UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

MIMO RESEARCH, LLC, ***Plaintiff,*** v. **NXP USA, INC., NXP B.V., AND NXP SEMICONDUCTORS N.V.,** ***Defendants.***	**Civil Action No. 6:22-cv-501** **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"); 7,200,166 (the "'166 patent"); 7,305,057 (the "'057 patent"); and 7,433,382 (the "'382 patent") (collectively, the "patents-in-suit"). Defendants NXP USA, Inc., NXP B.V., and NXP Semiconductors N.V. (collectively, "NXP" 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 NXP USA, Inc. is a Delaware corporation with a principal place of business at 6501 W. William Cannon Drive, Austin, Texas 78735.

4. Defendant NXP B.V. is a Dutch company with a principal place of business at High Tech Campus 60, 5656 AG Eindhoven, Netherlands.

5. Defendant NXP Semiconductors N.V. is a Dutch corporation with a principal place of business at High Tech Campus 60, 5656 AG Eindhoven, Netherlands.

[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.

6. NXP conducts business operations within the Western District of Texas where it sells, develops, and/or markets its products.

JURISDICTION AND VENUE

7. 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).

8. This Court has personal jurisdiction over NXP in this action because NXP has committed acts within the Western District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over NXP would not offend traditional notions of fair play and substantial justice. Defendant NXP, 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, NXP 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.

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

10. NXP has a regular and established place of business in this District and has committed acts of infringement in this District. NXP has permanent office locations in this district. NXP employs full-time personnel such as sales personnel and engineers in this District. NXP has also committed acts of infringement in this District by commercializing, marketing, selling, distributing, testing, and servicing certain Accused Products.

11. This Court has personal jurisdiction over NXP. NXP has conducted and does conduct business within the State of Texas. NXP, 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 Western 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 Western District of Texas. NXP, 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 Western 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 Western District of Texas. NXP has committed acts of patent infringement within the Western District of Texas. NXP interacts with customers in Texas, including through visits to customer sites in Texas. Through these interactions and visits, NXP directly infringes the patents-in-suit. NXP 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.

12. NXP 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 NXP.

THE ASSERTED PATENTS

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

13. 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.

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

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

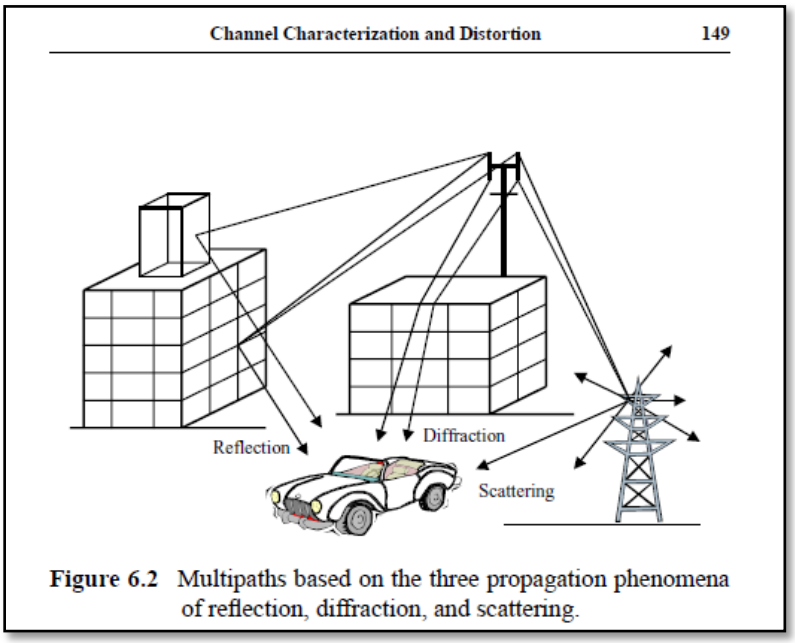
16. The '854 patent teaches the use of a sensor array unit coupled to an analog-to-digital converter which is coupled to a signal processing and data computing unit. The signal processing and data computing unit are coupled to a MIMO transceiver containing multiple antennas. This system improves average 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.

17. 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.

18. 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.

19. The '854 patent is directed to overcoming problems attendant to multipath propagation. "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).

20. 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.

21. The inventor of '854 patent described the problem of multipath propagation in his 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).

22. 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. 7,200,166

23. U.S. Patent No. 7,200,166 ("the '166 patent") entitled, *Dual-Mode Transceiver For Indoor And Outdoor Ultra Wideband Communications,* was filed on July 10, 2003. The '166 patent is subject to a 35 U.S.C. § 154(b) term extension of 768 days. MIMO Research, LLC is the owner by assignment of the '166 patent. A true and correct copy of the '166 patent is attached hereto as Exhibit B.

24. The '166 patent claims specific systems for a dual-mode digital lowpass shaping finite impulse response (FIR) filter.

25. The ‘166 patent is directed to enabling a communication device to operate in a dual mode where each mode has different emission masks and/or frequency bands.

26. The ‘166 patent is directed to allowing a single communication device to operate in a dual mode by employing a dual-mode architecture through digital transmission-shaping filters and receiver filters for two modes of operations.

27. The ‘166 patent teaches use of a digital lowpass-shaping FIR transmission filter to enable a dual-mode system. Further, the ‘166 patent teaches a FIR transmission filter wherein the filter with an impulse response that settles to zero in a finite amount of time.

28. The ‘166 patent teaches improvements to communication devices where operating in two or more modes is required where the modes include different masks of emissions limitations.

29. The ‘166 patent is directed to addressing the continuing need for a communication transceiver employing a dual-mode architecture of digital transmission-shaping filters and receiver filters for operating in two modes.

30. The ‘166 patent has been cited by 15 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 ‘166 patent as relevant prior art:

- Samsung Electronics Co., Ltd.
- Qualcomm, Inc.
- Tata Sons Ltd
- Interuniversity Microelectronics Centre
- Shandong Academy of Science Institute Of Automation

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

31. 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 C.

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

33. 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.

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

35. 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.

36. 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

37. 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 D.

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

39. 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.

40. 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.

41. 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.

42. 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.

43. 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.

44. 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

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

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

47. NXP designs, makes, sells, offers to sell, imports, and/or uses the following products: NXP Wi-Fi + Bluetooth Modules including: 88W8897, 88W8997, IW620, 88W9098, 88W9064, 88W9064S, 88W8964, 88W9098, 88Q9098, 88Q9098S, and 88W8897P (collectively, the “NXP ‘854 Products(s)”).

48. One or more NXP subsidiaries and/or affiliates use the NXP ‘854 Products in regular business operations.

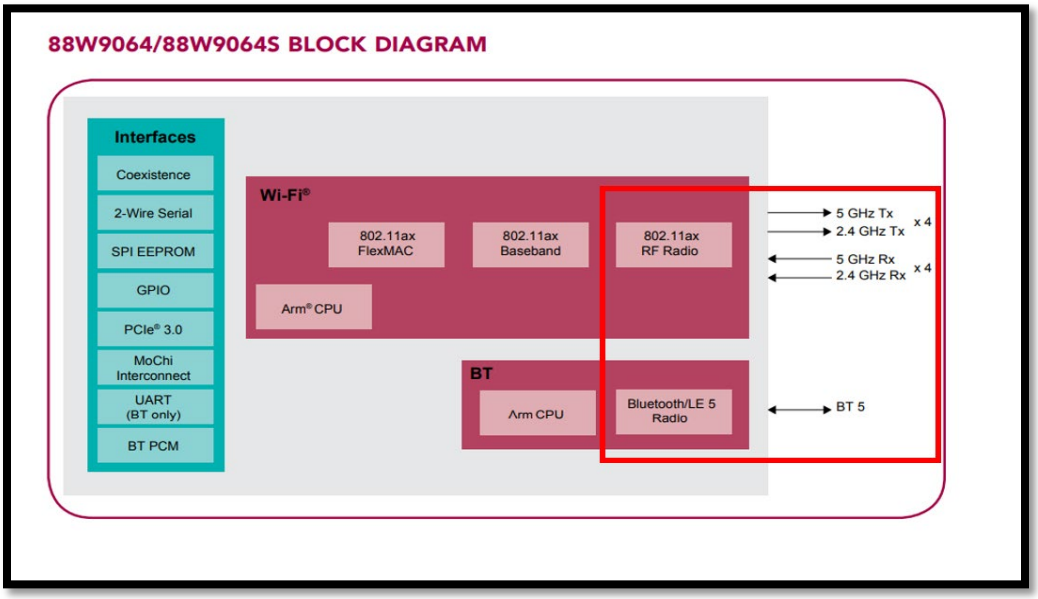
49. One or more of the NXP ‘854 Products include technology for a wireless multiple-input multiple-output sensor node and transceiver system.

PRODUCT OVERVIEW

Built to vastly improve mobile computing and high-definition multimedia applications, The 88W8897 2 x 2 combination low-power radio chip delivers the seamless wireless connectivity that gives consumers that "Always On, Always Connected"(AOAC) experience wherever they go. This SoC creates that experience by pairing today's most cutting-edge wireless technology — Bluetooth 5.0 — with mobile multiple input multiple output (MIMO), transmit beamforming and support for WI-FI CERTIFIED Miracast™ specification for point-to-point HD video streaming.

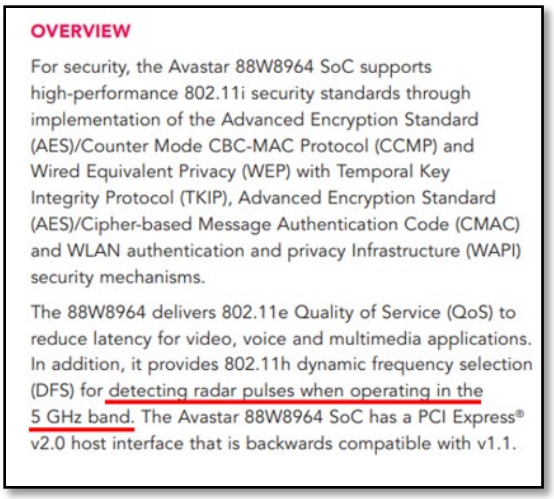
NXP 88W8897 2 X 2 WI-FI 802.11AC + BLUETOOTH SOC DATASHEET at 1 (2019) (emphasis added).

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



NXP 88W9064 4X4 WI-FI 6 DUAL BAND WITH BLUETOOTH 5 SOC FACT SHEET PAGE at 2 (September 2019) (emphasis added).

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



OVERVIEW

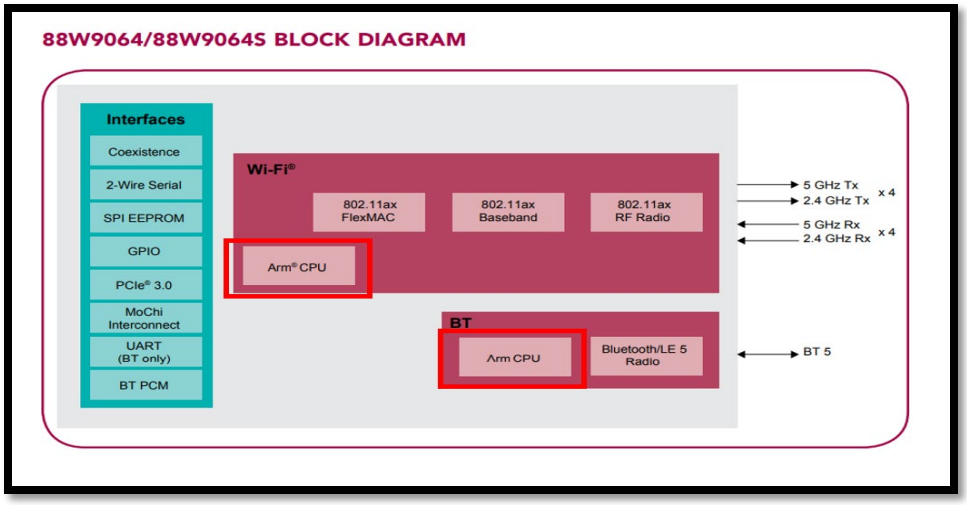
For security, the Avastar 88W8964 SoC supports high-performance 802.11i security standards through implementation of the Advanced Encryption Standard (AES)/Counter Mode CBC-MAC Protocol (CCMP) and Wired Equivalent Privacy (WEP) with Temporal Key Integrity Protocol (TKIP), Advanced Encryption Standard (AES)/Cipher-based Message Authentication Code (CMAC) and WLAN authentication and privacy Infrastructure (WAPI) security mechanisms.

The 88W8964 delivers 802.11e Quality of Service (QoS) to reduce latency for video, voice and multimedia applications. In addition, it provides 802.11h dynamic frequency selection (DFS) for detecting radar pulses when operating in the 5 GHz band. The Avastar 88W8964 SoC has a PCI Express® v2.0 host interface that is backwards compatible with v1.1.

NXP 88W9064 4X4 WI-FI 6 DUAL BAND WITH BLUETOOTH 5 SOC FACT SHEET PAGE at 2 (September 2019) (emphasis added).

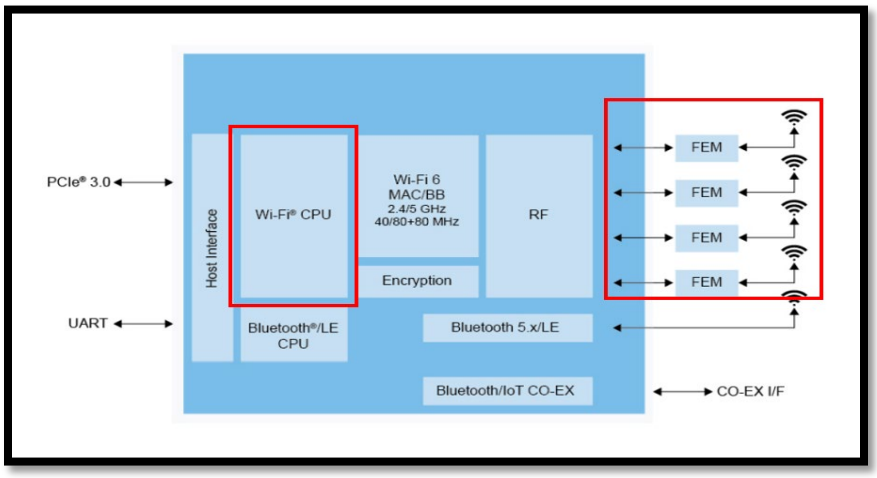
52. One or more of the NXP '854 Products comprise technology for an analog-to-digital converter unit coupled to a signal processing and data computing unit. For example, the NXP Products contain integrated circuits that perform signal processing and data computing. These integrated circuits are connected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

53. The NXP '854 Products contain an analog-to-digital (ADC) converter unit coupled to a signal processing and data computing unit. Specifically, the NXP '854 Products contain multiple CPUs to perform signal processing and data computing.



NXP 88W9064 4X4 WI-FI 6 DUAL BAND WITH BLUETOOTH 5 SOC FACT SHEET at 2 (September 2019) (emphasis added).

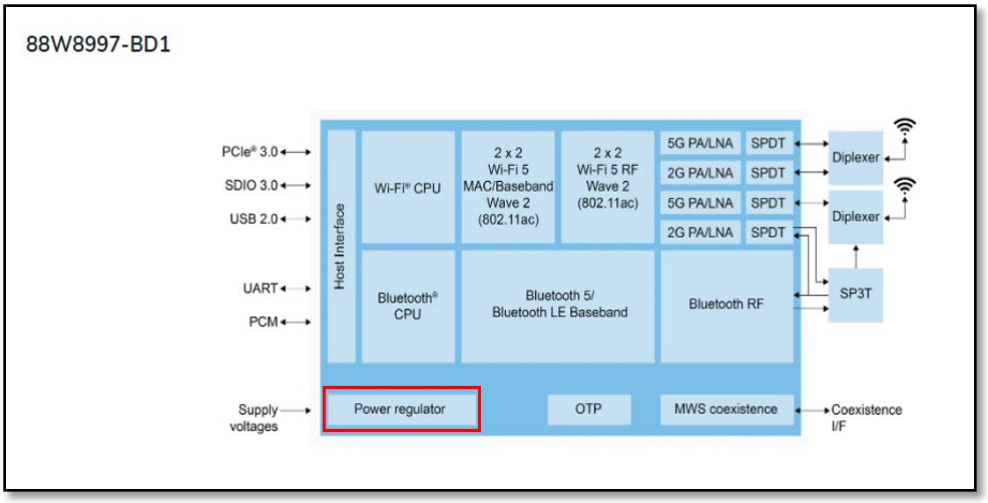
54. One or more of the NXP '854 Products include a signal processing and data computing unit that is coupled to a multiple-input multiple-output space-time transceiver that is connected to 2 or more antennas. The below diagram shows one example of the infringing functionality wherein there are four Wi-Fi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



2.4/5 GHZ DUAL-BAND 4X4 WI-FI® 6 (802.11AX) ACCESS SOLUTION | NXP SEMICONDUCTORS at 1 (2019) (emphasis added).

55. One or more of the NXP '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.

56. One or more of the NXP '854 Products include a power generator coupled to a power unit. Specifically, NXP documentation for the infringing products shows a power regulator connected to the power unit (supply voltages).



2.4/5 GHz Dual-Band 2x2 Wi-Fi 5 (802.11ac) + Bluetooth 5.3 Solution NXP Semiconductors at 1 (2019) (emphasis added).

57. One or more of the NXP '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.

Wireless Type	Type	Features List	Sub Features List	PCIe-UART		
				9098	8997	8997
Wi-Fi	AP	802.11n - High Throughput	2.4 GHz band supported channel bandwidths: 20 MHz	Y	Y	Y
			2.4 GHz band supported channel bandwidths: 40 MHz	N	Y	Y
			5 GHz band supported channel bandwidths: 20 MHz	Y	Y	Y
			5 GHz band supported channel bandwidths: 40 MHz	Y	Y	Y
			1 spatial stream (1x1)	Y	Y	Y
			2 spatial stream (2x2)	Y	Y	Y
			Short/long guard interval (400 ns/800 ns)	Y	Y	Y
			11n data rates – Up to 72 Mbit/s (MCS0 to MCS7)	Y	Y	Y
			11n data rates – Up to 150 Mbit/s (MCS0 to MCS7)	Y	Y	Y
			11n data rates - Up to 300 Mbit/s (MCS0 to MCS15)	Y	Y	Y
			Tx MCS rate adaptation (BGN)	Y	Y	Y
			Aggregated MAC Protocol Data Unit(AMPDU) Tx and Rx support	Y	Y	Y
			Aggregated MAC Service Data Unit(AMSDU) - 4k Rx support	Y	Y	Y
			HT protection mechanisms	Y	Y	Y
			RX and TX Space time block coding (STBC)	Y	Y	Y

NXP-WIRELESS-CHIPSET RELEASE NOTES REV. 2 at 11 (January 24, 2022) (emphasis added).

58. NXP 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 NXP '854 Products.

59. The NXP '854 Products are available to businesses and individuals throughout the United States.

60. The NXP '854 Products are provided to businesses and individuals located in the Western District of Texas.

61. 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 NXP '854 Products, NXP 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).

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

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

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 7,200,166

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

65. NXP designs, makes, uses, sells, and/or offers for sale in the United States products comprising a dual-mode system containing a transmission filter.

66. NXP designs, makes, sells, offers to sell, imports, and/or uses NXP LPC5500 MCU Series Microcontrollers (the "NXP '166 Product(s)").

67. One or more NXP subsidiaries and/or affiliates use the NXP '166 Products in regular business operations.

68. One or more of the NXP '166 Products comprise a dual-mode implementation system of a digital lowpass-shaping FIR transmission filter. Specifically, the NXP '166 Products comprise a FIR filter engine that enables a digital lowpass-shaping FIR transmission filter.

As a hardware module integrated inside the chip, PowerQuad executes the calculation task all on the hardware. It involves various computing engines:

- Transform engine
- Transcendental function engine
- Trigonometry function engine
- Dual biquad IIR filter engine
- Matrix accelerator engine
- FIR filter engine

Digital Signal Processing for NXP LPC5500 Using PowerQuad, NXP APPLICATION NOTE AN12282 at 2 (January 24, 2019) (emphasis added).

69. One or more of the NXP '166 Products contain a digital lowpass shaping FIR filter that enables the removal of the high frequency to get the low frequency from a mixed signal. The following excerpt from NXP documentation shows an example of an implementation of the digital lowpass FIR filter.

```
T=1/Fs;
Lenght=320;
t=(0:Lenght-1)*T;
Input_signal=(sin(2*pi*1000*t)+0.5*sin(2*pi*15000*t)+1.5)/3;
figure;
plot(Input_signal);

res=fft(Input_signal,Lenght);
figure;
f=((0:Lenght-1)/320*Fs);
plot(f,abs(res));
Cutoff_Freq=6000;
Nyq_Freq=Fs/2;
cutoff_norm=Cutoff_Freq/Nyq_Freq;
order=31;
FIR_Coeff=fir1(order,cutoff_norm,'high'); % for high-pass
%FIR_Coeff=fir1(order,cutoff_norm); % for low-pass
Filterd_signal=filter(FIR_Coeff,1,Input_signal);
figure;
plot(Filterd_signal);

fvtool(FIR_Coeff,'Fs',Fs); % generate the coeff and display the diagram
```

Digital Signal Processing for NXP LPC5500 Using PowerQuad, NXP APPLICATION NOTE AN12282 at 15 (January 24, 2019) (emphasis added).

70. One or more of the NXP '166 Products include a set of memory banks. The NXP '166 Products contain four banks of memory.

PowerQuad can handle the general RAM memory (shared with other AHB masters, like Cortex-M core) and private RAM memory (start from 0xE000_0000, 16 KB). Specially, for private RAM memory, as it is reserved only for PowerQuad, PowerQuad can access it without any arbitration delay, saving a lot of time for PowerQuad to get data. Then, PowerQuad can access the private RAM four banks of memory in parallel, giving 128-bit wide. So, it performs some functions even much faster, like FFT, FIR, convolution, matrix etc.

Some notes for using the private RAM:

- FFT engine may only use the private memory as temp memory (not as input or output).
- All data in private memory must be floating point. (You can get data in and out of private memory by using the matrix scale operation with private memory being destination).
- The private memory does not provide any scaling. Scaling is only available for data which is being read/written to the system memory.

Digital Signal Processing for NXP LPC5500 Using PowerQuad, NXP APPLICATION NOTE AN12282 at 5 (January 24, 2019) (emphasis added).

71. One or more of the NXP '166 Products include a set of multiply and accumulate (MAC) units.

The FPU fully supports single-precision add, subtract, multiply, divide, multiply and accumulate, and square root operations. It also provides conversions between fixed-point and floating-point data formats, and floating-point constant instructions.
The FPU provides floating-point computation functionality that is compliant with the ANSI/IEEE Std 754-2008, IEEE Standard for Binary Floating-Point Arithmetic, referred to as the IEEE 754 standard.

UM11126 LPC55S6x/LPC55S2x/LPC552x USER MANUAL, NXP DOCUMENTATION REV. 1.8 at 11 (October 24, 2019) (emphasis added).

72. One or more of the NXP '166 Products include a set of counter units.

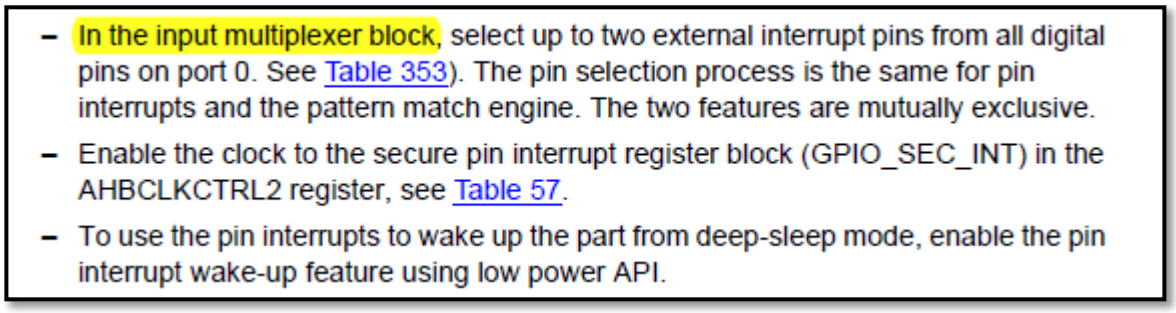
```
        TimerCount_Start();
        PQ_FIR(POWERQUAD_NS, inputF32, APP_PQ_FIR_SAMPLE_COUNT_240, EXAMPLE_PRIVATE_RAM, NUM_TAPS,
outputF32,PQ_FIR_FIR);
        PQ_WaitDone(POWERQUAD_NS);
        //arm_fir_f32(&S, inputF32, outputF32, FIR_INPUT_LEN);
        TimerCount_Stop(calcTime);

        /* Todo ...
         * - Record the time.
         * - Display the waveform.
         */
```

Digital Signal Processing for NXP LPC5500 Using PowerQuad, NXP APPLICATION NOTE AN12282 at 18 (January 24, 2019) (emphasis added).

73. One or more of the NXP '166 Products comprise a pre-addition unit.

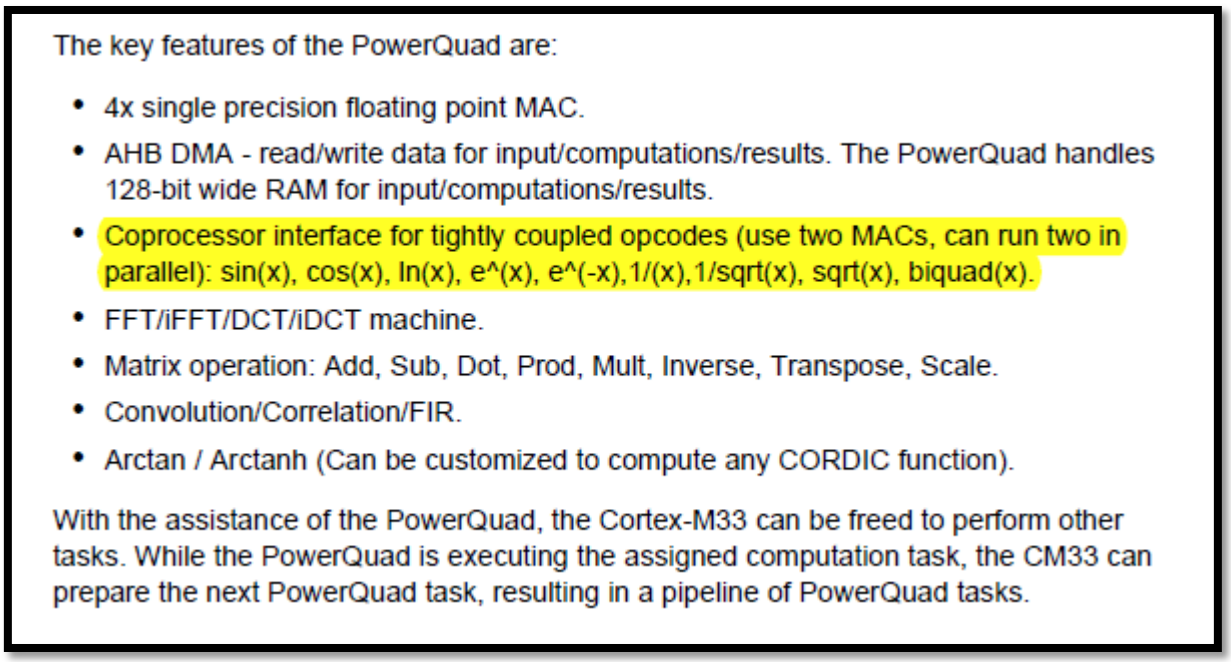
74. One or more of the NXP '166 Products include a multiplexer (MUX) unit.



- In the input multiplexer block, select up to two external interrupt pins from all digital pins on port 0. See Table 353). The pin selection process is the same for pin interrupts and the pattern match engine. The two features are mutually exclusive.
- Enable the clock to the secure pin interrupt register block (GPIO_SEC_INT) in the AHBCLKCTRL2 register, see Table 57.
- To use the pin interrupts to wake up the part from deep-sleep mode, enable the pin interrupt wake-up feature using low power API.

UM11126 LPC55S6x/LPC55S2x/LPC552x USER MANUAL, NXP DOCUMENTATION REV. 1.8 at 379 (October 24, 2019) (emphasis added).

75. One or more of the NXP '166 Products comprise a selectable unit.



The key features of the PowerQuad are:

- 4x single precision floating point MAC.
- AHB DMA - read/write data for input/computations/results. The PowerQuad handles 128-bit wide RAM for input/computations/results.
- Coprocessor interface for tightly coupled opcodes (use two MACs, can run two in parallel): sin(x), cos(x), ln(x), e^(x), e^(-x),1/(x),1/sqrt(x), sqrt(x), biquad(x).
- FFT/iFFT/DCT/iDCT machine.
- Matrix operation: Add, Sub, Dot, Prod, Mult, Inverse, Transpose, Scale.
- Convolution/Correlation/FIR.
- Arctan / Arctanh (Can be customized to compute any CORDIC function).

With the assistance of the PowerQuad, the Cortex-M33 can be freed to perform other tasks. While the PowerQuad is executing the assigned computation task, the CM33 can prepare the next PowerQuad task, resulting in a pipeline of PowerQuad tasks.

UM11126 LPC55S6x/LPC55S2x/LPC552x USER MANUAL, NXP DOCUMENTATION REV. 1.8 at 1078 (October 24, 2019) (emphasis added).

76. NXP has directly infringed and continues to directly infringe the '166 patent by, among other things, making, using, offering for sale, and/or selling technology comprising a dual-mode system containing a transmission filter, including but not limited to the NXP '166 Products.

77. The NXP '166 Products are available to businesses and individuals throughout the United States.

78. The NXP '166 Products are provided to businesses and individuals located in the Western District of Texas.

79. By making, using, testing, offering for sale, and/or selling products and services comprising a dual-mode system containing a transmission filter, including but not limited to the NXP '166 Products, NXP has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '166 patent, including at least claim 11 pursuant to 35 U.S.C. § 271(a).

80. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '166 patent.

81. As a result of NXP's infringement of the '166 patent, Plaintiff has suffered monetary damages, and seek recovery in an amount adequate to compensate for NXP's infringement, but in no event less than a reasonable royalty for the use made of the invention by NXP together with interest and costs as fixed by the Court.

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

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

83. NXP 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.

84. NXP designs, makes, sells, offers to sell, imports, and/or uses the following products: Trimension SR150, Trimension SR040, Trimension SR100T, and Trimension OL23D0 (collectively, the "NXP '057 Products(s)").

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

86. One or more of the NXP ‘057 Products comprise a UWB transmitter.

TRIMENSION SR040: SECURE UWB SOLUTION FOR IOT TAGS

Optimized for low-power operation and reducing the need for external components, Trimension SR040 is designed for use in battery-operated IoT devices, including UWB trackers and tags. The pre-developed FiRa MAC by NXP ensure interoperability and fast time-to-market. Trimension SR040 can be integrated with Bluetooth Low Energy or other connectivity controllers in one device. Being used as a Time Difference of Arrival (TDoA) RTLS tag, they can send blink packets only.

- Specialized part for battery-operated use cases
- On-chip flash for firmware, for download-free booting
- Optimized low-power modes
- Integrated Tx/Rx switch
- In accordance with FiRa certification development
- IEEE 802.15.4z compatible
- Arm® Cortex®-based

NXP Extends its Secure Ultra-Wideband Portfolio with New Sensing Solutions that Enable Emerging IoT Use Cases, NXP PRESENTATION at 7 (2020) (emphasis added).

87. One or more of the NXP ‘057 Products comprise a multichannel filter-based handheld UWB transmitter. Specifically, the NXP ‘057 Products utilize multiple channels for precise UWB localization.

PRECISE LOCALIZATION

- 6 to 8.5 GHz, 500 MHz bandwidth per channel
- Worldwide coverage using channels 5, 6, 8, and 9
- Integrated time-of-flight (ToF), time-difference of arrival (TDoA) and angle-of-arrival (AoA) algorithms
- Dual-Rx for AoA functionality (SR150)
- Range accuracy (nLOS): ±10 cm
- Software support for up to 3 antennas
- Support for 3D positioning using 3 antennas
- Optimized for use with CR2032 coin battery (SR040)

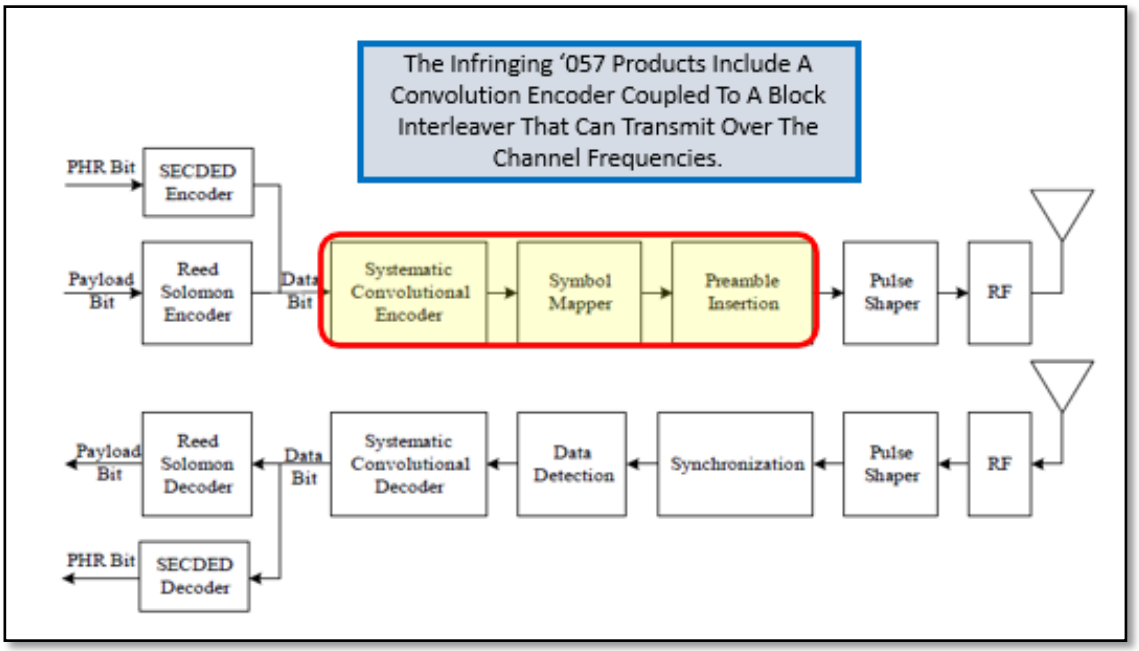
NXP Trimension SR150 and Trimension SR040 Fact Sheet, NXP DOCUMENTATION at 1 (2020) (emphasis added).

88. One or more of the NXP '057 Products include a convolution encoder coupled to a block interleaver.

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

89. One or more of the NXP '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 NXP '057 Products.



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

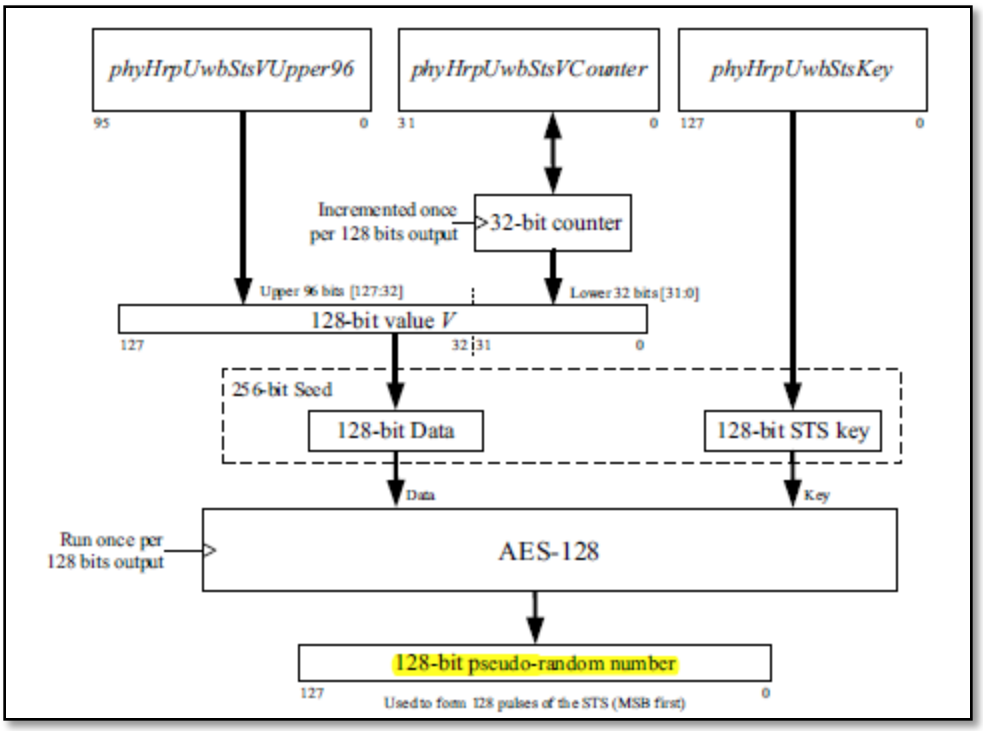
90. One or more of the NXP '057 Products include a multichannel-based multicarrier modulator coupled to a power amplifier.

91. One or more of the NXP '057 Products include a block interleaver coupled to a multichannel pseudorandom (PN) sequence mapping. Specifically, the NXP '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 (NXP and Hans-Juergen Pirch (HID), *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 8 (2020) (emphasis added).

92. One or more of the NXP '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.

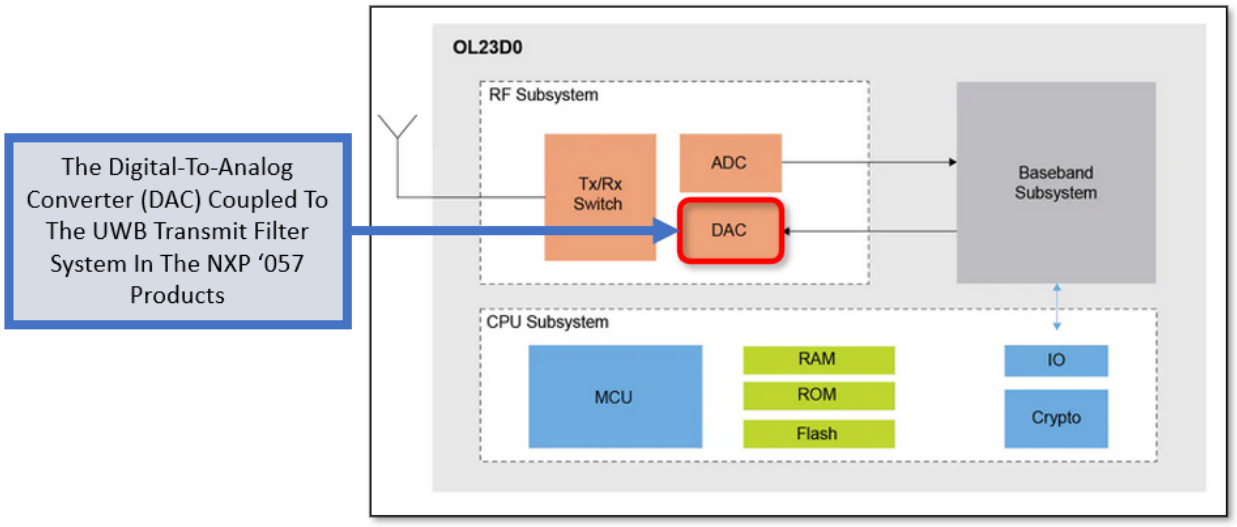


IEEE STANDARD FOR LOW-RATE WIRELESS NETWORKS - AMENDMENT 1: ENHANCED ULTRA WIDEBAND (UWB) PHYSICAL LAYERS (PHYS) AND ASSOCIATED RANGING TECHNIQUES 802.15.4z-2020 § 15.2.9.1 (2020) (emphasis added).

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

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

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



NXP Trimension OL23D0: Fully Customizable UWB Controller for IoT Webpage, NXP WEBSITE (last visited May 2022), *available at*: https://www.nxp.com/products/wireless/secure-ultra-wideband-uwb (annotation added).

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

97. One or more of the NXP '057 Products include a DAC that is connected to a modulator that transmits and receives UWB signals that have a center frequency of 6489.6 MHz, 6988.8 MHz, 7488.0 MHz, and 7987.2 MHz. Each UWB channel has a bandwidth of 499.2 MHz.

98. One or more of the NXP '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).

99. NXP 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 NXP '057 Products.

100. The NXP '057 Products are available to businesses and individuals throughout the United States.

101. The NXP '057 Products are provided to businesses and individuals located in the Western District of Texas.

102. 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 NXP '057 Products, NXP 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).

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

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

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

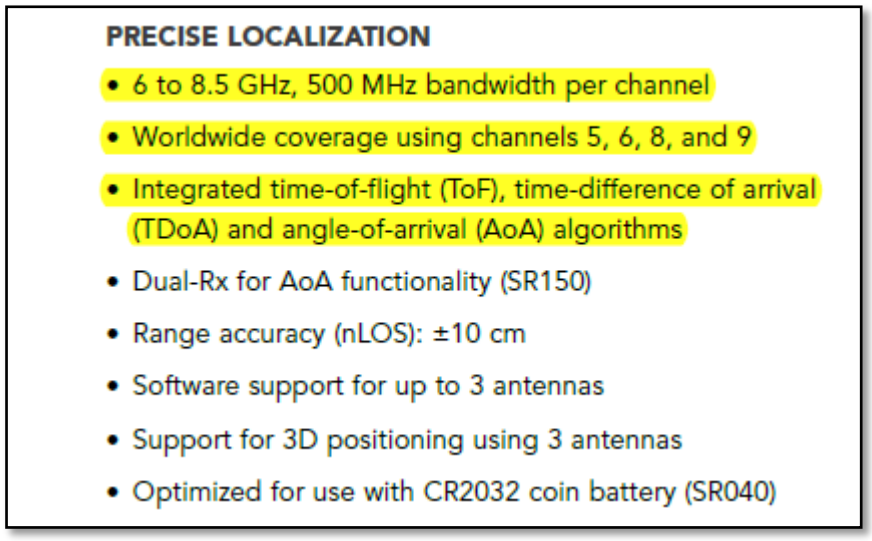
105. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

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

107. NXP designs, makes, sells, offers to sell, imports, and/or uses the following products: Trimension SR150, Trimension SR040, Trimension SR100T, and Trimension OL23D0 (collectively, the "NXP '382 Products(s)").

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

109. One or more of the NXP '382 Products comprise a spread spectrum based multichannel modulation UWB communication transceiver. Specifically, the NXP '382 Products utilize multichannel modulator in supporting UWB channels with a center frequency of 6489.6 MHz, 6988.8 MHz, 7488.0 MHz, and 7987.2 MHz. Each UWB channel has a bandwidth of 499.2 MHz.



NXP Trimension SR150 and Trimension SR040 Fact Sheet, NXP DOCUMENTATION at 1 (2020) (emphasis added).

110. The 'NXP '382 Products contain a spread-spectrum PHY wherein the preamble symbols are repeated by the transmitter in the NXP '382 Products such that the receiver and data symbols are spread across multiple pulses.

> The basic IEEE 802.15.4 HRP UWB PHY 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.
>
> 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 (NXP and Hans-Juergen Pirch (HID), *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 8 (2020) (emphasis added).

111. One or more of the NXP '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 at 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).

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

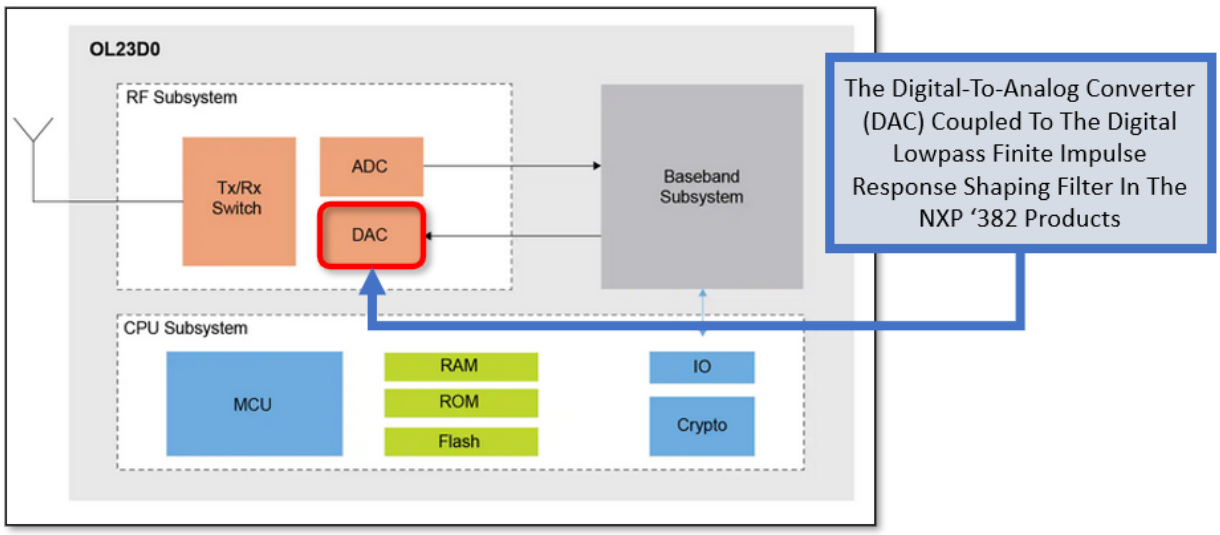
Frank Leong (NXP and Hans-Juergen Pirch (HID), *Introduction to Impulse Radio UWB Seamless Access Systems*, FIRA WHITE PAPER at 3 (2020) (emphasis added)

113. Further, the NXP '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).

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



NXP Trimension OL23D0: Fully Customizable UWB Controller for IoT Webpage, NXP WEBSITE (last visited May 2022), *available at*: https://www.nxp.com/products/wireless/secure-ultra-wideband-uwb (annotation added).

115. One or more of the NXP '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).

116. NXP 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 NXP '382 Products.

117. The NXP '382 Products are available to businesses and individuals throughout the United States.

118. The NXP '382 Products are provided to businesses and individuals located in the Western District of Texas.

119. 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 NXP '382 Products, NXP 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).

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

121. As a result of NXP's infringement of the '382 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for NXP's infringement, but in no event less than a reasonable royalty for the use made of the invention by NXP 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 NXP has infringed, either literally and/or under the doctrine of equivalents, the '854, '166, '057, and '382 patents;

B. An award of damages resulting from NXP's acts of infringement in

accordance with 35 U.S.C. § 284;

C. A judgment and order finding that NXP'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 NXP.

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: May 16, 2022

Respectfully submitted,

/s/ Daniel P. Hipskind

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