UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
TEXARKANA DIVISION

MIMO RESEARCH, LLC, ***Plaintiff,*** v. **LG ELECTRONICS U.S.A., INC. AND LG ELECTRONICS INC.,** ***Defendants.***	**Civil Action No._____** **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

MIMO Research, LLC ("MIMO Research" or "Plaintiff") brings this action and makes the following allegations of patent infringement relating to U.S. Patent Nos.: 7,091,854 (the "'854 patent"); 7,305,057 (the "'057 patent"); and 7,433,382 (the "'382 patent") (collectively, the "patents-in-suit"). Defendants LG Electronics U.S.A., Inc. and LG Electronics Inc. (collectively, "LG" or "Defendant") infringe the patents-in-suit in violation of the patent laws of the United States of America, 35 U.S.C. § 1 *et seq*.

THE PARTIES

1. Plaintiff MIMO Research, LLC ("Plaintiff" or "MIMO Research") is a New York limited liability company established in 2017. MIMO Research owns a portfolio of patents that cover Multiple Input Multiple Output ("MIMO") wireless communication, powerline networking, and ultra-wideband ("UWB") technology. MIMO Research is the owner of all rights, title, and interest in and to the patents-in-suit.

2. Highlighting the importance of the patents-in-suit is the fact that the MIMO Research's patent portfolio has been cited by over 800 U.S. and international patents and patent

applications assigned to a wide variety of the largest companies operating in the wireless integrated circuit field. MIMO Research's patents have been cited by companies such as:

- Apple Inc.[1]
- Samsung Electronics Co., Ltd. [2]
- Broadcom Inc.[3]
- STMicroelectronics N.V. [4]
- Sony Group Corporation[5]
- Nokia Corporation[6]
- Qualcomm, Inc.[7]
- Siemens AG[8]
- Fujitsu Limited[9]

3. Defendant LG Electronics U.S.A. Inc. ("LG USA") is a Delaware corporation with its principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632 and with regular and established places of business within this District, including at 2153-2155 Eagle Parkway, Fort Worth, Texas 76177 and 14901 Beach Street, Fort Worth, Texas 76177. LG USA may be served with process through its Texas registered agent, United States Corporation Co., 211 East 7th Street, Suite 620, Austin, Texas 78701.

[1] *See, e.g.*, U.S. Patent Nos. 7,548,577; 8,279,913; 8,705,641; 8,743,852; 8,958,760; 9,490,864; and 9,614,578.

[2] *See, e.g.*, U.S. Patent Nos. 8,478,271; 7,929,995; 7,305,250; 7,392,012; 7,969,859; 9,002,304; and 9,306,616.

[3] *See, e.g.*, U.S. Patent Nos. 7,885,323; 8,520,715; 7,680,083; 7,725,096; 7,795,973; 7,808,985; 7,860,146; 7,873,324; 7,877,078; 7,899,436; 7,956,689; 8,160,127; 8,213,895; 8,406,239; 8,437,387; 8,509,707; 8,750,362; 8,750,392; 8,885,814; 9,042,436; 9,065,465; 9,313,828; and 9,936,439.

[4] *See, e.g.*, U.S. Patent Nos. 7,660,342; 7,656,932; 7,660,341; 7,817,763; and 8,817,935.

[5] *See, e.g.*, U.S. Patent Nos. 9,265,004; 7,542,728; 7,545,787; 7,567,820; 7,688,784; 7,822,436; 7,881,252; 8,045,447; 8,121,144; 8,160,001; 8,259,823; 8,462,746; 9,036,569; 9,237,572; 9,258,833; 8,660,196; and 9,276,649.

[6] *See, e.g.*, U.S. Patent Nos. 7,499,674; 7,643,811; 7,697,893; 7,782,894; and 9,913,248.

[7] *See, e.g.*, U.S. Patent Nos. 8,767,812; 9,300,491; 7,916,081; 8,009,775; 8,054,223; 8,401,503; 8,452,294; 8,467,331; 8,472,551; 8,743,903; 8,745,137; 8,745,695; 8,774,334; and 8,824,477.

[8] *See, e.g.*, U.S. Patent Nos. 7,378,980; 7,382,271; 7,408,839; 8,155,664; and 10,051465.

[9] *See, e.g.*, U.S. Patent Nos. 7,702,022; 7,995,680; 8,761,275; and 8,938,017.

4. Defendant LG Electronics Inc. ("LG Korea") is a corporation organized and existing under the laws of the Republic of Korea with a principal place of business at LG Twin Towers, 20 Yoido-dong, Youngdungpo-gu, Seoul, South Korea. LG USA is a wholly owned subsidiary of LG Korea.

5. LG conducts business operations within the Eastern District of Texas where it sells, develops, and/or markets its products including facilities at 2153-2155 Eagle Parkway, Fort Worth, Texas 76177 and 14901 Beach Street, Fort Worth, Texas 76177.

JURISDICTION AND VENUE

6. This action arises under the patent laws of the United States, Title 35 of the United States Code. Accordingly, this Court has exclusive subject matter jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a).

7. This Court has personal jurisdiction over LG in this action because LG has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over LG would not offend traditional notions of fair play and substantial justice. Defendant LG, directly and/or through subsidiaries or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the patents-in-suit. Moreover, LG is registered to do business in the State of Texas, has offices and facilities in the State of Texas, and actively directs its activities to customers located in the State of Texas.

8. Venue is proper in this district under 28 U.S.C. §§ 1391(b)-(d) and 1400(b). Defendant LG is registered to do business in the State of Texas, has offices in the State of Texas, has transacted business in the Eastern District of Texas and has committed acts of direct and indirect infringement in the Eastern District of Texas.

9. LG has a regular and established place of business in this District and has committed acts of infringement in this District. LG has permanent office locations at 2153 and 2155 Eagle Parkway, Fort Worth, Texas 76177 and a distribution center at 14901 Beach Street, Fort Worth, Texas 76177, both of which are located within this District. LG employs full-time personnel such as sales personnel and engineers in this District, including in Fort Worth, Texas. LG has also committed acts of infringement in this District by commercializing, marketing, selling, distributing, testing, and servicing certain Accused Products.

10. This Court has personal jurisdiction over LG. LG has conducted and does conduct business within the State of Texas. LG, directly or through subsidiaries or intermediaries (including distributors, retailers, and others), ships, distributes, makes, uses, offers for sale, sells, imports, and/or advertises (including by providing an interactive web page) its products and/or services in the United States and the Eastern District of Texas and/or contributes to and actively induces its customers to ship, distribute, make, use, offer for sale, sell, import, and/or advertise (including the provision of an interactive web page) infringing products and/or services in the United States and the Eastern District of Texas. LG, directly and through subsidiaries or intermediaries (including distributors, retailers, and others), has purposefully and voluntarily placed one or more of its infringing products and/or services, as described below, into the stream of commerce with the expectation that those products will be purchased and used by customers and/or consumers in the Eastern District of Texas. These infringing products and/or services have been and continue to be made, used, sold, offered for sale, purchased, and/or imported by customers and/or consumers in the Eastern District of Texas. LG has committed acts of patent infringement within the Eastern District of Texas. LG interacts with customers in Texas, including through visits to customer sites in Texas. Through these interactions and visits, LG directly

infringes the patents-in-suit. LG also interacts with customers who sell the Accused Products into Texas, knowing that these customers will sell the Accused Products into Texas, either directly or through intermediaries.

11. LG has minimum contacts with this District such that the maintenance of this action within this District would not offend traditional notions of fair play and substantial justice. Thus, the Court therefore has both general and specific personal jurisdiction over LG.

THE ASSERTED PATENTS

U.S. PATENT NO. 7,091,854

12. U.S. Patent No. 7,091,854 (the "'854 patent") entitled, *Multiple-Input Multiple-Output Wireless Sensor Networks Communications,* was filed on April 9, 2004. The '854 patent is subject to a 35 U.S.C. § 154(b) term extension of 187 days. MIMO Research, LLC is the owner by assignment of the '854 patent. A true and correct copy of the '854 patent is attached hereto as Exhibit A.

13. The '854 patent claims specific systems for wireless multiple-input multiple-output communication devices.

14. The '854 patent teaches the use of a MIMO sensor transmitter that improves array gain, diversity, and reduces channel interference and inter-symbol interference.

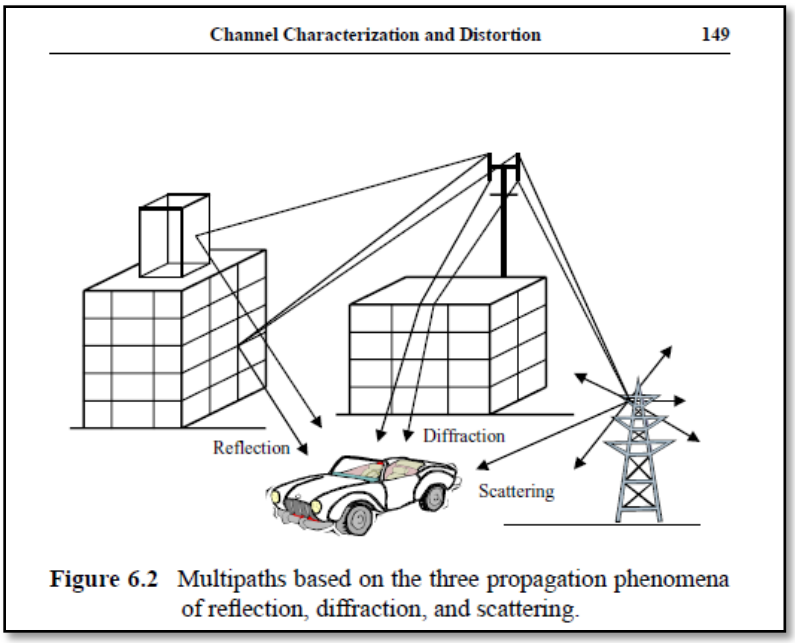
15. The '854 patent teaches the use of a sensor array unit coupled to an analog-to-digital converter which is coupled to a signal processing and data computing unit. The signal processing and data computing unit are coupled to a MIMO transceiver containing multiple antennas. This system improves average signal power, mitigates fading, and reduces channel interference and intersymbol interference. The reduction in channel and intersymbol interference allows the

systems claimed in the '854 patent to significantly improve the capacity, coverage, and quality of wireless communication.

16. The inventions taught in the '854 patent boost the data rate not only on uplink channels but also on downlink channels, which allows for better communication and control between wireless devices.

17. The '854 patent teaches the use of a MIMO transceiver to overcome multipath propagation. Multipath propagation arises from scattering, reflection, refraction or diffraction of the radiated energy off objects in the environment. Thus, received signals are much weaker than transmitted signals due to mean propagation loss. In addition to a mean path loss, the received signals exhibit fluctuations in a signal level that is referred to fading.

18. The '854 patent is directed to overcoming problems attendant to multipath propagation which occurs through the reflection, diffraction, and scattering of a wireless signal. "The multipath propagation arises from scattering, reflection, refraction or diffraction of the radiated energy off objects in the environment." '854 patent, col. 2:43-45. The inventor of the '854 patent illustrated the problem of multipath propagation in a subsequent textbook on signal processing.



George J. Maio, SIGNAL PROCESSING IN DIGITAL COMMUNICATIONS at 149 (2006).

19. The '854 patent teaches the use of a MIMO transceiver which turns multipath propagation into a benefit. By combining the use of the transmitter antennas at one end and receiver antennas, the systems taught in the '854 patent enhance wireless transmission over the MIMO channel.

20. The inventor of '854 patent described the problem of multipath propagation in a 2006 textbook on signal processing:

> Wireless channels experience multipath propagation due to reflection, diffraction, and/or scattering of radiated energy off of objects located in the environment. Signals at the receiver are much feebler than transmitted signals because of propagation path loss. In addition, received signals may display fading over traveling distance from the transmitter. The fading includes large-scale fading and small-scale fading.

George J. Maio, SIGNAL PROCESSING IN DIGITAL COMMUNICATIONS at 184-85 (2006).

21. The '854 patent has been cited by 61 United States and international patents and patent applications as relevant prior art. Specifically, patents issued to the following companies and research institutions have cited the '854 patent as relevant prior art:

- Qualcomm, Inc.

- NEC Corporation
- Samsung Electronics Co., Ltd.
- Allied Telesis Holdings K.k.
- University Of Virginia
- Texas Instruments Incorporated
- Honeywell International Inc.
- Shanghai Jiaotong University
- Zebra Technologies Corp.
- The Boeing Company
- Chinese Academy of Sciences
- Itron, Inc.
- HBX Control Systems, Inc.

U.S. PATENT NO. 7,305,057

22. U.S. Patent No. 7,305,057 entitled, *Multichannel Filter-Based Handheld Ultra Wideband Communications*, was filed on July 7, 2003. The '057 patent is subject to a 35 U.S.C. § 154(b) term extension of 922 days. MIMO Research, LLC is the owner by assignment of the '057 patent. A true and correct copy of the '057 patent is attached hereto as Exhibit B.

23. The '057 patent discloses novel systems for multichannel filter-based UWB transceivers that avoid interference with WLAN 802.11a devices.

24. The inventions disclosed in the '057 patent teach systems that permit a UWB device to operate using spectrum occupied by existing radio services without causing interference, thereby permitting scarce spectrum resources to be used more efficiently.

25. The '057 patent improves the operation of wireless networks by disclosing technologies that enable new products incorporating UWB technology.

26. The '057 patent discloses the use of a multichannel filter for a UWB transceiver. The multichannel filter allows the UWB transceiver to operate in the frequency band from 3.1 GHz to 10.6 GHz, with a conservative out of band emission mask to address interference with other devices.

27. The ‘057 patent has been cited by 16 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies and research institutions have cited the ‘057 patent as relevant prior art:

- University Of Minnesota
- Sorbonne Université
- Qualcomm, Inc.
- Nokia Corporation
- Huawei Technologies Co., Ltd.
- Industrial Technology Research Institute
- Graz University of Technology (Austria)

U.S. PATENT NO. 7,433,382

28. U.S. Patent No. 7,433,382 entitled, *Spread Spectrum Based Multichannel Modulation for Ultra Wideband Communications*, was filed on July 7, 2003. The ‘382 patent is subject to a 35 U.S.C. § 154(b) term extension of 704 days. MIMO Research, LLC is the owner by assignment of the ’382 patent. A true and correct copy of the ‘382 patent is attached hereto as Exhibit C.

29. The ‘382 patent discloses novel systems UWB devices that enable the transmission of data while avoiding interference with WLAN 802.11a devices.

30. The inventions disclosed in the ‘382 patent are directed to solving the problem of interference between UWB devices and other devices, such as WLAN 802.11a devices. Interference between UWB and 802.11a transmission was a problem at the time the inventions disclosed in the ‘382 patent were invented because the WLAN 802.11a devices operated in the frequency ranges 5.15 GHz to 5.35 GHz and 5.725 GHz to 5.825 GHz which overlapped with UWB signals that could operate in the frequency band of 3.1 GHz to 10.6 GHz.

31. The inventions disclosed in the '382 patent teach technologies that permit the transmission of data using UWB without interfering with the transmission of data using non-UWB signals that overlap with the UWB frequency band.

32. To address the issue of interference between devices operating in the UWB frequency band and non-UWB signals sent in an overlapping frequency band, the '382 patent teaches the use of multichannel pseudorandom noise mapping comprising N-I delay units coupled to N down sampling units followed by N Exclusive OR (XOR) units in parallel.

33. The '382 patent discloses systems that improve the operation of wireless networks by disclosing technologies that reduce interference with WLAN signals using a multichannel pseudorandom noise look-up table coupled to a multichannel sequence mapping component.

34. The '382 patent discloses the use of a digital finite impulse response shaping filter that attenuates signals with frequencies higher then specific thresholds. By using the disclosed filter the systems taught in the '382 patent reduce interference with non-UWB signal.

35. The '382 patent has been cited by 10 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies and research institutions have cited the '382 patent as relevant prior art:

- STMicroelectronics N.V.
- Industrial Technology Research Institute
- Huawei Technologies Co., Ltd.
- East China Normal University
- Beifang Tongyong Electronics Group Co., Ltd.
- Universite De Provence

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 7,091,854

36. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

37. LG designs, makes, uses, sells, and/or offers for sale in the United States products comprising a MIMO wireless sensor and transceiver system.

38. LG designs, makes, sells, offers to sell, imports, and/or uses devices that comprise a wireless MIMO sensor node and transceiver system including: LG notebook computers (including models: 14Z90Q, 15Z90Q, 16Z90Q, 17Z90Q, 14T90Q, 16T90Q, 14Z95P, 15Z95P, 16Z95P, 17Z95P, 14Z90P, 15Z90P, 16Z90P, 17Z90P, 15Z95N, 17Z95N, 14T90P, and 16T90P) and LG smartphones (including models: LG V60 ThinQ and LG H790) (collectively, the "LG '854 Products(s)").

39. One or more LG subsidiaries and/or affiliates use the LG '854 Products in regular business operations.

40. The LG H790 device supports 2x2 MIMO[10] and the LG V60 ThinQ is described in Federal Communications Commission submission from LG as "employ[ing] MIMO technology."[11]

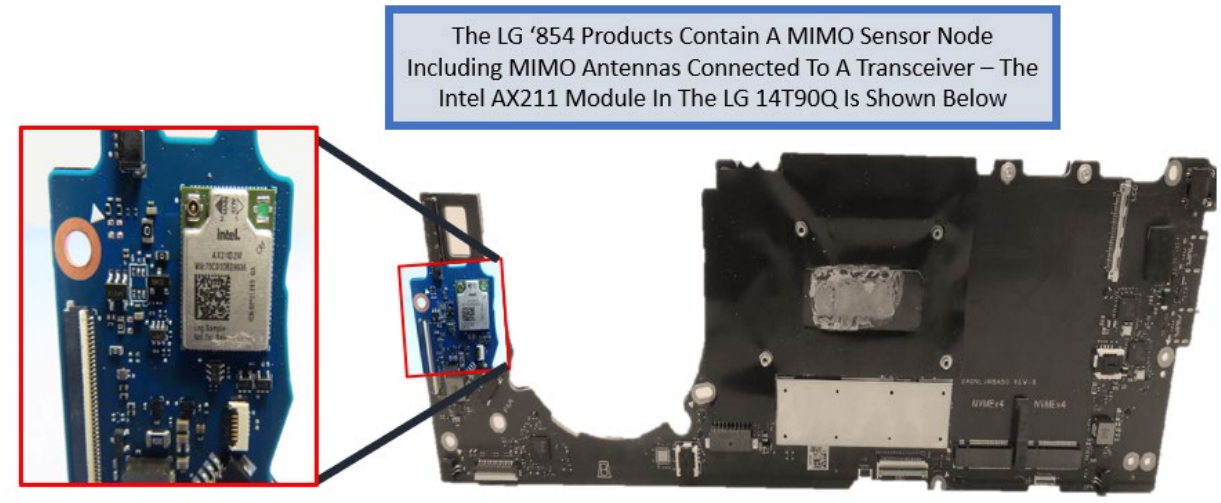
41. The LG notebook computer models 14Z90Q, 15Z90Q, 16Z90Q, 17Z90Q, 14T90Q, and 16T90Q include an Intel Wi-Fi 6E AX211 2x2 MIMO module.

42. The LG notebook computer models 14Z95P, 15Z95P, 16Z95P, 17Z95P, 14Z90P, 15Z90P, 16Z90P, 17Z90P, 15Z95N, 17Z95N, 14T90P, and 16T90P include an Intel Wi-Fi 6 AX201 2x2 MIMO module.

43. The LG '854 Products include technology for a wireless multiple-input multiple-output sensor node and transceiver system.

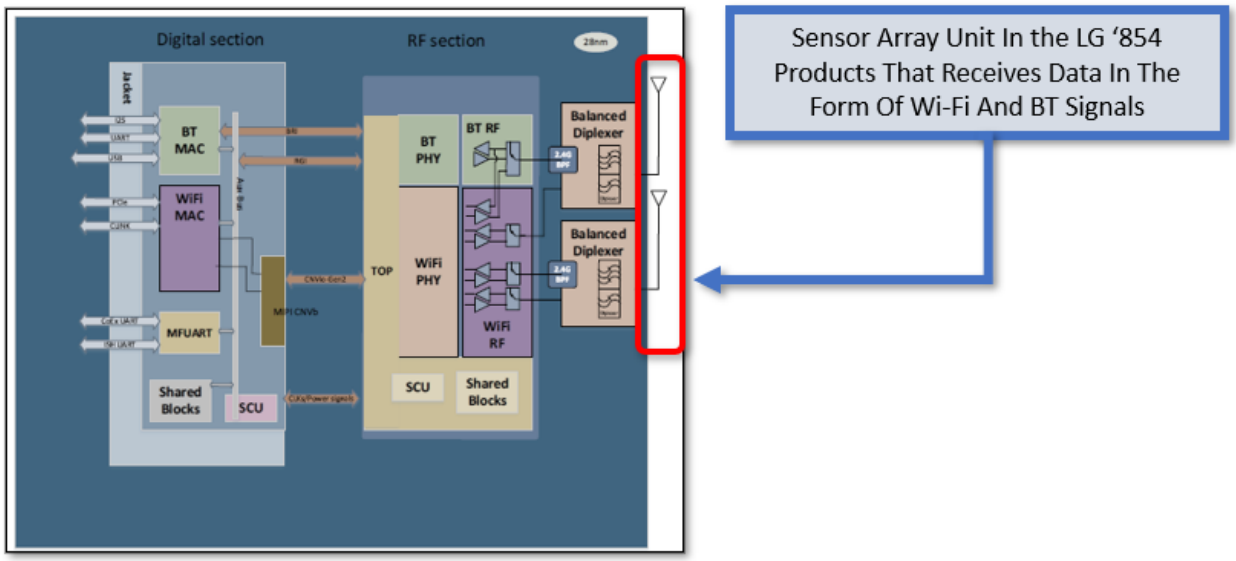
[10] *LG H790 Quartz Specifications,* LG.COM WEBSITE (last visited June 2022), *available at*: https://www.lg.com/us/cell-phones/lg-H790-Quartz-nexus-5x.

[11] FEDERAL COMMUNICATIONS COMMISSION TEST REPORT NO. 1M1912300226-06.ZNF at 5 (March 6, 2020).



TEARDOWN OF THE LG 14T90Q DEVICE (annotation added).

44. One or more of the LG '854 Products include a sensor array unit coupled to an analog-to-digital converter unit. Specifically, the LG '854 Products include a sensor array unit that receives data in the form of Wi-Fi and BT signals.



Intel Wi-Fi 6 AX2xx (Cyclone Peak 2) External Product Specification (EPS), INTEL DOCUMENTATION at 12 (March 2019) (annotation added).

45. The LG '854 Products enable dynamic frequency selection ("DFS") for detecting radar pulses when operating in the 5 GHz band.

B.2 Test results for Dynamic Frequency Selection (DFS)

Test procedure

The conducted setup shown on *Section A.1* was used to measure the Channel Closing Transmission Time and Channel Move Time.

The *Client Device* (UUT) is set up to associate with the *Master Device*. The channel loading test file is streamed from the *Master Device* to the *Client Device*. Radar test waveforms generated with the vector signal generator are injected into the *Master* on the operating channel above the DFS detection threshold. Observations are done on the transmissions of the UUT at the end of the radar burst on the Operating Channel for a duration greater than 10 seconds. We measured the transmissions from the UUT during the observation time, after radar detection occurs the Channel Move Time and Channel Closing Transmission Time are recorded.

Results tables

Tested Channel: 56, Frequency: 5280 MHz

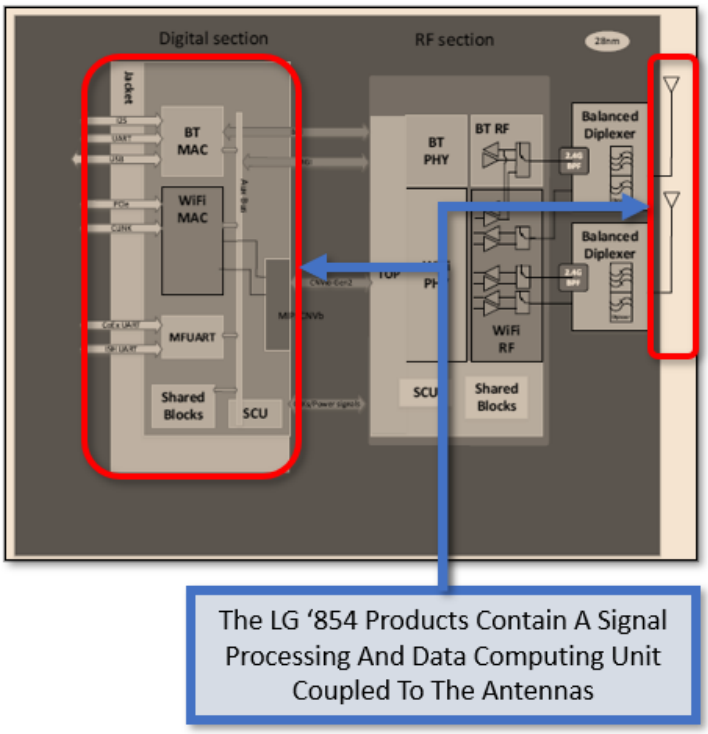
Test item	Results	Limit
Channel Closing Transmission Time	< 0.3 ms	200 ms + an aggregate of 60ms over remaining 10 seconds period.
Channel Move Time	0.3 ms	10 seconds
Non-Occupancy Period	> 30 minutes	30 minutes

INTEL WI-FI 6 AX201 FEDERAL COMMUNICATIONS TEST REPORT, REPORT NO. 180717-04.TR06 at 7 (October 16, 2018).

46. One or more of the LG '854 Products comprise technology for an analog-to-digital converter unit coupled to a signal processing and data computing unit. For example, the LG '854 Products contain integrated circuits that perform signal processing and data computing. These integrated circuits are connected to the transmission systems of the LG '854 Products that comprise technology to convert signals from analog to digital signals.

47. The LG '854 Products contain an analog-to-digital (ADC) converter unit coupled to a signal processing and data computing unit. Specifically, the LG '854 Products contain central processing unit(s) to perform signal processing and data computing.

48. One or more of the LG '854 Products include a signal processing and data computing unit that is coupled to a multiple-input multiple-output space-time transceiver that is connected to 2 or more antennas. The below diagram shows one example of the infringing functionality wherein Wi-Fi antennas are coupled to the signal processing and data computing unit.



Intel Wi-Fi 6 AX2xx (Cyclone Peak 2) External Product Specification (EPS), INTEL DOCUMENTATION at 12 (March 2019) (annotation added).

49. One or more of the LG '854 Products include a signal processing and data computing unit that is coupled to a multiple-input multiple-output space-time transceiver that is connected to 2 or more antennas.

50. One or more of the LG '854 Products include memory that is coupled to the analog-to-digital converter unit, the signal processing and data computing unit, and the multiple-input multiple-output space-time transceiver.

51. One or more of the LG '854 Products include a power generator coupled to a power unit.

52. One or more of the LG '854 Products include a power unit that is connected to the sensor array unit, the analog-to-digital converter unit, the signal processing and data computing unit, and the multiple-input multiple-output space-time transceiver.

53. LG has directly infringed and continues to directly infringe the '854 patent by, among other things, making, using, offering for sale, and/or selling technology for MIMO wireless sensor networks, including but not limited to the LG '854 Products.

54. The LG '854 Products are available to businesses and individuals throughout the United States.

55. The LG '854 Products are provided to businesses and individuals located in the Eastern District of Texas.

56. By making, using, testing, offering for sale, and/or selling products and services that comprise a MIMO wireless sensor, including but not limited to the LG '854 Products, LG has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '854 patent, including at least claim 15 pursuant to 35 U.S.C. § 271(a).

57. LG also indirectly infringes the '854 patent by actively inducing infringement under 35 U.S.C. § 271(b).

58. LG has had knowledge of the '854 patent since at least service of this Complaint or shortly thereafter, and LG knew of the '854 patent and knew of its infringement, including by way of this lawsuit.

59. LG intended to induce patent infringement by third-party customers and users of the LG '854 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. LG specifically intended and was aware that the normal and customary use of the accused products would infringe the '854 patent. LG performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '854 patent and with the knowledge that the induced acts would constitute infringement. For example, LG provides the LG '854 Products that have the

capability of operating in a manner that infringe one or more of the claims of the '854 patent, including at least claim 15, and LG further provides documentation and training materials that cause customers and end users of the LG '854 Products to utilize the products in a manner that directly infringe one or more claims of the '854 patent.[12] By providing instruction and training to customers and end-users on how to use the LG '854 Products in a manner that directly infringes one or more claims of the '854 patent, including at least claim 15, LG specifically intended to induce infringement of the '854 patent. LG engaged in such inducement to promote the sales of the LG '854 Products, e.g., through LG user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '854 patent. Accordingly, LG has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '854 patent, knowing that such use constitutes infringement of the '854 patent.

60. The '854 patent is well-known within the industry as demonstrated by multiple citations to the '854 patent in published patents and patent applications assigned to technology companies and academic institutions. LG is utilizing the technology claimed in the '854 patent without paying a reasonable royalty. LG is infringing the '854 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

[12] *See, e.g.,* LG V60 THINQ 5G UW LM-600VM USER GUIDE MFL71797801 V1.0 (2021); *Introducing the LG V60 ThinQ 5G*, LG MOBILE GLOBAL YOUTUBE.COM CHANNEL (February 27, 2020), *available at*: https://www.youtube.com/watch?v=TirD9GHOgac; *LG 14Z90Q Series Owner's Manual Notebook MFL71931525,* LG DOCUMENTATION (2022); *Connecting to a Wi-Fi Network (Quick Setup) – PC*, LG SUPPORT WEBSITE (last visited June 2022), *available at*: https://www.lg.com/us/support/help-library/connecting-to-a-wifi-network-pc-CT00000317-1443218577762; *LG 15Z95P Series LG Easy Guide Notebook,* LG DOCUMENTATION (2021); and *LG 2022 LG gram: Official Unboxing,* LG GLOBAL YOUTUBE.COM CHANNEL (May 15, 2022), *available at*: https://www.youtube.com/watch?v=ebkoYDXWxTk&t=2s.

61. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '854 patent.

62. As a result of LG's infringement of the '854 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for LG's infringement, but in no event less than a reasonable royalty for the use made of the invention by LG together with interest and costs as fixed by the Court.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 7,305,057

63. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

64. LG designs, makes, uses, sells, and/or offers for sale in the United States products comprising a multichannel filter-based handheld ultra-Wideband (UWB) communication transmitter.

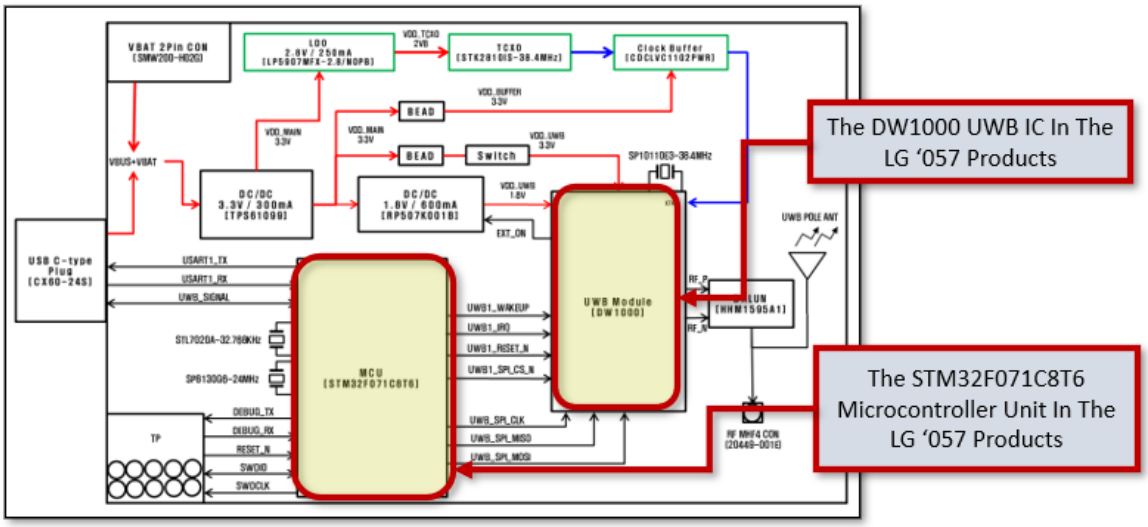
65. LG designs, makes, sells, offers to sell, imports, and/or uses the following products: the LCU-001,[13] UWB001,[14] and UWB002[15] modules (collectively, the "LG '057 Products(s)").

66. The LG '057 Products contain a microcontroller unit (STM32F071C8T6) and UWB IC (DW1000). This circuitry is shown in the following excerpt from LG documentation.

[13] The LCU-001 module can be identified via its Federal Communications Commission Identification Number: BEJ-LCU001.

[14] The UWB001 module can be identified via its Federal Communications Commission Identification Number: BEJ-UWB001.

[15] The UWB002 module can be identified via its Federal Communications Commission Identification Number: BEJ-UWB002.



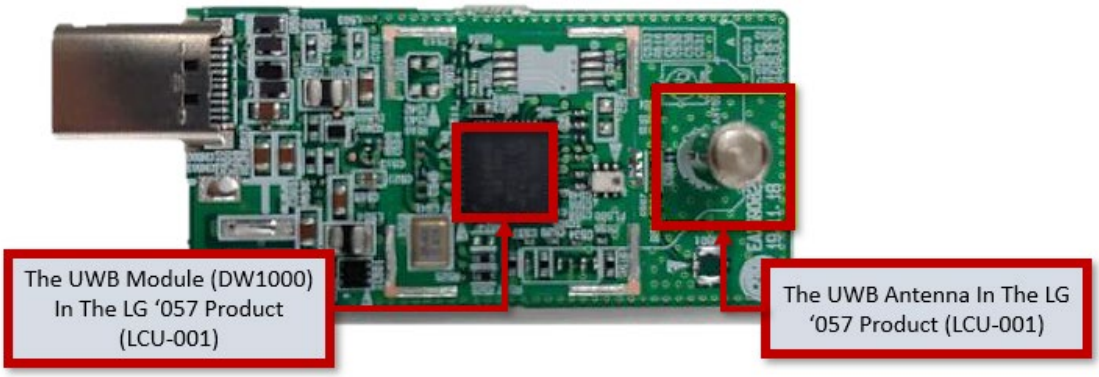
LG LCU-001 UWB MODULE USER MANUAL at 3 (2020) (annotation added).

67. The LG '057 Products are available to businesses and individuals throughout the United States.

68. The LG '057 Products are provided to businesses and individuals located in the Eastern District of Texas.

69. One or more LG subsidiaries and/or affiliates use the LG '057 Products in regular business operations.

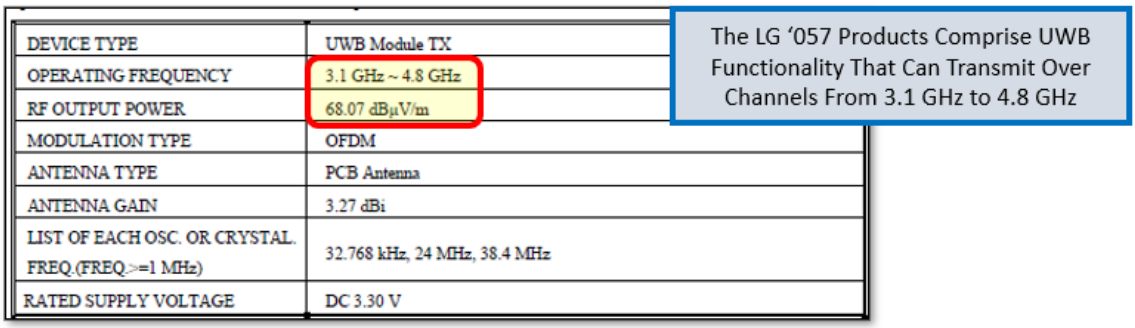
70. One or more of the LG '057 Products comprise a UWB transmitter that includes a UWB antenna for the transmission of UWB signals.



LG LCU-001 UWB MODULE TEARDOWN (annotation added).

71. One or more of the LG '057 Products comprise a multichannel filter-based

handheld UWB transmitter. Specifically, the LG '057 Products utilize multiple channels for precise UWB localization.



DEVICE TYPE	UWB Module TX
OPERATING FREQUENCY	3.1 GHz ~ 4.8 GHz
RF OUTPUT POWER	68.07 dBμV/m
MODULATION TYPE	OFDM
ANTENNA TYPE	PCB Antenna
ANTENNA GAIN	3.27 dBi
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	32.768 kHz, 24 MHz, 38.4 MHz
RATED SUPPLY VOLTAGE	DC 3.30 V

FEDERAL COMMUNICATIONS COMMISSION REPORT NO. W17NR-D083 at 7 (November 30, 2017) (annotation added).

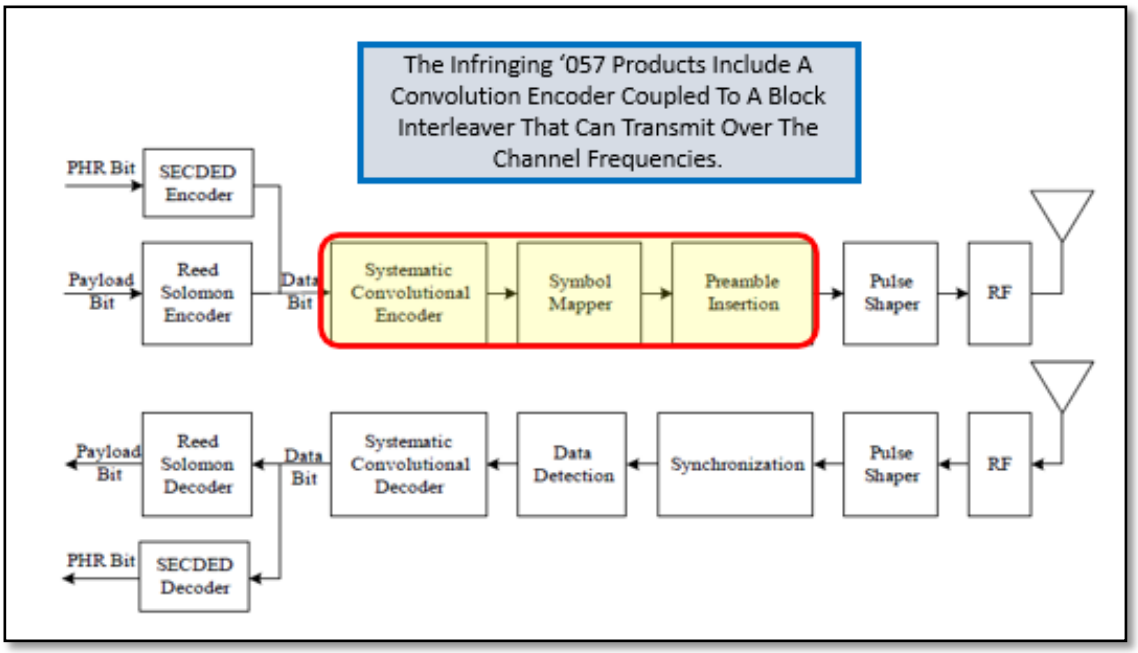
72. One or more of the LG '057 Products include a convolution encoder coupled to a block interleaver. Specifically, the forward error correction (FEC) "used by the HRP UWB PHY is a concatenated code consisting of an outer Reed-Solomon systematic block code and an inner half-rate systematic convolutional code." IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS 802.15.4-2020 § 15.3.3.1 (2020).

> Data bits, as used in the PHY Header (PHR) and the PHY Service Data Unit (PSDU), are encoded using either a SECDED (PHR) or Reed-Solomon (PSDU) code, followed by convolutional encoding, after which the coded bits are mapped via Burst Position Modulation (BPM) and BPSK onto sets of multiple pulses called "bursts". The pulses within a burst are transmitted back-to-back, meaning without gaps on the 499.2 MHz chip grid. The (BPSK) polarities of the pulses, as well as the (BPM) burst timings, are scrambled using a linear feedback shift register (LFSR), in order to whiten the spectrum, so as not to cause spectral peaks which would degrade the allowable transmitted integrated band power. Scrambling also increases orthogonality between different transmitted signals, which may provide benefits in (co-channel) interference scenarios.

Frank Leong and Hans-Juergen Pirch, *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 9 (2020) (emphasis added).

73. One or more of the LG '057 Products utilize a combination of BPM and BPSK to transmit and receive UWB signals over multiple channels. The combined BPM-BPSK is used to modulate symbols with each symbol composed of an active burst of UWB pulses. The following

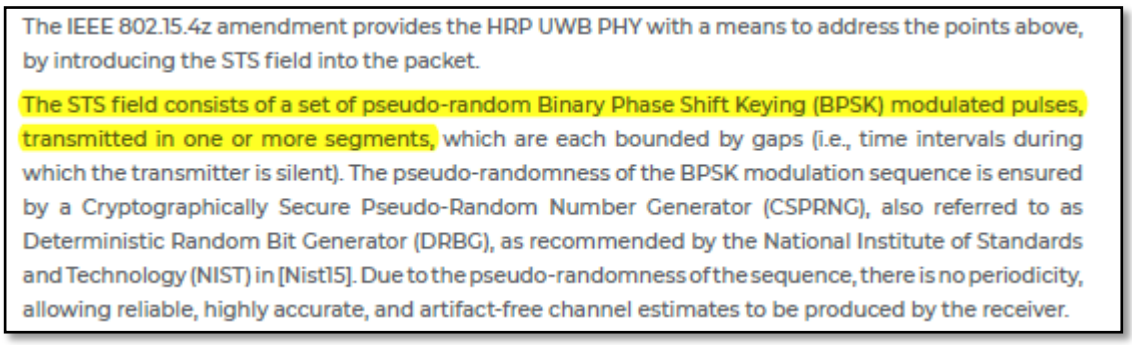
figure shows the sequence of processing steps used to create and modulate an HRP UWB PPDU by the LG '057 Products.



IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS 802.15.4-2020 § 15.1 (2020) (annotation added).

74. One or more of the LG '057 Products include a multichannel-based multicarrier modulator coupled to a power amplifier. Documentation of the UWB IC in the LG '057 Products states that "[t]he receiver consists of an RF front end which amplifies the received signal in a low-noise amplifier." DW1000 DATASHEET VERSION 2.09 at 5 (2015). When the LG '057 Products transmit a UWB signal, a power amplifier is used. "The modulated RF waveform is amplified before transmission from the external antenna." *Id.*

75. One or more of the LG '057 Products include a block interleaver coupled to a multichannel pseudorandom (PN) sequence mapping. Specifically, the LG '057 Products utilize a Cryptographically Secure Pseudo-Random Number Generator (CSPRNP), also referred to as a Deterministic Random Bit Generator (DRBG).

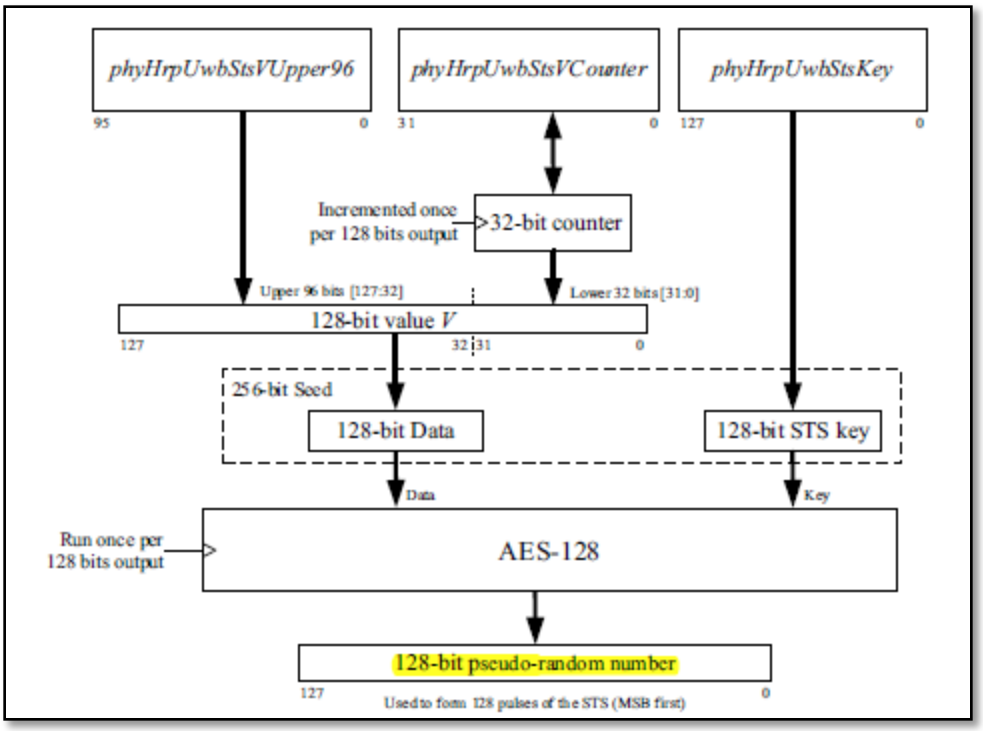


The IEEE 802.15.4z amendment provides the HRP UWB PHY with a means to address the points above, by introducing the STS field into the packet.

The STS field consists of a set of pseudo-random Binary Phase Shift Keying (BPSK) modulated pulses, transmitted in one or more segments, which are each bounded by gaps (i.e., time intervals during which the transmitter is silent). The pseudo-randomness of the BPSK modulation sequence is ensured by a Cryptographically Secure Pseudo-Random Number Generator (CSPRNG), also referred to as Deterministic Random Bit Generator (DRBG), as recommended by the National Institute of Standards and Technology (NIST) in [Nist15]. Due to the pseudo-randomness of the sequence, there is no periodicity, allowing reliable, highly accurate, and artifact-free channel estimates to be produced by the receiver.

Frank Leong and Hans-Juergen Pirch, *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 8 (2020) (emphasis added).

76. One or more of the LG '057 Products comprise a multichannel PN sequence mapping coupled to a digital UWB transmitter filter system. Each iteration of the CSPRNG/DRBG produces a 128-bit pseudo-random number. This transmits the most significant bit first, where each bit of value zero produces a positive polarity pulse and each bit of value one produces a negative polarity pulse. These pulses are spread and transmitted. The creation of the PM sequence mapping is shown in the below diagram.

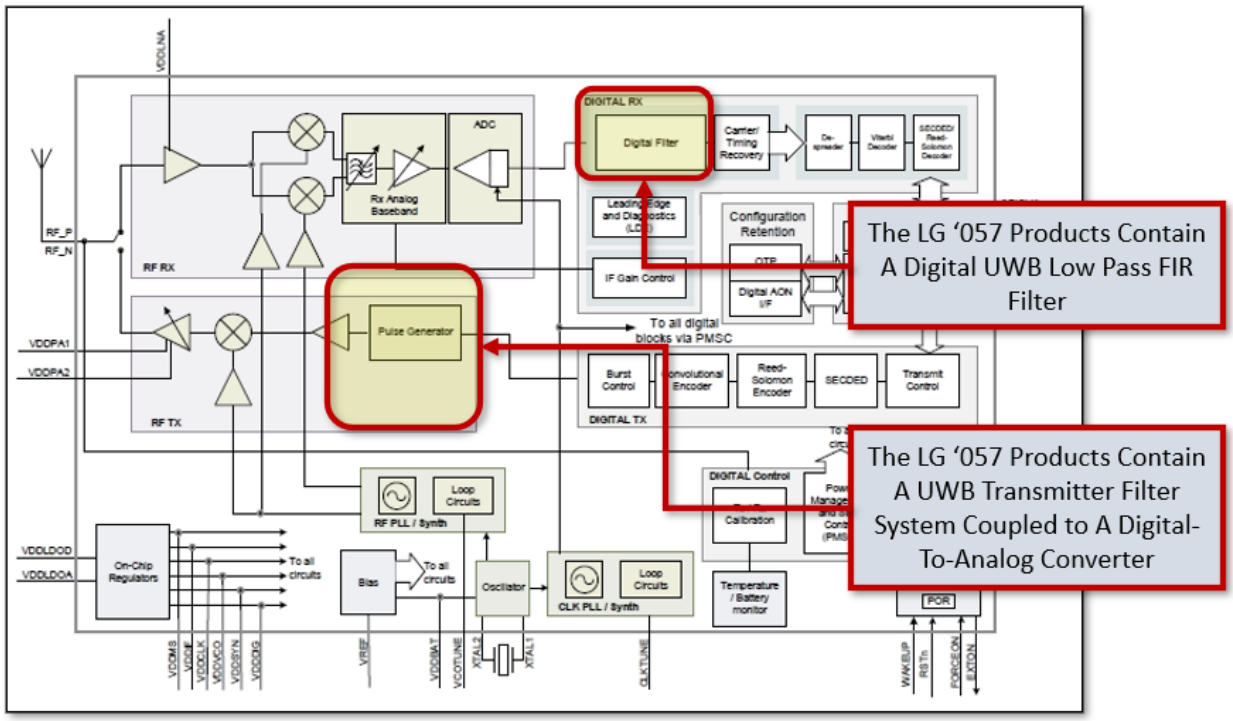


IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS - AMENDMENT 1: ENHANCED ULTRA WIDEBAND (UWB) PHYSICAL LAYERS (PHYS) AND ASSOCIATED RANGING TECHNIQUES 802.15.4z-2020 § 15.2.9.1 (2020) (emphasis added).

77. One or more of the LG '057 Products include a pseudorandom sequence look-up table coupled to a multichannel pseudorandom sequence mapping component.

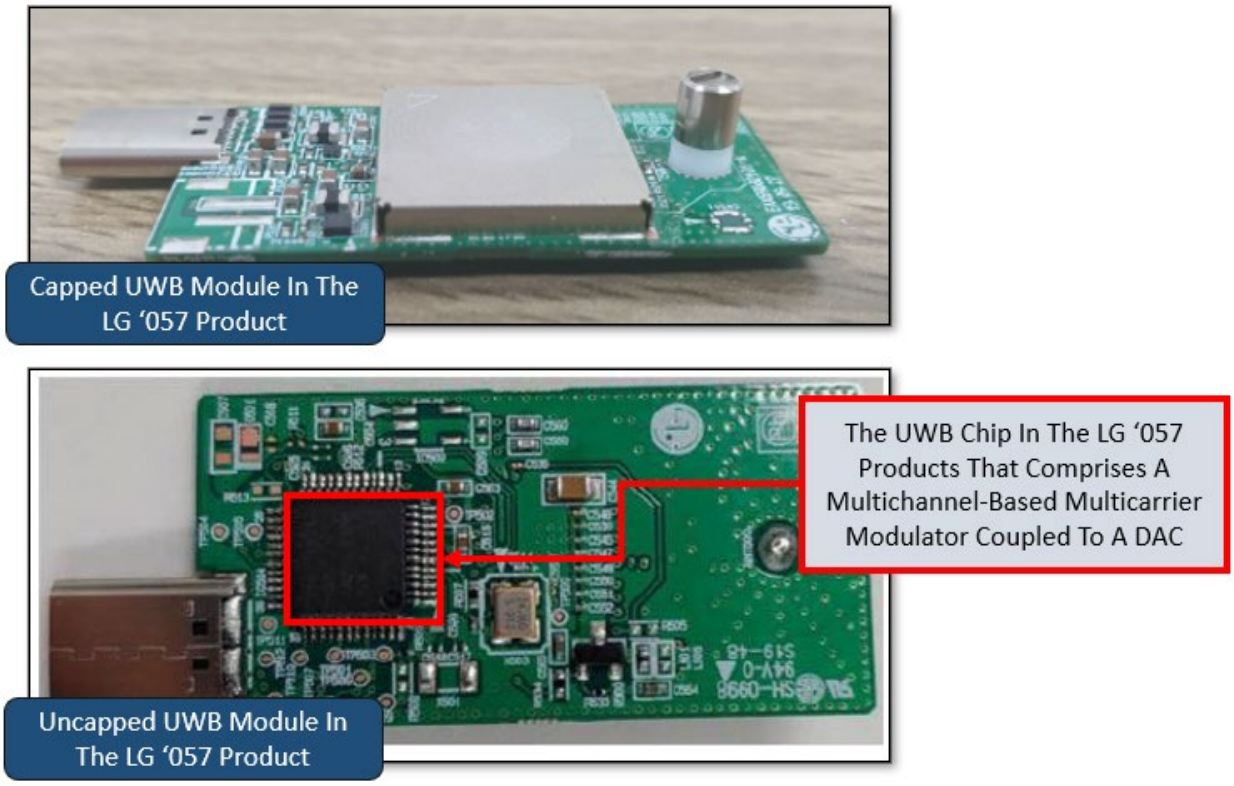
78. One or more of the LG '057 Products include a multichannel control coupled to the multichannel pseudorandom sequence mapping and coupled to the multichannel-based multicarrier modulator.

79. One or more of the LG '057 Products include a digital UWB transmitter filter system coupled to a digital-to-analog converter.



DW1000 DATASHEET VERSION 2.22 at 5 (2017) (annotation added).

80. One or more of the LG '057 Products comprise a digital-to-analog converter (DAC) connected to a multichannel-based multicarrier modulator.



LG LCU-001 UWB MODULE TEARDOWN (annotation added).

81. One or more of the LG '057 Products include a DAC that is connected to a modulator that transmits and receives UWB signals. Each UWB channel has a minimum bandwidth of 500 MHz.

82. One or more of the LG '057 Products comprise a clock control coupled to the digital UWB transmitter filter system, the digital-to-analog converter, and the multichannel-based multicarrier modulator.

> An HRP UWB transmitter shall be capable of chipping at the peak PRF given in Table 15-3 with an accuracy of $\pm 20 \times 10^{-6}$. In addition, for each HRP UWB PHY channel, the center of transmitted energy shall be within the values listed in Table 15-11 also with an accuracy of $\pm 20 \times 10^{-6}$. The measurements shall be made using a 1 MHz resolution bandwidth and a 1 kHz video bandwidth. The carrier center frequency and the chip rate frequency shall be derived from the same reference oscillator.

IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS - AMENDMENT 1: ENHANCED ULTRA WIDEBAND (UWB) PHYSICAL LAYERS (PHYS) AND ASSOCIATED RANGING TECHNIQUES 802.15.4z-2020 § 15.4.6 (2020) (emphasis added).

83. The LG ‘057 Products have circuitry for a clocking scheme that is based around 3 main circuits: a crystal oscillator, clock PLL and RF PLL.

> The on-chip oscillator is designed to operate at a frequency of 38.4 MHz using an external crystal. An external 38.4 MHz clock signal may be applied in place of the crystal if an appropriately stable clock is available elsewhere in the user’s system. This 38.4 MHz clock is used as the reference clock input to the two on-chip PLLs. The clock PLL (denoted CLKPLL) generates the clock required by the digital back end for signal processing. The RF PLL generates the down-conversion local oscillator (LO) for the receive chain and the up-conversion LO for the transmit chain. An internal 13 kHz oscillator is provided for use in the SLEEP state.

DW1000 DATASHEET VERSION 2.22 at 5 (2017) (emphasis added).

84. LG has directly infringed and continues to directly infringe the ‘057 patent by, among other things, making, using, offering for sale, and/or selling technology comprising a multichannel filter-based handheld ultra-Wideband (UWB) communication transmitter, including but not limited to the LG ‘057 Products.

85. By making, using, testing, offering for sale, and/or selling products and services comprising a multichannel filter-based handheld ultra-Wideband (UWB) communication transmitter, including but not limited to the LG ‘057 Products, LG has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the ‘057 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

86. LG also indirectly infringes the ‘057 patent by actively inducing infringement under 35 U.S.C. § 271(b).

87. LG has had knowledge of the ‘057 patent since at least service of this Complaint or shortly thereafter, and LG knew of the ‘057 patent and knew of its infringement, including by way of this lawsuit.

88. LG intended to induce patent infringement by third-party customers and users of the LG ‘057 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. LG specifically

intended and was aware that the normal and customary use of the accused products would infringe the '057 patent. LG performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '057 patent and with the knowledge that the induced acts would constitute infringement. For example, LG provides the LG '057 Products that have the capability of operating in a manner that infringe one or more of the claims of the '057 patent, including at least claim 1, and LG further provides documentation and training materials that cause customers and end users of the LG '057 Products to utilize the products in a manner that directly infringe one or more claims of the '057 patent.[16] By providing instruction and training to customers and end-users on how to use the LG '057 Products in a manner that directly infringes one or more claims of the '057 patent, including at least claim 1, LG specifically intended to induce infringement of the '057 patent. LG engaged in such inducement to promote the sales of the LG '057 Products, e.g., through LG user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '057 patent. Accordingly, LG has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '057 patent, knowing that such use constitutes infringement of the '057 patent.

89. The '057 patent is well-known within the industry as demonstrated by multiple citations to the '057 patent in published patents and patent applications assigned to technology companies and academic institutions. LG is utilizing the technology claimed in the '057 patent

[16] *See, e.g., LG LCU-001 UWB Module User Manual,* LG DOCUMENTATION (2020); *LG UWB001 Module User Manual*, LG DOCUMENTATION (2017); *LG UWB002 Module User Manual*, LG DOCUMENTATION (2017); *LG Innotek "A Smartphone Will Become a Car Key", LG Innotek Develops a "Digital Car Key Module*," LG PRESS RELEASE (January 25, 2021), *available at*: https://www.lgcorp.com/media/release/22981; and *LG Autonomous Solution – Digital Key Module*, LGINNOTEK WEBSITE (last visited June 2022), *available at*: https://www.lginnotek.com/product/199/detail.do?locale=en.

without paying a reasonable royalty. LG is infringing the '057 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

90. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '057 patent.

91. As a result of LG's infringement of the '057 patent, Plaintiff has suffered monetary damages, and seek recovery in an amount adequate to compensate for LG's infringement, but in no event less than a reasonable royalty for the use made of the invention by LG together with interest and costs as fixed by the Court.

COUNT III
INFRINGEMENT OF U.S. PATENT NO. 7,433,382

92. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

93. LG designs, makes, uses, sells, and/or offers for sale in the United States products comprising a multichannel modulation Ultra-Wideband (UWB) communication transceiver.

94. LG designs, makes, sells, offers to sell, imports, and/or uses the following products: the LCU-001,[17] UWB001,[18] and UWB002[19] modules (collectively, the "LG '382 Products(s)").

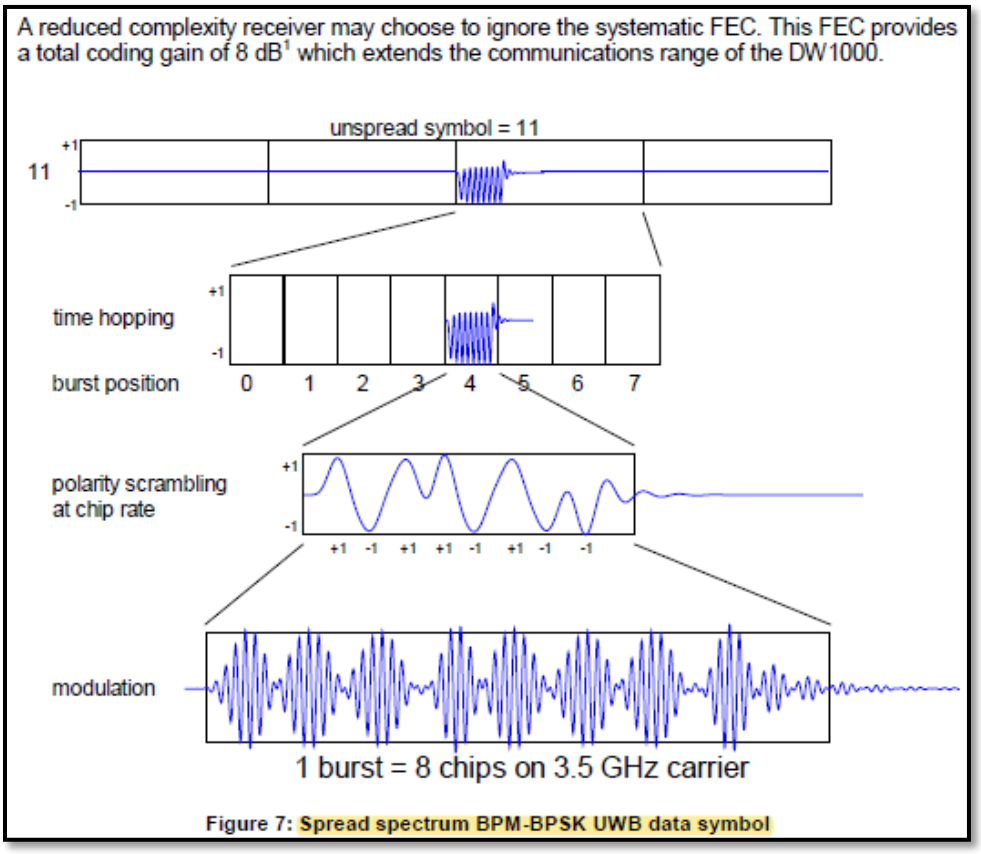
95. One or more LG subsidiaries and/or affiliates use the LG '382 Products in regular business operations.

[17] The LCU-001 module can be identified via its Federal Communications Commission Identification Number: BEJ-LCU001.

[18] The UWB001 module can be identified via its Federal Communications Commission Identification Number: BEJ-UWB001.

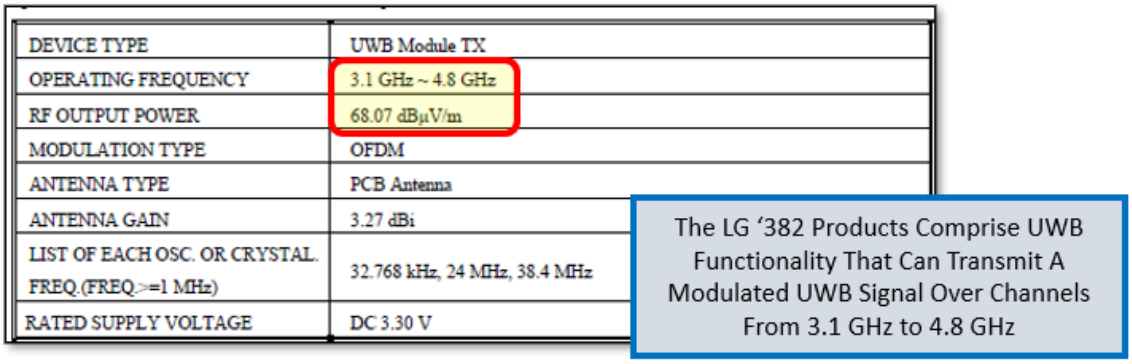
[19] The UWB002 module can be identified via its Federal Communications Commission Identification Number: BEJ-UWB002.

96. One or more of the LG '382 Products comprise a spread spectrum based multichannel modulation UWB communication transceiver. Specifically, the LG '057 Products contain functionality for using the polarity of a transmitted burst and so may utilize it in a convolutional decoding algorithm. The LG '057 Products use systematic forward error correction (FEC) to preserve the original data bits when transmitted using UWB. The type of FEC used in the DW1000 is a concatenation of convolution coding and Reed-Solomon coding. The concatenation of these two error coding schemes is a form of inner and outer coding.



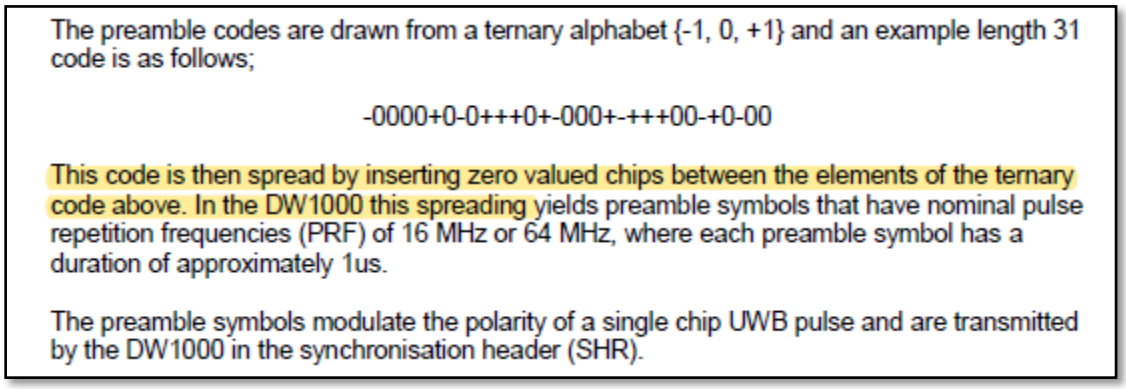
APS010 APPLICATION NOTE: WIRELESS SENSOR NETWORKS AND THE DW1000 VERSION 0.1 at 15 (2014) (emphasis added).

97. Specifically, the LG '382 Products utilize multichannel modulator in transmitting UWB signals.



FEDERAL COMMUNICATIONS COMMISSION REPORT NO. W17NR-D083 at 7 (November 30, 2017) (annotation added).

98. The LG '382 Products enables the use of spreading codes wherein preamble codes used in the LG '382 Product UWB IC are defined by the IEEE 802.15.4-2011 standard and are based on perfect periodic autocorrection in coherent and non-coherent receives and low cross-correlation between codes in the same channel.



APS010 APPLICATION NOTE: WIRELESS SENSOR NETWORKS AND THE DW1000 VERSION 0.1 at 15 (2014) (emphasis added).

99. The LG '382 Products contain a spread-spectrum PHY wherein the encoded block is spread and modulated using BPM-BPSK modulation such that the transmit waveform during the *k*th symbol interval may be expressed as follows:

$$x^{(k)}(t) = [1-2g_1^{(k)}] \sum_{n=1}^{N_{cpb}} [1-2s_{n+kN_{cpb}}] \times p(t-g_0^{(k)}T_{BPM}-h^{(k)}T_{burst}-nT_c)$$

IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS 802.15.4-2020 § 15.3.1 (2020).

100. The LG '382 Products use the spreading sequence to improve the interference rejection capabilities of the UWB PHY.

> Data bits, as used in the PHY Header (PHR) and the PHY Service Data Unit (PSDU), are encoded using either a SECDED (PHR) or Reed-Solomon (PSDU) code, followed by convolutional encoding, after which the coded bits are mapped via Burst Position Modulation (BPM) and BPSK onto sets of multiple pulses called "bursts". The pulses within a burst are transmitted back-to-back, meaning without gaps on the 499.2 MHz chip grid. The (BPSK) polarities of the pulses, as well as the (BPM) burst timings, are scrambled using a linear feedback shift register (LFSR), in order to whiten the spectrum, so as not to cause spectral peaks which would degrade the allowable transmitted integrated band power. Scrambling also increases orthogonality between different transmitted signals, which may provide benefits in (co-channel) interference scenarios.

Frank Leong and Hans-Juergen Pirch, *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 8 (2020).

101. One or more of the LG '382 Products contain a pseudorandom noise sequence look-up table coupled to a multichannel pseudorandom noise sequence mapping.

> [T]he BPSK modulated STS sequence is used for enabling secure ranging in HRP mode of IEEE 802.15.4. In absence of multi-path and receiver noise, HRP with STS can be used to implement a secure ranging system. In such a scenario the receiver might be able to decode most of the individual pulses of the STS sequence and can require high correlation of the received and template STS. Since an adversary is unable to predict the pseudo-randomly generated sequence it will not be able to generate a high enough correlation peak that satisfies the checks applied at the receiver.

M. Singh, *et al.*, *Security Analysis of IEEE 802.15.4z/HRP UWB Time-of-Flight Distance Measurement,* PROCEEDINGS OF THE 14TH ACM CONFERENCE ON SECURITY AND PRIVACY IN WIRELESS AND MOBILE NETWORKS at 4 (June 28, 2021).

102. One or more of the LG '382 Products comprise a multichannel pseudorandom noise sequence mapping coupled to a digital lowpass finite impulse response shaping filter. Specifically,

the LG '382 Products use a pulse shaper to ensure compliance to the specified transmit mask and avoid distortion of other channels.

> In order to match the UWB signal to the 500 MHz bandwidth of [Ieee15], the pulse shape needs to be chosen carefully to ensure compliance to the [Ieee15] specified transmit spectrum mask and avoid distortion of adjacent channels. Additionally, stringent regulatory transmit limits must be respected. Figure 2 shows the [Ieee15] Root Raised Cosine (RRC) HRP UWB reference pulse with a center frequency that corresponds to channel 9, as well as an upconverted 8th order Butterworth low pass pulse with a -3 dB bandwidth of 500 MHz and a center frequency that corresponds to channel 5. Both of these pulses would meet the requirements specified in [Ieee15] to be used for IR-UWB radios.

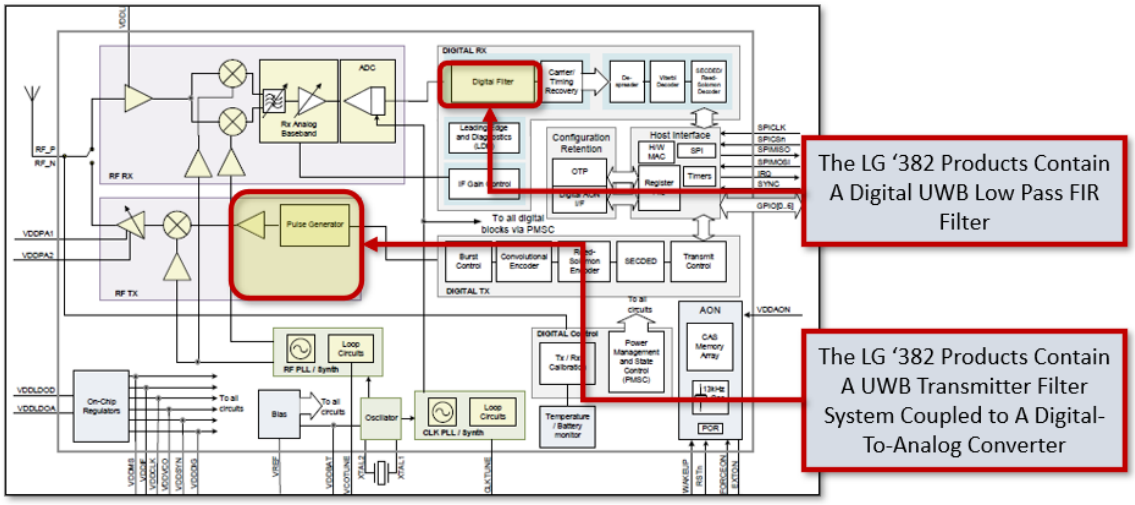
Frank Leong and Hans-Juergen Pirch (HID), *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 3 (2020) (emphasis added)

103. Further, the LG '382 Products use the multichannel PN sequence mapping to ensure compliance with the IEEE 802.15.4z standard.

> In other words, some systematic redundancy is added into the data in order to recover the correct data at the receiver in the presence of errors. Then, the coded data is mapped onto specific symbols for modulation purposes. As an example, the coded data can be mapped onto binary phase shift keying (BPSK) symbols, which take values from the set {−1,+1}.

Sinan Gezici and H. Vincent Poor, *Position Estimation via Ultra-Wideband Signals,* PROCEEDINGS OF THE IEEE 97.2 at 25 (2009).

104. One or more of the LG '382 Products comprise a digital lowpass finite impulse response shaping filter coupled to a digital-to-analog converter.



DW1000 DATASHEET VERSION 2.22 at 5 (2017) (annotation added).

105. The LG '382 Products comprise a spread spectrum physical layer (PHY). Specifically, the LG '382 Products enable what is "essentially a spread-spectrum PHY. Preamble symbols are repeated by the transmitter such that energy can be accumulated in the receiver and data symbols are spread across multiple pulses." Frank Leong and Hans-Juergen Pirch, *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 9 (2020).

106. One or more of the LG '382 Products contain a multichannel pseudorandom noise sequence mapping wherein two or more I delay units are coupled to two or more down sampling units followed by two or more Exclusive OR (XOR) units in parallel and said two or more XOR units are connected to a pseudorandom noise sequence look-up table.

Table 15-1 and Table 15-2 show how the PHR field, $H_0 - H_{18}$, PHY Payload field, $D_0 - D_{N-1}$, and Tail field, $T_0 - T_1$, are mapped onto the symbols. In these tables, the polarity bit column operation is an XOR. The tables also show when the transition from the header bit rate to the data bit rate takes place. Note that the delay line of the convolutional code is initialized to zero. For this reason, the position bit of Symbol 0 shall always be zero..

Table 15-1—Mapping of PHR field bits, PHY Payload field bits, and Tail field bits onto symbols with Viterbi rate 0.5

Symbol #	Input data	Position bit	Polarity bit	
0	H_0	0	H_0	21 symbols of PHY header at 850 kb/s or 110 kb/s
1	H_1	H_0	H_1	
2	H_2	H_1	$H_0 \oplus H_2$	
3	H_3	H_2	$H_1 \oplus H_3$	
...	...	...	...	
16	H_{16}	H_{15}	$H_{14} \oplus H_{16}$	
17	H_{17}	H_{16}	$H_{15} \oplus H_{17}$	
18	H_{18}	H_{17}	$H_{16} \oplus H_{18}$	
19	D_0	H_{18}	$H_{17} \oplus D_0$	
20	D_1	D_0	$H_{18} \oplus D_1$	
21	D_2	D_1	$D_0 \oplus D_2$	N symbols of data at data rate, e.g., 6.8 Mb/s
...	...	...	...	
N+17	D_{N-2}	D_{N-3}	$D_{N-4} \oplus D_{N-2}$	
N+18	D_{N-1}	D_{N-2}	$D_{N-3} \oplus D_{N-1}$	
N+19	T_0	D_{N-1}	$D_{N-2} \oplus T_0$	
N+20	T_1	T_0	$D_{N-1} \oplus T_1$	

IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS 802.15.4-2020 § 15.2.2 (2020) (emphasis added).

107. LG has directly infringed and continues to directly infringe the '382 patent by, among other things, making, using, offering for sale, and/or selling technology for a multichannel modulation Ultra-Wideband (UWB) communication transceiver, including but not limited to the LG '382 Products.

108. The LG '382 Products are available to businesses and individuals throughout the United States.

109. The LG '382 Products are provided to businesses and individuals located in the Eastern District of Texas.

110. By making, using, testing, offering for sale, and/or selling products and services for a multichannel modulation Ultra-Wideband (UWB) communication transceiver, including but not limited to the LG '382 Products, LG has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '382 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

111. LG also indirectly infringes the '382 patent by actively inducing infringement under 35 U.S.C. § 271(b).

112. LG has had knowledge of the '382 patent since at least service of this Complaint or shortly thereafter, and LG knew of the '382 patent and knew of its infringement, including by way of this lawsuit.

113. LG intended to induce patent infringement by third-party customers and users of the LG '382 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. LG specifically intended and was aware that the normal and customary use of the accused products would infringe the '382 patent. LG performed the acts that constitute induced infringement, and would induce

actual infringement, with knowledge of the '382 patent and with the knowledge that the induced acts would constitute infringement. For example, LG provides the LG '382 Products that have the capability of operating in a manner that infringe one or more of the claims of the '382 patent, including at least claim 1, and LG further provides documentation and training materials that cause customers and end users of the LG '382 Products to utilize the products in a manner that directly infringe one or more claims of the '382 patent.[20] By providing instruction and training to customers and end-users on how to use the LG '382 Products in a manner that directly infringes one or more claims of the '382 patent, including at least claim 1, LG specifically intended to induce infringement of the '382 patent. LG engaged in such inducement to promote the sales of the LG '382 Products, e.g., through LG user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '382 patent. Accordingly, LG has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '382 patent, knowing that such use constitutes infringement of the '382 patent.

114. The '382 patent is well-known within the industry as demonstrated by multiple citations to the '382 patent in published patents and patent applications assigned to technology companies and academic institutions. LG is utilizing the technology claimed in the '382 patent without paying a reasonable royalty. LG is infringing the '382 patent in a manner best described

[20] *See, e.g., LG LCU-001 UWB Module User Manual,* LG DOCUMENTATION (2020); *LG UWB001 Module User Manual*, LG DOCUMENTATION (2017); *LG UWB002 Module User Manual*, LG DOCUMENTATION (2017); *LG Innotek "A Smartphone Will Become a Car Key", LG Innotek Develops a "Digital Car Key Module*," LG PRESS RELEASE (January 25, 2021), *available at*: https://www.lgcorp.com/media/release/22981; and *LG Autonomous Solution – Digital Key Module*, LGINNOTEK WEBSITE (last visited June 2022), *available at*: https://www.lginnotek.com/product/199/detail.do?locale=en.

as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

115. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '382 patent.

116. As a result of LG's infringement of the '382 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for LG's infringement, but in no event less than a reasonable royalty for the use made of the invention by LG together with interest and costs as fixed by the Court.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff MIMO Research, LLC respectfully requests that this Court enter:

A. A judgment in favor of Plaintiff that LG has infringed, either literally and/or under the doctrine of equivalents, the '854, '057, and '382 patents;

B. An award of damages resulting from LG's acts of infringement in accordance with 35 U.S.C. § 284;

C. A judgment and order finding that LG's infringement was willful, wanton, malicious, bad-faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate within the meaning of 35 U.S.C. § 284 and awarding to Plaintiff enhanced damages.

D. A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding to Plaintiff reasonable attorneys' fees against LG.

E. Any and all other relief to which Plaintiff may show themselves to be entitled.

JURY TRIAL DEMANDED

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff MIMO Research, LLC requests a trial by jury of any issues so triable by right.

Dated: June 24, 2022

Respectfully submitted,

/s/ Daniel P. Hipskind

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