UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

MIMO RESEARCH, LLC, ***Plaintiff,*** v. **TEXAS INSTRUMENTS INC.,** ***Defendant.***	**Civil Action No. 6:22-cv-643** **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") and 7,200,166 (the "'166 patent") (collectively, the "patents-in-suit"). Defendant Texas Instruments, Inc. ("Texas Instruments" or "Defendant") infringes 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. Texas Instruments has cited the MIMO Research patents in 7 patents and patent applications, including: U.S. Patent Nos. 9,184,967 and 9,641,219; and U.S. Patent Application Nos. 2005/0190817; 2005/0232139; 2005/0232174; 2005/0237923; and 2016/0043773.

4. Defendant Texas Instruments, Inc. ("Texas Instruments"), is a Delaware corporation with its principal place of business at 12500 TI Boulevard, Dallas, Texas 75243. Texas Instruments may be served through its registered agent C T Corporation System at 1999 Bryan

[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.

Street Suite 900, Dallas, Texas 75201. Texas Instruments is registered to do business in the State of Texas.

5. Texas Instruments conducts business operations within the Western District of Texas where it sells, develops, and/or markets its products including facilities at: 12357 Riata Trace Pkwy, Austin, Texas 78727 and 9433 Bee Caves Road, Austin, Texas 78733.

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 Texas Instruments in this action because Texas Instruments 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 Texas Instruments would not offend traditional notions of fair play and substantial justice. Defendant Texas Instruments, 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, Texas Instruments 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 Texas Instruments 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.

9. Texas Instruments has a regular and established place of business in this District and has committed acts of infringement in this District. Texas Instruments has permanent office locations at 12357 Riata Trace Pkwy, Austin, Texas 78727 and 9433 Bee Caves Road, Austin, Texas 78733, both of which are located within this District. Texas Instruments employs full-time personnel such as sales personnel and engineers in this District, including in Austin, Texas. Texas Instruments 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 Texas Instruments. Texas Instruments has conducted and does conduct business within the State of Texas. Texas Instruments, 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. Texas Instruments, 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. Texas Instruments has committed acts of patent infringement within the Western District of Texas. Texas Instruments interacts with customers in Texas, including through visits to customer sites in

Texas. Through these interactions and visits, Texas Instruments directly infringes the patents-in-suit. Texas Instruments 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. Texas Instruments 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 Texas Instruments.

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.

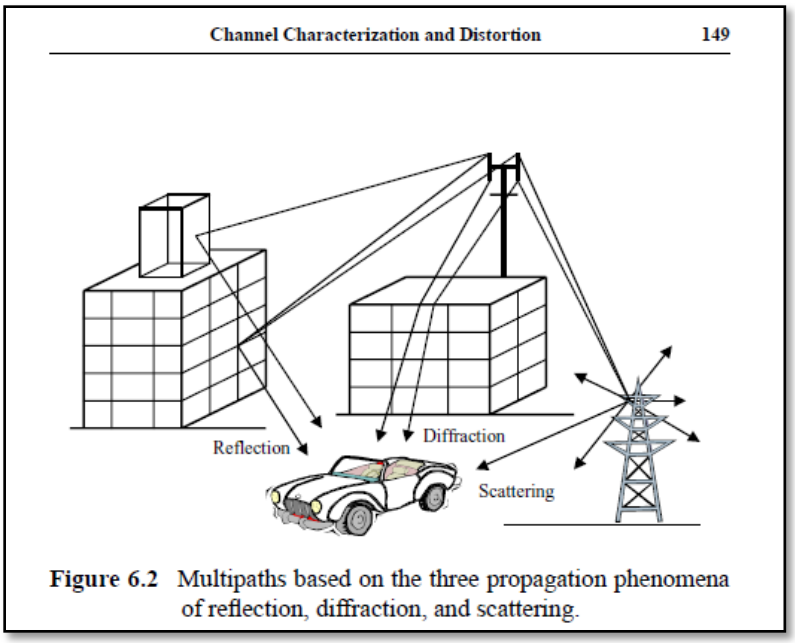
15. The '854 patent teaches the use of a sensor array unit coupled to an analog-to-digital converter which is coupled to a signal processing and data computing unit. The signal processing and data computing unit are coupled to a MIMO transceiver containing multiple antennas. This system improves average 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. 7,200,166

22. 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.

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

24. 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.

25. 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.

26. 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 is a filter whose impulse response is of a finite duration as the filter settles to zero after a period of time.

27. 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.

28. 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.

29. 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

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

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

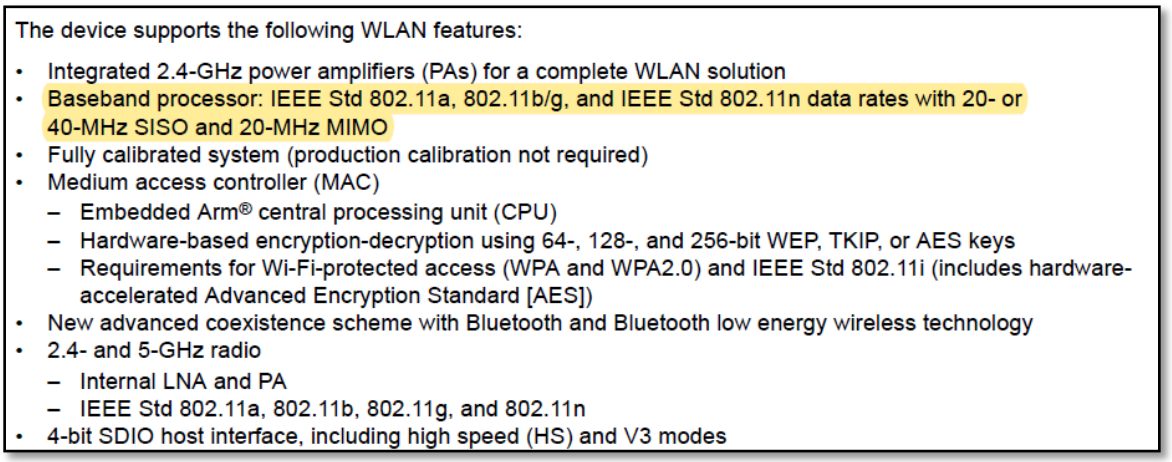
31. Texas Instruments designs, makes, uses, sells, and/or offers for sale in the United States products comprising a MIMO wireless sensor and transceiver system.

32. Texas Instruments designs, makes, sells, offers to sell, imports, and/or uses the following products: WL1805MOD WiLink 8 Module, WL1807MOD WiLink 8 Module, WL1835MOD WiLink 8 Module, and WL1837MOD WiLink 8 Module (collectively, the "Texas Instruments '854 Products(s)").

33. One or more Texas Instruments subsidiaries and/or affiliates use the Texas Instruments '854 Products in regular business operations.

34. The Texas Instruments '854 Products include technology for a wireless multiple-input multiple-output sensor node and transceiver system.

35. The Texas Instruments '854 Products include a sensor array unit coupled to an analog-to-digital converter unit. Specifically, the Texas Instruments '854 Products include a sensor array unit that receives data in the form of Wi-Fi and BT signals



The device supports the following WLAN features:

- Integrated 2.4-GHz power amplifiers (PAs) for a complete WLAN solution
- Baseband processor: IEEE Std 802.11a, 802.11b/g, and IEEE Std 802.11n data rates with 20- or 40-MHz SISO and 20-MHz MIMO
- Fully calibrated system (production calibration not required)
- Medium access controller (MAC)
  - Embedded Arm® central processing unit (CPU)
  - Hardware-based encryption-decryption using 64-, 128-, and 256-bit WEP, TKIP, or AES keys
  - Requirements for Wi-Fi-protected access (WPA and WPA2.0) and IEEE Std 802.11i (includes hardware-accelerated Advanced Encryption Standard [AES])
- New advanced coexistence scheme with Bluetooth and Bluetooth low energy wireless technology
- 2.4- and 5-GHz radio
  - Internal LNA and PA
  - IEEE Std 802.11a, 802.11b, 802.11g, and 802.11n
- 4-bit SDIO host interface, including high speed (HS) and V3 modes

WL18x7MOD WiLink 8 Dual-Band Industrial Module Data Sheet, TEXAS INSTRUMENTS DOCUMENTATION at 29 (April 2021) (emphasis added).

36. The Texas Instruments '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.

37. The Texas Instruments '854 Products are available to businesses and individuals throughout the United States.

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

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

The certified WiLink™ 8 module from TI offers high throughput and extended range along with Wi-Fi® and *Bluetooth*® coexistence (WL1837MOD only) in a power-optimized design. The WL18x7MOD is a Wi-Fi, dual-band, 2.4- and 5-GHz module solution with two antennas supporting industrial temperature grade. The device is FCC, IC, ETSI/CE, and TELEC certified for AP (with DFS support) and client. TI offers drivers for high-level operating systems, such as Linux® and Android™. Additional drivers, such as WinCE and RTOS, which includes QNX, Nucleus, ThreadX, and FreeRTOS, are supported through third parties.

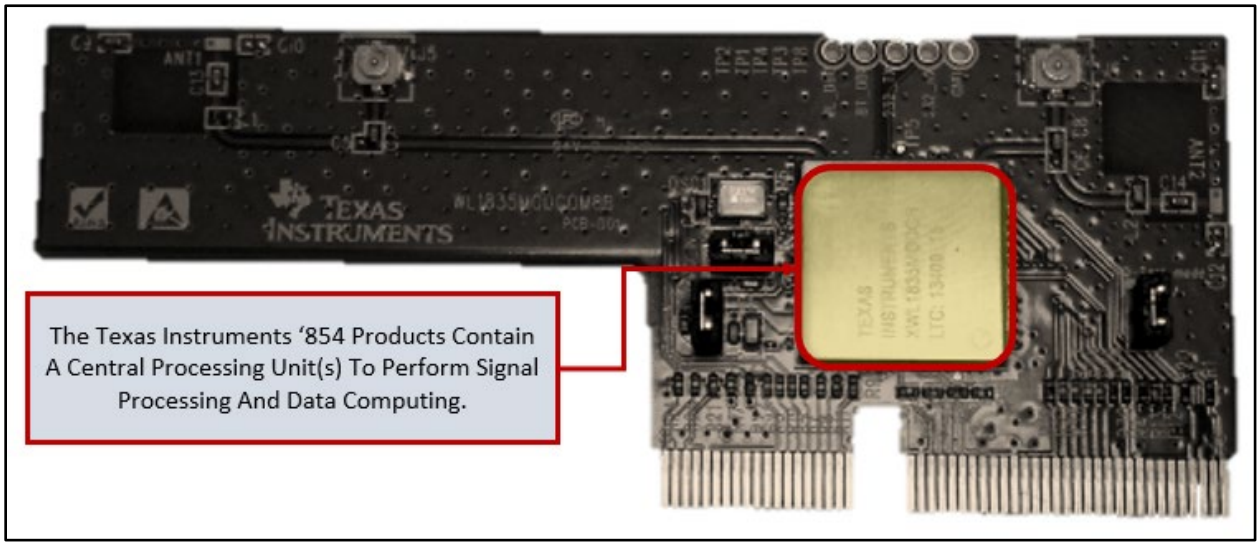
Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE
WL1807MOD	QFM (100)	13.3 mm × 13.4 mm × 2 mm
WL1837MOD	QFM (100)	13.3 mm × 13.4 mm × 2 mm

WL18x7MOD WiLink 8 Dual-Band Industrial Module Data Sheet, TEXAS INSTRUMENTS DOCUMENTATION at 1 (April 2021) (emphasis added)

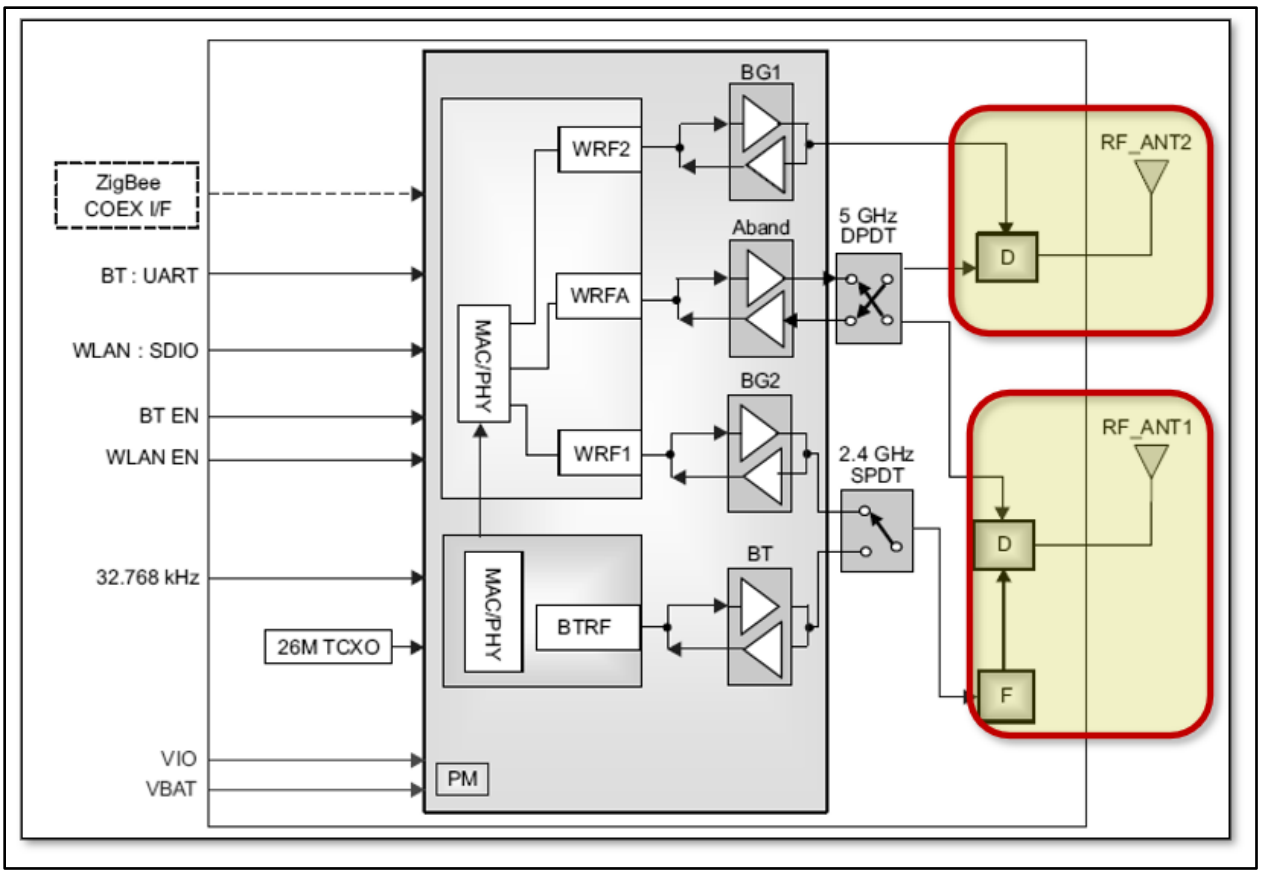
40. The Texas Instruments '854 Products comprise technology for an analog-to-digital converter unit coupled to a signal processing and data computing unit. For example, the Texas Instruments '854 Products contain integrated circuits that perform signal processing and data computing. These integrated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

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



WL1835MODCOM8B WLAN MIMO and Bluetooth Module Evaluation Board for TI Sitara Platform User's Guide, TEXAS INSTRUMENTS DOCUMENTATION at 4 (2014) (annotation added).

42. One or more of the Texas Instruments '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 two 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.

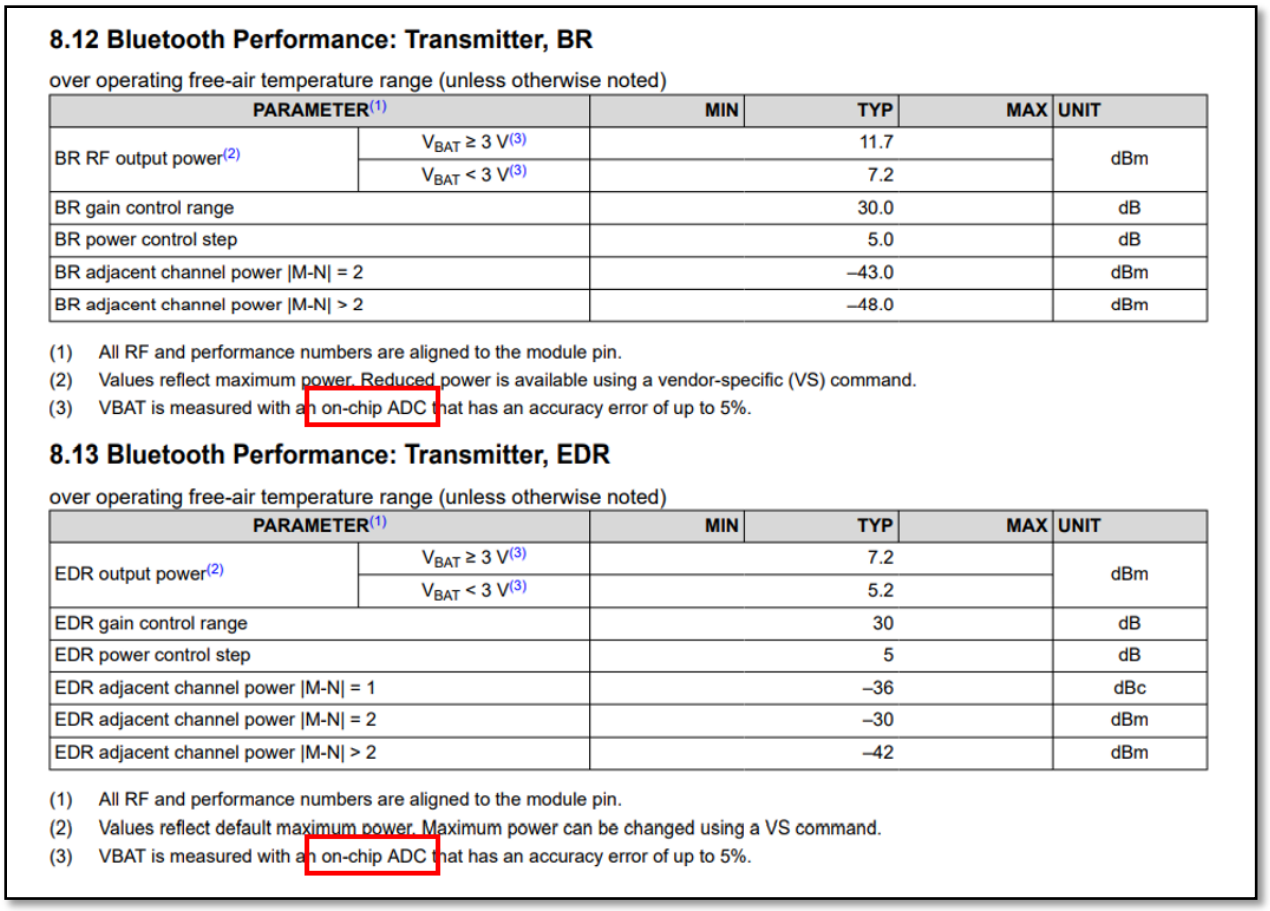


WL18x7MOD WiLink 8 Dual-Band Industrial Module Data Sheet, TEXAS INSTRUMENTS DOCUMENTATION at 2 (April 2021) (annotation added).

43. The Texas Instruments '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 two or more antennas.

44. One or more of the Texas Instruments '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.

45. The Texas Instruments '854 Products contain a sensor array unit coupled to an analog-to-digital converter unit. The analog-to-digital converter unit (ADC) is on-chip.



8.12 Bluetooth Performance: Transmitter, BR

over operating free-air temperature range (unless otherwise noted)

PARAMETER(1)		MIN	TYP	MAX	UNIT
BR RF output power(2)	$V_{BAT} \geq 3$ V(3)		11.7		dBm
	$V_{BAT} < 3$ V(3)		7.2		
BR gain control range			30.0		dB
BR power control step			5.0		dB
BR adjacent channel power |M-N| = 2			–43.0		dBm
BR adjacent channel power |M-N| > 2			–48.0		dBm

(1) All RF and performance numbers are aligned to the module pin.
(2) Values reflect maximum power. Reduced power is available using a vendor-specific (VS) command.
(3) VBAT is measured with an on-chip ADC that has an accuracy error of up to 5%.

8.13 Bluetooth Performance: Transmitter, EDR

over operating free-air temperature range (unless otherwise noted)

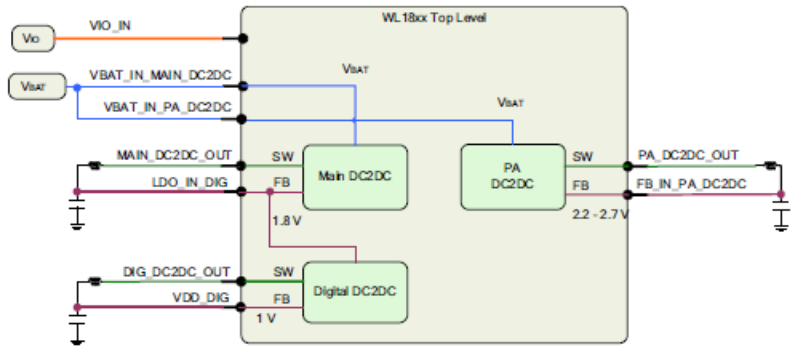
PARAMETER(1)		MIN	TYP	MAX	UNIT
EDR output power(2)	$V_{BAT} \geq 3$ V(3)		7.2		dBm
	$V_{BAT} < 3$ V(3)		5.2		
EDR gain control range			30		dB
EDR power control step			5		dB
EDR adjacent channel power |M-N| = 1			–36		dBc
EDR adjacent channel power |M-N| = 2			–30		dBm
EDR adjacent channel power |M-N| > 2			–42		dBm

(1) All RF and performance numbers are aligned to the module pin.
(2) Values reflect default maximum power. Maximum power can be changed using a VS command.
(3) VBAT is measured with an on-chip ADC that has an accuracy error of up to 5%.

SWRS170J WL18x7MOD WiLink Dual-Band Industrial Module – Wi-Fi, Bluetooth, and Bluetooth Low Energy (LE) at 17 (April 2021) (emphasis added).

46. The Texas Instruments ‘854 Products include a power generator coupled to a power unit. Specifically, Texas Instruments documentation for the infringing products shows a power regulator connected to the power unit (supply voltages).

The device incorporates three internal DC-DCs (switched-mode power supplies) to provide efficient internal supplies, derived from V_{BAT}.



WL18x7MOD WiLink 8 Dual-Band Industrial Module Data Sheet, TEXAS INSTRUMENTS DOCUMENTATION at 20 (April 2021).

47. The Texas Instruments '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. The below excerpt from Texas Instruments documentation shows that the Texas Instruments '854 Products come with power amplifiers and power management integrated into the device.

Features

General
- Integrates RF, power amplifiers (PAs), clock, RF switches, filters, passives, and power management
- Quick hardware design with TI module collateral and reference designs
- Operating temperature: –20°C to +70°C
- Small form factor: 13.3 × 13.4 × 2 mm
- 100-pin MOC package
- FCC, IC, ETSI/CE, and TELEC certified with PCB, dipole, chip, and PIFA antennas
- Dual-mode Bluetooth and Bluetooth low energy
- TI's Bluetooth and Bluetooth low energy certified stack

• Key benefits
- Reduces design overhead
- Differentiated use cases by configuring WiLink™ 8 simultaneously in two roles (STA and AP) to connect directly with other Wi-Fi devices on different RF channel (Wi-Fi networks)
- Best-in-class Wi-Fi with high-performance audio and video streaming reference applications with up to 1.4× the range versus

WL18x1MOD, WL18x5MOD WiLink 8 Single-Band Combo Module – Wi-Fi, Bluetooth, and Bluetooth Low Energy (LE), TEXAS INSTRUMENTS DOCUMENTATION at 1 (April 2021) (emphasis added).

48. Texas Instruments 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 Texas Instruments '854 Products.

49. 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 Texas Instruments '854 Products, Texas Instruments 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).

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

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

52. Alternatively, Texas Instruments has had knowledge of the '854 patent since at least April 4, 2008, when the '854 patent was identified by the United States Patent and Trademark Office as relevant prior art during the prosecution of U.S. Patent Application No. 11/108,412. U.S. Patent Application No. 11/108,412 was assigned to Texas Instruments.

Notice of References Cited			Application/Control No. 11/108,412		Applicant(s)/Patent Under Reexamination ONGGOSANUSI ET AL.	
			Examiner SHAFIQUL KHAN		Art Unit 4183	Page 1 of 1
U.S. PATENT DOCUMENTS						
*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name		Classification
*	A	US-2005/0226344	10-2005	Kuchi et al.		375/267
*	B	US-2003/0200243	10-2003	Yomo et al.		708/306
*	C	US-2006/0203771	09-2006	Molev-Shteiman et al.		370/329
*	D	US-5,144,256	09-1992	Lim, Mu-gil		329/302
*	E	US-2005/0111596	05-2005	Olsson et al.		375/346
*	F	US-2003/0161258	08-2003	Zhang et al.		370/203
*	G	US-7,091,854	08-2006	Miao, George J.		340/539.26
*	H	US-7,299,017	11-2007	Pajukoski et al.		455/137

US. PATENT APPLICATION NO. 11/108,412 LIST OF REFERENCES CITED BY EXAMINER at 1 (April 4, 2008) (emphasis added).

53. The '854 Patent was cited repeatedly during the prosecution of Texas Instrument's Patent Application No. 11/108,412. In an April 4, 2008 Non-Final Rejection, the Patent Examiner rejected multiple claims based on the '854 patent.

> Miao, in the same field of invention, discloses space time matrix equalizer is used to cancel co-channel interference (Col 7, lines 15-25, i.e. space time matrix equalizer performs space time interference suppression with a space time interference matrix). Miao demonstrates space time matrix equalizer to cancel co-channel interference in order to have better reception (Col 7, lines 15-25). The combination of

U.S. PATENT APPLICATION NO. 11/108,412 NON-FINAL REJECTION at 11 (April 4, 2008) (emphasis added).

54. Despite amending the claims, the Patent Examiner again rejected the claims in Texas Instrument's Patent Application No. 11/108,412 based in-part on the '854 patent.

> 8. Claim 15-16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuchi, Yomo and Staszewski as applied to claims 1 and 18 above, and further in view of Miao (US 7,091,854) and Webster (US 5,500,879).

U.S. PATENT APPLICATION NO. 11/108,412 NON-FINAL REJECTION at 13 (October 30, 2008) (emphasis added).

55. Following the second non-final rejection, Texas Instruments abandoned Patent Application No. 11/108,412 on May 28, 2009. The three individuals named on Texas Instrument's abandoned Patent Application No. 11/108,412 were senior members of the technical staff at Texas Instruments and were involved in the development of Texas Instruments' wireless products. One of the three inventors listed on Texas Instrument's abandoned patent application was Anand G. Dabak who is currently a Texas Instruments Fellow working on signal processing.[10] Previously,

[10] TEXAS INSTRUMENTS ANNUAL REPORT at 135 (2021).

Mr. Dabak worked on hardware development at Texas Instruments with a focus on ultra-wideband and multiple antenna techniques.[11] Tim Schmidl, the second individual listed on Texas Instrument's abandoned patent application is currently a senior member of Texas Instruments' technical staff.[12] Previously, Mr. Schmidl worked on developing wireless technologies for Texas Instruments including the infringing technologies incorporated in the Texas Instruments '854 Products. Eko Onggosanusi, the third individual listed on Texas Instrument's abandoned patent application was a senior member of Texas Instruments technical staff where he developed wireless systems and antenna technologies.[13] Mr. Onggosanusi is currently a Senior Director for Wireless Standards at Samsung Research America.

56. Texas Instruments intended to induce patent infringement by third-party customers and users of the Texas Instruments '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

[11] T. Muharemovict, E. N. Onggosanusi, A. G. Dabak and B. Aazhang, *Hybrid linear-iterative detection algorithms for MIMO CDMA systems in multipath channels,* 2002 IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING pp. III-2621-III-2624 (2002); B. Varadarajan, E. Onggosanusi, A. Dabak and R. Chen, *Nested codebook design for MIMO precoders*, 2008 42ND ASILOMAR CONFERENCE ON SIGNALS, SYSTEMS AND COMPUTERS pp. 723-727 (2008); and N. Al-Dhahir, A. Dabak, M. Moonen, A. H. Sayed and Z. Zvonar, *Introduction to the Issue on DSP Techiques for RF/Analog Circuit Impairments*, IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, vol. 3, no. 3, pp. 345-347 (June 2009).

[12] T. Schmidl, et al. *A comparison of the open loop transmit diversity schemes for third generation wireless systems*, 2000 IEEE WIRELESS COMMUNICATIONS AND NETWORKING CONFERENCE. CONFERENCE RECORD (CAT. NO.00TH8540) pp. 437-442 vol.1 (2000); and T. Schmidl, et al, *Capacity analysis of frequency-selective MIMO channels with sub-optimal detectors*, 2002 IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING pp. III-2369-III-2372 (2002).

[13] *See* E. Onggosanusi, M. Zhang, Y. Zhang and J. Kang, *Enhancing 5G MIMO Core Spectral Efficiency with Higher-Resolution Multi-User MIMO and Multi-Beam Operation,* IEEE COMMUNICATIONS STANDARDS MAGAZINE, *VOL.* 6, no. 1, pp. 20-26 (March 2022); J. Jeon *et al*., *MIMO Evolution toward 6G: Modular Massive MIMO in Low-Frequency Bands*, IEEE COMMUNICATIONS MAGAZINE, vol. 59, no. 11, pp. 52-58 (November 2021); and E. Onggosanusi et al., *Reduced space channel feedback for FD-MIMO*, 2015 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC) pp. 3873-3878 (2015).

infringement. Texas Instruments specifically intended and was aware that the normal and customary use of the accused products would infringe the '854 patent. Texas Instruments 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, Texas Instruments provides the Texas Instruments '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 Texas Instruments further provides documentation and training materials that cause customers and end users of the Texas Instruments '854 Products to utilize the products in a manner that directly infringe one or more claims of the '854 patent.[14] By providing instruction and training to customers and end-users on how to use the Texas Instruments '854 Products in a manner that directly infringes one or more claims of the '854 patent, including at least claim 15, Texas Instruments specifically intended to induce infringement of the '854 patent. Texas Instruments engaged in such inducement to promote the sales of the Texas Instruments '854 Products, e.g., through Texas Instruments user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '854 patent. Accordingly, Texas Instruments 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.

[14] *See e.g., WL18x1MOD, WL18x5MOD WiLink 8 Single-Band Combo Module – Wi-Fi, Bluetooth, and Bluetooth Low Energy (LE),* TEXAS INSTRUMENTS DOCUMENTATION (April 2021); *WL18x7MOD WiLink 8 Dual-Band Industrial Module Data Sheet,* TEXAS INSTRUMENTS DOCUMENTATION (April 2021); *SWRS170J WL18x7MOD WiLink Dual-Band Industrial Module – Wi-Fi, Bluetooth, and Bluetooth Low Energy (LE),* TEXAS INSTRUMENTS DOCUMENTATION (April 2021); and *WL1835MODCOM8B WLAN MIMO and Bluetooth Module Evaluation Board for TI Sitara Platform User's Guide*, TEXAS INSTRUMENTS DOCUMENTATION (2014).

57. 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. Texas Instruments is utilizing the technology claimed in the '854 patent without paying a reasonable royalty. Texas Instruments 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.

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

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

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

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

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

62. Texas Instruments designs, makes, sells, offers to sell, imports, and/or uses the following products: ADS1281, ADS1282, ADS1282-HT, ADS1282-SP, ADS1283, ADS1284, ADS1285, ADS1287, ADS1287-D, ADC12DJ4000RF, and ADC12DJ5200RF (collectively, the "Texas Instruments '166 Products(s)").

63. One or more Texas Instruments subsidiaries and/or affiliates use the Texas Instruments '166 Products in regular business operations.

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

8.3.3.2 Digital Filter

The digital filter receives the modulator output and decimates the data stream. By adjusting the amount of filtering, tradeoffs can be made between resolution and data rate: filter more for higher resolution, filter less for higher data rate.

The digital filter is comprised of three cascaded filter stages: a variable-decimation, fifth-order sinc filter; a fixed-decimation FIR, low-pass filter (LPF) with selectable phase; and a programmable, first-order, high-pass filter (HPF), as shown in Figure 35.

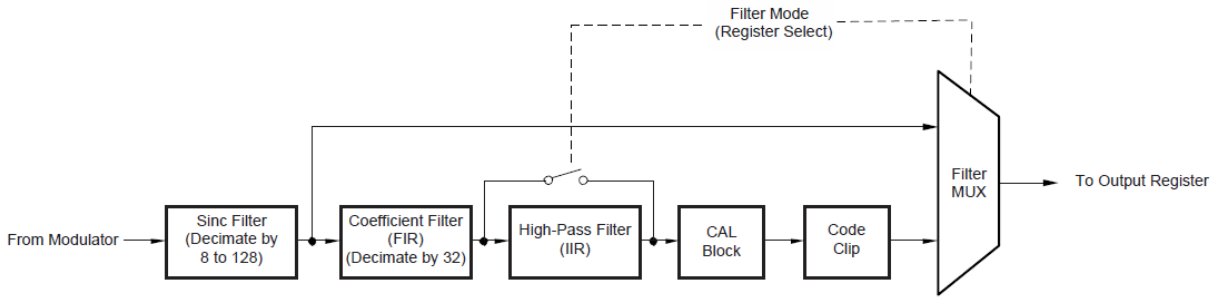


Figure 35. Digital Filter and Output Code Processing

ADS1283 High-Resolution, Analog-to-Digital Converter, TEXAS INSTRUMENTS DATA SHEET at 23 (August 2019) (emphasis added).

65. One or more of the Texas Instruments '166 Products comprise a selectable unit. Specifically, the Texas Instruments '166 Products select from "two coefficient sets." *Id*. at 15.

66. The Texas Instruments '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 Texas Instruments documentation shows an example of an implementation of the digital lowpass FIR filter.

The second stage of the ADS1283 digital filter is an FIR low-pass filter. Data are supplied to this stage from the sinc filter. The FIR stage is segmented into four substages, as shown in Figure 38.

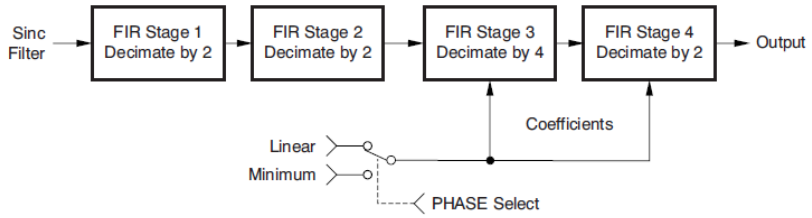


Figure 38. FIR Filter Substages

The first two substages are half-band filters with decimation ratios of two. The third substage decimates by four, and the fourth substage decimates by two. The overall decimation of the FIR stage is 32. Note that two coefficient sets are used for the third and fourth sections, depending on the phase selection. Table 8 lists the data rates and overall decimation ratio of the FIR stage. See Table 9 for the FIR filter coefficients.

ADS1283 High-Resolution, Analog-to-Digital Converter, TEXAS INSTRUMENTS DATA SHEET at 23 (August 2019) (emphasis added).

67. One or more of the Texas Instruments '166 Products include a set of memory banks. Specifically, the memory banks in the Texas Instruments '166 Products can be used to store the FIR filter coefficients in memory such as the PFIR_Ax and PRIF_Bx registries.

Table 8-7. PFIR Operating Modes (continued)

PFIR Mode	Center Tap Resolution	Center Tap LSB Weight	Non-Center Tap Resolution	Non-Center Tap LSB Weight	Filter Coefficients
Time Varying Filter	18 bits	2^{-16}	12 bits	2^{-10}, 2^{-11}...2^{-16}	9 per coefficient set, 2 coefficient sets

Programming information for the various PFIR modes is given in Table 8-8. The coefficients are programmed into the PFIR_Ax and PFIR_Bx registers.

Table 8-8. Programmable FIR Filter Mode Programming

PFIR Mode	PFIR_MODE	PFIR_SHARE	PFIR_MERGE
PFIR Disabled	0	X	X
Dual Channel Equalization	2	0	0
Single Channel Equalization	2	1	1
Time Varying Filter	2	0	1

ADC12DJ4000RF 8-GSPS Single-Channel or 4-GSPS Dual-Channel, 12-bit, RF-Sampling Analog-to-Digital Converter (ADC), TEXAS INSTRUMENTS DATA SHEET at 66 (May 2022) (emphasis added).

68. One or more of the Texas Instruments '166 Products include a set of multiply and accumulate (MAC) units. Specifically, the Texas Instruments '166 Products contain multiply and

accumulate units that enable the multiplying of a coefficient by a corresponding delayed data sample and accumulating the result.

69. One or more of the Texas Instruments '166 Products include a set of counter units. Specifically, the Texas Instruments '166 Products comprise multiple counter and timing units including the JESD_EN Register.

70. One or more of the Texas Instruments '166 Products comprise a pre-addition unit.

71. One or more of the Texas Instruments '166 Products include a multiplexer (MUX) unit.

Table 5. Multiplexer Modes

MUX[2:0]	SWITCHES	DESCRIPTION
000	S_1, S_5	AINP1 and AINN1 connected to preamplifier
001	S_2, S_6	AINP2 and AINN2 connected to preamplifier
010	S_3, S_4	Preamplifier inputs shorted together through 400-Ω internal resistors
011	S_1, S_5, S_2, S_6	AINP1, AINN1 and AINP2, AINN2 connected together and to the preamplifier
100	S_8, S_7	External short, preamplifier inputs shorted to AINN2 (common-mode test)

The typical value of multiplexer on-resistance is 30 Ω (each switch). When the multiplexer is used to drive an external load connected to one channel by a signal generator connected to the other channel, on-resistance and on-resistance variation can lead to measurement errors. Figure 34 shows THD versus load resistance and amplitude (PGA gain). In this configuration, THD performance improves when used with high-impedance loads and low amplitude drive signals. The data are measured with the circuit from Figure 35 with the channel connected to each other for measurement (MUX[2:0] = 011).

ADS1284 High-Resolution, Analog-to-Digital Converter, TEXAS INSTRUMENTS DATA SHEET at 19 (August 2019).

72. Texas Instruments 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 Texas Instruments '166 Products.

73. The Texas Instruments '166 Products are available to businesses and individuals throughout the United States.

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

75. 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 Texas Instruments '166 Products, Texas Instruments 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).

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

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

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

C. A judgment and order finding that Texas Instrument'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 Texas Instruments.

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 21, 2022

Respectfully submitted,

/s/ Daniel P. Hipskind

Dorian S. Berger (CA SB No. 264424)
Daniel P. Hipskind (CA SB No. 266763)
Erin E. McCracken (CA SB No. 244523)
BERGER & HIPSKIND LLP
9538 Brighton Way, Ste. 320
Beverly Hills, CA 90210
Telephone: 323-886-3430
Facsimile: 323-978-5508
E-mail: dsb@bergerhipskind.com
E-mail: dph@bergerhipskind.com
E-mail: eem@bergerhipskind.com

Elizabeth L. DeRieux
State Bar No. 05770585
Capshaw DeRieux, LLP
114 E. Commerce Ave.
Gladewater, TX 75647
Telephone: 903-845-5770
E-mail: ederieux@capshawlaw.com

Attorneys for MIMO Research, LLC