is an approach for wireless communications in a communications network that uses a frequency hopping signal transmission technique in which information or data is transmitted over a set of frequencies in a communications frequency band.” (Id. at 2:5-9.) “The order in which the communications network hops among the set of frequencies is known as the hopping sequence.” (Id. at 2:11-13) “With the FH approach, the frequency band is broken up into separate frequencies, often referred to as ‘channels.’ The FH system transmits data on one channel, hops to the next channel in the hopping sequence to transmit more data, and continues by transmitting data on subsequent channels in the hopping sequence. The switch-
The use of an FH protocol helps to reduce problems with interference from other communications systems and other interference sources.” *(Id. at 2:19-27.)*

24. “An example of a frequency hopping protocol is the Institute of Electrical and Electronics Engineers (IEEE) 802.15.1 Wireless Personal Area Network Standard, which is based on the Bluetooth™ wireless personal area network (WPAN) technology. . . . The Bluetooth protocol uses 79 individual randomly chosen frequency channels numbered from 0 to 78 and changes the frequencies 1600 times per second.” *(Id. at 2:32-40.)*

25. To manage the use of communications channels under potential interference, the system of the ’624 patent selects a first set of communications channels “based on the performance of the communications channels and channel selection criteria.” *(Id. at 4:12-13.)* For example, at start-up of the communications network, the system selects an initial set of channels. *(Id. at 6:19-21.)* The system then periodically selects sets of channels based on later performance of the communications channels. *(Id. at 4:14-16.)*

26. The ’624 patent describes various techniques for measuring performance of communications channels. *(See Id. at 10:19-14:59.)* The disclosed techniques include special test packets *(Id. at 10:33-12:35),* received signal strength in-
The special test packet technique involves sending a packet containing known content and calculating “the number of error bits (NEB) that occur in the known content . . . to determine channel performance.” (Id. at 10:42-44.) The RSSI technique involves a master listening on a return channel of a slave where the slave is not transmitting. (Id. at 12:41-52.) “If there is interference, such as from another communications system, the RSSI will be high. Conversely, if there is no interference, the RSSI will be low.” (Id. at 12:52-55.) The CRC technique involves determining whether the complete contents of a packet or the payload of the packet are received correctly based on a CRC check. (Id. at 13:54-13:57.) Regardless of the specific technique used, not every channel in the set of available communications channels must be measured: “For example, for a communications system that uses 100 channels, some or all of the 100 channels may be tested to determine channel performance.” (Id. at 6:28-31.)

27. The system of the ’624 patent classifies a communication channel based on channel performance and one or more classification criteria. (Id. at 14:63-65.) “For example, a channel may be classified as ‘good’ or ‘bad’ based on the results of the channel performance testing by applying one or more performance measurements to specified performance criteria.” (Id. at 14:65-15:2.)
28. “Channel testing and classification may be performed by a master” (e.g., master 210) “or other participants, such as slaves” (e.g., slaves 220 or 230). (Id. at 16:42-43.) “In addition, channel testing and classification from multiple participants may be combined and/or weighted to determine an overall, or final, classification for the channels of interest.” (Id. at 16:43-46.) The ’624 patent describes one technique for this “‘referendum’ approach” involving voting by participants, including the master. (Id. at 16:47-49.)

29. In the exemplary voting technique, a participant has a “‘vote’ on whether to use a channel or not.” (Id. at 16:65-66.) For example, a vote may indicate that the participant prefers not to use the channel (e.g., participant finds channel “bad”) or a vote may indicate that the participant prefers to use the channel (e.g., participant finds channel “good”). (Id. at 16:66-17:4.) A certain number of total votes “is required for the channel to be judged ‘good’ and therefore available for use by the FH communications system.” (Id. at 17:5-7.) “Not every participant needs to have input for each channel under consideration.” (Id. at 17:29-30.) As explained in the ’624 patent, participants “may collect and combine the channel performance information, or votes, to determine the final channel classifications.” (Id. at 17:30-34.)

VII. Background of the Technologies Disclosed in the ’624 Patent
A. Frequency Hopping

30. Prior to January 2001, frequency hopping (FH) was one of two known major technologies designed for spread spectrum data communications. Spread spectrum technologies were initially developed for the military and intelligence communities to overcome shortcomings against interception and jamming. The basic idea is to spread each user signal energy/power over a much broader spectrum than necessary. For a fixed transmission power, broader spectrum means lower signal power level as well as improved spectral redundancy. The low signal power level makes the communication signals difficult to detect and intercept, whereas high spectral redundancy makes the signals more resistant to (intentional or unintentional) partial band jamming.

31. Prior to January 2001, there were two dominant spread spectrum technologies: frequency hopping (FH) spread spectrum and direct sequence (DS) spread spectrum.

32. The concept of frequency hopping spread spectrum is in fact quite simple. Each user can still use a conventional modulation. The only change is that now the transmitting user’s carrier frequency can vary over regular intervals. By letting each user vary its carrier frequency according to a pre-determined, pseudo-random pattern, its evasive signal would effectively be occupying a broader spectrum band and become harder to intercept and jam. This pre-determined, pseudo-
random carrier frequency variation pattern is known as the *frequency hopping pattern*. To receive the FH transmission, a receiver can also synchronously change its own carrier frequency by following exactly the same FH pattern as the transmitter. A simple analogy to FH transmission and reception is for a television (TV) show to be broadcast over several TV stations in a sequential manner. In FH, a TV program begins on station A, lasting 10 minutes, then moves to station B, lasting another 10 minutes, and so forth. TV viewers can simply follow this hopping pattern so long as they are aware of the hopping pattern.

**B. Bluetooth**

33. Prior to January 2001, Bluetooth was a short range communication technology used in electronic products such as cell-phones, computers, automobiles, modems, headsets, and appliances. Replacing the line-of-sight infrared, Bluetooth was acceptable for situations when two or more devices are in proximity to each other. Bluetooth was one of the most successful commercial wireless technologies that utilized the frequency hopping (FH) technology for data transmission.

34. Prior to January 2001, Bluetooth devices operated in the license-free industrial, scientific, and medical (ISM) band of 2.4-2.4835 GHz. *(See, e.g., Exhibit 1012, Specification of the Bluetooth System Version 1.0B (“Bluetooth Version 1.0B”), December 1, 1999, p. 19.)* To avoid interfering with other devices and networks in the ISM band, the prior art Bluetooth protocol divided the frequency band
into 79 channels of 1 MHz bandwidth and executed frequency hopping at a rate up to 1600 hops per second. (Id. at 43.) Two Bluetooth devices communicated in a master-slave mode relationship in order to synchronize transmission and reception frequency hopping. (Id. at 41-42.) A network group of up to eight participant devices form a *piconet* which is a local wireless network controlled by one master node to facilitate data communications. (Id.) FIG. 1.2 from Bluetooth Version 1.0B illustrates exemplary piconets.

**VIII. Claim Construction**

35. The term “hopping sequence” is used in claims 5, 6, 17, 18, and 20. This term is a well-understood term of art. *(See, e.g., Bluetooth Version 1.0B, pp. 127-133.)* The specification uses the term in accordance with its well-understood meaning stating that “[t]he order in which the communication network hops among the set of frequencies is known as the hopping sequence.” *(‘624 patent, 2:11-13.)*
IX. **Gerten**

A. **Overview of Gerten**

36. Gerten is directed “to a system and method for removing channels in a frequency hopping scheme having strong interference or interferers in a wireless communication system.” (Gerten, Exhibit 1003, 2:34-37.) FIG. 1 of Gerten (reproduced below) depicts a network having three piconets 10, 12, and 14. (Id. at 3:8-12.) As shown in FIG. 1, the first piconet 10 has a plurality of mobile units 20 including a master mobile unit and a slave mobile unit. (Id. at 3:27-31.) The master mobile unit in Gerten is a device “whose clock and hopping sequence are employed to synchronize other devices in the piconet—all devices in a piconet that are not the master are typically slaves.” (Id. at 3:22-26.)
37. The mobile device 20 of Gerten, depicted below in FIG. 2, includes a transceiver 32, a frequency synthesizer 60 having a memory 62, and a central control system 30 that can include “a processor or the like that is programmed to control and operate various components within the mobile communication unit 20 in order to carry out various functions.” (Id. at 3:44-48.) The “frequency synthesizer component 60 cooperates with the central control system 30 and a device clock 64 to provide frequency hopping for the mobile communication unit 20.” (Id. at 3:65-4:1)

38. In operation, a master device determines “which channels have [the] strongest interference.” (Id. at 4:50-51.) For example, the master device may employ “signal strength measurements on N number of channels (N being an integer) of the frequency hopping scheme to determine M number of channels (M being an
integer less than or equal to N) to avoid.” (Id. at 2:37-41.) The master device communicates the channels to be avoided (the bad channels) to a remote device. (Id. at 2:41-47.) The master and remote device then modify their respective hopping sequences and begin transmitting data at the modified hopping sequence with the remaining N-M good channels. (Id. at 2:47-52.) As explained by Gerten, “[t]he frequency hopping scheme can be modified by providing a first register bank storing synthesizer codes for generating frequency hopping over the N total channels in normal mode with an alternate register bank storing synthesizer codes for generating frequency hopping over N-M channels for interference avoidance mode.” (Id.) The master device “periodically updates the channels to be avoided.” (Id. at 4:58-59.) When a subsequent update occurs, the master device again communicates the channels to be avoided to a remote device and they both modify their respective hopping sequences again. (Id. at 4:62-65.)

B. **Independent claim 5**

39. Gerten discloses each and every limitation recited in claim 5. Claim 5 is reproduced below. The claim limitations have been labeled for ease of discussion.

5. [P] A communications apparatus comprising:
[A] means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels;

[B] means for causing the first set of two or more communications channels to be used for communications between a pair of participants;

[C] means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels; and

[D] means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels,

[E] wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants,

[F] wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based
on the performance of the plurality of communications channels, and the communications channel selector apparatus further comprises:

[G] means [for] the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels.

1. **Gerten discloses “[a] communications apparatus” [5P].**

40. As illustrated above in FIG. 1, a piconet of Gerten is “a collection of devices that can be connected via Bluetooth technology.” (Gerten, 3:8-12.) The master mobile unit of the piconet is a “communication apparatus.” (Id. at 3:27-31.)

2. **Gerten discloses “means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels” [5A].**

41. The master mobile unit of the piconet includes a central control system 30 that “is responsible for controlling general operations of the mobile communication unit 20.” (Gerten, 3:40-44.) One of the operations controlled by the central control system is the channel identification algorithm of Gerten. This operation is a function for managing the use of communications channels and is disclosed by Gerten as utilizing software in the central control system 30: “The iden-
tification algorithm can use hardware (e.g., measurement power component 66) and software (e.g., residing in central control system 30) to read signal strength of channels and determine which channels to avoid.” (Gerten, 5:20-24, emphasis added.)

42. As was well-known to one of ordinary skill in the art well prior to January 2001, software consists of a set of instructions used to program a processor to perform a specific task. A processor retrieves the instructions from memory and executes them to carry out the task. Because Gerten discloses that the identification algorithm uses software residing in central control system 30 to read the signal strength of channels and to determine which channels to avoid, the set of instructions that make up the software are necessarily stored in a memory and processed by a processor.

43. In fact, Gerten discloses such a memory and processor. Specifically, Gerten discloses that “[t]he central control system 30 can include a processor or the like that is programmed to control and operate various components within the mobile communication unit 20 in order to carry out various functions.” (Id. at 3:44-48, emphasis added.) Gerten further discloses that “[t]he memory component 62 may include a plurality of register banks for storing synthesizer codes that are employed to facilitate frequency hopping. Alternatively, the register banks may re-
side in the central control system 30 (e.g., in a memory component, onboard registers or memory in a processor or in separate register components).” (Id. at 4:1-6, emphasis added.) In order for the software that resides in central control system 30 to be used for channel identification, the set of instructions making up the software is necessarily stored in memory and processed by the processor.

44. By executing the instructions for performing the channel identification algorithm, the processor in the central control system 30 of Gerten provides the same functionality to and is structurally the same as the “means for” of claim [5A].

45. As part of the channel identification algorithm performed by the processor, Gerten selects a first set of two or more communications channels based upon scanning the performance of a plurality of communications channels. In Gerten, “the master device performs a channel scan at completion of its last transmission (step 120) and determines which channels have strongest interference.” (Gerten, 4:47-51.) As shown in the example in Gerten, the master unit of Gerten performs signal strength measurements on N channels in a frequency hopping scheme to determine each channel’s performance. (Id. at 2:37-41.) Based on the performance data, the master unit determines “M number of channels (M being an integer less than or equal to N) to avoid.” (Id.) This selection process of Gerten occurs at a first time. The system of Gerten then “modif[ies] the frequency hopping
scheme to avoid transmission over the M channels.” (Id. at 2:41-42.) The resulting set of channels (N-M) used in the modified hopping sequence is the “first set of two or more communications channels from the plurality of communications channels.” (See, e.g., Id. at 2:47-52.)

3. **Gerten discloses** “means for causing the first set of two or more communications channels to be used for communications between a pair of participants” [5B].

46. After the master unit of Gerten selects the first set of two or more communications channels, the master unit communicates the M channels to be avoided “to [remote mobile] units involved in the communication system, so that the members of the wireless communication system can **frequency hop together** over the modified frequency hopping scheme.” (Gerten, 2:43-47, emphasis added.) Once the mobile units “modify their respective hopping sequences . . . [then] in step 170, the master device and the remote device begin transmitting data at the modified hopping sequences.” (Id. at 4:54-58.) Accordingly, in Gerten, the master mobile unit causes “the first set of two or more communications channels to be used for communications between a pair of participants.”

47. As discussed above, the processor in the central control system 30 of the master mobile unit “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2.) One of the functions performed by the master mo-
bile unit is communicating the M channels to be avoided to the wireless units involved in the communication system and modifying the master mobile unit’s hopping sequence as described above and shown in steps 140-160 in FIG. 3. The processor in the central control system 30 programmed to perform this three-step function provides the same functionality to and is structurally the same as the “means for” of claim [5B].

4. **Gerten discloses “means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels” [5C].**

48. After establishing a modified hopping sequence “at a first time” (as discussed above), the master unit of Gerten “periodically updates the channels to be avoided.” (Gerten, 4:58-59, emphasis added; see also, Fig. 3 (block 180).) When a subsequent update occurs, the master unit repeats the identification process described above: the master unit determines \([M_2]\) number of channels (\([M_2]\) being an integer less than or equal to N) to avoid. (Id. at 2:37-52; see also id. at 9:64-10:2, “[e]ach time the master decides to update the channels to be avoided, a new packet is sent . . . . Preferably, a master and slave can remain in the interference avoidance hop mode for the duration of their connection.”) The subsequent update occurs at a second time that is later than the first time. The system of Gerten then “modif[i]es the frequency hopping scheme to avoid transmission over the \([M_2]\)
channels.” (Id. at 2:41-42, FIG. 3, block 180.) I use M₂ to reflect that the value of M could change during a subsequent update. The resulting set of channels (N-M₂) is the “second set of two or more communications channels from the plurality of communications channels.” (See, e.g., id. at 2:47-52.)

49. By performing the channel identification algorithm, the processor in the central control system 30 of Gerten provides the same functionality to and is structurally the same as the “means for” of claim [5C].

5. **Gerten discloses “means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels” [5D].**

50. The first set of two or more communications channel are used until the master device repeats the selection process and communicates a new set of M₂ channels to be avoided to remote mobile units involved in the communication system. (Id. at 4:58-65.) The remote mobile units modify their respective hopping sequences based on the new set of M₂ channels, and then “the master device and the remote device begin transmitting data at the modified hopping sequences.” (Id. at 4:54-58.) Accordingly, in Gerten, the master mobile unit causes “the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels.”
51. As discussed above, the processor in the central control system 30 of the master mobile unit “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2.) One of the functions performed by the master mobile unit is communicating the $M_2$ channels to be avoided to the wireless units involved in the communication system and modifying the master mobile unit’s hopping sequence as described above and shown in steps 140-160 in FIG. 3. The processor in the central control system 30 programmed to perform this three-step function provides the same functionality to and is structurally the same as the “means for” of claim [5D].

6. **Gerten** discloses “wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants” [5E].

52. One of the functions performed in Gerten is communication using a FH scheme:

The present invention employs signal strength measurements on N number of channels (N being an integer) of the frequency hopping scheme to determine M number of channels (M being an integer less than or equal to N) to avoid. The system and/or method then modify the frequency hopping scheme to avoid transmission over the M channels. The M channels to avoid can be communicated to wireless
units involved in the communication system, so that the members of
the wireless communication system can frequency hop together over
the modified frequency hopping scheme. (Id. at 2:37-47.)

53. Gerten describes an exemplary system using Bluetooth frequency
hopping. Gerten recognizes that Bluetooth used a frequency hopping protocol.
(Id. at 1:13-15; 1:39-55.) This is consistent with the Bluetooth Version 1.0B, in
existence prior to the filing date of Gerten, which described the use of frequency
hopping protocol in Bluetooth. (See, e.g., Bluetooth Version 1.0B, Exhibit 1012,
pp. 41-44, 127-138.)

54. As I discussed above in regard to claim limitation [5D], a master de-
vice in Gerten transmits to and receives from another communication device over
“[a] first set of two or more communication channels.” In a hopping sequence
based on a frequency hopping protocol such as used in Bluetooth, only one com-
munications channel is used for communications between a first device and a sec-
ond device at each hop. The ’624 patent, in the Background section, acknowledges
that these limitations were known aspects of conventional frequency hopping sys-
tems: “The F[requency]H[opping] system transmits data on one channel, hops to
the next channel in the hopping sequence to transmit more data, and continues by
transmitting data on subsequent channels in the hopping sequence.” (’624 patent,
2:20-24, emphasis added.)
55. Gerten confirms these limitations were well-known explaining that “Bluetooth radio modules attempt to avoid interference from other signals by **hopping to a new frequency** after transmitting or receiving a packet as compared to other systems operating at the same frequency band.” (Gerten, 1:36-43, emphasis added.) Hopping to **a new frequency** for transmission or reception of the next packet is the use of “only one communications channel” for communications.

56. Thus, Gerten discloses “at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants.”

7. **Gerten discloses “wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based on the performance of the plurality of communications channels” [5F].**

57. As illustrated in FIG. 1 above, the piconet 10 of Gerten includes “a plurality of mobile units 20 each wirelessly communicating with one another through an antenna 21.” (Gerten, 3:27-29.) Gerten explains that the piconet can start with “two connected devices . . . and may grow to eight connected devices.” (Id. at 3:12-14.) Specifically, the piconet includes a master unit (first participant) and multiple slave units (second and third participants).
58. The wireless communications devices of Gerten have two modes of operation – normal mode and interference avoidance mode: “The frequency hopping scheme can be modified by providing a first register bank storing synthesizer codes for generating frequency hopping over the N total channels in normal mode with an alternate register bank storing synthesizer codes for generating frequency hopping over N-M channels for interference avoidance mode.” (Id. at 2:47-52, emphasis added.)

59. “Interference avoidance mode” uses N-M frequency channels for devices capable of interference avoidance. “Normal mode” in Gerten uses all N available frequency channels for “legacy” devices that cannot perform interference avoidance. The N channels loaded in the first register for “normal mode” are therefore a “default set of two or more communications channels” because they are not changed based on the signal strength measurements of the channel scan for detecting interference in particular channels. The default N set of channels in Gerten is “associated with a hopping sequence.” (See e.g. Id. at 3:2-7, 7:6-8.)

60. The master device of Gerten performs a service discovery request to determine if each slave device has interference avoidance capabilities. (See, Id. at 4:38-51.) If not, the “normal mode” of operation is used for communications; oth-
erwise, the interference avoidance mode is used for communications. (*Id.* at 4:44-52, FIG.3, step 110.)

8. *Gerten discloses “wherein . . . the communications channel selector apparatus further comprises: means [for] the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels” [5G].*

61. Referring to FIG. 1 provided above, piconet 10 includes “a plurality of mobile units 20 each wirelessly communicating with one another . . . [and] includes a master mobile unit [20] and a slave mobile unit [20] . . . .” (Gerten, 3:27-31.) Upon examination of FIG.1, the master mobile unit 20 in piconet 10 is shown having simultaneous wireless connections with 4 slave mobile units 20. This is consistent with the statement that a piconet can start with “two connected devices . . . and may grow to eight connected devices.” (*Id.* at 3:10-14.)

62. When Gerten’s interference avoidance scheme is applied to the piconet 10, the transceiver in the master mobile unit 20 (i.e., “first participant”) can wirelessly communicate with a slave mobile unit 20 (i.e., “second participant”) using the **interference avoidance mode** while wirelessly communicating with another slave mobile unit 20 (i.e., “third participant”) that is a legacy device using the **normal mode**. This is apparent from the fact that the master device performs a
service discovery request before wirelessly communicating with each slave mobile unit 20 in piconet 10 to determine if they support interference avoidance or are a legacy device. (Id. at 4:38-51.)

63. As I explained above, the interference avoidance mode uses (N-M) channels for frequency hopping that are down-selected from the N total channels available for frequency hopping, where the down-selection is based on channel scans that measure interferer signal strength (i.e., channel performance). (Id. at 2:37-47.) Since the channel scans are updated over time, the (N-M) channels used for frequency hopping provide the first and second set of the “two or more communications channels” when updated over time. The normal mode uses all N available frequency channels and is unaffected by any channel scan, and therefore represents a “default set of two or more communications channels associated with a hopping sequence” that are “not changed” based the interferer signal strength measurements during the channel scans (e.g., “performance of the plurality of channels”).

64. As I further explained above, the processor in the central control system 30 “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2.) One of the functions performed by the master mobile unit is the
service discovery request as described above and shown in steps 100 and 110 in FIG. 3 “to determine if a remote device has interference avoidance capabilities.” (Id. at 4:41-42.) The processor in central control system programmed to perform this two-step function provides the same functionality to and is structurally the same as the “means for” of claim [5G].

65. Accordingly, Gerten discloses “means [for] the first participant communicating with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels,” as recited in claim 5.

C. Dependent claim 8

66. Gerten discloses each and every limitation recited in claim 8. Claim 8 is reproduced below. The claim limitations have been labeled for ease of discussion.

8. A communications apparatus as recited in claim 5, further comprising:

[A] means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants; and
[B] means for, after selecting the second set of two or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants.

1. Gerten discloses “[the] communications apparatus . . . further comprising . . . means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants” [8A].

67. The wireless communications devices of Gerten include “a first register bank storing synthesizer codes for generating frequency hopping over the N total channels in normal mode with an alternate register bank storing synthesizer codes for generating frequency hopping over N-M channels for interference avoidance mode.” (Gerten, 2:47-52, emphasis added.) Both the master and slave units of Gerten have registers: “the master device and the slave device define an alternate register bank of N-M channels…and [i]n step 330, the alternate register bank is loaded with N-M synthesizer code words for the N-M channels with the synthesizer code words for the M channels to be avoided removed.” (Id. at 7:11-18, FIG. 5, emphasis added.)

68. The synthesizer codes in Gerten allow the frequency synthesizer (FIG. 2) to generate carrier frequencies for the modulator according to the frequency hopping pattern. They identify channels (id. at 2:47-52, 7:6-8) corresponding to
the claimed “channels to be loaded into a register.” This is consistent with the ’624 specification, which discloses that “after a participant has received the set of selected communications channels, the participant stores data that indicates the new set of selected channels.” (’624 Patent, 19:27-30, emphasis added.) For Bluetooth frequency hopping, the ’624 specification further explains that “channel numbers” are stored in a register, and a selection kernel generates sets of addresses corresponding to slots in the register, where “the content of each slot in the register is a channel number.” (Id. at 19:32-34.)

69. After the M channels to be avoided are determined, the processor in the master unit of Gerten causes the alternate register bank (i.e., register) in each of the master device and slave device (i.e., the pair of participants) to be loaded with synthesizer codes for generating frequency hopping over N-M channels (i.e. first set of two or more communications channels). Further, the master device communicates the M channels to be avoided to the slave device, so as to cause the alternate register bank in the slave device to be loaded with synthesizer codes for generating frequency hopping over N-M channels. The processor in central control system provides the same functionality to, and is structurally the same as, the “means for” of claim [8A].

2. **Gerten discloses “[the] communications apparatus . . . further comprising . . . means for, after selecting the second set of two**
or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” [8B].

70. Gerten discloses that the master device “periodically updates the channels to be avoided.” (Id. at 4:58-59.) The master device then “create[s] another link and communicate[s] the new channels to the remote device.” (Id. at 4:62-65; see also, 9:64-10:2.) Accordingly, the master device in Gerten updates the channel avoidance over time, and therefore as explained above the master and the slave will load their respective alternate register banks with synthesizer codes for generating frequency hopping over the updated N-M₂ channels, resulting in the “second set of two or more communications” to be loaded in the “register” of each of the master device and the slave device (“the pair of participants”). The processor in central control system provides the same functionality to and is structurally the same as the “means for” of claim [8B].

D. Independent claim 17

71. Gerten discloses each and every limitation in claim 17. Claim 17 is reproduced below. The claim limitations have been labeled for ease of discussion.

17. [P] A communications apparatus comprising:

[A] means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels;
[B] means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants;

[C] means for causing the first set of two or more communications channels to be used for communications between a pair of participants;

[D] means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels

[E] means for, after selecting the second set of two or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants; and

[F] means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels,

[G] wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants.
1. **Gerten discloses “[a] communications apparatus” [17P].**

72. As illustrated above in FIG. 1, a piconet of Gerten is “a collection of devices that can be connected via Bluetooth technology.” (Gerten, 3:8-12.) The master mobile unit of the piconet is a “communication apparatus.” (Id. at 3:27-31.)

2. **Gerten discloses “means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels” [17A].**

73. The master mobile unit of the piconet includes a central control system 30 that “is responsible for controlling general operations of the mobile communication unit 20.” (Gerten, 3:40-44.) One of the operations controlled by the central control system is the channel identification algorithm of Gerten. This operation is a function for managing the use of communications channels and is disclosed by Gerten as utilizing software in the central control system 30: “The identification algorithm can use hardware (e.g., measurement power component 66) and **software (e.g., residing in central control system 30)** to read signal strength of channels and determine which channels to avoid.” (Gerten, 5:20-24, emphasis added.)

74. As was well-known to one of ordinary skill in the art well prior to January 2001, software consists of a set of instructions used to program a processor to perform a specific task. A processor retrieves the instructions from memory and
executes them to carry out the task. Because Gerten discloses that the identification algorithm uses software residing in central control system 30 to read the signal strength of channels and to determine which channels to avoid, the set of instructions that make up the software are necessarily stored in a memory and processed by a processor.

75. In fact, Gerten discloses such a memory and processor. Specifically, Gerten discloses that “[t]he central control system 30 can include a processor or the like that is programmed to control and operate various components within the mobile communication unit 20 in order to carry out various functions.” (Id. at 3:44-48, emphasis added.) Gerten further discloses that “[t]he memory component 62 may include a plurality of register banks for storing synthesizer codes that are employed to facilitate frequency hopping. Alternatively, the register banks may reside in the central control system 30 (e.g., in a memory component, onboard registers or memory in a processor or in separate register components).” (Id. at 4:1-6, emphasis added.) In order for the software that resides in central control system 30 to be used for channel identification, the set of instructions making up the software is necessarily stored in memory and processed by the processor.

76. By executing the instructions for performing the channel identification algorithm, the processor in the central control system 30 of Gerten provides the
same functionality to and is structurally the same as the “means for” of claim [17A].

77. As part of the channel identification algorithm performed by the processor, Gerten selects a first set of two or more communications channels based upon scanning the performance of a plurality of communications channels. In Gerten, “the master device performs a channel scan at completion of its last transmission (step 120) and determines which channels have strongest interference.” (Gerten, 4:47-51.) As shown in the example in Gerten, the master unit of Gerten performs signal strength measurements on N channels in a frequency hopping scheme to determine each channel’s performance. (Id. at 2:37-41.) Based on the performance data, the master unit determines “M number of channels (M being an integer less than or equal to N) to avoid.” (Id.) This selection process of Gerten occurs at a first time. The system of Gerten then “modif[ies] the frequency hopping scheme to avoid transmission over the M channels.” (Id. at 2:41-42.) The resulting set of channels (N-M) used in the modified hopping sequence is the “first set of two or more communications channels from the plurality of communications channels.” (See, e.g., Id. at 2:47-52.)
3. **Gerten discloses** “means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants” [17B].

78. The wireless communications devices of Gerten include “a first register bank storing synthesizer codes for generating frequency hopping over the N total channels in normal mode with an alternate register bank storing synthesizer codes for generating frequency hopping over N-M channels for interference avoidance mode.” (Gerten, 2:47-52, emphasis added.) Both the master and slave units of Gerten have registers: “the master device and the slave device define an alternate register bank of N-M channels…and in step 330, the alternate register bank is loaded with N-M synthesizer code words for the N-M channels with the synthesizer code words for the M channels to be avoided removed.” (Id. at 7:11-18, FIG. 5, emphasis added.)

79. The synthesizer codes in Gerten allow the frequency synthesizer (FIG. 2) to generate carrier frequencies for the modulator according to the frequency hopping pattern. They identify channels (id. at 2:47-52, 7:6-8) corresponding to the claimed “channels to be loaded into a register.” This is consistent with the ’624 specification, which discloses that “after a participant has received the set of selected communications channels, the participant stores data that indicates the new set of selected channels.” (’624 Patent, 19:27-30, emphasis added.) For Bluetooth
frequency hopping, the ’624 specification further explains that “channel numbers” are stored in a register, and a selection kernel generates sets of addresses corresponding to slots in the register, where “the content of each slot in the register is a channel number.” (Id. at 19:32-34.)

80. After the M channels to be avoided are determined, the processor in the master unit of Gerten causes the alternate register bank (i.e., register) in each of the master device and slave device (i.e., the pair of participants) to be loaded with synthesizer codes for generating frequency hopping over N-M channels (i.e. first set of two or more communications channels). Further, the master device communicates the M channels to be avoided to the slave device, so as to cause the alternate register bank in the slave device to be loaded with synthesizer codes for generating frequency hopping over N-M channels. The processor in central control system provides the same functionality to, and is structurally the same as, the “means for” of claim [17B].

4. Gerten discloses “means for causing the first set of two or more communications channels to be used for communications between a pair of participants” [17C].

81. After the master unit of Gerten selects the first set of two or more communications channels, the master unit communicates the M channels to be avoided “to [remote mobile] units involved in the communication system, so that the members of the wireless communication system can frequency hop together
over the modified frequency hopping scheme.” (Gerten, 2:43-47, emphasis added.) Once the mobile units “modify their respective hopping sequences . . . [then in step 170, the master device and the remote device begin transmitting data at the modified hopping sequences.” (Id. at 4:54-58.) Accordingly, in Gerten, the master mobile unit causes “the first set of two or more communications channels to be used for communications between a pair of participants.”

82. As discussed above, the processor in the central control system 30 of the master mobile unit “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2.) One of the functions performed by the master mobile unit is communicating the M channels to be avoided to the wireless units involved in the communication system and modifying the master mobile unit’s hopping sequence as described above and shown in steps 140-160 in FIG. 3. The processor in the central control system 30 programmed to perform this three-step function provides the same functionality to and is structurally the same as the “means for” of claim [17C].
5. **Gerten discloses “means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels” [17D].**

83. After establishing a modified hopping sequence “at a first time” (as discussed above), the master unit of Gerten “periodically updates the channels to be avoided.” (Gerten, 4:58-59, emphasis added; see also, Fig. 3 (block 180).) When a subsequent update occurs, the master unit repeats the identification process described above: the master unit determines \([M_2]\) number of channels (\([M_2]\) being an integer less than or equal to \(N\)) to avoid. (Id. at 2:37-52; see also id. at 9:64-10:2, “[e]ach time the master decides to update the channels to be avoided, a new packet is sent . . . . Preferably, a master and slave can remain in the interference avoidance hop mode for the duration of their connection.”) The subsequent update occurs at a second time that is later than the first time. The system of Gerten then “modif[ies] the frequency hopping scheme to avoid transmission over the \([M_2]\) channels.” (Id. at 2:41-42, FIG. 3, block 180.) I use \(M_2\) to reflect that the value of \(M\) could change during a subsequent update. The resulting set of channels (\(N-M_2\)) is the “second set of two or more communications channels from the plurality of communications channels.” (See, e.g., id. at 2:47-52.)
84. By performing the channel identification algorithm, the processor in the central control system 30 of Gerten provides the same functionality to and is structurally the same as the “means for” of claim [17D].

6. **Gerten discloses “means for, after selecting the second set of two or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” [17E].**

85. Gerten discloses that the master device “periodically updates the channels to be avoided.” *(Id. at 4:58-59.)* The master device then “create[s] another link and communicate[s] the new channels to the remote device.” *(Id. at 4:62-65; see also, 9:64-10:2.)* Accordingly, the master device in Gerten updates the channel avoidance over time, and therefore as explained above the master and the slave will load their respective *alternate register banks* with synthesizer codes for generating frequency hopping over the *updated* N-M₂ channels, resulting in the “second set of two or more communications” to be loaded in the “register” of each of the master device and the slave device (“the pair of participants”). The processor in central control system provides the same functionality to and is structurally the same as the “means for” of claim [17E].
7. **Gerten discloses “means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels” [17F].**

86. The first set of two or more communications channel are used until the master device repeats the selection process and communicates a new set of $M_2$ channels to be avoided to remote mobile units involved in the communication system. *(Id. at 4:58-65.)* The remote mobile units modify their respective hopping sequences based on the new set of $M_2$ channels, and then “the master device and the remote device begin transmitting data at the modified hopping sequences.” *(Id. at 4:54-58.)* Accordingly, in Gerten, the master mobile unit causes “the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels.”

87. As discussed above, the processor in the central control system 30 of the master mobile unit “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” *(Id. at 3:40-52, FIG. 2.)* One of the functions performed by the master mobile unit is communicating the $M_2$ channels to be avoided to the wireless units involved in the communication system and modifying the master mobile unit’s hopping sequence as described above and shown in steps 140-160 in FIG. 3. The pro-
cessor in the central control system 30 programmed to perform this three-step function provides the same functionality to and is structurally the same as the “means for” of claim [17F].

8. Gerten discloses “wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants” [17G].

88. One of the functions performed in Gerten is communication using a FH scheme:

The present invention employs signal strength measurements on N number of channels (N being an integer) of the frequency hopping scheme to determine M number of channels (M being an integer less than or equal to N) to avoid. The system and/or method then modify the frequency hopping scheme to avoid transmission over the M channels. The M channels to avoid can be communicated to wireless units involved in the communication system, so that the members of the wireless communication system can frequency hop together over the modified frequency hopping scheme. (Id. at 2:37-47.)

89. Gerten describes an exemplary system using Bluetooth frequency hopping. Gerten recognizes that Bluetooth used a frequency hopping protocol. (Id. at 1:13-15; 1:39-55.) This is consistent with the Bluetooth Version 1.0B, in existence prior to the filing date of Gerten, which described the use of frequency
hopping protocol in Bluetooth. (See, e.g., Bluetooth Version 1.0B, Exhibit 1012, pp. 41-44, 127-138.)

90. As I discussed above in regard to claim limitation [17F], a master device in Gerten transmits to and receives from another communication device over “[a] first set of two or more communication channels.” In a hopping sequence based on a frequency hopping protocol such as used in Bluetooth, only one communications channel is used for communications between a first device and a second device at each hop. The ’624 patent, in the Background section, acknowledges that these limitations were known aspects of conventional frequency hopping systems: “The F[requency]H[opping] system transmits data on one channel, hops to the next channel in the hopping sequence to transmit more data, and continues by transmitting data on subsequent channels in the hopping sequence.” (’624 patent, 2:20-24, emphasis added.)

91. Gerten confirms these limitations were well-known explaining that “Bluetooth radio modules attempt to avoid interference from other signals by hopping to a new frequency after transmitting or receiving a packet as compared to other systems operating at the same frequency band.” (Gerten, 1:36-43, emphasis added.) Hopping to a new frequency for transmission or reception of the next packet is the use of “only one communications channel” for communications.
92. Thus, Gerten discloses “at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants.”

**E. Dependent claim 20**

93. Gerten discloses each and every limitation recited in claim 20. Claim 20 is reproduced below. The claim limitations have been labeled for ease of discussion.

20. A communications apparatus as recited in claim 17,

[A] wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based on the performance of the plurality of communications channels, and

[B] the communications channel selector apparatus further comprises: means for the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels.
I. Gerten discloses “wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based on the performance of the plurality of communications channels” [20A].

94. As illustrated in FIG. 1 above, the piconet 10 of Gerten includes “a plurality of mobile units 20 each wirelessly communicating with one another through an antenna 21.” (Gerten, 3:27-29.) Gerten explains that the piconet can start with “two connected devices . . . and may grow to eight connected devices.” (Id. at 3:12-14.) Specifically, the piconet includes a master unit (first participant) and multiple slave units (second and third participants).

95. The wireless communications devices of Gerten have two modes of operation – normal mode and interference avoidance mode: “The frequency hopping scheme can be modified by providing a first register bank storing synthesizer codes for generating frequency hopping over the N total channels in normal mode with an alternate register bank storing synthesizer codes for generating frequency hopping over N-M channels for interference avoidance mode.” (Id. at 2:47-52, emphasis added.)

96. “Interference avoidance mode” uses N-M frequency channels for devices capable of interference avoidance. “Normal mode” in Gerten uses all N available frequency channels for “legacy” devices that cannot perform interference avoidance. The N channels loaded in the first register for “normal mode” are
therefore a “default set of two or more communications channels” because they are not changed based on the signal strength measurements of the channel scan for detecting interference in particular channels. The default N set of channels in Gerten is “associated with a hopping sequence.” (See e.g. Id. at 3:2-7, 7:6-8.)

97. The master device of Gerten performs a service discovery request to determine if each slave device has interference avoidance capabilities. (See, Id. at 4:38-51.) If not, the “normal mode” of operation is used for communications; otherwise, the interference avoidance mode is used for communications. (Id. at 4:44-52, FIG.3, step 110.)

2. Gerten discloses “the communications channel selector apparatus further comprises: means for the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels” [20B].

98. Referring to FIG. 1 provided above, piconet 10 includes “a plurality of mobile units 20 each wirelessly communicating with one another . . . [and] includes a master mobile unit [20] and a slave mobile unit [20] . . . .” (Gerten, 3:27-31.) Upon examination of FIG.1, the master mobile unit 20 in piconet 10 is shown having simultaneous wireless connections with 4 slave mobile units 20. This is
consistent with the statement that a piconet can start with “two connected devices . . . and may grow to eight connected devices.” (*Id.* at 3:10-14.)

99. When Gerten’s interference avoidance scheme is applied to the piconet 10, the transceiver in the master mobile unit 20 (i.e., “first participant”) can wirelessly communicate with a slave mobile unit 20 (i.e., “second participant”) using the **interference avoidance mode** while wirelessly communicating with another slave mobile unit 20 (i.e., “third participant”) that is a legacy device using the **normal mode**. This is apparent from the fact that the master device performs a service discovery request before wirelessly communicating with each slave mobile unit 20 in piconet 10 to determine if they support interference avoidance or are a legacy device. (*Id.* at 4:38-51.)

100. As I explained above, the **interference avoidance mode** uses (N-M) channels for frequency hopping that are down-selected from the N total channels available for frequency hopping, where the down-selection is based on channel scans that measure interferer signal strength (i.e., channel performance). (*Id.* at 2:37-47.) Since the channel scans are updated over time, the (N-M) channels used for frequency hopping provide the first and second set of the “two or more communications channels” when updated over time. The **normal mode** uses all N available frequency channels and is unaffected by any channel scan, and therefore
represents a “default set of two or more communications channels associated with a hopping sequence” that are “not changed” based the interferer signal strength measurements during the channel scans (e.g., “performance of the plurality of channels”).

101. As I further explained above, the processor in the central control system 30 “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2.) One of the functions performed by the master mobile unit is the service discovery request as described above and shown in steps 100 and 110 in FIG. 3 “to determine if a remote device has interference avoidance capabilities.” (Id. at 4:41-42.) The processor in central control system programmed to perform this two-step function provides the same functionality to and is structurally the same as the “means for” of claim [20B].

102. Accordingly, Gerten discloses “means [for] the first participant communicating with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels,” as recited in claim 20.
X. **Gerten in view of Cuffaro**

A. **Dependent claims 6 and 18**

103. Gerten discloses each and every element of claims 6 and 18 except Gerten fails to explicitly disclose “the performance of the plurality of communications channels is based on channel performance data that is transmitted over one or more of the plurality of communications channels based on the hopping sequence according to the frequency hopping protocol.” However, as described in detail below, this limitation is explicitly disclosed by Cuffaro. Claims 6 and 18 are reproduced below.

6 [18]. A communications apparatus as recited in claim 5 [17], further comprising means for performing the hopping sequence based on a frequency hopping protocol, wherein:

at each hop in the hopping sequence based on the frequency hopping protocol, only one communications channel of the first set of two or more communications channels is used for communications between the pair of participants;

at each hop in the hopping sequence based on the frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants; and
the performance of the plurality of communications channels is based on channel performance data that is transmitted over one or more of the plurality of communications channels based on the hopping sequence according to the frequency hopping protocol.

1. The combination of Gerten and Cuffaro discloses the hopping sequence claim limitations of claims 6 and 18.

104. The processor in the central control system 30 of Gerten, when processing instructions, “cause[s] the hopping sequence to be performed based on a frequency hopping protocol” and is therefore equivalent to the “means for” of claims 6 and 18. As discussed above, the processor in the central control system 30 “control[s] and operate[s] various components within the mobile communication unit 20 in order to carry out various functions described herein.” (Id. at 3:40-52, FIG.2, emphasis added.) One of the functions performed in Gerten is to communicate using a FH scheme:

The present invention employs signal strength measurements on N number of channels (N being an integer) of the frequency hopping scheme to determine M number of channels (M being an integer less than or equal to N) to avoid. The system and/or method then modify the frequency hopping scheme to avoid transmission over the M channels. The M channels to avoid can be communicated to wireless units involved in the communication system, so that the members of the wireless communica-
tion system can frequency hop together over the modified frequency hopping scheme. (Id. at 2:37-47.)

105. Gerten describes an exemplary system using Bluetooth frequency hopping. Gerten recognizes that Bluetooth used a frequency hopping protocol. (Id. at 1:13-15; 1:39-55.) This is consistent with the Bluetooth Version 1.0B, in existence prior to the filing date of Gerten, which described the use of frequency hopping protocol in Bluetooth. (See, e.g., Bluetooth Version 1.0B, Exhibit 1012, pp. 41-44, 127-138.)

106. As I discussed above in my discussion of claim limitation [5A], a master device in Gerten transmits to and receives from another communication device over “[a] first set of two or more communication channels.” In a hopping sequence based on a frequency hopping protocol such as used in Bluetooth, only one communications channel is used for communications between a first device and a second device at each hop. The ’624 patent, in the Background section, acknowledges that these limitations were known aspects of conventional frequency hopping systems: “The F[requency]H[opping] system transmits data on one channel, hops to the next channel in the hopping sequence to transmit more data, and continues by transmitting data on subsequent channels in the hopping sequence.” (’624 patent, 2:20-24, emphasis added.)
107. Gerten confirms these limitations were well-known explaining that “Bluetooth radio modules attempt to avoid interference from other signals by *hopping to a new frequency* after transmitting or receiving a packet as compared to other systems operating at the same frequency band.” (Gerten, 1:36-43, emphasis added.) Hopping to a *new frequency* for transmission or reception of the next packet is the use of “only one communications channel” for communications.

108. As I discussed above in my discussion of claim limitation [5C], after subsequent modification of the hopping sequence, the communication channel of the second set is used for communications.

2. *The combination of Gerten and Cuffaro discloses “the performance of the plurality of communications channels is based on channel performance data that is transmitted over one or more of the plurality of communications channels based on the hopping sequence according to the frequency hopping protocol” of claims 6 and 18.*

109. Cuffaro discloses transmitting performance data from a remote device (e.g., mobile station) to a master device (e.g., base station). In Cuffaro, a base station 14 serves mobile devices 16 using n-number of assigned frequencies selected from m-number of allocated frequencies. (Cuffaro, Exhibit 1004, 5:30-43.) A quality metric is measured for each of the unassigned and assigned frequencies. *(Id. at 7:23-26.)* “The type of measurements made on each frequency may be up-link and downlink frequency channel measurements…[and] may include, for ex-
ample, signal strength measurements and/or interference signal strength measurements.” (Id. at 7:26-33.) Regarding the downlink frequency channel measurements, Cuffaro further states, “[m]obile stations 16 may be used to measure the signal strength on each frequency allocated to the base station 14 serving the cell 10 . . . . These measurements may then be reported back to the base station 14 . . . . Alternatively, the mobile stations 16 may be commanded by the base station 14 to make continuous measurements, for instance, once per second on the downlink frequency channels allocated to the cell 10 and report the measurements to the base station 14 .” (Id. at 7:37-47, emphasis added.)

110. Upon receipt of the quality metrics, a processor 24 in the base station 14 operates to “perform the management functionality of the present invention, which is to compare the quality metrics of the measurements and swap high signal quality unassigned frequencies with low signal quality assigned frequencies to the transceivers in the base station. By managing the allocated frequencies to the base station, the base station provides the frequencies with the highest signal quality for subscriber communication.” (Id. at 6:60-7:2.) The processor in the base station then evaluates the “performance” of each channel by performing a comparison to determine if a high quality unassigned channel should replace a low quality assigned channel.
111. Cuffaro does not limit the type of communications link or connection that is used to report the “channel performance data” from the mobile device to the base station. When combined with Gerten, one skilled in the art would consider it obvious for the slave device in Gerten to perform the interference signal strength measurements. It would have further been obvious to communicate the “channel performance data” that is measured by the slave device over “one or more of the plurality of communications channels based on the hopping sequence,” which Gerten uses to avoid interference and one skilled in the art would have been motivated to use to transmit performance data critical to the determination of channel updates on good channels.

112. A person of ordinary skill in the art would have combined Gerten and Cuffaro for a variety of reasons. Cuffaro and Gerten are in the same field of endeavor – channel selection to avoid interference in a communication system. Gerten relates to “a system and method for improving noise and interference immunity in a wireless communication system.” (Gerten, 1:6-9, emphasis added.) Similarly, Cuffaro “solves the problem of degradation of signal quality when increasing capacity on an interference driven channel selection/quality driven channel selection (IDCS/QDCS) equipped telecommunications system.” (Cuffaro, 2:14-17, emphasis added.)
113. A person of ordinary skill in the art would have been motivated to use the transmitted performance data of Cuffaro in the selection process of Gerten because measuring interference signal strength at a slave device such as described in Cuffaro provides a more accurate determination of the effect of interference on the forward link reception and therefore would in turn provide more accurate identification of “bad channels” in Gerten. Gerten suggests such a modification. Gerten discusses that both a master and a slave can participate in identifying channels to avoid. (Gerten, 7:9-11 (“In step 300, the master device and the slave device identify M channels to be avoided among N total channels.”).)

114. The combination of Gerten and Cuffaro is merely a simple substitution of Gerten’s interference signal strength measurements determined at the master device with signal strength measurements transmitted from the remote slave device. Making such a combination would have yielded predictable results. In other words, one skilled in the art would recognize that performance data generated anywhere within the network can be used in a predictable manner to determine bad channels.

**B. Dependent claims 7 and 19**

115. The combination of Gerten and Cuffaro discloses each and every limitation of claims 7 and 19. I note that the limitations of claims 7 and 19 substantially repeat the selecting limitations of claim 5, adding only that the selecting
of the first and second set of two or more communications channels is based on both the “the performance of the plurality of communications channels” and “the channel selection criteria.” Claims 7 and 19 are reproduced below.

7 [19]. A communications apparatus as recited in claim 5 [17], wherein:

the means for selecting the first set of two or more communications channels includes means for selecting, based upon the performance of the plurality of communications channels at the first time and channel selection criteria, the first set of two or more communications channels from the plurality of communications channels;

the means for selecting the second set of two or more communications channels includes means for selecting, based upon the performance of the plurality of communications channels at the second time and the channel selection criteria, the second set of two or more communications channels from the plurality of communications channels; and

the channel selection criteria specifies that for a particular communications channel to be selected, the particular communications channel receives a specified number of votes to use the particular communications channel from among a plurality of votes.
116. As I discussed above relative to claim 5, Gerten discloses selecting, based upon the performance of the plurality of communications channels, a first set of two or more communications channels at a first time and a second set of two or more communications channels at a second time. Gerten also explicitly discusses identifying “bad” channels. (Id. at 8:54-58 (“replacing bad channels”); 9:13-17 (“four worst channels avoided”).) However, Gerten does not explicitly describe channel selection criteria specifying “that for a particular communications channel to be selected, the particular communications channel receives a specified number of votes to use the particular communications channel from among a plurality of votes” (referred to as the channel voting feature). However, Cuffaro, in the same field of endeavor as Gerten, explicitly describes this channel voting feature.

117. In Cuffaro, a wireless device measures frequency channels to obtain quality metrics such as “signal strength measurements and/or interference strength measurements.” (Cuffaro, 7:30-32.) After comparing the quality metric measurements made on unassigned frequency channels against the quality metric measurements made on assigned idle frequency channels, the wireless device makes a vote “for the unassigned frequency channel or the assigned idle frequency channels based upon the results of the measurements.” (Id. at 8:10-12.)
118. The step of voting in Cuffaro “basically adds and subtracts numerical values in a virtual frequency exchange (VFE) matrix or memory location after each measurement sample.” (Id. at 8:10-21.) Accordingly, each sample results in a vote, so that a plurality of samples produces a “plurality of votes” applied to the assigned and unassigned frequencies based on the comparison at each sample.

119. FIGS. 4, 5A, and 5B illustrate the voting mechanism in Cuffaro. FIG. 4 illustrates one iteration (i.e., sample) of interference signal strength measurements 405 (in dBm) on assigned frequency channels F1, F8, F15, F22 and unassigned frequency channels F29, F36, F43, and F50. (Id. at 8:66-9:3, FIG.4.) In example 515 in FIG. 4, unassigned F43 has a lower interference signal strength (-118 dBm) than assigned F22 (-106 dBm), “so that a vote is cast in favor of unassigned frequency f43 and a +1 is placed into the corresponding matrix element” shown in FIG. 5A, which provides a matrix that illustrates the relative voting between the assigned and unassigned frequencies for one sample. (Id. at 9:53-57, FIG.4, FIG. 5A.) “If the adjusted interference measurement is below (i.e., more negative) than the assigned idle frequency measurements 510, then a vote for the unassigned frequency f43 is indicated as a +1. If the unassigned frequency adjusted interference measurement is higher than (i.e., less negative) an idle assigned frequency 510, then a vote is made for the assigned idle frequency and indicated as a -
1.” (Id. at 9:39-46.) The votes of Cuffaro indicate whether to use (or not to use) one communications channel over another channel.

![FIG. 4]

120. FIG. 5B below illustrates the voting over 10 samples of interference signal strength measurements. (Id. at 10:19-20, 10:31-34.) As can be seen, unassigned F43 has a +8 vote margin over assigned F15 when determined over 10 samples of signal strength measurements, which happens to be the largest positive vote margin that is shown in the matrix of FIG. 5B that tallies the votes over the 10 samples. (Id. at 10:34-37, FIG. 5B.) “These frequencies are swapped so that f43 becomes a frequency that is assigned and f15 becomes a frequency that is unassigned to the base station servicing cell 10(1).” (Id. at 10:51-53.)

![FIG. 5A]
121. The voting feature of Cuffaro compares interference signal strength measurements of assigned and unassigned frequency channels over a plurality of samples so as to generate a “plurality of votes” associated with the unassigned frequency channels as illustrated in FIG. 5B. (See Id. at 7:23-32, 8:60-66, 8:10-21.) Further, the unassigned frequency channel (e.g. “particular communications channel”) that has the maximum number of positive votes (“specified number”) replaces the corresponding assigned frequency channel and therefore is “selected” for a “first [or second] set of communications channels” as recited in claim 3. (Id. at 10:34-37, 10:51-53, FIG. 5B.) The maximum number of positive votes is a “specified number of votes” in the context of claim 3 in multiple fashions. For example, the positive vote requirement of Cuffaro necessitates that the unassigned frequency receive at least one vote (e.g., a +1) for there to be a channel swap. Also, for any given set of samples (FIG. 5B), there will only be one maximum number of positive votes, if one exists, and that can also meet the “specified number” of
votes. Additionally, should the Board construe the term “specified number of votes” as requiring a pre-defined specific number, a person of ordinary skill in the art would recognize that instead of using the “maximum number of positive votes,” a specific number of positive votes (e.g., +6) could be used to select channels for replacement in Cuffaro.

122. As I explained above, a person of ordinary skill in the art would have combined Gerten and Cuffaro because both are directed at channel selection from among a plurality of channels to avoid interference. Also, a person of ordinary skill in the art would have been motivated to use the voting feature of Cuffaro in the selection process of Gerten to improve channel selection for interference avoidance in wireless communications. For example, because the voting feature of Cuffaro compares interference signal strength measurements of assigned and unassigned frequency channels over a plurality of samples to generate the votes associated with the unassigned frequency channels before selecting a channel, the channel selection process may be less susceptible to short periods of variation in interference. (See, e.g., id. at 8:32-36.) Furthermore, because the combination merely adds a known technique to an existing system, such a modification would have been well within the skill of a person of ordinary skill in the art and would have yielded a predictable result.
XI. Gendel in view of Haartsen

A. Overview of Gendel

123. Gendel is directed to “frequency hopping [(FH)] communication system[s].” (Gendel, Exhibit 1005, 1:17-20.) The network of Gendel (illustrated in FIG. 1 of Gendel reproduced below) includes multiple communications devices, such as a primary system 102 and secondary systems 104, 106, and 108. The primary system 102 performs FH communication with the secondary system 104 using a subsystem 122, and FH communication with the secondary system 106 using a subsystem 124. (Id. at 6:67-7:9.)

124. Subsystems 122 and 124 are “adapted (a) to detect the occurrence or non-occurrence of a reception error from received data, (b) to identify a used segment from the hopping pattern in which the reception error occurred, and (c) to
store and modify an error value for each used segment . . . .” (Id. at 7:20-28.) A segment is derived from an available frequency bandwidth and corresponds to a subset of frequencies. (Id. at 3:52-62.) Subsystems 122 and 124 replace a particular used segment and all its hopping frequencies with an unused segment “[w]hen the error value of [the] particular used segment reaches or exceeds a predetermined threshold.” (Id. at 7:28-32.) Gendel discloses that a spreading code control unit 317 in each of subsystems 122 and 124 is specifically responsible for modifying error values of each used segment and changing or updating the frequency hopping pattern by replacing or substituting an errored segment with an unused segment. (Id. at 8:50-67.)

B. Independent claim 5

125. The combination of Gendel and Haartsen renders claim 5 obvious.

1. The combination of Gendel and Haartsen discloses “[a] communications apparatus” [5P].

126. FIG. 1 of Gendel (reproduced above) illustrates “a primary system 102, which performs [frequency hopping (FH)] communication with a plurality of secondary systems generally denoted by the reference numerals 104, 106, and 108.” (Id. at 6:67-7:4.) Each of primary system 102 and secondary systems 104, 106, and 108 are “a communications apparatus.”
2. The combination of Gendel and Haartsen discloses “means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels” [5A].

Gendel discloses that an available spectrum is divided into a plurality of segments, where a segment contains a subset of frequencies from which carrier or hopping frequencies are selected. (Id. at 3:52-62.) Some of the plurality of segments are used by the primary system 102 for FH communications (“used segments”), while others are not used for FH communications (“unused segments”). (Id.) The plurality of segments (and their respective frequencies) are the “plurality of communications channels” recited in claim 1. FIG. 2A of Gendel (reproduced below) illustrates a sample division of an available spectrum into a plurality of segments (with each segment containing a subset of frequencies).

Figure 1A of Gendel
128. The spreading code control unit 317 of the communications device in Gendel selects, “at a first time, a first set of two or more communications channels from the plurality of communications channels.”

129. The spreading code control unit 317 of the communication device in Gendel determines performance data for the plurality of communications channels: “Spreading code control unit 317 includes an update error counter arrangement . . . for modifying error values associated with each used segment according to the occurrence or non-occurrence of reception errors detected” over frequencies of the used segment. (Gendel, 8:55-60.) A reception error on a channel relates to the performance of the channel and therefore the error values are performance data for the plurality of frequencies in segments.

130. The spreading code control unit 317 selects the first set of two or more communications channels based upon this performance data: “Spreading code control unit 317 also changes or updates the frequency hopping pattern by replacing or substituting a particular used segment with an unused segment, when the error value of the particular used segment reaches or exceeds a predetermined threshold.” (Id. at 8:63-67.) The first set of two or more communications channels includes: the unused segment (and its respective frequencies) that is selected to replace the particular used segment at the time its error value reaches or exceeds the
predetermined threshold, and the remaining used segments (and their respective frequencies). FIG. 2B of Gendel (reproduced below with annotations) illustrates the selected first set of two or more communications channels.

![Figure 2B of Gendel (Annotated)](image)

131. While Gendel discloses that the spreading code control unit 317 has channel selection functionality, Gendel does not explicitly disclose that the spreading code control unit 317 is performed by a processor executing instructions similar to the “means for” recited in claim [5A]. Such a processor was well known as of the filing date of Gendel. A person of ordinary skill in the art would have immediately recognized that the spreading code control unit 317 of Gendel could be implemented using a processor in the communications device executing instructions. (Id.) Haartsen explicitly discloses such an implementation.

132. Specifically, Haartsen describes an original hop selection function that selects hop carriers according to a hop sequence and a post-processing function that replaces certain ones of the selected hop carriers (e.g., those with a substantial
amount of interference) with other hop carriers. (Haartsen, Exhibit 1006, 11:4-48, 8:24-31.) Haartsen further discloses that these functions (among others) “may be embodied in any of a variety of forms, including but not limited to hard-wired circuits, or a processor executing a suitable set of program instructions stored on a computer readable storage medium such as a random access memory (RAM).” (Id. at 10:56-65, emphasis added.)

133. It would have been obvious to one of ordinary skill in the art to use the processor executing a suitable set of program instructions as taught in Haartsen to implement the spreading code control unit 317 in Gendel. Both Haartsen and Gendel are directed to the same technology – FH communications. In fact, Haartsen discloses similar functionality as performed by the spreading code control unit 317 in Gendel. Furthermore, because the use of processors was well-known prior to the earliest possible priority date of the ’624 patent, the use of the processor of Haartsen to implement the spreading code control unit 317 of Gendel (particularly since Gendel teaches flowcharts for implementing the disclosed system) would have been a predictable, obvious variation to a person of ordinary skill in the art.

Interactively search this docket at https://libpatent.com/network/graph/ptabdocket/5792/IPR2015-01580
134. The processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel, provides the same functionality to and is structurally the same as the “means for” of claim [5A].

3. **The combination of Gendel and Haartsen discloses “means for causing the first set of two or more communications channels to be used for communications between a pair of participants” [5B].**

135. Gendel discloses that, after the spreading code control unit 317 modifies the frequency hopping pattern by replacing or substituting a used segment as described above, the modified hopping pattern is used to perform FH communication: “When the error value or a number of detected errors of a used segment reaches or exceeds a predetermined threshold, the used segment (e.g., erred segment) and all its hopping frequencies are replaced with an unused segment from the available spectrum. The other communicating party is notified of the replacement, and FH communication is then resumed with the modified hopping pattern.” (Gendel, 6:38-44.) Gendel discloses that the spreading code control unit 317 performs the process (shown in FIG. 6) of notifying the other communicating party of the modification to the hopping pattern. (See, e.g., Id. at 8:63-9:7.)

136. By modifying the frequency hopping pattern and notifying the other communicating party of the modification, the spreading code control unit 317 causes the “first set of two or more communications channels” (as described
above) to be used by the primary system 102 (the first participant of the “pair of participants”) to transmit to and receive from the secondary system 104 or 106 (the second participant of the “pair of participants”). Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionality to and is structurally the same as the “means for” of claim [5B].

4. The combination of Gendel and Haartsen discloses “means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels” [5C].

137. This feature recited in claim 5 is a repetition of the previously discussed feature [5A] above, but is performed “based upon performance of the plurality of communications channels at a second time” as opposed to at “a first time.”

138. Gendel discloses that the segment replacement process performed by the spreading code control unit 317, described above, is re-performed each time an error value associated with a used segment reaches or exceeds the predetermined threshold. (See Gendel FIG. 5, which shows a flowchart of the operations involved in updating segment error counters and marking segments for replacement when the error counters exceed the threshold; the flowchart continuously loops after initialization steps 600 and 602 during FH communication.)
139. Thus, Gendel discloses that the spreading code control unit 317, after selecting the first set of segments described above, selects a second set of segments (and their respective frequencies) based on the error values at a second time. The second set of segments includes: an unused segment that is selected to replace a particular used segment from the first set of segments at the time the error value of the particular used segment reaches or exceeds the predetermined threshold, and the remaining used segments.

140. For example, my FIG. A modifies and annotates FIG. 2B of Gendel to illustrate the substitution of used segment 2 of the first set of two or more communications channels with previously unused segment 9. The result is a second set of two or more communications channels.

![Figure A: Modified and Annotated FIG. 2B of Gendel](image)

141. The processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel, provides the same functionality to and is structurally the same as the “means for” of claim [5C].
5. The combination of Gendel and Haartsen discloses “means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels” [5D].

142. The “first set of two or more communications channels” (as described above) are used to perform FH communication until a change in the hopping pattern occurs due to errors on a used segment exceeding a predetermined threshold, resulting in the creation of the “second set of two or more communications channels” (also as described above). (See Gendel, 6:38-44.) The “second set of two or more communications channels” would then be used by the primary system 102 (the first participant of “the pair of participants”) to transmit to and receive from the secondary system 104 or 106 (the second participant of “the pair of participants”) until a subsequent change in the hopping pattern due to another occurrence of errors on a used segment exceeding a predetermined threshold. (Id.)

143. In the same manner as described above in regard to claim [5B], the spreading code control unit 317 causes the “second set of two or more communications channels” (as described above) to be used by the primary system 102 (the first participant of the “pair of participants”) to transmit to and receive from the secondary system 104 or 106 (the second participant of the “pair of participants”). Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionali-
ty to and is structurally the same as the “means for” of claim [5D].

6. The combination of Gendel and Haartsen discloses “wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants” [5E].

144. The spreading code control unit 317 in the communications device of Gendel performs a hopping sequence based on a frequency hopping protocol: “Spreading code control 317 includes a spreading series code generating circuit (not shown) that selects frequencies according to a spreading code, e.g., a frequency hopping pattern, and controls frequency synthesizer 308 to output the selected frequency.” (Gendel, 8:50-55.) The selected frequency output by the frequency synthesizer 308 is used to transmit data to and receive data from another device. (Id. at 9:14-43.) The approach in Gendel using a FH signal transmission technique to transmit data is a frequency hopping protocol.

145. In a hopping sequence based on a frequency hopping protocol, only one communications channel is used for communications between a first device and a second device at each hop. Gendel discloses this well-known aspect of frequency hopping communications: “[e]ach subsystem 122, 124 . . . is adapted to transmit and receive data according to a spreading code designating a segment hopping sequence or pattern (e.g., S0, S2, S5, S6 and S7), with the hopping frequencies being contained within the used segments.” (Id. at 7:14-18.) According to
Gendel, “[a] hopping frequency may be randomly selected from a used segment or be a predetermined frequency from the used segment.” (Id. at 7:18-20.)

146. Thus, in Gendel, at each hop in the segment hopping sequence or pattern, a single hopping frequency selected from the current used segment in the sequence is used by the primary system 102 (the first participant of “the pair of participants”) to communicate with the secondary system 104 or 106 (the second participant of “the pair of participants”). Communications channels from the second set are used in the hopping sequence for communications between the devices. Gendel and Haartsen therefore disclose “at each hop in the hopping sequence based on the frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants.”

7. The combination of Gendel and Haartsen discloses “wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based on the performance of the plurality of communications channels” [5F].

147. As illustrated in FIG. 1 of Gendel (reproduced above), primary system 102 of Gendel [the “first participant”] communicates with other wireless devices such secondary system 104 [the “second participant”]. Gendel describes that in certain circumstances the “default set of two or more communications channels
is associated with a hopping sequence and is not changed based on the performance of the plurality of communications channels.” Specifically, Gendel discloses that the primary system 102 performs FH communication with secondary system 108 but does not substitute or change segments in the frequency hopping pattern based on errors detected over the segments. (See Gendel, FIG. 1, noting in block 126 that the “segment substitution mechanism [is] not implemented.”) Gendel provides block 126 to support legacy communication systems, such as secondary system 108, that do not support segment substitution. Thus, communication between the primary system 102 and a secondary system uses the “default set of two or more communications channels.”

8. The combination of Gendel and Haartsen discloses “wherein . . . the communications channel selector apparatus further comprises: means [for] the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels” [5G].

148. FIG. 1 of Gendel also illustrates that primary system 102 communicates with “the second participant” (e.g., secondary system 104) and “a third participant” (e.g., secondary system 108). The primary system 102 of Gendel transmits to and receives from the secondary system 104 or 106 implementing Gendel’s segment substitution mechanism over “the first set of two or more communications channels” [5G].
channels” and, subsequently, “the second set of two or more communications channels.” This communication can occur while the subsystem 126 of primary system 102 transmits to and receives from the secondary system 108 over “the default set of two or more communications channels.” For example, this is achieved because primary system 102 includes a separate subsystem to communicate with each secondary system and because FIG. 1 of Gendel illustrates separate links between primary system 102 and each secondary system.

149. The transmitting unit and the receive unit of the primary system 102 used to transmit to and receive from the secondary system 104 or 106 and the transmitting unit and the receive unit of the primary system 102 used to transmit to and receive from the secondary system 108 provide the same functionality to and are structurally the same as the “means for” of claim [5G].

C. Dependent claim 8

1. The combination of Gendel and Haartsen discloses “[the] communications apparatus . . . further comprising . . . means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants” [8A].

150. The primary system 102 (the first participant of “the pair of participants”) of Gendel stores its used segments (where each segment includes a subset of frequencies) (“the first set of two or more communications channel”) in a seg-
ment hopping table after the selection process is complete. The spreading code control unit 317 of primary system 102 then updates the segment hopping table by replacing the particular used segment (or “S\text{ERROR}”) in the segment hopping table with the unused segment (or “S\text{UNUSED}”). (Gendel, 12:45-48 and FIG. 6, step 662.) The update of the hopping table in the primary system occurs after an acknowledgment is received from the secondary device.

151. The “first set of two or more communications channels” is also loaded into a table in the secondary system 104 or 106 (the second participant of “the pair of participants”) after the selection process. As part of the replacement process, the spreading code control unit 317 of primary system 102 sends a request to the secondary system\textsuperscript{1} identifying a “bad” used segment and requesting that the secondary system replace the “bad” used segment with a specific unused segment. (\textit{Id.} at 12:36-42 and FIG. 6, step 654.) After determining whether to use the specific unused segment, the secondary system sends an acknowledgment receipt and ac-

\textsuperscript{1} The secondary system implements the same segment replacement process shown in FIG. 6 as the spreading code control unit 317 of the primary system 102. (\textit{See Id.} at 8:13-16 and 8:63-9:2, disclosing that the subsystems 132 and 134 of secondary systems 104 and 106 also include a spreading code control unit 317 that implements that segment replacement process shown in FIG. 6.)
ceptance to the primary system. (Id. at 12:20-29.) The secondary system then updates its segment hopping table by replacing the particular used segment (or “$S_{ERR}$”) in the segment hopping table with the unused segment (or “$S_{UNUSED}$”). (Id. at 12:29-32 and FIG. 6, step 662.)

152. Gendel does not explicitly describe that the table is stored in a “register” in each of the primary system (the first participant of “the pair of participants”) and the secondary system (the second participant of “the pair of participants”). However, the use of a register to store a table would have been an obvious design choice for a person of ordinary skill in the art. Indeed, Haartsen discloses a similar table stored in a memory (Haartsen, 13:4-22) and Gendel discloses using registers to store maximum and minimum reception power levels for used segments (Gendel, 14:9-16). Under the broadest reasonable interpretation standard, a “register” is, e.g., a “set of bits of high-speed memory within a microprocessor or other electronic device, used to hold data for a particular purpose.” (See, e.g., Microsoft Press Computer Dictionary, 3rd Edition, Exh. 1010, p. 402.) A person of ordinary skill in the art would have been motivated to use a register to store the frequency hopping sequence because of the speed required to access channels during a frequency hopping sequence.

153. Because the spreading code control unit 317 of primary system 102
updates the hopping table in the primary system 102 and sends the request to the secondary system identifying the “bad” used segment and requesting that the secondary system replace the “bad” used segment with the specific unused segment, the spreading code control unit causes the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants.”

Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionality to and is structurally the same as the “means for” of claim [8A].

2. The combination of Gendel and Haartsen discloses “[the] communications apparatus . . . further comprising . . . means for, after selecting the second set of two or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” [8B].

154. This limitation of claim 8 merely repeats the prior limitation for the “second set of two or more communications channels.” As discussed above, Gendel periodically performs the same replacement process. The primary system and secondary system operate in the same manner during a subsequent replacement process. Accordingly, means for causing “the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” is obvious based on the combination of Gendel and Haartsen.
D. Independent claim 17

155. The combination of Gendel and Haartsen renders claim 17 obvious.

1. The combination of Gendel and Haartsen discloses “[a] communications apparatus” [17P].

156. FIG. 1 of Gendel (reproduced above) illustrates “a primary system 102, which performs [frequency hopping (FH)] communication with a plurality of secondary systems generally denoted by the reference numerals 104, 106, and 108.” (Id. at 6:67-7:4.) Each of primary system 102 and secondary systems 104, 106, and 108 are “a communications apparatus.”

2. The combination of Gendel and Haartsen discloses “means for selecting, based upon performance of a plurality of communications channels at a first time, a first set of two or more communications channels from the plurality of communications channels” [17A].

157. Gendel discloses that an available spectrum is divided into a plurality of segments, where a segment contains a subset of frequencies from which carrier or hopping frequencies are selected. (Id. at 3:52-62.) Some of the plurality of segments are used by the primary system 102 for FH communications (“used segments”), while others are not used for FH communications (“unused segments”). (Id.) The plurality of segments (and their respective frequencies) are the “plurality of communications channels” recited in claim 1. FIG. 2A of Gendel (re-
produced below) illustrates a sample division of an available spectrum into a plurality of segments (with each segment containing a subset of frequencies).

![Sample Division of the Spectrum to Segments](image)

**Figure 2A of Gendel**

158. The spreading code control unit 317 of the communications device in Gendel selects, “at a first time, a first set of two or more communications channels from the plurality of communications channels.”

159. The spreading code control unit 317 of the communication device in Gendel determines performance data for the plurality of communications channels: “Spreading code control unit 317 includes an update error counter arrangement . . . for modifying error values associated with each used segment according to the occurrence or non-occurrence of reception errors detected” over frequencies of the used segment. (Gendel, 8:55-60.) A reception error on a channel relates to the performance of the channel and therefore the error values are performance data for the plurality of frequencies in segments.
160. The spreading code control unit 317 selects the first set of two or more communications channels based upon this performance data: “Spreading code control unit 317 also changes or updates the frequency hopping pattern by replacing or substituting a particular used segment with an unused segment, when the error value of the particular used segment reaches or exceeds a predetermined threshold.” (Id. at 8:63-67.) The first set of two or more communications channels includes: the unused segment (and its respective frequencies) that is selected to replace the particular used segment at the time its error value reaches or exceeds the predetermined threshold, and the remaining used segments (and their respective frequencies). FIG. 2B of Gendel (reproduced below with annotations) illustrates the selected first set of two or more communications channels.

![Figure 2B of Gendel (Annotated)](image)

161. While Gendel discloses that the spreading code control unit 317 has channel selection functionality, Gendel does not explicitly disclose that the spreading code control unit 317 is performed by a processor executing instructions simi-
lar to the “means for” recited in claim [17A]. Such a processor was well known as of the filing date of Gendel. A person of ordinary skill in the art would have immediately recognized that the spreading code control unit 317 of Gendel could be implemented using a processor in the communications device executing instructions. (Id.) Haartsen explicitly discloses such an implementation.

162. Specifically, Haartsen describes an original hop selection function that selects hop carriers according to a hop sequence and a post-processing function that replaces certain ones of the selected hop carriers (e.g., those with a substantial amount of interference) with other hop carriers. (Haartsen, Exhibit 1006, 11:4-48, 8:24-31.) Haartsen further discloses that these functions (among others) “may be embodied in any of a variety of forms, including but not limited to hard-wired circuits, or a processor executing a suitable set of program instructions stored on a computer readable storage medium such as a random access memory (RAM).” (Id. at 10:56-65, emphasis added.)

163. It would have been obvious to one of ordinary skill in the art to use the processor executing a suitable set of program instructions as taught in Haartsen to implement the spreading code control unit 317 in Gendel. Both Haartsen and Gendel are directed to the same technology – FH communications. In fact, Haartsen discloses similar functionality as performed by the spreading code control
unit 317 in Gendel. Furthermore, because the use of processors was well-known prior to the earliest possible priority date of the '624 patent, the use of the processor of Haartsen to implement the spreading code control unit 317 of Gendel (particularly since Gendel teaches flowcharts for implementing the disclosed system) would have been a predictable, obvious variation to a person of ordinary skill in the art.

164. The processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel, provides the same functionality to and is structurally the same as the “means for” of claim [17A].

3. The combination of Gendel and Haartsen discloses “means for, after selecting the first set of two or more communications channels, causing the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants” [17B].

165. The primary system 102 (the first participant of “the pair of participants”) of Gendel stores its used segments (where each segment includes a subset of frequencies) (“the first set of two or more communications channel”) in a segment hopping table after the selection process is complete. The spreading code control unit 317 of primary system 102 then updates the segment hopping table by replacing the particular used segment (or “S_ERROR”) in the segment hopping table with the unused segment (or “S_UNUSED”). (Gendel, 12:45-48 and FIG. 6, step 662.)
The update of the hopping table in the primary system occurs after an acknowledgment is received from the secondary device.

166. The “first set of two or more communications channels” is also loaded into a table in the secondary system 104 or 106 (the second participant of “the pair of participants”) after the selection process. As part of the replacement process, the spreading code control unit 317 of primary system 102 sends a request to the secondary system\(^3\) identifying a “bad” used segment and requesting that the secondary system replace the “bad” used segment with a specific unused segment. (Id. at 12:36-42 and FIG. 6, step 654.) After determining whether to use the specific unused segment, the secondary system sends an acknowledgment receipt and acceptance to the primary system. (Id. at 12:20-29.) The secondary system then updates its segment hopping table by replacing the particular used segment (or “\(S_{ERROR}\)” in the segment hopping table with the unused segment (or “\(S_{UNUSED}\)”). (Id. at 12:29-32 and FIG. 6, step 662.)

\(^3\) The secondary system implements the same segment replacement process shown in FIG. 6 as the spreading code control unit 317 of the primary system 102. (See Id. at 8:13-16 and 8:63-9:2, disclosing that the subsystems 132 and 134 of secondary systems 104 and 106 also include a spreading code control unit 317 that implements that segment replacement process shown in FIG. 6.)
167. Gendel does not explicitly describe that the table is stored in a “register” in each of the primary system (the first participant of “the pair of participants”) and the secondary system (the second participant of “the pair of participants”). However, the use of a register to store a table would have been an obvious design choice for a person of ordinary skill in the art. Indeed, Haartsen discloses a similar table stored in a memory (Haartsen, 13:4-22) and Gendel discloses using registers to store maximum and minimum reception power levels for used segments (Gendel, 14:9-16). Under the broadest reasonable interpretation standard, a “register” is, e.g., a “set of bits of high-speed memory within a microprocessor or other electronic device, used to hold data for a particular purpose.” (See, e.g., Microsoft Press Computer Dictionary, 3rd Edition, Exh. 1010, p. 402.) A person of ordinary skill in the art would have been motivated to use a register to store the frequency hopping sequence because of the speed required to access channels during a frequency hopping sequence.

168. Because the spreading code control unit 317 of primary system 102 updates the hopping table in the primary system 102 and sends the request to the secondary system identifying the “bad” used segment and requesting that the secondary system replace the “bad” used segment with the specific unused segment, the spreading code control unit causes the first set of two or more communications channels to be loaded into a register of each participant of the pair of participants.”
Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionality to and is structurally the same as the “means for” of claim [8A].

4. The combination of Gendel and Haartsen discloses “means for causing the first set of two or more communications channels to be used for communications between a pair of participants” [17C].

169. Gendel discloses that, after the spreading code control unit 317 modifies the frequency hopping pattern by replacing or substituting a used segment as described above, the modified hopping pattern is used to perform FH communication: “When the error value or a number of detected errors of a used segment reaches or exceeds a predetermined threshold, the used segment (e.g., erred segment) and all its hopping frequencies are replaced with an unused segment from the available spectrum. The other communicating party is notified of the replacement, and FH communication is then resumed with the modified hopping pattern.” (Gendel, 6:38-44.) Gendel discloses that the spreading code control unit 317 performs the process (shown in FIG. 6) of notifying the other communicating party of the modification to the hopping pattern. (See, e.g., Id. at 8:63-9:7.)

170. By modifying the frequency hopping pattern and notifying the other communicating party of the modification, the spreading code control unit 317 causes the “first set of two or more communications channels” (as described
above) to be used by the primary system 102 (the first participant of the “pair of participants”) to transmit to and receive from the secondary system 104 or 106 (the second participant of the “pair of participants”). Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionality to and is structurally the same as the “means for” of claim [17C].

5. The combination of Gendel and Haartsen discloses “means for selecting, based upon performance of the plurality of communications channels at a second time that is later than the first time, a second set of two or more communications channels from the plurality of communications channels” [17D].

171. This feature recited in claim 17 is a repetition of the previously discussed feature [17A] above, but is performed “based upon performance of the plurality of communications channels at a second time” as opposed to at “a first time.”

172. Gendel discloses that the segment replacement process performed by the spreading code control unit 317, described above, is re-performed each time an error value associated with a used segment reaches or exceeds the predetermined threshold. (See Gendel FIG. 5, which shows a flowchart of the operations involved in updating segment error counters and marking segments for replacement when the error counters exceed the threshold; the flowchart continuously loops after initialization steps 600 and 602 during FH communication.)
173. Thus, Gendel discloses that the spreading code control unit 317, after selecting the first set of segments described above, selects a second set of segments (and their respective frequencies) based on the error values at a second time. The second set of segments includes: an unused segment that is selected to replace a particular used segment from the first set of segments at the time the error value of the particular used segment reaches or exceeds the predetermined threshold, and the remaining used segments.

174. For example, my FIG. A modifies and annotates FIG. 2B of Gendel to illustrate the substitution of used segment 2 of the first set of two or more communications channels with previously unused segment 9. The result is a second set of two or more communications channels.

![Figure A: Modified and Annotated FIG. 2B of Gendel](image)

175. The processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel, provides the same functionality to and is structurally the same as the “means for” of claim [17D].
6. The combination of Gendel and Haartsen discloses “means for, after selecting the second set of two or more communications channels, causing the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” [17E].

176. This limitation of claim 17 merely repeats the prior limitation [17B] for the “second set of two or more communications channels.” As discussed above, Gendel periodically performs the same replacement process. The primary system and secondary system operate in the same manner during a subsequent replacement process. Accordingly, means for causing “the second set of two or more communications channels to be loaded into the register of each participant of the pair of participants” is obvious based on the combination of Gendel and Haartsen.

7. The combination of Gendel and Haartsen discloses “means for causing the second set of two or more communications channels to be used for communications between the pair of participants instead of the first set of two or more communications channels” [17F].

177. The “first set of two or more communications channels” (as described above) are used to perform FH communication until a change in the hopping pattern occurs due to errors on a used segment exceeding a predetermined threshold, resulting in the creation of the “second set of two or more communications channels” (also as described above). (See Gendel, 6:38-44.) The “second set of two or more communications channels” would then be used by the primary system 102 (the first participant of “the pair of participants”) to transmit to and re-
ceive from the secondary system 104 or 106 (the second participant of “the pair of participants”) until a subsequent change in the hopping pattern due to another occurrence of errors on a used segment exceeding a predetermined threshold. (Id.)

178. In the same manner as described above in regard to claim [17C], the spreading code control unit 317 causes the “second set of two or more communications channels” (as described above) to be used by the primary system 102 (the first participant of the “pair of participants”) to transmit to and receive from the secondary system 104 or 106 (the second participant of the “pair of participants”). Based on this, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel as described above, provides the same functionality to and is structurally the same as the “means for” of claim [17F].

8 The combination of Gendel and Haartsen discloses “wherein at each hop in a hopping sequence based on a frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants” [17G].

179. The spreading code control unit 317 in the communications device of Gendel performs a hopping sequence based on a frequency hopping protocol: “Spreading code control 317 includes a spreading series code generating circuit (not shown) that selects frequencies according to a spreading code, e.g., a frequency hopping pattern, and controls frequency synthesizer 308 to output the selected frequency.” (Gendel, 8:50-55.) The selected frequency output by the frequency
synthesizer 308 is used to transmit data to and receive data from another device. 
(\textit{Id.} at 9:14-43.) The approach in Gendel using a FH signal transmission technique to transmit data is a frequency hopping protocol.

180. In a hopping sequence based on a frequency hopping protocol, only one communications channel is used for communications between a first device and a second device at each hop. Gendel discloses this well-known aspect of frequency hopping communications: “[e]ach subsystem 122, 124 . . . is adapted to transmit and receive data according to a spreading code designating a segment hopping sequence or pattern (e.g., S0, S2, S5, S6 and S7), with the hopping frequencies being contained within the used segments.” (\textit{Id.} at 7:14-18.) According to Gendel, “[a] hopping frequency may be randomly selected from a used segment or be a predetermined frequency from the used segment.” (\textit{Id.} at 7:18-20.)

181. Thus, in Gendel, at each hop in the segment hopping sequence or pattern, a single hopping frequency selected from the current used segment in the sequence is used by the primary system 102 (the first participant of “the pair of participants”) to communicate with the secondary system 104 or 106 (the second participant of “the pair of participants”). Communications channels from the second set are used in the hopping sequence for communications between the devices. Gendel and Haartsen therefore disclose “at each hop in the hopping sequence
based on the frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the pair of participants.”

**E. Dependent claim 20**

182. The combination of Gendel and Haartsen renders claim 20 obvious.

1. The combination of Gendel and Haartsen discloses “wherein the pair of participants includes a first participant and a second participant, wherein a default set of two or more communications channels is associated with the hopping sequence and is not changed based on the performance of the plurality of communications channels” [20A].

183. As illustrated in FIG. 1 of Gendel (reproduced above), primary system 102 of Gendel [the “first participant”] communicates with other wireless devices such as secondary system 104 [the “second participant”]. Gendel describes that in certain circumstances the “default set of two or more communications channels is associated with a hopping sequence and is not changed based on the performance of the plurality of communications channels.” Specifically, Gendel discloses that the primary system 102 performs FH communication with secondary system 108 but does not substitute or change segments in the frequency hopping pattern based on errors detected over the segments. (See Gendel, FIG. 1, noting in block 126 that the “segment substitution mechanism [is] not implemented.”) Gendel provides block 126 to support legacy communication systems, such as secondary system
108, that do not support segment substitution. Thus, communication between the primary system 102 and a secondary system uses the “default set of two or more communications channels.”

2. The combination of Gendel and Haartsen discloses “the communications channel selector apparatus further comprises: means for the first participant to communicate with a third participant over the default set of two or more communications channels while communicating with the second participant over the first set of two or more communications channels and while communicating with the second participant over the second set of two or more communications channels” [20B].

184. FIG. 1 of Gendel also illustrates that primary system 102 communicates with “the second participant” (e.g., secondary system 104) and “a third participant” (e.g., secondary system 108). The primary system 102 of Gendel transmits to and receives from the secondary system 104 or 106 implementing Gendel’s segment substitution mechanism over “the first set of two or more communications channels” and, subsequently, “the second set of two or more communications channels.” This communication can occur while the subsystem 126 of primary system 102 transmits to and receives from the secondary system 108 over “the default set of two or more communications channels.” For example, this is achieved because primary system 102 includes a separate subsystem to communicate with each secondary system and because FIG. 1 of Gendel illustrates separate links between primary system 102 and each secondary system.
185. The transmitting unit and the receive unit of the primary system 102 used to transmit to and receive from the secondary system 104 or 106 and the transmitting unit and the receive unit of the primary system 102 used to transmit to and receive from the secondary system 108 provide the same functionality to and are structurally the same as the “means for” of claim [20B].

F. Dependent claims 7 and 19

186. The limitations of claims 7 and 19 substantially repeat the functionality of the “selecting” limitations of claims 5 and 17, respectively, adding only that the selecting of the first and second set of two or more communications channels is not only based on the “the performance of the plurality of communications channels,” but also based on “the channel selection criteria.” Claims 7 and 19 provide that “the channel selection criteria specifies that for a particular communications channel to be selected, the particular communications channel receives a specified number of votes to use the particular communications channel from among a plurality of votes.” As described below, Gendel discloses selecting its sets of communications channels further based on the claimed channel selection criteria.

187. Gendel discloses votes because the communications devices of Gendel provide an indication (“vote”) regarding whether or not to use a communication channel. Gendel’s determination by the primary device that a channel is bad and should be replaced (i.e., not used) is a vote: “Spreading code control unit 317
also changes or updates the frequency hopping pattern by replacing or substituting a particular used segment with an unused segment, when the error value of the particular used segment reaches or exceeds a predetermined threshold.” (Gendel, 8:63-67.)

188. In Gendel, the secondary system in communication with the primary system 102 also votes whether or not to use a channel through an acknowledgment message. Specifically, in Gendel, the primary system 102 transmits the index “X” of the used segment to be replaced and the index “Y” of the unused segment that is to replace the used segment to the transceiver of the other communicating party. (Id. at 12:36-42, FIG. 6, step 654.) This transmission is a vote by the primary system not to use “X” and a vote to use “Y”.

189. The spreading code control unit 317 of the primary system does not actually replace the used segment with the selected unused segment unless it receives an acknowledgment from the other communicating party that it will replace the used segment with the unused segment. (Id. at 12:42-57, FIG. 6, steps 656 and 662.) Positive (“correct”) acknowledgement message is a vote by the secondary system not to use “X” and a vote to use “Y.” In Figure 6, Gendel checks whether a “correct ‘acknowledge’” from other transceiver” is received at step 656 before updating a local table to switch “X” to “Y” at step 662. (Id. at 12:22-31.)
“Acknowledge” sent from the secondary system in Gendel is an indication whether or not to use a channel.

190. Thus, a communications channel in Gendel is not selected for use in communications between devices until the channel receives a specified number of votes to use the particular communication channel (e.g., 2 votes) from among a plurality of votes (e.g., votes from both the primary and secondary systems).

XII. Gendel in view of Haartsen and Sage

A. Dependent claims 6 and 18

1. The combination of Gendel, Haartsen, and Sage discloses the hopping sequence claim limitations of claims 6 and 18.

191. The spreading code control unit 317 in the communications device of Gendel performs a hopping sequence based on a frequency hopping protocol: “Spreading code control 317 includes a spreading series code generating circuit (not shown) that selects frequencies according to a spreading code, e.g., a frequency hopping pattern, and controls frequency synthesizer 308 to output the selected frequency.” (Gendel, 8:50-55.) The selected frequency output by the frequency synthesizer 308 is used to transmit data to and receive data from another device. (Id. at 9:14-43.) The approach in Gendel using a FH signal transmission technique to transmit data is a frequency hopping protocol.
192. Based on the above, the processor in Haartsen, programmed to implement the spreading code control unit 317 in Gendel, provides the same functionality to and is structurally the same as the “means for” of claims 6 and 18.

193. In a hopping sequence based on a frequency hopping protocol, only one communications channel is used for communications between a first device and a second device at each hop. Gendel discloses this well-known aspect of frequency hopping communications: “[e]ach subsystem 122, 124 . . . is adapted to transmit and receive data according to a spreading code designating a segment hopping sequence or pattern (e.g., S0, S2, S5, S6 and S7), with the hopping frequencies being contained within the used segments.” (Id. at 7:14-18.) According to Gendel, “[a] hopping frequency may be randomly selected from a used segment or be a predetermined frequency from the used segment.” (Id. at 7:18-20.)

194. Thus, in Gendel, at each hop in the segment hopping sequence or pattern, a single hopping frequency selected from the current used segment in the sequence is used by the primary system 102 (the first participant of “the pair of participants”) to communicate with the secondary system 104 or 106 (the second participant of “the pair of participants”). Communications channels from the first set are used in the hopping sequence for communications between the devices. Gendel and Haartsen therefore disclose “at each hop in the hopping sequence based on the
frequency hopping protocol, only one communications channel of the first set of two or more communications channels is used for communications between the pair of participants.”

195. After subsequent modification of the hopping sequence, communications channels from the second set are used in the hopping sequence for communications between the devices. Gendel and Haartsen also disclose “at each hop in the hopping sequence based on the frequency hopping protocol, only one communications channel of the second set of two or more communications channels is used for communications between the communications device and the other communications device.”

2. The combination of Gendel, Haartsen, and Sage discloses “the performance of the plurality of communications channels is based on channel performance data that is transmitted over one or more of the plurality of communications channels based on the hopping sequence according to the frequency hopping protocol” of claims 6 and 18.

196. As described above, Gendel discloses that the spreading code control unit 317 determines error values associated with each used segment: “Spreading code control unit 317 includes an update error counter arrangement . . . for modifying error values associated with each used segment according to the occurrence or non-occurrence of reception errors detected.” (Gendel, 8:55-60.) A reception error on a channel relates to the performance of the channel and therefore the error val-
ues are performance data for the plurality of frequencies in segments. Gendel further discloses that the performance of a segment (and its respective frequencies) is based on its associated error value (*Id.* at 7:28-32.)

197. While Gendel discloses that the performance of a segment is based on its associated error value, Gendel does not explicitly disclose that “the performance of the plurality of communications channels is based on channel performance data that is transmitted over one or more of the plurality of communications channels based on the hopping sequence according to the frequency hopping protocol.” However, Sage explicitly discloses this feature. Specifically, Sage discloses a mobile station that determines error-rate statistics (e.g., number of errors per unit of time or bit-error rate) of frequencies used to perform frequency hopping based on signals received from a base station over those frequencies. (*Sage, Exhibit 1007, 8:12-19.*) Sage further discloses that the mobile station uploads the error-rate statistics to the base station to allow the base station “to make a determination of whether the error-rate statistics warrant modifying the mobile station transmit frequency hopping table” to avoid error-prone frequencies. (*Id.* at 8:19-29.) Thus, Sage discloses transmitting channel performance data from the mobile station to the base station.
198. A person of ordinary skill in the art would have been motivated to use the error statistics provided by the mobile device in the system of Gendel. For example, one of ordinary skill in the art would have been motivated to modify Gendel based on Sage as discussed above to reduce the complexity and/or power consumption of primary system 102 by moving the functionality of error detection and counting to secondary system 104 or 106. Moreover, such a modification would have yielded predictable results given that all that is essentially changing is where the error values are determined.

199. Furthermore, determining error-rate statistics at secondary system 104 or 106 (and reporting it back to primary system 102) can provide more accurate performance measurement data on the impact of interference on the forward-link channel performance for Gendel’s selection process. For example, as would have been understood by a person of ordinary skill in the art at the time of the invention, a communication channel often not only consists of the physical channel but also imperfections in components of the device receiving a transmission over the communication channel, including, for example, the receiving device’s antenna, mixers, analog-to-digital converter, etc. These imperfections at secondary system 104 or 106 can cause additional degradation of channel performance and therefore the potential for different and potentially more accurate error statistics than would be determined at primary system 102 for a communication channel.
200. In addition, because the primary system and secondary system in Gendel communicate over the frequencies used to perform frequency hopping, it would have been further obvious to one of ordinary skill in the art to send the error statistics from the secondary system to the primary system in Gendel over one or more of those frequencies based on the hopping sequence. For example, depending on available data connections from the secondary system to the primary system, there are only so many ways to send back the error statistics from the secondary system to the primary system in Gendel. Using the communication link formed by frequency hopping over the selected frequencies to send back the error statistics from the secondary system to the primary system in Gendel was a known potential option within the grasp of one of ordinary skill in the art. Because the error statistics simply represent data commonly transmitted over the frequencies used to perform frequency hopping, a person of ordinary skill in the art could have pursued this communication option with a reasonable expectation of success. Furthermore, one of ordinary skill in the art would have been motivated to send the error statistics from the secondary system to the primary system in Gendel over one or more of the frequencies used to perform frequency hopping in Gendel based on the hopping sequence given that spreading code control unit 317, which determines the error statistics, is coupled to data communication control unit 314 as shown in FIG. 3 of Gendel. (Id.) As disclosed in Gendel, data communication control unit 314 re-
ceives data to be transmitted to another party and modifies the data into packet sizes suitable for transmission” over the frequencies used to perform frequency hopping. (Gendel, 9:14-29.)

XIII. Conclusion

201. In signing this declaration, I recognize 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 also recognize 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.

202. 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.
Executed this 26th day of November 2014 in Davis, CA, USA

Respectfully submitted

[Signature]

Dr. Zhi Ding