IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF GEORGIA
ATLANTA DIVISION

GEORGIA TECH RESEARCH CORPORATION, Plaintiff, v. MURATA ELECTRONICS NORTH AMERICA, INC., and MURATA MANUFACTURING CO., LTD., Defendants.	Case No. _____ **COMPLAINT FOR PATENT INFRINGEMENT AND DEMAND FOR JURY TRIAL**

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Georgia Tech Research Corporation ("GTRC") brings this action against Defendants Murata Electronics North America, Inc. and Murata Manufacturing Co., Ltd. (collectively, "Murata" or "Defendants") and hereby alleges as follows:

THE PARTIES

1. GTRC is a corporation organized and existing under the laws of Georgia and having a place of business at 926 Dalney Street, NW, Atlanta, Georgia 30332-0415.

2. GTRC is a 501(c)(3) company and an affiliated organization of the Georgia Institute of Technology ("Georgia Tech"), that supports academic and other units, including the six colleges of Georgia Tech.

3. GTRC is the contracting entity for all sponsored activities for these colleges and other units at Georgia Tech that are not part of the Georgia Tech Research Institute.

4. GTRC promotes research through stewardship of funds for sponsored research and financial support of research activities, and GTRC is the assignee of intellectual property created at Georgia Tech.

5. GTRC does not itself commercialize intellectual property, but is responsible for maintaining, licensing, and enforcing, as may be applicable, such intellectual property.

6. GTRC is the owner of a family of patents relating to integrated devices using multi-layer organic laminates (the "GTRC Multi-Layer Organic Patents"), including U.S. Patent No. 7,489,914 ("the '914 Patent"), entitled "Multi-Band RF Transceiver with Passive Reuse in Organic Substrates," a copy of which is attached hereto as **Exhibit 1**.

7. Upon information and belief, Murata Electronics North America, Inc. ("Murata Electronics") is a limited liability corporation, incorporated in Texas,

with a principal place of business located at 3330 Cumberland Blvd SE, Suite 700, Atlanta, Georgia 30339.

8. Murata Electronics may be served with process by serving its registered agent, Corporation Service Company, 40 Technology Parkway South #300, Norcross, Georgia 30092.

9. Murata Electronics is a wholly owned subsidiary of Murata Manufacturing Co., Ltd. ("Murata Manufacturing"), a corporation organized and existing under the laws of Japan with its principal place of business at 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan.

10. In addition to Murata Electronics, on information and belief, Murata Manufacturing also operates a radio frequency research and development facility at 3079 Premier Parkway, Suite 140, Duluth, Georgia, which is known as the Murata Americas RF Product Department.

11. Murata has expressed its desire of "[b]ecoming the Global No. 1 Component & Module Supplier while continuing to cement [itself as an] Innovator in Electronics position within the industry." Murata 2023 Value Report, p. 7 (**Exhibit 2**), *available at* https://corporate.murata.com/-/media/corporate/ir/library/murata-value-report/2023_e/murata-value-report2023-a4-e.ashx?la=en-us&cvid=20231214070005000000 (last visited Nov. 15, 2024) (quoting President of Murata Manufacturing, Norio Nakajima).

12. On information and belief, Murata Electronics is "the organization responsible for the regional management of the Murata companies located in North and South America." Murata Electronics Overview (**Exhibit 11**), *available at* https://corporate.murata.com/en-us/company/muratalocations/affiliated_usa/murataelectronics-northamerica (last visited Nov. 15, 2024). In this capacity, Murata Electronics "serve[s] as the regional and functional headquarters supporting [its] customers' engineering and procurement activities throughout the Americas. *Id.*

13. On information and belief, Murata Electronics utilizes a network of Technical Sales Managers, Sales Representatives, and Authorized Distributors across the United States to service its customers' requirements for sales and technical support, design expertise, logistics and supply chain initiatives.

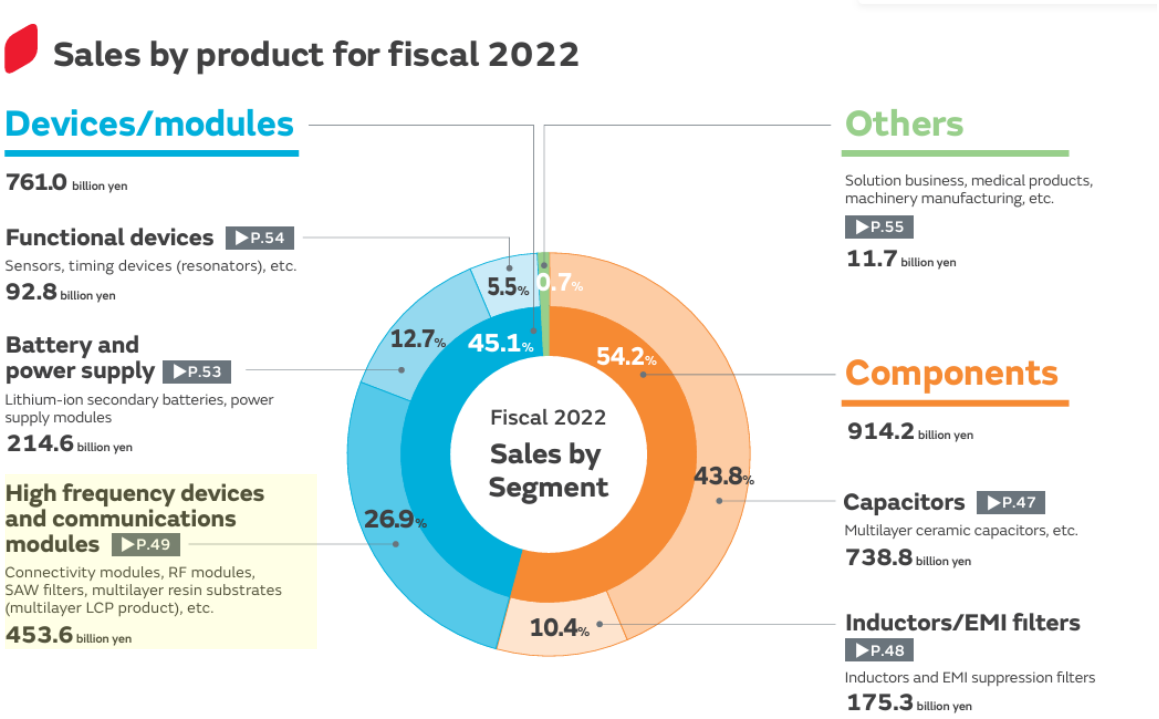
14. Murata has made, used, sold and offered for sale and makes, uses, sells, and offers for sale in the United States multi-band antenna modules utilizing multi-layer organic substrates for use in routers, personal computers, smartphones, IoT devices, automobiles, and other products, including without limitation radio frequency devices and modules offered and sold in the United States under Murata's MetroCirc™ or "multi-layer LCP" brands ("the Accused Products").

15. Accordingly, Murata is doing business in the United States and, more particularly, in the Northern District of Georgia by designing, marketing, making,

using, selling, importing, and/or offering for sale multi-band, multi-layer organic products that that are at issue in this action or by transacting other business in this District.

16. On information and belief, sales of Murata's organic substrate products, including multi-band antenna modules with multi-layer liquid crystal polymer ("LCP") substrates, drive a significant amount of Murata's total sales.

17. For example, in fiscal year 2022, sales of Murata's "multilayer LCP products" totaled 26.9% of Murata's total sales (approximately $3.1 billion USD):



Murata 2023 Value Report (**Exhibit 2**) at p. 17.

JURISDICTION AND VENUE

18. This action arises under the Patent Laws of the United States, 35 U.S.C. § 1, et seq. This Court has subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

19. This Court has personal jurisdiction over Murata Electronics because it directly committed one or more acts within the state of Georgia giving rise to this action. Specifically, Murata Electronics committed acts of patent infringement in this District by, among other things, having made, used, offered for sale, sold, and imported the Accused Products. Further, Murata Electronics has its principal corporate office and principal place of business at 3330 Cumberland Blvd., SE, Suite 700, Atlanta, GA 30339. Thus, this Court has both general and specific personal jurisdiction over Murata Electronics.

20. This Court also has personal jurisdiction over Murata Manufacturing. Murata Manufacturing has conducted and does conduct business within the State of Georgia, including through Murata Electronics and Murata Americas RF Product Department. Murata, directly or through its subsidiaries or intermediaries (including distributors, retailers, and others), ships, distributes, makes, uses, offers for sale, sells, imports, and/or advertises its products and/or services in the United States and the Northern District of Georgia and/or contributes to and actively induces its customers to ship, distribute, make, use, offer for sale, sell, import,

and/or advertise infringing products and/or services in the United States and the Northern District of Georgia.

21. Murata Manufacturing, directly and through Murata Electronics, Murata Americas RF Product Department, and/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 Northern District of Georgia. 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 Northern District of Georgia. Murata Manufacturing has thus committed acts of patent infringement within the Northern District of Georgia.

22. Murata Manufacturing uses its subsidiary Murata Electronics, with its principal place of business in this District, as its "regional and functional headquarters" for regional management of all Murata companies in North and South America. Murata Manufacturing services its customers' requirements for sales and technical support, design expertise, logistics, and supply chain from its subsidiary's headquarters in this district.

23. As outlined herein, Murata Manufacturing further entered into discussions regarding a potential license of the '914 Patent in this District.

24. Murata Manufacturing accordingly 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. The Court has both general and specific personal jurisdiction over Murata Manufacturing.

25. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391(b), 1391(c), 1391(d), and 1400(b). Murata Electronics has its principal place of business in this District, located at 3330 Cumberland Blvd., SE, Suite 700, Atlanta, GA 30339. Murata Manufacturing maintains a wholly owned subsidiary (Murata Electronics) and regular place of business in the Northern District of Georgia; has transacted business in the Northern District of Georgia, including through Murata Electronics and Murata Americas RF Product Department; has undertaken efforts to negotiate a potential license of the '914 Patent in this District; and has committed acts of direct and indirect infringement in the Northern District of Georgia.

FACTS COMMON TO ALL COUNTS

The '914 Patent

26. On February 10, 2009, the '914 Patent was duly and legally issued by the United States Patent and Trademark Office to inventors Vinu Govind, Sidharth Dalmia, Amit Bavisi, Vekatesh Sundraram, Madhavan Swaminathan, and George White (collectively "the '914 inventors").

27. The ’914 Patent is presumed valid and enforceable pursuant to 35 U.S.C. § 282.

28. The application leading to the ’914 Patent, United States Patent Application No. 11/114,733, was filed on April 25, 2005, and claims priority to United States Patent No. 6,900,708, filed March 28, 2003, and United States Provisional Application No. 60/565,254, filed April 23, 2004. The ’914 Patent expired on July 27, 2024.

29. The ’914 Patent was assigned by the ’914 inventors to GTRC on July 20, 2005, and all rights in the ’914 Patent are vested solely with GTRC. Any prior licenses to the ’914 Patent were terminated by at least March 2013. Accordingly, there are no licensees of the ‘914 Patent at present, nor have there been any licensees of the ’914 Patent since at least March 2013.

30. The ’914 Patent discloses multi-band integrated devices utilizing multi-layer organic structure, wherein such organic structure may be, but is not limited to, liquid crystal polymer (“LCP”). *See, e.g.,* ’914 Patent at 1:25-31.

31. The ‘914 Patent is well-known within the industry as demonstrated by multiple citations to the ‘914 Patent in published patents and patent applications assigned to technology companies and academic institutions around the world.

32. The ’914 Patent describes various embodiments of multi-band devices with multi-layer organic substrates comprising both passive and active components.

33. Passive devices are components such as resistors, inductors, and capacitors that may be formed of a single unitary metal layer.

34. The exemplary embodiments disclosed therein include “multi-band, multimode integrated RF transceiver topologies, comprised of on-chip actives and in-package embedded high-Q passives in organic substrates….” ‘’914 Patent at 2:8-11.

35. Prior to the ’914 Patent, multi-band RF devices utilized inorganic substrates, such as Low Temperature Co-Fired Ceramics (LTCC).

36. The ’914 Patent teaches that the exemplary embodiments disclosed therein are particularly adapted for and advantageous for radio frequency (RF) devices because the materials and design of the multi-band devices allow for low noise and miniaturization of antenna modules. 914 Patent at 25:1-3 (“[T]he devices can be designed such that they are optimized for high performance or for small size.”).

37. For example, in certain embodiments, “high-performance [low-noise amplifiers (“LNAs”)] with low noise figures (NF) and VCOs with low phase noise

may be formed from high-Q passive components embedded in organic substrates such as LCP (liquid crystalline polymer).” ’914 Patent at 2:16-20.

38. “In a simplified form, the LNA includes an active device with passive matching networks at its input and output” that “provide[s] impedance transformation for minimum NF at the input and maximum power gain at the output.” 914 Patent at 24:10-14.

39. Such applications provide a “low noise amplifier (LNA) for an RF application, including reasonable gain, a good input impedance match, high linearity, and the lowest possible noise figure (NF).” 914 Patent at 23:60-64. This is because “[t]he use of high-Q embedded passives in organic substrates for implementing these matching networks results in lower NF and higher gain for the LNAs.” 914 Patent at 24:14-16.

40. The ’914 Patent further notes that “[t]he metal layers on each surface of the LCP may contain inductors and parallel plate capacitors,” (’914 Patent at 25:7-9) and that the “inductors are preferably formed on the LCP layers and the capacitors are formed on either the LCP layer or the Laminate layers” (’914 Patent at 25:12-15).

41. Various figures accompany the disclosure of exemplary RF applications utilizing the multi-layer organic substrate inventive technology.

42. For example, Figure 14 illustrates an exemplary embodiment for a multi-band RF device that includes two embedded matching networks in an LCP substrate. As disclosed, "FIG. 14 illustrates an exemplary multi-band receiver portion of a transceiver that uses multiple single-band paths, each of which may be selectable using switches." '914 Patent at 16:53-58.

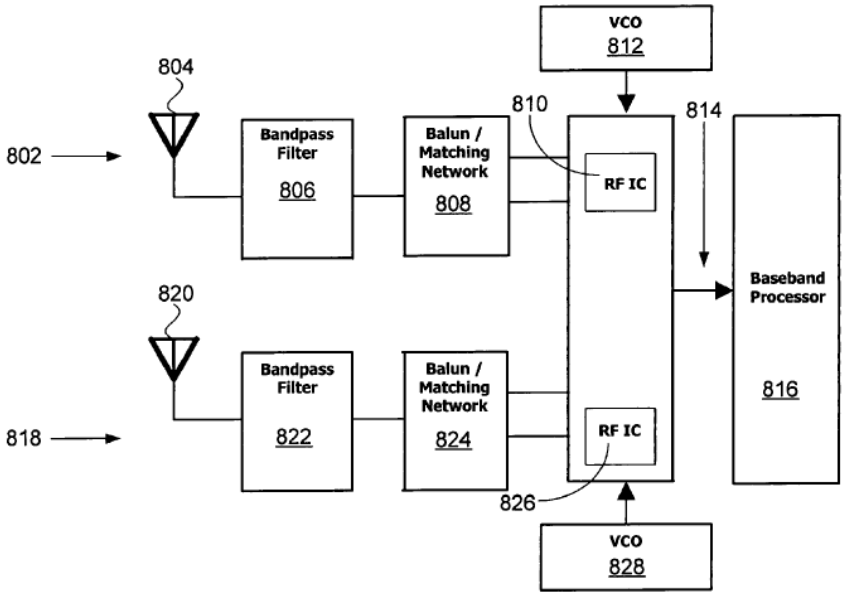


FIG. 14

43. "[T]wo parallel paths 802 and 818 are provided for multi-band receiver in which each path operates in a different frequency range (or band)," and where each path may include, for example, an antenna for receiving specific

signals in a range, a matching network, and an RF integrated circuit. '914 Patent at 16:56-66.[1]

44. In another exemplary embodiment, "Figure 35 illustrates an LNA circuit with an active device … and [] matching networks that will be embedded in an organic substrate." '914 Patent at 24:20-25.

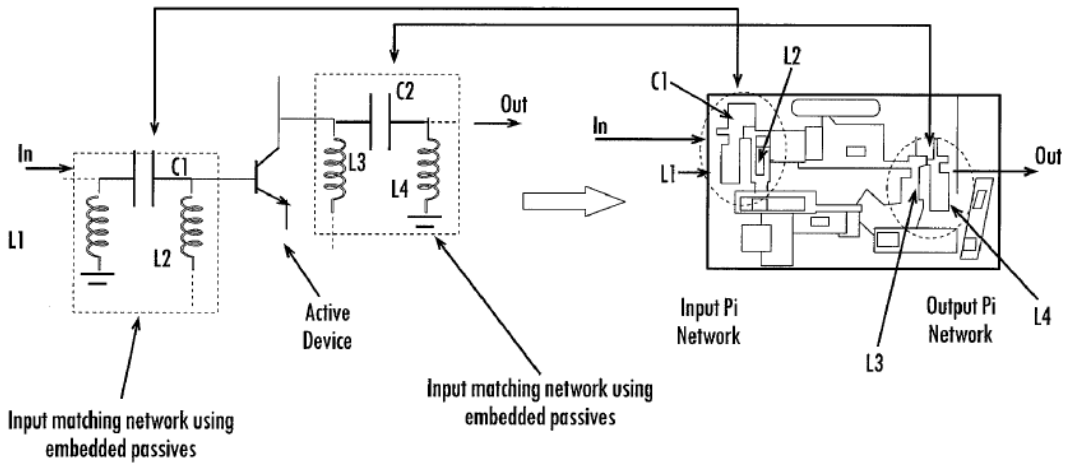


Fig. 35

45. The embedded passive networks are disclosed as including inductors and a capacitor and are connected to the outputs and/or inputs of an input device to send/receive multiple frequencies as a transceiver module. As noted, "inductors or transmission lines or a combination of capacitor(s), inductor(s) and transmission line(s) can be utilized, as desired." '914 Patent at 7:31-41.

[1] The exemplary embodiments disclosed in the '914 Patent are "exemplary in nature only" and "many variations would be known to one of ordinary skill in the art." '914 Patent at 17:36-39.

46. The ’914 Patent further discloses that a high-Q substrate is desirable “to obtain near minimum phase noise performance,” thus “the use of organic substrates such as LCP … may be used since [it] may provide Qs of over 100 for capacitors.” 914 Patent at 18:53-55.

47. Further, “in order to make the designs more compact,” the ’914 Patent notes that “metal layers may be formed on either side of an LCP substrate with embedded passives,” such as shown in FIG. 16B.[2] ’914 Patent at 18:57-61 and 19:18-20.

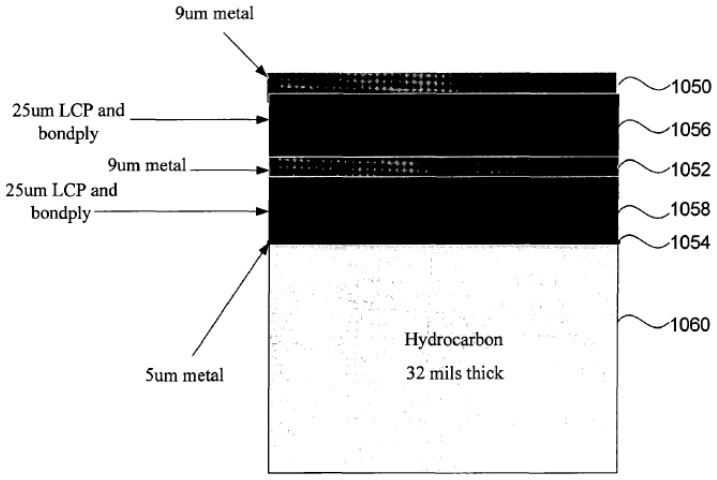


FIG. 16B

[2] The ’914 Patent provides this description with reference to FIG. 16B. The patent makes clear that “the cross-section in FIG. 16B is for illustrate purposes only” and that “the numbers of metal layers and organic layers may change depending on the number of components to be included and the specification of the components.” ’914 Patent at 18:65—19:5.

48. The ’914 Patent further highlights that “Low Form Factor Modules” are possible using exemplary embodiments of multi-layer organic substrate as outlined in the specification. The ’914 Patent notes the desirability of low form factor RF modules, disclosing:

> With the drive towards embedding wireless functionality in consumer devices (flat-panel displays, PDAs, etc.), implementation of the above multi-band multi-mode RF transceivers in low-profile ultra thin modules may also be desirable. According to an embodiment of the present invention, the topology and circuits discussed previously may be implemented in low-profile modules (e.g., a maximum thickness of 1.1 mm).”

914 Patent at 24:38-46.

49. To this end, the ’914 Patent discloses “three embodiments of low form factor modules according to embodiments of the present invention,” wherein the substrate “consists of multilayer stickups, including Hydrocarbons like Rogers 4340B, single or multiple layers of LCP, single or multiple layers of high-K materials or any combination of the above.” ’914 Patent at 24:49-53.

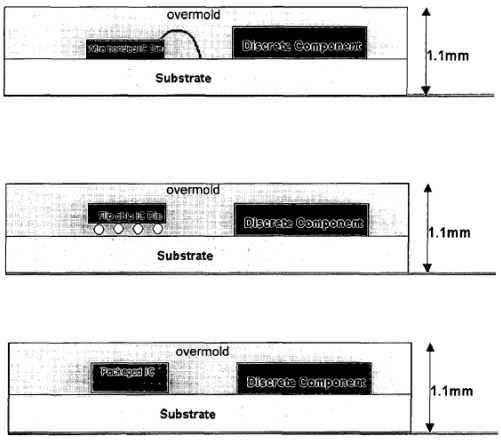


FIG. 37

50. The disclosure further sets forth that "[s]everal different types of ICs may be supported by the substrate" and "an even smaller version of the low form factor may be obtained by embedding the IC and the discrete components within the substrate." '914 Patent at 24:53-62.

51. The '914 Patent further discloses various non-limiting exemplary embodiments of substrate stack-ups utilizing the inventive embedded passives and LCP substrate, noting that "[t]he metal layers on each surface of the LCP layer may contain inductors and parallel plate capacitors," and highlighting various multi-layer LCP substrates that could be possible, including "an extremely thin stackup" of "three LCP layers," while noting that "[o]ne of ordinary skill would recognize that the stackup in FIG. 38D is not limited to 3 LCP layers but could contain additional layers." '914 Patent at 25:29-41.

52. Accordingly, the embodiments of the '914 Patent provide novel and non-obvious approaches to designing radio frequency devices and modules using embedded passives in multi-layer LCP substrates that provide superior form factors, noise suppression, and less power consumption than conventional technologies.

53. Murata likewise acknowledges such benefits of multi-layer LCP substrates, stating that multilayer LCP products "enable[] miniaturization and high

performance as well as ensure reliability." Murata 2023 Value Report (Exhibit 2) at p. 52.

54. Similarly, Murata has noted that "Multilayer LCP Product[s] … [contribute] to smaller, thinner, and higher performance devices with low energy consumption." Murata High Frequency Devices (**Exhibit 3**), p. 5, *available at* https://corporate.murata.com/en-us/company/business/highfrequencydevicesandcommunicationsmodules (last visited Nov. 15, 2024).

Murata's Knowledge of the '914 Patented Technology

55. In 2004, GTRC licensed the GTRC Multi-Layer Organic Patents—including the pending patent application that would later become the '914 Patent—to Jacket Micro Devices (JMD), an entity formed by former faculty and research members of Georgia Tech, including inventors of the '914 Patent.

56. At its inception, George White, Ph.D., an esteemed former research faculty member at Georgia Tech and named inventor of the '914 Patent, became President of JMD. Likewise, other named inventors assisted in the formation of JMD, the purpose of which was to commercialize technology relating to the GTRC Multi-Layer Organic Patents as a start-up supported by Georgia Tech.

57. Accordingly, from 2005 to 2009, JMD sought to and was indeed successful in commercializing certain intellectual property subject to the GTRC

Multi-Layer Organic Patents. However, as noted below, JMD did not commercialize the inventions covered by the ’914 Patent.

58. On November 10, 2005, the pending application leading to the ’914 Patent was published as U.S. Patent Publication No. US 2005/0248418 A1 (“the ’418 Publication”).

59. Shortly following this publication, JMD entertained inquiries from Murata relating to the GTRC Multi-Layer Organic Patents, including inquiries about joint development of multi-layer LCP substrate RF devices as described and claimed in the ’418 Publication.

60. Specifically, in 2006, Murata engaged with JMD to discuss a possible business collaboration to manufacture and sell multi-band radio frequency devices comprised of multi-layer LCP substrates as disclosed in the ’418 Publication.

61. On information and belief, the first inquiry from Murata occurred in approximately June 2006, when Murata Manufacturing’s President, Tsuneo Murata, and an Executive Vice President of Module Development, Hiroki Mandai, visited JMD in Atlanta and entered into an NDA to assess JMD’s intellectual property and JMD’s proposed organic-based products on a confidential basis.

62. At this time in June 2006, on information and belief, Murata had neither designed nor manufactured products using multi-layer organic substrates.

Instead, Murata's sales relating to substrate technology as of June 2006 were centered on LTCC modules and components for electronic devices.

63. Accordingly, at the meeting in Atlanta in June of 2006, Dr. White and others from JMD explained to Murata's President and EVP of Module Development the benefits of organic-based substrates for high-frequency communication devices, the inventive technologies' low noise profiles, and the desirability of adopting the technology to support future low form-factor, high-Q mobile applications—discussion points supported by the invention disclosure of the '418 Publication that later became the '914 Patent.

64. To support Murata's review and analysis of the new LCP technology, JMD supplied Murata with prototype passive components comprising LCP as a substrate.

65. Based on Murata's apparent interest in the LCP technology, in August 2006, Dr. White and others representing JMD visited Murata Manufacturing's LTCC factory in Fukui, as well as the Murata headquarters in Kyoto, Japan, to discuss potential mutual product interests based on the intellectual property licensed to JMD from GTRC.

66. During discussions at Murata's headquarters, Dr. White and various members of the Murata Manufacturing team, including Tsuneo Murata (then President), Hiroshi Iwatsubo (then GM Corporation Planning), and Satoshi Ishino

(then GM Product Promotion) discussed a potential collaboration surrounding the manufacture and sale of multi-layer organic substrate products, a potential license of GTRC's patents covering the inventive organic substrate technology, and the prototype LCP-based substrate components provided to Murata for assessment.

67. Murata continued to express an interest in partnering with JMD to commercialize the GTRC Multi-Layer Organic Patents, including the multi-layer LCP substrate inventions, throughout the remainder of 2006.

68. In January 2007, Dr. White and others from JMD, including another inventor of the '914 Patent technology, Sidharth Dalmia, Ph.D., met Norio Sakai (then General Manager, Production Engineering Department of Murata Manufacturing) and other individuals from the Murata Manufacturing engineering team at Murata's Yasu Research and Development center in Japan.

69. At this meeting, the companies again discussed details relating to multi-layer organic substrate design, fabrication of circuits embedded in LCP substrate, and GTRC Multi-Layer Organic Patents licensed by JMD from GTRC, including the inventions disclosed in the '418 Publication.

70. And during this meeting, Murata again expressed an interest in the opportunity to work with JMD to commercialize multi-layer LCP substrates for very thin applications, proposing to commercialize the very innovations covered by the '914 Patent disclosure. JMD was open to exploring such commercialization,

subject to defining partnership terms, including royalty terms for sub-licensing the patented and patent-pending technology to Murata.

71. Accordingly, in April 2007, Hiroshi Iwatsubo (then GM Corporation Planning of Murata Manufacturing) visited JMD in Atlanta to further discuss a collaboration between the parties to commercialize the GTRC Multi-Layer Organic Patents licensed by JMD from GTRC. During this meeting, Murata provided a presentation of its company and JMD entertained questions again around its licensed intellectual property, including the inventions of the ’914 Patent, and sought to further reach a mutual agreement as to possible commercialization of multi-layer LCP substrate products.

72. Murata reiterated its interest at this time in manufacturing and selling radio frequency products that incorporated thin LCP substrates as disclosed by the ’418 Publication as part of the proposed commercial arrangement.

73. In May of 2007, Murata provided a framework for proceeding forward with JMD whereby Murata would co-develop multi-layer LCP products based on the issued and pending GTRC Multi-Layer Organic Patents licensed to JMD by GTRC. Further, the proposal provided that JMD would design initial radio frequency modules product for Murata based on Murata’s customer specifications, and in turn, Murata would make certain capital payments for building the products

and would also provide JMD an on-going royalty for production volume of LCP products falling within the GTRC Multi-Layer Organic Patents.

74. As such, JMD would contribute process development experience and intellectual property to the proposed joint endeavor in exchange for an ongoing royalty on products manufactured and sold by Murata using the technology, including the ’914 Patent inventions.

75. In July of 2007, Dr. White and others conducted a teleconference at Murata’s request to further discuss the organic substrate technology and intellectual property in order to prepare Murata executives for meetings with Murata senior management regarding the proposed commercial relationship. Murata expressed optimism at this time that the parties would indeed work together relating to radio devices incorporating multi-layer LCP substrate technology.

76. This proposed business arrangement between JMD and Murata, however, never materialized. Following its senior management meetings in late 2007, Murata informed JMD—without explanation—that Murata had elected not to proceed forward with entering into a relationship with JMD to commercialize the multi-layer substrate technology protected by the ’914 Patent.

77. Despite this, Murata continued to communicate with JMD and assess potential JMD products through 2008.

78. Following the termination of the potential commercial relationship with Murata, JMD sought other avenues for capitalizing the business, but did not have an opportunity to commercialize the multi-band radio frequency devices covered by the ’914 patent.

79. JMD effectively ceased its commercial operations by the end of 2008, and no products relating to any GTRC Multi-Layer Organic Patents were manufactured or sold by JMD in 2009 or thereafter.

80. As such, no commercial products embodying the ’914 Patent have ever been sold by GTRC or any licensee of the ’914 Patent technology.

81. Further, because no products embodying the ’914 Patent have ever been sold by a licensee of the ’914 Patent since the ’914 Patent issued in February 2009, no such products have existed that would be subject to the marking provisions of 35 U.S.C. § 287.

With Full Knowledge of the Inventions of the ’914 Patent, Murata Begins Making and Selling Multi-Band, Multi-Layer LCP Products

82. On information and belief, Murata continued to take steps to commercialize multi-layer LCP products following its termination of discussions with JMD in 2008.

83. Indeed, on information and belief, from 2009 until at least 2016, Murata continued to monitor market conditions for LCP-based products and

formulated strategies for manufacturing and selling electronic multi-layer LCP modules and components in the RF market.

84. Because of its continued interest in multi-layer LCP products, Murata acquired an LCP manufacturer, Primatec, in late 2016. Murata Manufacturing Acquires Primatec (**Exhibit 4**), *available at* https://siliconsemiconductor.net/article/100579/Murata_Manufacturing_acquires_Primatec_ (last visited Nov. 15, 2024).

85. Primatec was dedicated to developing, manufacturing, and selling various products founded upon highly functional polymer products such as LCP (liquid crystal polymer) electronic materials, [] in particular for the energy and display sectors." Murata Manufacturing Acquires Primatec (**Exhibit 4**).

86. In November 2016, Primatec became a wholly owned subsidiary of Murata. Murata Manufacturing Acquires Primatec (**Exhibit 4**).

87. Publications reported the following as Murata's reasons for the Primatec acquisition:

> "Murata will utilize the materials technology of Primatec to expand sales of MetroCirc (a multilayered resin substrate) used in smartphones, etc., and additionally develop new advanced products that lead the global market in new applications for IoT devices and data centers. This acquisition is part of Murata's strategy to continue to strengthen and expand its businesses in all Electronic markets."

Murata Manufacturing Acquires Primatec (**Exhibit 4**).

88. Thus, on information and belief, Murata acquired Primatec in order to produce multi-layer LCP products and modules under Murata's MetroCirc™ brand. Murata Expands Into Emerging Markets (**Exhibit 5**), *available at* https://www.newelectronics.co.uk/content/interviews/murata-looks-for-opportunities-in-emerging-markets/ (last visited Nov. 15, 2024).

89. On information and belief, the addition of multi-layer LCP substrate products to Murata's product portfolio was also important to Murata given the proliferation of high-frequency (5G) radio signals in electronic devices such as mobile phones. Murata Expands Into Emerging Markets (**Exhibit 5**).

90. As Murata's Executive Vice President of Global Sales and Marketing Unit, Satoshi Sonoda, remarked after the acquisition of Primatec: "While we believe the number of smartphones will not grow as quickly as in the past, the electronics content – particularly the RF element – will increase" and that "[w]e expect LTE and 5G to be a fundamental driver of the business." Murata Expands Into Emerging Markets (**Exhibit 5**).

91. On information and belief, multi-layer LCP substrate products were and continue to be a "fundamental driver" of Murata's business.

92. Indeed, Murata extolls the superior qualities of LCP over other substrates as it relates to mmWave products, noting that multi-layer LCP exhibits

"[s]uperiority in low transmission loss properties in the high-frequency band." Murata High Frequency Devices (**Exhibit 3**).

93. Accordingly, on information and belief, Murata's acquisition of Primatec in 2016 was driven by its desire to gain the benefits of the advantages of LCP substrate for high-frequency devices and modern electronics—information that Murata became aware of through its dealings with JMD and, in particular, its knowledge of the '914 Patent.

Murata Manufactures, Offers for Sale, Sells, and/or Imports Multi-Band Antenna Modules Utilizing Multi-Layer Organic Substrates

94. On information and belief, in 2017, shortly after its acquisition of Primatec, Murata first began offering and selling multi-band antenna products utilizing LCP as a substrate. Murata Manufacturing Acquires Primatec (**Exhibit 4**).

95. In 2017, Murata advertised its MetroCirc™ product as a "a new multilayer resin substrate that combines Murata's monolithic, multilayer and design technologies with the high-performance resin materials of Ise Murata Manufacturing Co., Ltd. (formerly Primatec Inc.), a company newly added to the Murata Group." 2017 Murata Company Report (**Exhibit 6**), p. 22, *available at* https://corporate.murata.com/-/media/corporate/about/company/report/2017/muratareport.ashx?la=en-us&cvid=20170822040000000000 (last visited Nov. 15, 2024).

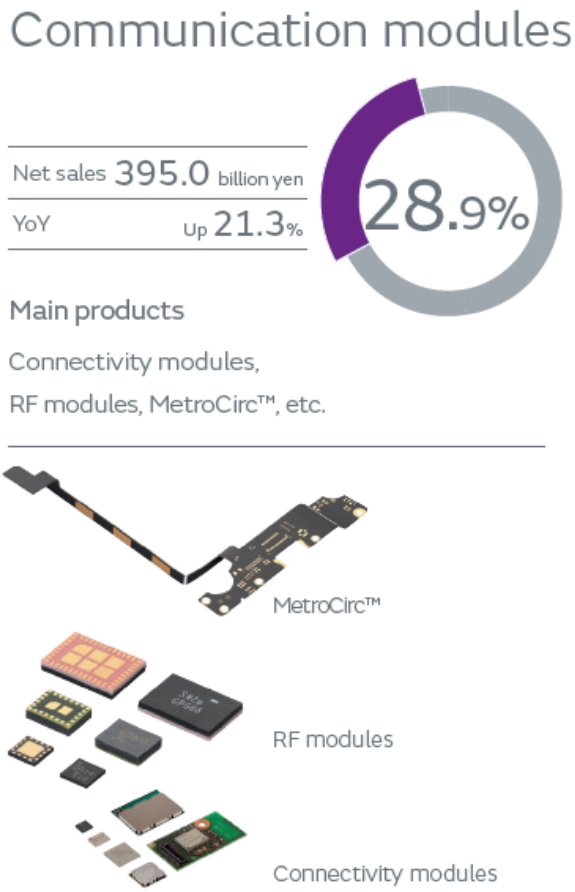
96. Murata described MetroCirc™ as "a multilayer resin substrate comprising resin sheets using LCP film and copper foil sheets stacked in many layers employing Murata's multilayer technology" that "can be used for RF and digital signal transmission wires, antennas, and much more, enabling the development of components of any shape with exceptional RF characteristics." 2018 Murata Market Value Report (**Exhibit 7**), p. 23, *available at* https://corporate.murata.com/-/media/corporate/about/company/report/2018/murata-value-report-2018.ashx?la=en&cvid=20190111100623146500 (last visited Nov. 15, 2024); 2017 Murata Company Report (**Exhibit 6**), p. 8.

97. At that time, Murata asserted that the "concept, implementation, and production" of MetroCirc™ were "cutting-edge." 2017 Murata Company Report (**Exhibit 6**), p. 22.

98. Murata further noted that the use of LCP in its MetroCirc™ products would allow for passive devices to be integrated "into the substrate," allowing it to act as a functional module (*e.g.*, antenna-in-package (AiP) modules). Murata Expands Into Emerging Markets (**Exhibit 5**).

99. In 2018, following the introduction of MetroCirc™, Murata reported a 21.3% year-over-year increase in its "communication modules," which on

information and belief was due to multi-layer LCP substrate (MetroCirc™) product sales.



2018 Murata Market Value Report (**Exhibit 7**), p. 22.

100. Indeed, Murata noted that "[s]ales in multilayer resin substrates also achieved substantial growth as an increasing number were used in high-end smartphones" contributing to sales that were "up 21.3% year-on-year." 2018 Murata Market Value Report (**Exhibit 7**), p. 22.

101. Accordingly, on information and belief, Murata has sold and offered for sale since 2017 a family of multi-band, multi-layer devices utilizing organic

substrate referred to by Murata as "multi-layer LCP products" or MetroCirc™ products.

102. All Murata multi-band RF devices and antenna modules that comprise multi-layer LCP substrates, including those devices branded by Murata under the MetroCirc™ brand, are included herein as the "Accused Products."

103. The Accused Products sold by Murata since 2017 also include antenna-in-package (AiP) modules.

104. As noted by Murata, by utilizing multi-layer LCP, "you can manufacture not only a substrate, but also transmission lines and other components for smart phones and tablet devices, *as well as composite components that combine antennas and matching circuits with Multi-layer LCP product*." Murata Multi-Layer LCP Products (**Exhibit 8**) (emphasis added), *available at* https://www.murata.com/en-us/products/pcb/metrocirc (last visited Nov. 15, 2024).

105. Thus, multi-layer technology can be implemented "[t]hrough various circuit designs" and "function not only as a substrate but also as a transmission wire component, or have integrated coil functionality." 2018 Murata Market Value Report (**Exhibit 7**), p. 23.

106. Along these lines, in 2021, Murata submitted a white paper to an IEEE Symposium outlining use of its multi-layer LCP products in antenna in module ("AiM")—also referred to as "AiP"—devices. Murata IEEE MetroCirc

White Paper (**Exhibit 9**), p. 155, *available at* https://ieeexplore.ieee.org/document/9648902 (last visited Nov. 15, 2024).

107. One figure from this white paper showed Murata's "use case" for multi-layer LCP substrate incorporation in Murata's AiM products modules, noting the use of LCP in antenna modules and for signal transmission to/from the "RF front end":

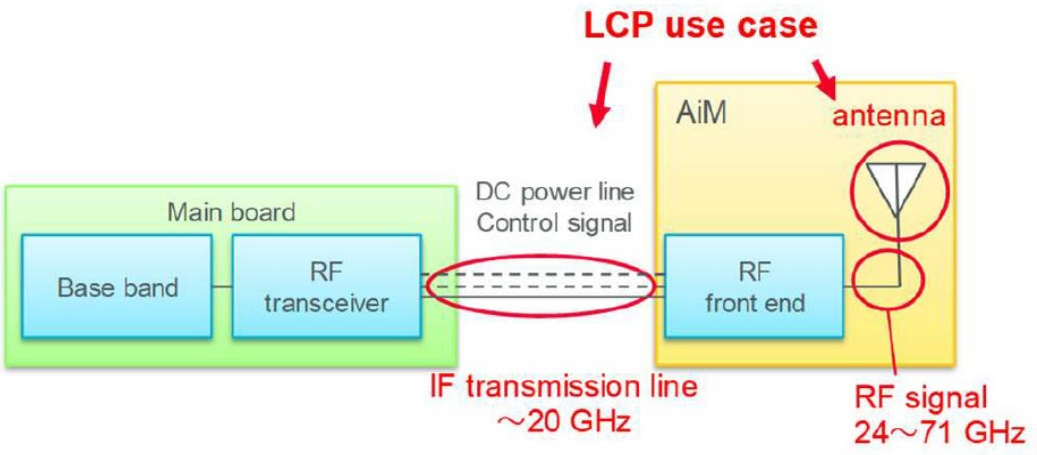
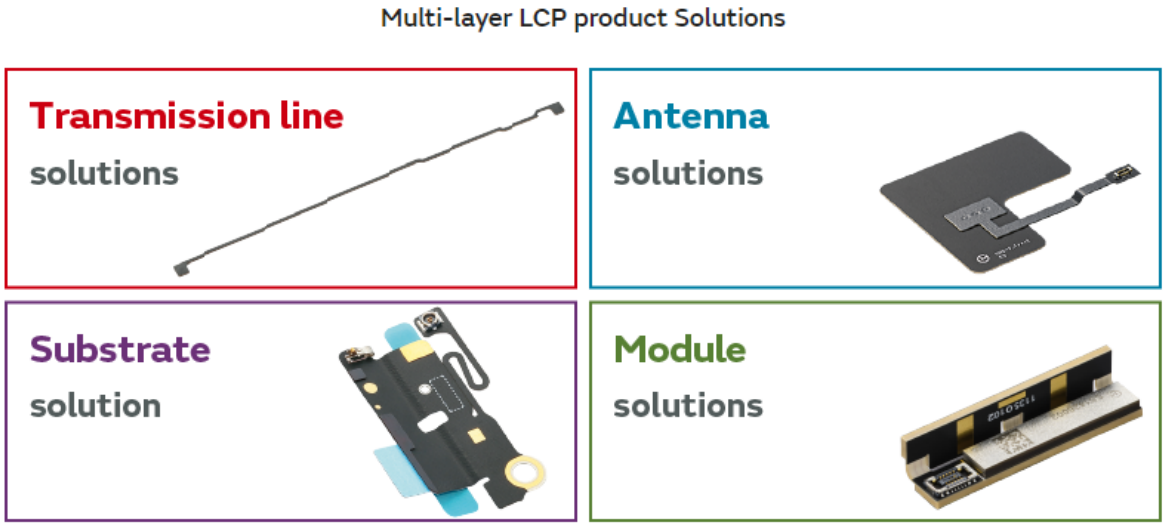


Fig. 5. Use case of LCP in 5G millimeter wave circuit.

Murata IEEE MetroCirc White Paper (**Exhibit 9**), p. 155.

108. And in this same white paper, the author noted that Murata was using multi-layer LCP substrates (MetroCirc™) "in many RF application, *e.g.*, RF transmission lines, Wi-Fi antenna or antenna integrated modules (AiMs)." Murata IEEE MetroCirc White Paper (**Exhibit 9**), p. 155.

109. Murata's current website advertises multi-layer modules and components utilizing multi-layer LCP substrates in at least four product lines:



Murata Multi-Layer LCP Products (**Exhibit 8**).

110. On information and belief, at least two of these four product solutions—specifically Murata's connectivity modules and RF modules—incorporate multi-layer LCP substrates that practice claims of the '914 Patent.

111. For example, Murata's "RF modules are electronic component units that realize an analogue high-frequency circuit that controls communications among wireless devices by integrating various key devices in a small package. This module is comprised of passive devices such as SAW filters, high power amplifiers (PA) in transmission circuits, low-noise amplifiers (LNA) in reception circuits, antenna changeover switches and other semiconductor devices. RF modules are used for various types of wireless devices including smartphones and tablet PCs." Murata 2023 Value Report (**Exhibit 2**), p. 50.

112. Accordingly, GTRC contends that "RF modules" manufactured and sold by Murata to customers in the United States that encompass multi-band RF modules utilizing LCP substrates are considered to be included in the Accused Products previously outlined herein.

113. In addition to "RF modules," Murata also advertises "connectivity modules" that are designed for high frequency devices and communication modules. Murata describes these connectivity modules as "essential compound components that wirelessly connect various devices" and which are "mounted on familiar home appliances used in our daily lives, such as smartphones, tablet PCS, digital cameras and air conditioners, and in-vehicle devices such as car navigation system. They are also used in various other settings, enabling users to download and upload photos and music from the internet and perform hands-free calling while driving." Murata 2023 Value Report (**Exhibit 2**), p. 52.

114. Murata specifically notes as a "strength" of these products the incorporation of "[m]illimeter wave modules using Murata's unique multilayer resin substrates (Multilayer LCP Product)," which technology "enables miniaturization and high performance as well as ensure reliability." Murata 2023 Value Report (**Exhibit 2**), p. 52.

115. Accordingly, GTRC contends that "connectively modules" manufactured and sold by Murata to customers in the United States that encompass

multi-band RF modules utilizing LCP substrates are considered to be included in the Accused Products previously outlined herein.

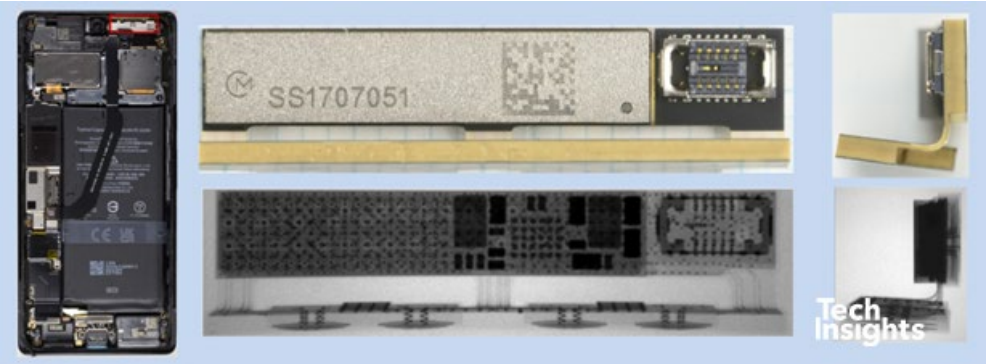
116. As one representative example of "RF Modules" or "connectivity modules," in 2021 Murata introduced its LKBA series antenna module, which Murata advertises as a "compact antenna array module for mmWave 5G." *See*, *e.g.*, Murata LBKA RF Module (**Exhibit 10**), available at https://passive-components.eu/murata-releases-compact-antenna-array-module-for-mmwave-5g/ (last visited Nov. 15, 2024).

Murata's LKBA Series Multi-Band Antenna Module

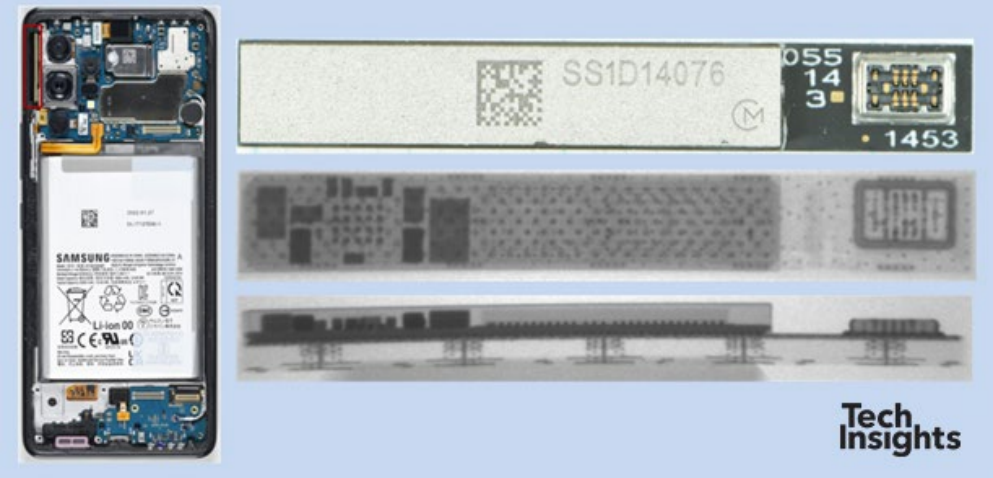
117. The LKBA series antenna device is described as a "a space-saving antenna array integrated module for mmWave 5G designed specifically to meet the demanding requirements of the smartphone, Internet of Things (IoT) and local/private 5G markets." Murata Releases Compact Antenna Array Module for mmWave 5G (**Exhibit 10**), available at https://passive-components.eu/murata-

releases-compact-antenna-array-module-for-mmwave-5g/ (last visited Nov. 15, 2024).

118. On information and belief, Murata has also manufactured and sold this particular RF module to Google and Samsung for inclusion in 5G mobile handsets, as shown in the images below:[3]



Murata's Dual Substrate LBKA Module in a Google Pixel Pro 6



Murata's Single Substrate LBKA Module in a Samsung Galaxy A53

[3] Tech Insights images available online at Tech Insights - Murata mmWave AiP Modules (**Exhibit 12**), available at https://www.techinsights.com/blog/muratasamsung-2nd-gen-mmwave-aip-discovered-samsung-galaxy-a53 (last visited August 22, 2024).

119. As shown, these Murata 5G multi-layer LCP substrates modules come in at least two form factors—(i) a L-shaped dual substrate AiP as found in the Google Pixel Pro and (ii) a single substrate AiP as found in the Samsung Galaxy.[4]

120. On information and belief, each of these LBKA modules practice one or more claims of the ’914 Patent. Further details of these LBKA series RF module products made and sold by Murata, as well as how Murata infringes the ’914 Patent claims by making and selling such products, are outlined in detail in representative claim charts attached hereto as **Appendix A and Appendix B**, which are incorporated herein by reference.

121. In addition to the above, GTRC has identified an additional AiP module that Murata has manufactured and sold for application in consumer mobile devices that likewise practices one or more claims of the ’914 Patent.

122. Specifically, on information and belief, Murata has manufactured and sold high-frequency AiP modules for Apple products that utilize multi-layer LCP substrates that practice the claims of the ’914 Patent, as shown in the image below:

[4] On information and belief, Murata also manufactures and sells the LBKA series antenna module to other customers for inclusion in devices such as Wi-Fi routers, IoT devices, auto applications, and wearables.

Murata's 2FGG LG Module Located in Apple iPhone 12

123. As with the LBKA modules, details of this additional Murata RF module product, as well as how Murata infringes the '914 Patent claims by making and selling such products, are outlined in detail in **Appendix C**, which is incorporated herein by reference.

Murata Touts Advantages of Multi-Layer LCP Substrate Products

124. Murata touts the superiority of multi-layer LCP technology over prior substrate technology for use in modern electronics, including its low-form factor, decreased power consumption, and low noise characteristics—the very same benefits recognized and disclosed by the inventors of the '914 Patent in the early 2000's.

125. For example, Murata touts that its "Multilayer LCP Product is used in smartphones, wearable devices, and other applications, contributing to smaller, thinner, and higher performance devices with low energy consumption." Murata High Frequency Devices (**Exhibit 3**); 2018 Murata Market Value Report (**Exhibit**

7), p. 23 (noting that multi-layer LCP technology "contributes to smaller, thinner, and higher performance smartphones and wearable devices").

126. And Murata, like the inventors of the '914 Patent, recognizes the benefits of multi-layer LCP substrates for high frequency RF modules.

127. As noted by Murata, "Multilayer LCP Product demonstrates advantages in applications such as millimeter-wave transmission lines, which leverage its low transmission loss performance at ultra-high frequencies." Murata 2023 Value Report (**Exhibit 2**), p. 51.

128. Indeed, just as recognized by the '914 Patent inventors, as "compared to the materials used in previous resin substrates (Glass Epoxy Substrate, FPC, etc.), the high-performance resin material possesses a smaller relative dielectric constant (εr), loss tangent (tanδ), and absorption rate." Murata Multi-Layer LCP Products (**Exhibit 8**).

129. Thus, "Multi-layer LCP product is able to achieve low-loss products to contribute to low power consumption and improve communication performance in customer products." Murata Multi-Layer LCP Products (**Exhibit 8**).

130. Further, "the formation of minute electrode patterns enables highly precise impedance control, which is important in the high frequency range and in high-speed digital transmission." Murata Multi-Layer LCP Products (**Exhibit 8**). And "as the frequencies used become higher, Multilayer LCP Product will be able

to show its competitive superiority in terms of transmission loss compared with competing technologies." Murata 2023 Value Report (**Exhibit 2**), p. 51.

COUNT I

Infringement of United States Patent No. 7,489,914 by Murata

131. GTRC re-alleges and incorporates by reference the foregoing allegations as though fully set forth here.

132. All the elements of at least claims 1, 2, 11, 12, 13, 14, 15, and 16 of the '914 Patent are embodied in the Accused Products. This is demonstrated at least through the representative claim charts attached hereto as **Appendix A**, **Appendix B**, and **Appendix C**, which are incorporated herein by reference.

133. Murata thus directly infringed the '914 Patent by having made, used, sold, and/or offered to sell the Accused Products throughout the United States.

134. Pursuant to 35 U.S.C. § 271(a), Murata is liable for direct infringement of the '914 Patent, including without limitation claims 1, 2, 11, 12, 13, 14, 15, and 16, by having made, used, offered for sale, sold, and/or imported the Accused Products in the United States.

135. Murata has had knowledge of the inventions of GTRC's '914 patent since at least June 2006. Such knowledge was obtained during or in relation to meetings, presentations, and disclosures regarding potential business relationship

between Murata and JMD (including inventors of the ’914 Patent) relating to the patented technology from June 2006 through 2009.

136. On information and belief, Murata has been on notice of the claims of the ’914 Patent since the ’914 Patent first published as the ’418 Publication on November 10, 2005, and had further notice since the issuance of the ’914 Patent on February 10, 2009.

137. Despite its knowledge of the ’914 Patent, Murata has made, used, sold, and/or offered to sell multi-band antenna modules comprising multi-layer LCP substrates that practice the claims of the ’914 Patent.

138. On information and belief, Murata had specific intent to infringe the ’914 patent at the time of its infringement, making Murata’s infringement willful and deliberate.

139. As a result of Murata’s infringement, GTRC has suffered monetary damages and is entitled to a money judgment in an amount adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made by Murata of the invention, together with interest and costs as fixed by the court.

140. On information and belief, the conduct of Murata presents an exceptional case such that GTRC is entitled to an award of its reasonable attorneys’ fees, as provided by 35 U.S.C. § 285.

COUNT II

Indirect Infringement of United States Patent No. 7,489,914 by Murata

141. GTRC re-alleges and incorporates by reference the foregoing allegations as though fully set forth here.

142. Murata indirectly infringes the ’914 Patent by inducement of infringement in accordance with 35 U.S.C. § 271(b).

143. As outlined herein, Murata provides the Accused Products—including Murata’s multi-band, multi-layer LCP substrate modules that practice one or more of the ’914 Patent claims as shown in the attached representative claim charts (**Appendix A, B, and C**)—to companies and/or end-user customers in the United States who, in turn offer to sell, sell, import, or use Murata’s devices. These acts of these other companies and/or end-user customers infringe at least one claim of the ’914 Patent.

144. On information and belief, Murata offers for sale and sells the Accused Devices to its customers with knowledge that use, sale, or importation of the Accused Devices would constitute infringement of the ’914 Patent.

145. On information and belief, Murata further aided, instructed, or otherwise acted with the intent to cause acts by its customers, by either selling the Accused Products, using the Accused Products, or importing the Accused Products in the United States, that would give rise to infringement of the ’914 Patent.

146. On information and belief, at least because of Murata's intimate knowledge of the '914 Patent, Murata knew, or showed willful blindness, that the use, selling, or importation of the Accused Devices in the United States by its customers would give rise to infringement of at least one claim of the '914 Patent.

147. Accordingly, on information and belief, Murata indirectly infringes the '914 Patent because Murata has actively induced others, including companies that import, offer for sale, sell, or import the Accused Products containing Murata's multi-band, multi-layer LCP substrate products, to directly infringe one or more claims of the '914 Patent.

148. Further, Murata indirectly infringes the '914 Patent through contributory infringement as provided pursuant to 35 U.S.C. § 271(c).

149. Murata aided, instructed, or otherwise acted with the intent to cause the acts of direct infringement by its customers and/or end users of products as alleged herein by providing the Accused Product for use in devices in the United States.

150. As outlined herein, Murata knew of the '914 Patent, or showed willful blindness to the existence of the '914 Patent, at that time that it manufactured, offered to sell, or sold Accused Products to its customers.

151. On information and belief, the Accused Devices are not a staple article or commodity of commerce capable of substantial non-infringing use.

Indeed, the Accused Products are designed, manufactured, sold, and/or imported as RF Modules that practice the claims of the '914 Patent as set forth in the representative claim charts (**Appendix A, B, and C**).

152. On information and belief, at least because of Murata's intimate knowledge of the '914 Patent, Murata knew that the Accused Products were specially made or adapted to infringe the '914 Patent.

153. Accordingly, on information and belief, Murata also contributorily infringes the '914 Patent by providing Murata's multi-band, multi-layer LCP substrate products that practice one or more claims of the '914 Patent to end-users who sell, use, or import such Accused Products in the United States.

PRAYER FOR RELIEF

WHEREFORE, GTRC prays for judgment and seeks relief against Murata as follows:

A. For a judgment that one or more claims of the '914 Patent has been infringed by Murata;

B. For a judgment that Murata's infringement of the '914 Patent has been willful;

C. For a judgment and an award of damages sustained by Murata as a result of Murata's acts of infringement;

D. For a judgment and award of enhanced damages pursuant to 35 U.S.C. § 284;

E. For a judgment and an award of attorneys' fees pursuant to 35 U.S.C. § 285 or as otherwise permitted by law;

F. For a judgment and an award of all interest and costs; and

G. For a judgment and award of such other and further relief as the Court may deem just and proper.

DEMAND FOR JURY TRIAL

In accordance with Fed. R. Civ. P. 38 and 39, GTRC asserts its rights under the Seventh Amendment to the United States Constitution and demands a trial by jury on all issues that may be so tried.

Respectfully submitted,

/s/David S. Moreland
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