

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 12,095,149 B2
BASED ON U.S. PATENT APPLICATION NO. 2007/0200773 TO DOU ET AL. (“DOU”)

Based upon Plaintiff’s Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendants’ accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious some or all of the asserted claims. These invalidity contentions are not an admission by the Defendants that the accused products are covered by or infringe claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, and 20 (the “’149 Asserted Claims”)¹, particularly when these claims are properly construed and applied.

AIA law applies because the application that issued as the ’149 Patent was filed on June 22, 2023, after the AIA came into force on March 16, 2013.

U.S. Patent Application No. 2007/0200773 to Dou et al. (“Dou”) was filed on February 24, 2006, published on August 30, 2007, on August 30, 2007, issued as U.S. Patent No. 7,548,208 on June 16, 2009. This patent is prior art under at least 35 U.S.C. § 102(e), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 12,095,149 (the “’149 Patent”), are invalid as anticipated by Dou.

To the extent that Dou is found not to anticipate one or more of the asserted claims of the ’149 Patent, these claims are invalid as obvious in view of Dou alone or as modified in view of or in combination with other prior art references disclosed in Defendants’ Invalidity Contentions and accompanying charts, including without limitation as set forth below.

- Chinese Patent No. 2,765,337. (“Wei”) was filed on February 6, 2005, and was granted on March 15, 2006. This patent is prior art under at least 35 U.S.C. §§ 102(a), 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- PCT Publication No. 2004/042868 to Castany et al. (“Castany868”) was filed on November 7, 2002 and published on May 21, 2004, on August 30, 2007. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- U.S. Patent No. 6,943,746 to Talvitie et al. (“Talvitie”) was filed on October 23, 2003, published on July 15, 2004, and issued on September 13, 2005. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- U.S. Patent Application No. 2002/0238433 to Chou (“Chou”) was filed on March 1, 2005, published on October 26, 2006, and issued as U.S. Patent No. 7,129,898 on October 31, 2006. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).

¹ Defendants understand that, by not charting claims 6, 11, and 16 in its Infringement Contentions, Plaintiff does not assert these claims against Defendants.

- Microstrip Sierpinski Carpet Antenna Using Transmission Line Feeding by Mohamad Kamal A. Rahim, et al., Asia-Pacific Microwave Conference Proceedings, (“Rahim”) published in December 2005. This paper/book is prior art under at least 35 U.S.C. § 102(a) and 103(a).

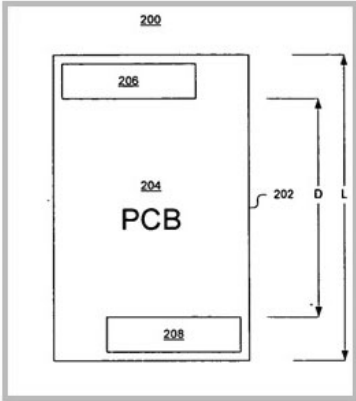
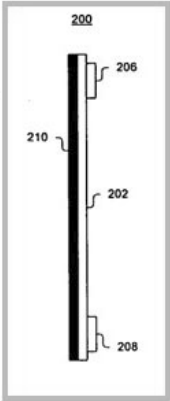
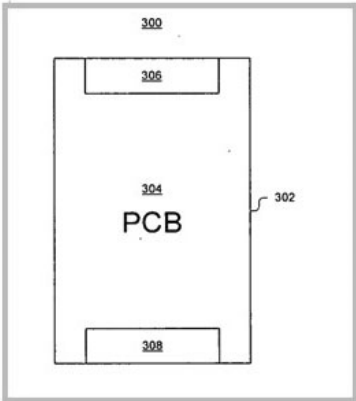
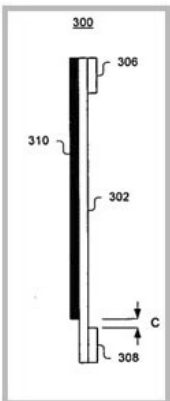
These invalidity contentions are not an admission that the Defendants concede or acquiesce to any claim construction implied or suggested by Plaintiff’s Complaint or Infringement Contentions. Nor are Defendants asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature. Defendants reserve the right to update their constructions and contentions in view of this Court’s claim construction order.²

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
Claim 1		
1[pre]	A wireless device comprising:	<p>To the extent the preamble is limiting, Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“A wireless device typically operates using a radio transmitter/receiver (“transceiver”) and one or more antennas. Recently, diversity antennas have been applied to wireless devices such as mobile telephones and handheld computers. In general, diversity antennas are based on the concept of a smart array and tend to improve the receiving sensitivity of a wireless device by reducing multi-path interference.”</p> <p>Dou at [0001]</p> <p>“FIG. 1 illustrates a wireless device 100 having a conventional diversity antenna architecture. As shown, the wireless device 100 comprises an external housing 102 and a printed circuit board (PCB) 104. The diversity antenna architecture includes an external antenna 106 and an internal antenna 108 having different polarized radiation patterns to reduce mutual coupling and allow cooperative operation.”</p>

² Defendants incorporate herein any related work performed by or on behalf of an author or an inventor in the United States under 35 U.S.C. § 102(g)(2). Defendants reserve the right to supplement and/or alter this chart based on further investigation and ongoing discovery.

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>Dou at [0002]</p> <p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“FIG. 3A illustrates one embodiment of a wireless device 300 having an internal diversity antenna architecture. In various embodiments, the wireless device 300 may be similar in some structural and operational aspects as wireless device 200, as described above.”</p> <p>Dou at [0031]</p> <p>“FIG. 4A illustrates one embodiment of a wireless device 400 having an internal diversity antenna architecture. In various embodiments, the wireless device 400 may be similar in some structural and operational aspects as wireless device 200 and/or wireless device 300, as described above.”</p> <p>Dou at [0035]</p> <p>“When implemented as a wireless system, for example, system 100 may include one or more wireless nodes arranged to communicate information over one or more types of wireless communication media,</p>

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		<p>sometimes referred to herein as wireless shared media. An example of a wireless communication media may include portions of a wireless spectrum, such as the radio-frequency (RF) spectrum. The wireless nodes may include components and interfaces suitable for communicating information signals over the designated wireless spectrum, such as one or more antennas, wireless transceivers, amplifiers, filters, control logic, and so forth. As used herein, the term “transceiver” may be used in a very general sense to include a transmitter, a receiver, or a combination of both. The embodiments are not limited in this context.”</p> <p>Dou at [0052]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="676 365 1029 763"></div> <div data-bbox="772 771 882 808">FIG. 2A</div> <div data-bbox="1085 365 1253 763"></div> <div data-bbox="1110 771 1220 808">FIG. 2B</div> <div data-bbox="676 844 1029 1242"></div> <div data-bbox="772 1250 882 1287">FIG. 3A</div> <div data-bbox="1085 844 1253 1242"></div> <div data-bbox="1110 1250 1220 1287">FIG. 3B</div>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="669 399 1247 829"> <p style="text-align: center;">FIG. 4A FIG. 4B</p> </div> <p>Dou at Figures 2A-B, 3A-B, and 4A-B</p>
1[a]	a ground plane;	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“FIG. 2B illustrates a side view of the wireless device 200 of FIG. 2A. As shown, the wireless device 200 may comprise a ground plane 210. In various implementations, the ground plane 210 may improve antenna performance in talk position and reduce SAR. As shown, the ground plane 210 may extend underneath the first internal antenna 206 and the second internal antenna 208. The ground plane 210 may be required underneath the second internal antenna 208, for example, if a key pad is positioned at the edge</p>

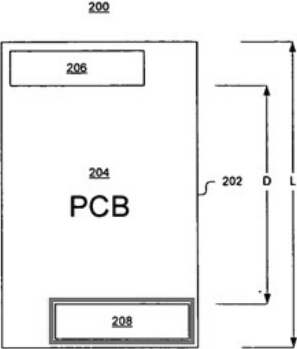
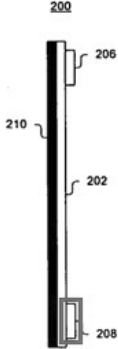
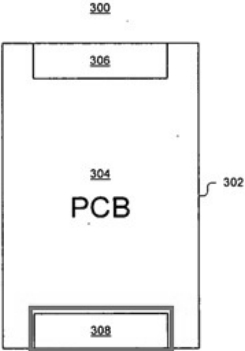
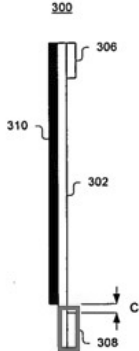
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>of the PCB 204 and demands a ground layer underneath for its circuitry. In this embodiment, the first internal antenna 206 and the second antenna 208 may each comprise a planar inverted F-antenna, for example, including at least one read port and one or more ground ports. The embodiments are not limited in this context.”</p> <p>Dou at [0029]</p> <p>“FIG. 3B illustrates a side view of the wireless device 300 of FIG. 3A. As shown, the wireless device 300 may comprise a ground plane 310 to improve antenna performance in talk position and reduce SAR. As shown, the ground plane 310 does not extend underneath the second internal antenna 308. In this embodiment, the second internal antenna 208 may be separated from the ground plane 310 by a clearance distance (C) that is no less than 5 mm (>5 mm). The first internal antenna 206 may comprise, for example, a planar inverted F-antenna. The second internal antenna 208 may comprise, for example, a monopole-antenna, an inverted-L antenna, a meandered monopole, a printed helical antenna, a dipole antenna, a balanced antenna, or other suitable antenna. The embodiments are not limited in this context.”</p> <p>Dou at [0034]</p>

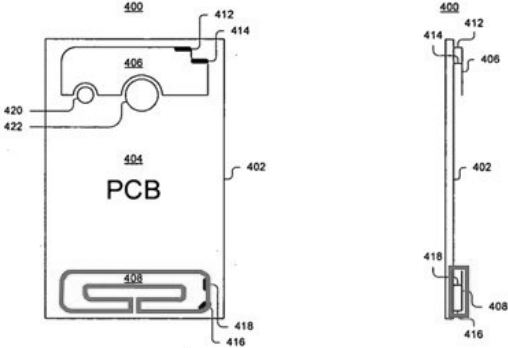
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><div><div><div>200</div><div><div>206</div><div>204 PCB</div><div>208</div></div><div>202</div><div>D</div></div><div>FIG. 2A</div></div><div><div><div>200</div><div><div>206</div><div>210</div><div>202</div><div>208</div></div></div><div>FIG. 2B</div></div><div><div><div>300</div><div><div>306</div><div>304 PCB</div><div>308</div></div><div>302</div></div><div>FIG. 3A</div></div><div><div><div>300</div><div><div>306</div><div>310</div><div>302</div><div>308</div></div><div>C</div></div><div>FIG. 3B</div></div><div>Figures 2A-B and 3A-B</div></div>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
1[b]	a first planar antenna	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“In various embodiments, the first internal antenna 206 and/or the second internal antenna 208 may be implemented using any type of suitable internal antenna, such as a planar inverted-F antenna, a planar inverted-L antenna, an inverted-F antenna with a helical structure, an inverted-L antenna with a helical structure, a monopole antenna, a meandered monopole antenna, a dipole antenna, a balanced antenna, a printed helical antenna, a chip antenna, and a ceramic antenna. The embodiments are not limited in this context.</p> <p>FIG. 2B illustrates a side view of the wireless device 200 of FIG. 2A. As shown, the wireless device 200 may comprise a ground plane 210. In various implementations, the ground plane 210 may improve antenna performance in talk position and reduce SAR. As shown, the ground plane 210 may extend underneath the first internal antenna 206 and the second internal antenna 208. The ground plane 210 may be required underneath the second internal antenna 208, for example, if a key pad is positioned at the edge</p>

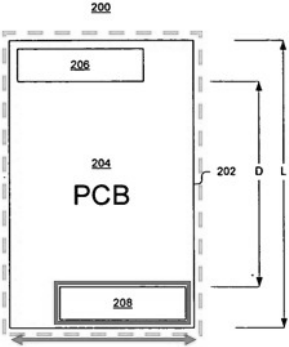
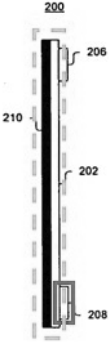
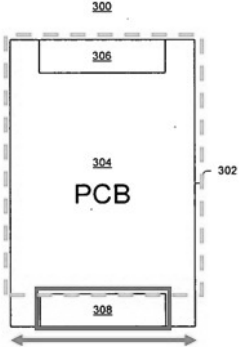
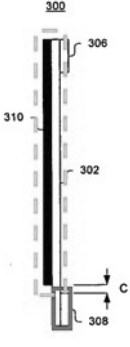
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>of the PCB 204 and demands a ground layer underneath for its circuitry. In this embodiment, the first internal antenna 206 and the second antenna 208 may each comprise a planar inverted F-antenna, for example, including at least one read port and one or more ground ports. The embodiments are not limited in this context.”</p> <p>Dou at [0028]-[0029]</p> <p>“As shown in FIG. 3A, the wireless device 300 may have an internal diversity antenna architecture comprising a first internal antenna 306 and a second internal antenna 308 disposed on the PCB 304 for achieving diversity. In this embodiment, the internal diversity antenna architecture may comprise a first internal antenna 306 located substantially at the top of the wireless device 300. For example., the first internal antenna 306 may be located substantially at the top of the housing 302 and/or the top of the PCB 304. The internal diversity antenna architecture may comprise a second internal antenna 308 located substantially at the bottom of the wireless device 300. For example, the second internal antenna 308 may be located substantially at the bottom of the housing 302 and/or the bottom of the PCB 304.”</p> <p>Dou at [0032]</p> <p>“FIG. 3B illustrates a side view of the wireless device 300 of FIG. 3A. As shown, the wireless device 300 may comprise a ground plane 310 to improve antenna performance in talk position and reduce SAR. As shown, the ground plane 310 does not extend underneath the second internal antenna 308. In this embodiment, the second internal antenna 208 may be separated from the ground plane 310 by a clearance distance (C) that is no less than 5 mm (>5 mm). The first internal antenna 206 may comprise, for example, a planar inverted F-antenna. The second internal antenna 208 may comprise, for example, a monopole-antenna, an inverted-L antenna, a meandered monopole, a printed helical antenna, a dipole antenna, a balanced antenna, or other suitable antenna. The embodiments are not limited in this context.”</p> <p>Dou at [0034]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>“As shown in FIG. 4A, the wireless device 400 may have an internal diversity antenna architecture comprising a first internal antenna 406 and a second internal antenna 408 disposed on the PCB 404 for achieving diversity. In this embodiment, the first internal antenna 406 may comprise a first feed point 412 and a first ground point 414, and the second internal antenna 408 may comprise a second feed point 416 and a second ground point 418. The first internal antenna 406 may be located substantially near the top of the wireless device 400, and the second internal antenna 408 may be located substantially near the bottom of the wireless device 400.</p> <p>Dou at [0036]</p>

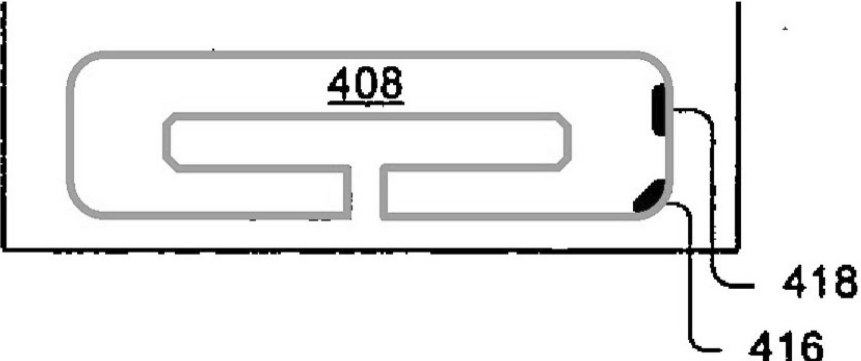
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><div><p>FIG. 2A</p></div><div><p>FIG. 2B</p></div><div><p>FIG. 3A</p></div><div><p>FIG. 3B</p></div></div>

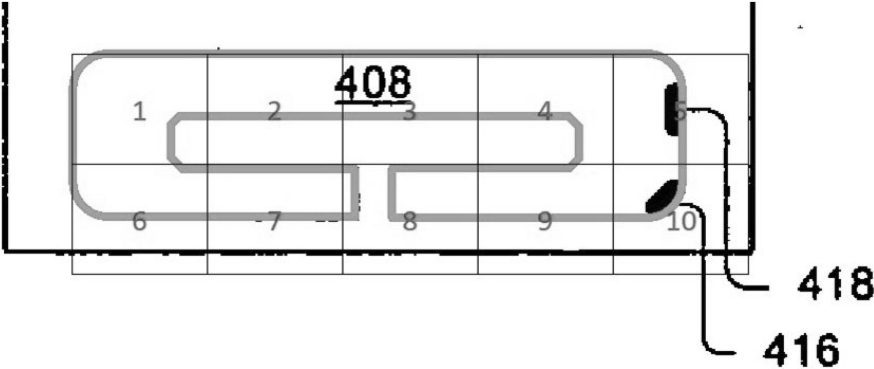
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p data-bbox="720 800 814 824">FIG. 4A</p> <p data-bbox="1035 800 1129 824">FIG. 4B</p> <p data-bbox="632 894 1010 922">Figures 2A-B, 3A-B, and 4A-B</p>
1[c]	<p data-bbox="310 971 606 1177"><i>[the first planar antenna]</i> proximate to a first side of a ground plane rectangle enclosing the ground plane,</p>	<p data-bbox="632 971 1314 1003">Dou expressly or inherently discloses this claim element.</p> <p data-bbox="632 1036 741 1068"><i>See, e.g.,</i></p> <p data-bbox="632 1101 1892 1239">It is also worthy to note that any reference to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of the phrase “in one embodiment” in various places in the specification are not necessarily all referring to the same embodiment.”</p> <p data-bbox="632 1271 800 1304">Dou at [0013]</p>

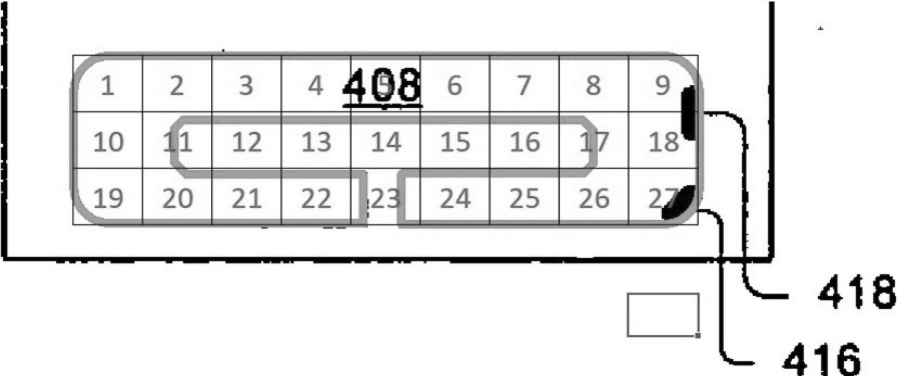
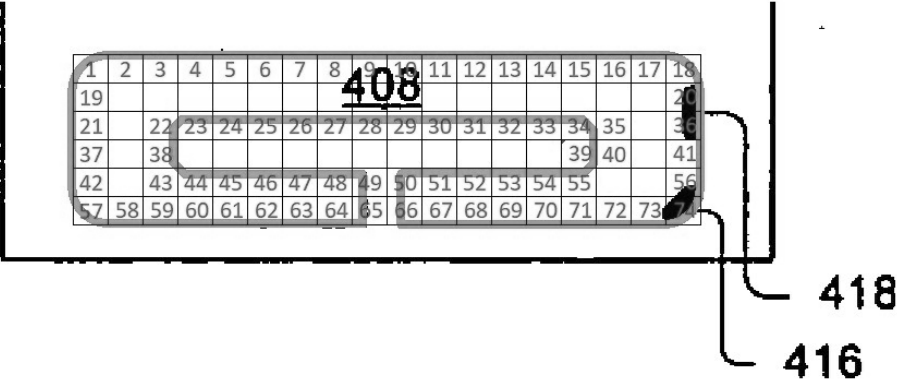
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>“FIG. 2B illustrates a side view of the wireless device 200 of FIG. 2A. As shown, the wireless device 200 may comprise a ground plane 210. In various implementations, the ground plane 210 may improve antenna performance in talk position and reduce SAR. As shown, the ground plane 210 may extend underneath the first internal antenna 206 and the second internal antenna 208. The ground plane 210 may be required underneath the second internal antenna 208, for example, if a key pad is positioned at the edge of the PCB 204 and demands a ground layer underneath for its circuitry. In this embodiment, the first internal antenna 206 and the second antenna 208 may each comprise a planar inverted F-antenna, for example, including at least one read port and one or more ground ports. The embodiments are not limited in this context.”</p> <p>Dou at [0029]</p> <p>“As shown, the communications system 500 may include a wireless node 510. In various embodiments, the wireless node 510 may be implemented as a wireless device such as wireless device 200, 300, or 400. Examples of wireless node 510 also may include any of the previous examples for a node as previously described.”</p> <p>Dou at [0053]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><div><p>FIG. 2A</p></div><div><p>FIG. 2B</p></div><div><p>FIG. 3A</p></div><div><p>FIG. 3B</p></div><p>Dou at Figures 2A-B and 3A-B</p></div>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
1[d]	the first planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The first internal antenna 206 and the second internal antenna 208 may be tuned for operating at one or more frequency bands. For example, the first internal antenna 206 and the second internal antenna 208 may allow the wireless device 200 to operate in the 824-894 Megahertz (MHz) frequency band for GSM operations, the 1850-1990 MHz frequency band for Personal Communications Services (PCS) operations, the 1575 MHz frequency band for Global Positioning System (GPS) operations, the 824-860 MHz frequency band for NAMPS operations, the 1710-2170 MHz frequency band for WCDMA/UMTS operations, ISM band in 2.4 GHz range for WiFi and Bluetooth, and other frequency bands. This may be desirable since the wireless device 200 may be compatible with multiple wireless data, multimedia and cellular telephone systems. In addition, first internal antenna 206 and the second internal antenna 208 may be used to implement various spatial diversity techniques to improve communication of wireless signals across one or more frequency bands of wireless shared media.</p> <p>In various embodiments, the first internal antenna 206 and the second internal antenna 208 may be designed for Evolution Data Optimized (EVDO) diversity at both the 800 MHz band (cellular) and the 1900 MHz (PCS). In various implementations, for EVDO diversity, the efficiency may be approximately 50% at 850 MHz and 60% at 1900 MHz.”</p> <p>Dou at [0022]-[0023]</p> <p>“The transceiver may be implemented, for example, by any transceiver suitable for operating at a given set of operating frequencies and wireless protocols for a particular wireless system. For example, the transceiver may be a two-way radio transceiver arranged to operate in the 824-894 MHz frequency band (GSM), the 1850-1990 MHz frequency band (PCS), the 1575 MHz frequency band (GPS), the 824-860 MHz frequency band (NAMPS), the 1710-2170 MHz frequency band (WCDMA/UMTS), or other frequency bands.</p>

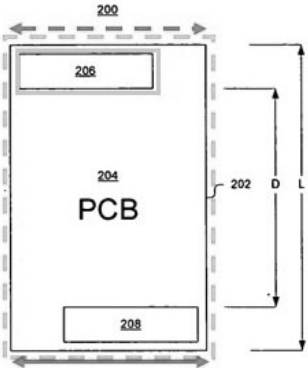
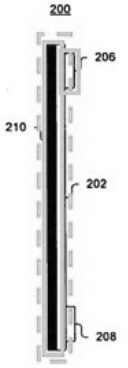
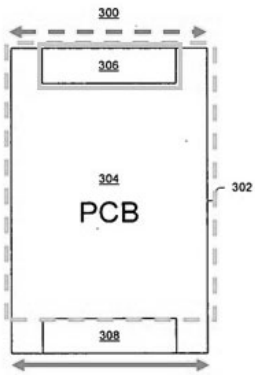
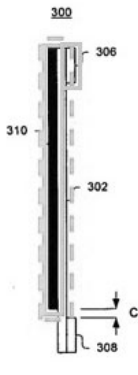
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>In various embodiments, an antenna may be electrically connected to a transceiver operatively associated with a signal processing circuit or processor positioned on a PCB. In order to increase power transfer, the transceiver may be interconnected to an antenna such that respective impedances are substantially matched or electrically tuned to compensate for undesired antenna impedance. In some cases, the transceiver may be implemented as part of a chip set associated with a processor. The embodiments are not limited in this context.”</p> <p>Dou at [0045]-[0046]</p>
1[e]	the first planar antenna defining a first contour,	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>  <p>The diagram shows a planar antenna structure 408, which is a rectangular loop with a horizontal gap. Two terminals, 416 and 418, are located on the right side of the structure, connected to the loop. Terminal 416 is at the bottom and terminal 418 is at the top. The entire structure is enclosed within a larger rectangular frame.</p> <p>Dou at Figure 4A</p>

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1[f]	wherein the first contour has a level of complexity defined by complexity factor F21 having a value of at least 1.20 and complexity factor F32 having a value of at least 1.35; and	<p data-bbox="632 345 1314 378">Dou expressly or inherently discloses this claim element.</p> <p data-bbox="632 410 741 443"><i>See, e.g.,</i></p>  <p data-bbox="632 906 1031 938">Dou at Figure 4A, Calculating N_1</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><p>Dou at Figure 4A, Calculating N_2</p><p>Dou at Figure 4A, Calculating N_3</p></div>

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		<p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 10;$ $N_2 = 27; \text{ and}$ $N_3 = 74;$ <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$ <p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(27) - \log_{10}(10))}{\log_{10} 1/2} = 1.4330$ <p>and</p> $1.20 \leq 1.4330$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(74) - \log_{10}(27))}{\log_{10} 1/2} = 1.4546$

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>and</p> $1.35 \leq 1.4546$ <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>
1[g]	a second antenna proximate to a second side of the ground plane rectangle,	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><p>FIG. 2A</p></div> <div><p>FIG. 2B</p></div> <div><p>FIG. 3A</p></div> <div><p>FIG. 3B</p></div> <p>Figures 2A-B and 3A-B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
1[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The first internal antenna 206 and the second internal antenna 208 may be tuned for operating at one or more frequency bands. For example, the first internal antenna 206 and the second internal antenna 208 may allow the wireless device 200 to operate in the 824-894 Megahertz (MHz) frequency band for GSM operations, the 1850-1990 MHz frequency band for Personal Communications Services (PCS) operations, the 1575 MHz frequency band for Global Positioning System (GPS) operations, the 824-860 MHz frequency band for NAMPS operations, the 1710-2170 MHz frequency band for WCDMA/UMTS operations, ISM band in 2.4 GHz range for WiFi and Bluetooth, and other frequency bands. This may be desirable since the wireless device 200 may be compatible with multiple wireless data, multimedia and cellular telephone systems. In addition, first internal antenna 206 and the second internal antenna 208 may be used to implement various spatial diversity techniques to improve communication of wireless signals across one or more frequency bands of wireless shared media.</p> <p>In various embodiments, the first internal antenna 206 and the second internal antenna 208 may be designed for Evolution Data Optimized (EVDO) diversity at both the 800 MHz band (cellular) and the 1900 MHz (PCS). In various implementations, for EVDO diversity, the efficiency may be approximately 50% at 850 MHz and 60% at 1900 MHz.”</p> <p>Dou at [0022]-[0023]</p> <p>“The transceiver may be implemented, for example, by any transceiver suitable for operating at a given set of operating frequencies and wireless protocols for a particular wireless system. For example, the transceiver may be a two-way radio transceiver arranged to operate in the 824-894 MHz frequency band (GSM), the 1850-1990 MHz frequency band (PCS), the 1575 MHz frequency band (GPS), the 824-860 MHz frequency band (NAMPS), the 1710-2170 MHz frequency band (WCDMA/UMTS), or other frequency bands.</p>

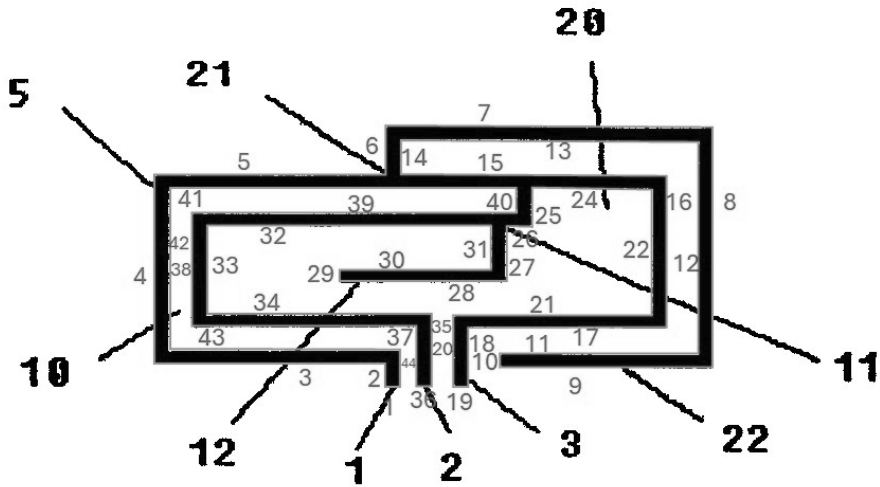
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>In various embodiments, an antenna may be electrically connected to a transceiver operatively associated with a signal processing circuit or processor positioned on a PCB. In order to increase power transfer, the transceiver may be interconnected to an antenna such that respective impedances are substantially matched or electrically tuned to compensate for undesired antenna impedance. In some cases, the transceiver may be implemented as part of a chip set associated with a processor. The embodiments are not limited in this context.”</p> <p>Dou at [0045]-[0046]</p>
1[i]	<p>wherein the first contour is defined as a perimeter of the first planar antenna and perimeters of any closed apertures defined within the first planar antenna;</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[f]</i></p>
1[j]	<p>wherein the complexity factors F21 and F32 are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_4) - \log(N_2)}{\log(1/2)}$ <p>where N1 is a number of cells of a grid G1</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[f]</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	<p>that include at least a point of the first contour, N2 is a number of cells of a grid G2 that include at least a point of the first contour, and N3 is a number of cells of a grid G3 that include at least a point of the first contour, the grid G2 divides a minimum-sized rectangle enclosing the first planar antenna into nine columns of equal width arranged along a long side of the minimum-sized rectangle and into an odd number of rows of equal height arranged along a short side of the minimum-sized rectangle, wherein the number of rows results in the cells of grid G2 being as square as possible, the grid G1 being aligned</p>	

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	with a corner of the grid G2 to cover the minimum-sized rectangle, the cells of the grid G1 having widths and heights that respectively are double the widths and heights of the cells of the grid G2, and	
1[k]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The first internal antenna 204 and the second internal antenna 208 may be arranged to transmit and/or receive electrical energy in accordance with a given set of performance or design constraints as desired for a particular implementation. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may operate at the same time for transmitting, receiving, or both. During transmission, an antenna may accept energy from a transmission line and radiate this energy into space via a wireless shared media. During reception, an antenna may gather energy from an incident wave received over wireless shared media, and provide this energy to a corresponding transmission line. The amount of power radiated from or received by an antenna is typically described in terms of gain. In addition, an antenna may operate in accordance with a desired Voltage Standing Wave Ratio (VSWR) value. For example, VSWR relates to the impedance match of an antenna feed point with a feed line or transmission line of a communications device. To radiate radio frequency energy with minimum loss, or to pass along received RF energy to a wireless receiver with minimum loss, the impedance of an antenna may be matched to the impedance of a transmission line or feed point of a PCB.”</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>Dou at [0019]</p> <p>“The first internal antenna 206 and the second internal antenna 208 may be tuned for operating at one or more frequency bands. For example, the first internal antenna 206 and the second internal antenna 208 may allow the wireless device 200 to operate in the 824-894 Megahertz (MHz) frequency band for GSM operations, the 1850-1990 MHz frequency band for Personal Communications Services (PCS) operations, the 1575 MHz frequency band for Global Positioning System (GPS) operations, the 824-860 MHz frequency band for NAMPS operations, the 1710-2170 MHz frequency band for WCDMA/UMTS operations, ISM band in 2.4 GHz range for WiFi and Bluetooth, and other frequency bands. This may be desirable since the wireless device 200 may be compatible with multiple wireless data, multimedia and cellular telephone systems. In addition, first internal antenna 206 and the second internal antenna 208 may be used to implement various spatial diversity techniques to improve communication of wireless signals across one or more frequency bands of wireless shared media.”</p> <p>Dou at [0022]</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>“Fractal antennas are antennas that have the shaped of fractal structures. The fractal antennas consist of geometrical shapes that are repeated. Each one of the shapes has unique attributes. By careful selection. Fractal antennas can be design in many shapes such as Sierpinski gasket, Sierpinski carpet, Koch island,</p>

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		<p>Hilbert curve and Miskowski. In this paper a microstrip sierpinski carpet antenna has been designed and analyzed. The performance of the antenna has been investigated in term of the return loss and the radiation pattern.”</p> <p>Rahim at p. 1</p> <p>“A square microstrip Sierpinski Carpet antenna was constructed using fractal geometry for multiband operation. The measured results indicate that the antenna exhibits a good radiation and input return loss. This type of antenna is the best candidate for wireless communications for multiband operation.”</p> <p>Rahim at p. 4</p>
Claim 2		
2	<p>The wireless device of claim 1, wherein the first antenna contour comprises at least 20 segments.</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p>

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		<div data-bbox="646 354 1520 837"></div> <p data-bbox="630 881 837 914">Wei at Figure 2B</p>

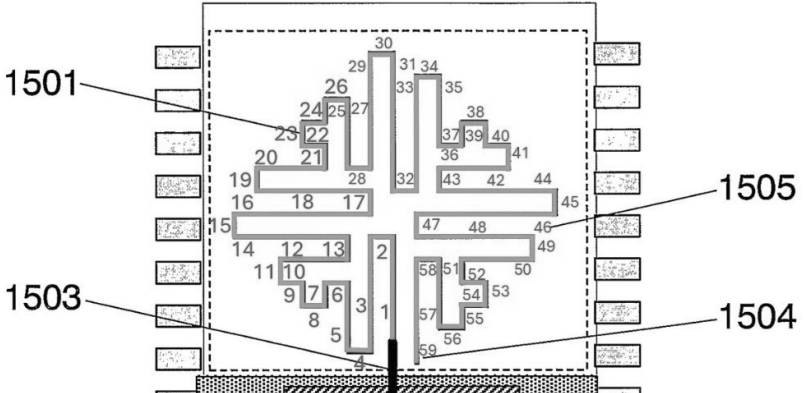
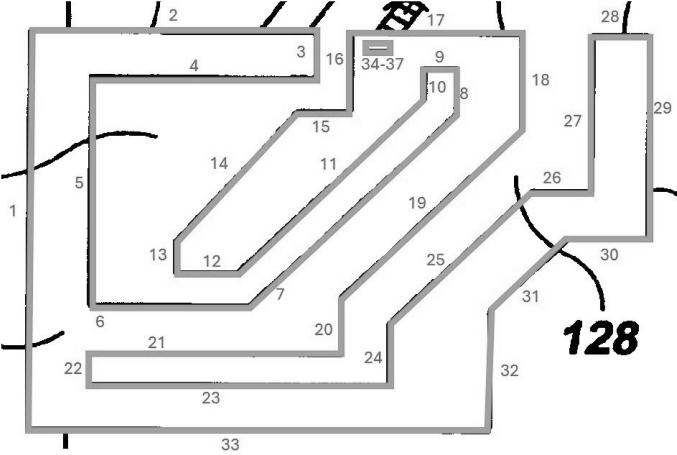
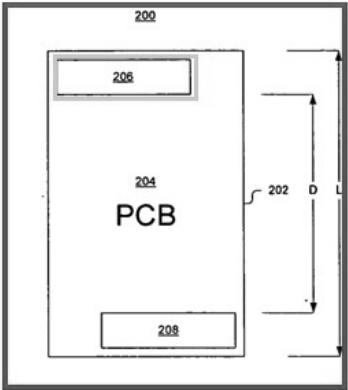
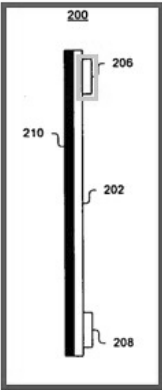
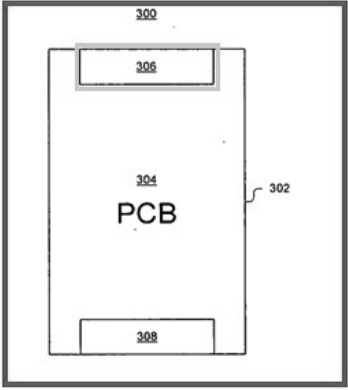
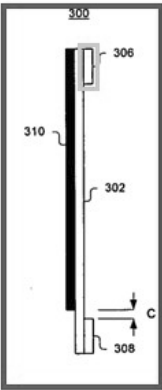
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p data-bbox="766 349 808 381">40</p>  <p data-bbox="640 876 924 909">Castany868 at Figure 15</p>

Exhibit – F – 01

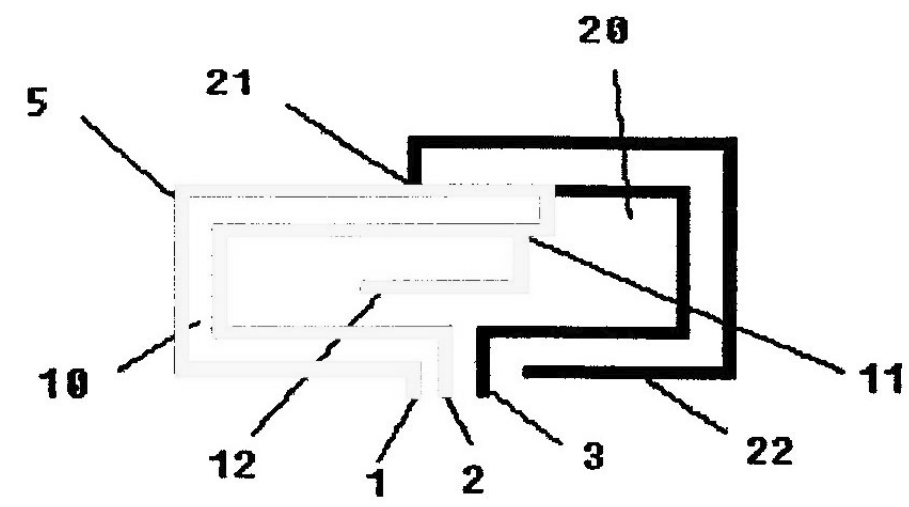
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p>Talvitie at Figure 1</p>
Claim 3		
3	The wireless device of claim 2, wherein the perimeter of the first antenna contour comprises at least 35 segments.	Dou expressly or inherently discloses this claim element. <i>See, e.g., claim element 3</i>
Claim 4		

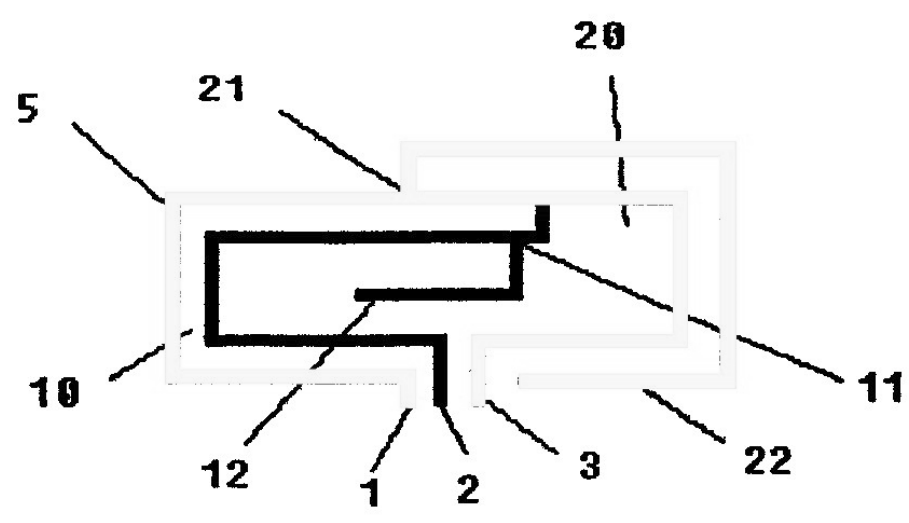
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
4	The wireless device of claim 1, wherein the antenna system comprises a third antenna configured to receive signals employing a 4G communication standard.	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“In various embodiments, for example, the antenna architecture may comprise three or more antennas. In some implementations, an additional antenna may comprise any suitable type of internal antenna disposed within the housing of a wireless device. In other implementations, an additional antenna may comprise any suitable type of external antenna such as a whip antenna, extendable antenna, antenna stubby, and so forth. The embodiments are not limited in this context”</p> <p>Dou at [0040]</p> <p>“The transceiver may be implemented, for example, by any transceiver suitable for operating at a given set of operating frequencies and wireless protocols for a particular wireless system. For example, the transceiver may be a two-way radio transceiver arranged to operate in the 824-894 MHz frequency band (GSM), the 1850-1990 MHz frequency band (PCS), the 1575 MHz frequency band (GPS), the 824-860 MHz frequency band (NAMPS), the 1710-2170 MHz frequency band (WCDMA/UMTS), or other frequency bands.</p> <p>In various embodiments, an antenna may be electrically connected to a transceiver operatively associated with a signal processing circuit or processor positioned on a PCB. In order to increase power transfer, the transceiver may be interconnected to an antenna such that respective impedances are substantially matched or electrically tuned to compensate for undesired antenna impedance. In some cases, the transceiver may be implemented as part of a chip set associated with a processor. The embodiments are not limited in this context.”</p> <p>Dou at [0045]-[0046]</p> <p>“When implemented as a wireless system, for example, system 100 may include one or more wireless nodes arranged to communicate information over one or more types of wireless communication media,</p>

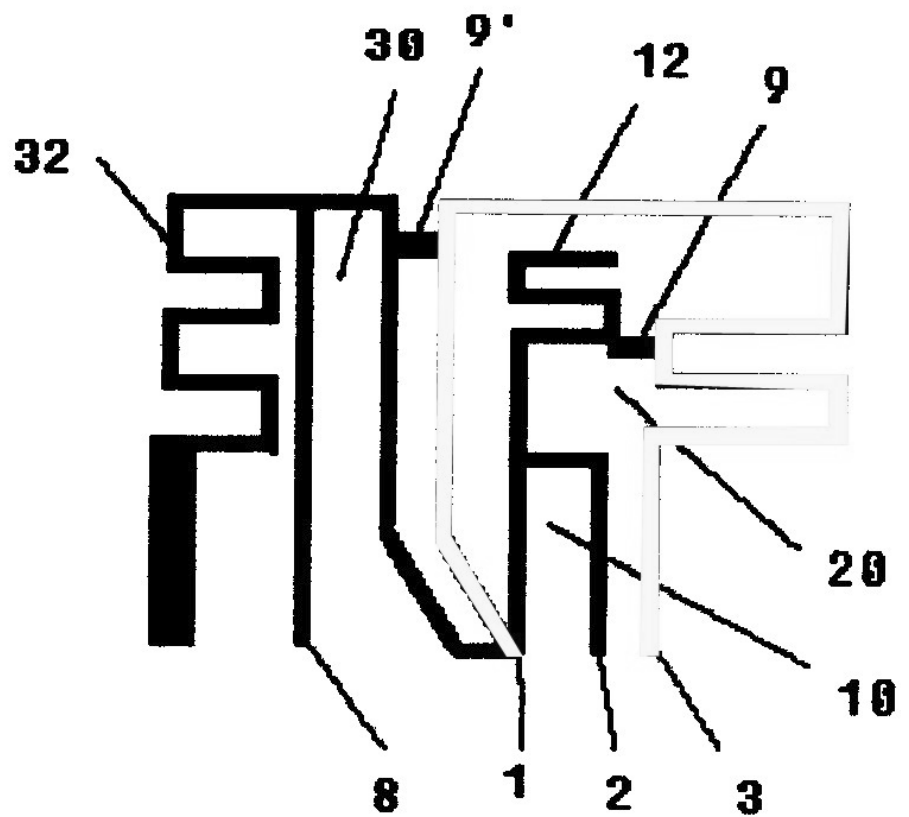
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>sometimes referred to herein as wireless shared media. An example of a wireless communication media may include portions of a wireless spectrum, such as the radio-frequency (RF) spectrum. The wireless nodes may include components and interfaces suitable for communicating information signals over the designated wireless spectrum, such as one or more antennas, wireless transceivers, amplifiers, filters, control logic, and so forth. As used herein, the term “transceiver” may be used in a very general sense to include a transmitter, a receiver, or a combination of both. The embodiments are not limited in this context.”</p> <p>Dou at [0052]</p>

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		 <p>FIG. 2A</p>	 <p>FIG. 2B</p>
		 <p>FIG. 3A</p>	 <p>FIG. 3B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="632 349 1192 771"> <p style="text-align: center;">FIG. 4A FIG. 4B</p> </div> <p>Dou at Figures 2A-B, 3A-B, and 4A-B</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p>

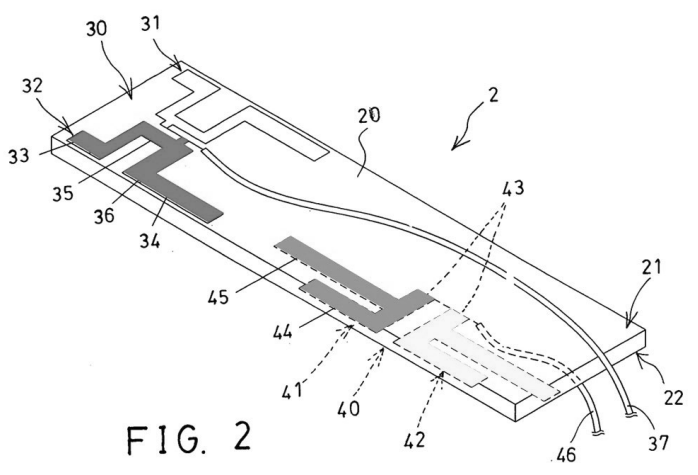
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p data-bbox="630 893 840 941">Wei at Figure 2B</p>

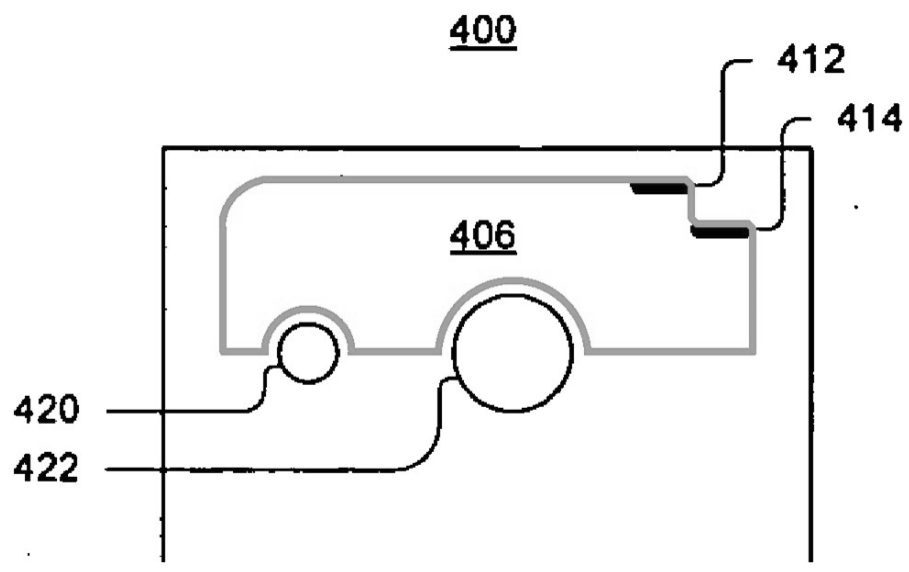
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p>Wei at Figure 2B (Alternative)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="630 357 1533 1169"></div> <p data-bbox="630 1218 819 1258">Wei at Figure 9</p> <p data-bbox="630 1282 1929 1360">“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p>

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		<p>FIG. 2</p> <p>Chou at Figure 2</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p>FIG. 2</p> <p>Chou at Figure 2 (Alternative)</p>
Claim 5		
5	<p>The wireless device of claim 4, wherein the third antenna defines an antenna contour comprising an entire perimeter of the third antenna, and wherein the antenna contour of the third antenna has a</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim elements 1[e], 1[k], 1[l], 1[m], 4</p>

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	level of complexity defined by complexity factor F21 having a value of at least 1.2 and a complexity factor F32 having a value of at least 1.35.	<div data-bbox="630 341 1533 909"></div> <p data-bbox="630 925 840 966">Dou at Figure 4A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="735 373 1449 828"><p style="text-align: center;">400</p><p>The diagram shows a 3x3 grid of cells. The cells are numbered 1 through 13. Cell 1 is top-left, 2 is top-middle, 3 is top-right, 4 is middle-left, 5 is middle-middle, 6 is middle-right, 7 is bottom-left, 8 is bottom-middle, 9 is bottom-right. There are additional numbers: 10 is at the bottom-left corner of the grid, 11 is at the bottom-middle corner, 12 is at the bottom-right corner, and 13 is at the bottom-right corner of the grid. Annotations include: 406 is above cell 3, 412 is above cell 5, 414 is to the right of cell 5, 420 is to the left of cell 7, and 422 is to the left of cell 8. Lines connect these numbers to their respective locations on the grid.</p></div> <p>Dou at Figure 4A, Calculating N_1</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><p style="text-align: center;">400</p><p>The diagram shows a 31-day calendar grid. The days are numbered 1 through 31. The grid is 5 rows high and 9 columns wide. The first row contains days 1-9, the second row 10-16, the third row 17-24, the fourth row 25-31, and the fifth row is empty. The grid is enclosed in a rectangular frame. Annotations include: 400 pointing to the top of the frame; 406 pointing to the center of the grid; 412 pointing to the top right corner of the grid; 414 pointing to the right side of the grid; 420 pointing to the bottom left corner of the grid; and 422 pointing to the bottom right corner of the grid.</p></div> <p>Dou at Figure 4A, Calculating N₂</p>

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		<p>Dou at Figure 4A, Calculating N_3</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> <p> $N_1 = 13;$ $N_2 = 31;$ and $N_3 = 71;$ </p> <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$

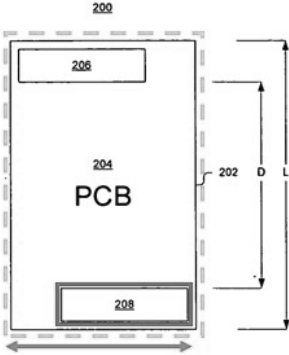
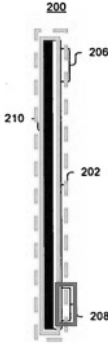
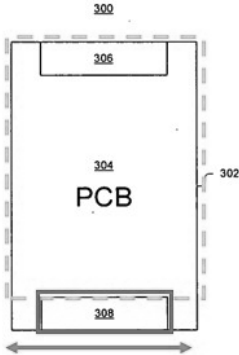
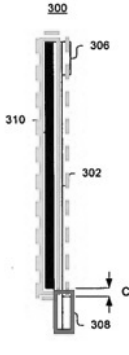
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(31) - \log_{10}(13))}{\log_{10} 1/2} = 1.2538$ <p>and</p> $1.20 \leq 1.2538$ <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>
Claim 7		
7[pre]	A wireless device comprising:	<p>To the extent the preamble is limiting, Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[pre]</p>
7[a]	a ground plane;	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[a]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
7[b]	a first non-planar antenna	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[b]</i></p> <p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“In various embodiments, the first internal antenna 206 and/or the second internal antenna 208 may be implemented using any type of suitable internal antenna, such as a planar inverted-F antenna, a planar inverted-L antenna, an inverted-F antenna with a helical structure, an inverted-L antenna with a helical structure, a monopole antenna, a meandered monopole antenna, a dipole antenna, a balanced antenna, a printed helical antenna, a chip antenna, and a ceramic antenna. The embodiments are not limited in this context.</p> <p>Dou at [0028]</p>

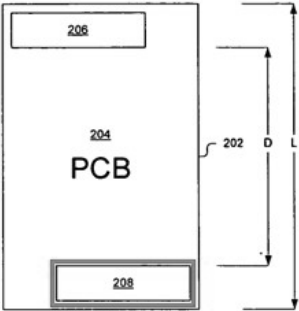
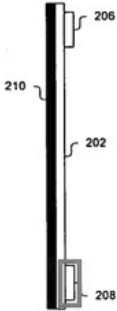
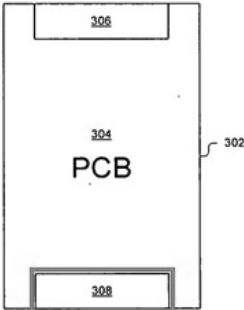
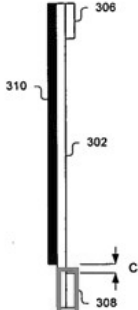
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>“As shown in FIG. 3A, the wireless device 300 may have an internal diversity antenna architecture comprising a first internal antenna 306 and a second internal antenna 308 disposed on the PCB 304 for achieving diversity. In this embodiment, the internal diversity antenna architecture may comprise a first internal antenna 306 located substantially at the top of the wireless device 300. For example., the first internal antenna 306 may be located substantially at the top of the housing 302 and/or the top of the PCB 304. The internal diversity antenna architecture may comprise a second internal antenna 308 located substantially at the bottom of the wireless device 300. For example, the second internal antenna 308 may be located substantially at the bottom of the housing 302 and/or the bottom of the PCB 304.”</p> <p>Dou at [0032]</p> <p>“FIG. 3B illustrates a side view of the wireless device 300 of FIG. 3A. As shown, the wireless device 300 may comprise a ground plane 310 to improve antenna performance in talk position and reduce SAR. As shown, the ground plane 310 does not extend underneath the second internal antenna 308. In this embodiment, the second internal antenna 208 may be separated from the ground plane 310 by a clearance distance (C) that is no less than 5 mm (>5 mm). The first internal antenna 206 may comprise, for example, a planar inverted F-antenna. The second internal antenna 208 may comprise, for example, a monopole-antenna, an inverted-L antenna, a meandered monopole, a printed helical antenna, a dipole antenna, a balanced antenna, or other suitable antenna. The embodiments are not limited in this context.”</p> <p>Dou at [0034]</p> <p>“As shown in FIG. 4A, the wireless device 400 may have an internal diversity antenna architecture comprising a first internal antenna 406 and a second internal antenna 408 disposed on the PCB 404 for achieving diversity. In this embodiment, the first internal antenna 406 may comprise a first feed point 412 and a first ground point 414, and the second internal antenna 408 may comprise a second feed point 416 and a second ground point 418. The first internal antenna 406 may be located substantially near the top of the wireless device 400, and the second internal antenna 408 may be located substantially near the bottom of the wireless device 400.</p>

Exhibit – F – 01

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		Dou at [0036]
7[c]	[<i>the first non-planar antenna</i>] proximate to a first side of a ground plane rectangle enclosing the ground plane,	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[c]

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div><div><p>FIG. 2A</p></div><div><p>FIG. 2B</p></div><div><p>FIG. 3A</p></div><div><p>FIG. 3B</p></div><p>Figures 2A-B and 3A-B</p></div>

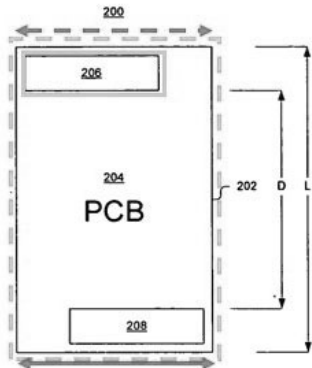
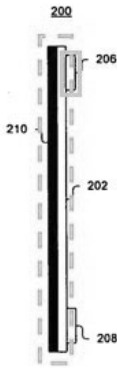
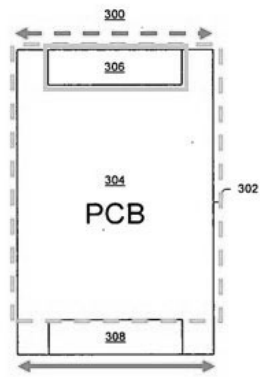
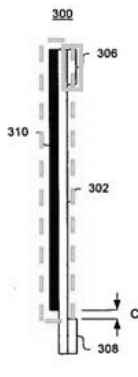
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
7[d]	the first non-planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[d]
7[e]	a minimum-sized parallelepiped completely enclosing a volume of the first non-planar antenna,	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i>

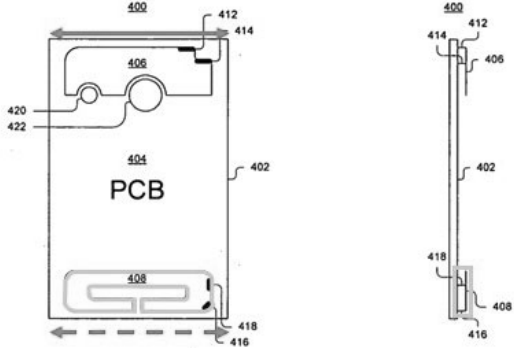
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="653 375 949 724"><p>200</p><p>206</p><p>204 PCB</p><p>208</p><p>202</p><p>D</p></div> <p data-bbox="699 776 804 805">FIG. 2A</p> <div data-bbox="1035 375 1150 724"><p>200</p><p>206</p><p>210</p><p>202</p><p>208</p></div> <p data-bbox="1041 776 1146 805">FIG. 2B</p> <div data-bbox="653 857 894 1206"><p>300</p><p>306</p><p>304 PCB</p><p>308</p><p>302</p></div> <p data-bbox="699 1258 804 1287">FIG. 3A</p> <div data-bbox="1035 857 1171 1206"><p>300</p><p>306</p><p>310</p><p>302</p><p>C</p><p>308</p></div> <p data-bbox="1041 1258 1146 1287">FIG. 3B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="655 431 926 781"> <p>FIG. 4A</p> </div> <div data-bbox="1056 431 1163 781"> <p>FIG. 4B</p> </div> <p>Figures 2A-B, 3A-B, 4A-B</p>
7[f]	the minimum-sized parallelepiped having a face with a largest area;	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="653 375 949 724"><p>200</p><p>206</p><p>204 PCB</p><p>208</p><p>202</p><p>D</p></div> <p data-bbox="699 776 804 805">FIG. 2A</p> <div data-bbox="1033 375 1150 724"><p>200</p><p>206</p><p>210</p><p>202</p><p>208</p><p>D</p></div> <p data-bbox="1039 776 1144 805">FIG. 2B</p> <div data-bbox="653 857 896 1206"><p>300</p><p>306</p><p>304 PCB</p><p>308</p><p>302</p><p>D</p></div> <p data-bbox="699 1258 804 1287">FIG. 3A</p> <div data-bbox="1033 857 1171 1206"><p>300</p><p>306</p><p>310</p><p>302</p><p>308</p><p>c</p><p>D</p></div> <p data-bbox="1039 1258 1144 1287">FIG. 3B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="640 430 1155 828"> <p>FIG. 4A FIG. 4B</p> </div> <p>Figures 2A-B, 3A-B, 4A-B</p>
7[g]	a second antenna proximate to a second side of the ground plane rectangle, and	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[g]</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="667 373 976 738"></div> <div data-bbox="724 771 835 808">FIG. 2A</div> <div data-bbox="1060 373 1176 738"></div> <div data-bbox="1066 771 1176 808">FIG. 2B</div> <div data-bbox="667 852 924 1226"></div> <div data-bbox="724 1250 835 1287">FIG. 3A</div> <div data-bbox="1060 852 1197 1226"></div> <div data-bbox="1066 1250 1176 1287">FIG. 3B</div>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p data-bbox="737 800 835 824">FIG. 4A</p> <p data-bbox="1052 800 1150 824">FIG. 4B</p> <p data-bbox="632 914 957 943">Figures 2A-B, 3A-B, 4A-B</p>
7[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	<p data-bbox="632 992 1314 1021">Dou expressly or inherently discloses this claim element.</p> <p data-bbox="632 1057 972 1086"><i>See, e.g.,</i> claim element 1[h]</p>
7[i]	wherein the first non-planar antenna has a first contour defined as	<p data-bbox="632 1245 1314 1274">Dou expressly or inherently discloses this claim element.</p> <p data-bbox="632 1310 972 1339"><i>See, e.g.,</i> claim element 1[e]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	a perimeter of any portions of the first non-planar antenna arranged in the face, perimeters of any closed apertures of any portions of the first non-planar antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first non-planar antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	
7[j]	wherein the first contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
7[k]	complexity factor F_{32} having a value of at least 1.35;	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]
7[l]	<p>Wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,</p>	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	<p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are double the widths and heights of the cells of the grid G2, and</p>	
7[m]	<p>wherein the level of complexity of the first contour is configured to provide operation of the wireless device in</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[k]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	the at least three frequency bands.	
Claim 8		
8	The wireless device of claim 7, wherein the first non-planar antenna includes at least two antenna elements that are electromagnetically coupled.	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“In various embodiments, the first internal antenna 206 and/or the second internal antenna 208 may be implemented using any type of suitable internal antenna, such as a planar inverted-F antenna, a planar inverted-L antenna, an inverted-F antenna with a helical structure, an inverted-L antenna with a helical structure, a monopole antenna, a meandered monopole antenna, a dipole antenna, a balanced antenna, a printed helical antenna, a chip antenna, and a ceramic antenna. The embodiments are not limited in this context.</p> <p>Dou at [0028]</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p>

Exhibit – F – 01

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>“According to a design result, the signal loops may be further short-circuited through a conductor connection sheet, thus forming additional signal loops. In the first to third preferred embodiments, a part of the first signal loop 10 except the common conductor 5 and a part of the second signal loop 20 except the common conductor 5 may be connected through at least one conductor connection sheet 9. In the fourth preferred embodiment, the first signal loop 10 and the second signal loop 20 may be connected through at least one conductor connection sheet 9.”</p> <p>Wei at 16:9-15</p>

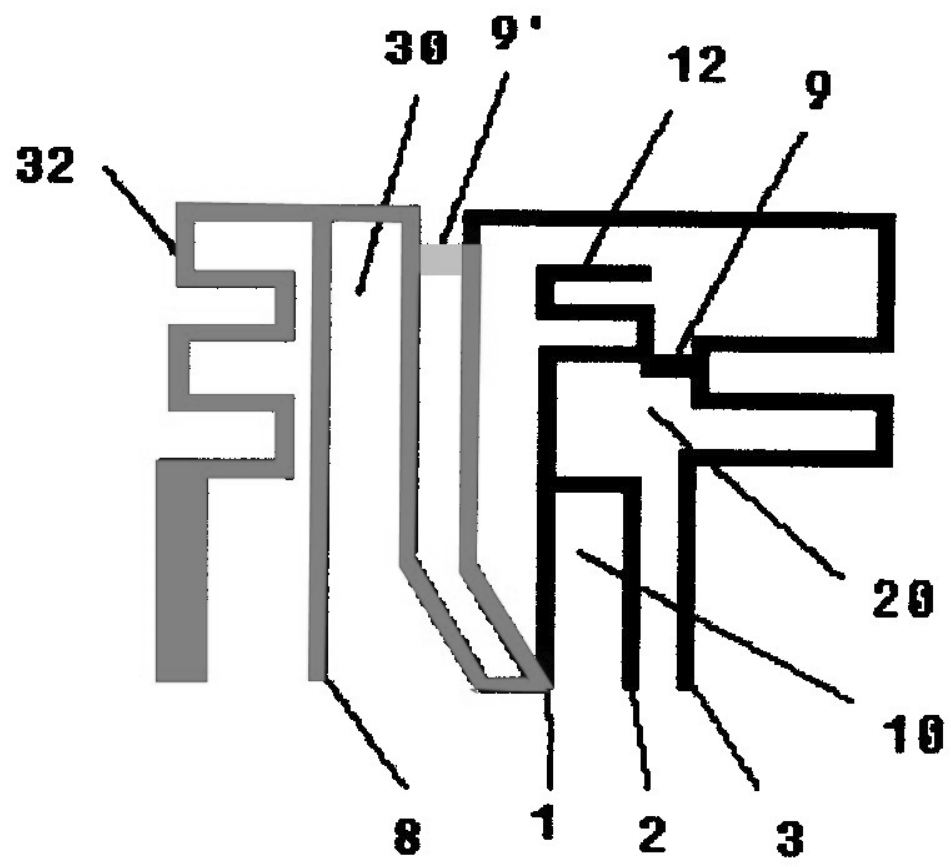
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p>The diagram shows a complex mechanical assembly with several components labeled with numbers. The labels and their corresponding parts are: 1 (a vertical rod), 2 (a horizontal bar), 3 (a vertical bar), 8 (a vertical rod), 9 (a horizontal bar), 9' (a horizontal bar), 10 (a vertical bar), 12 (a horizontal bar), 20 (a horizontal bar), 30 (a horizontal bar), and 32 (a vertical bar). The assembly is shown in a perspective view, with some components being thicker than others.</p> <p>Wei at Figure 9</p>

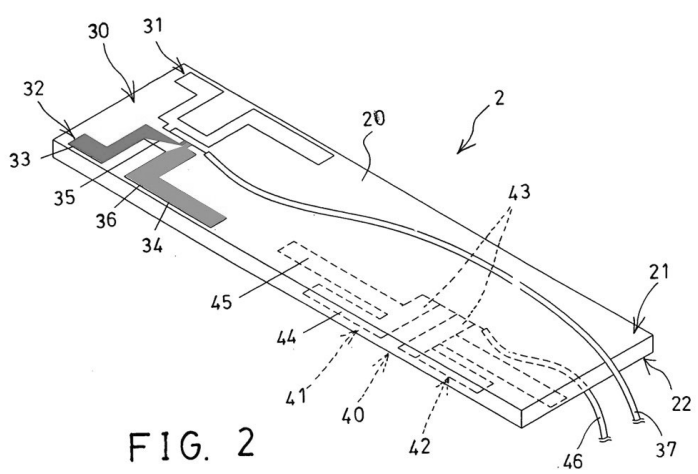
Exhibit – F – 01

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>“Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package such as for instance 753. Also, the package will include at least another terminal within the set of terminals 107 to externally ground one of the RF voltage references of die 103. Two conducting parts of the antenna such as the active monopole 751 and the parasitic one 752 are coupled by means of a close proximity region 754 such that the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna.”</p> <p>Castany868 at 17:30-18:9</p>

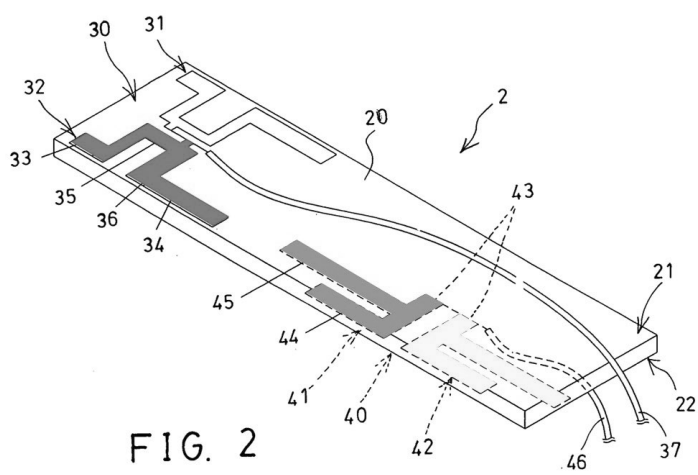
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="651 357 1113 1169"></div> <p data-bbox="630 1209 861 1242">Figures 7A and 7B</p>

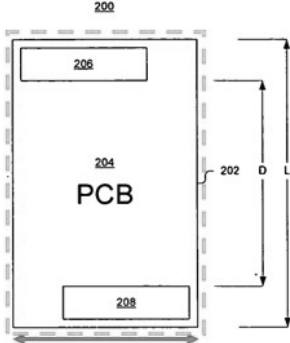
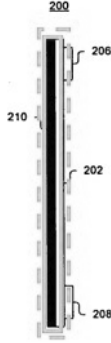
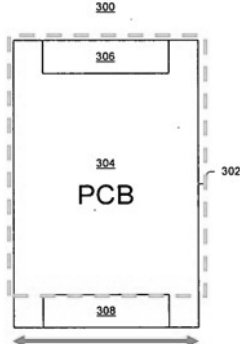
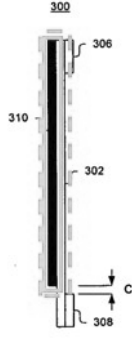
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
9	The wireless device of claim 7, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.</i>, claim element 1[f]</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 13;$ $N_2 = 31; \text{ and}$ $N_3 = 71;$ <p>that given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(71) - \log_{10}(31))}{\log_{10} 1/2} = 1.1956$ <p>and</p> $1.1956 < 1.75$
Claim 10		

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
10[a]	The wireless device of claim 7, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.</i>, claim element 1[h], 4</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.</i>,</p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p>  <p>FIG. 2</p> <p>Chou at Figure 2</p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<p>symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		 <p>FIG. 2</p> <p>Chou at Figure 2</p>
10[b]	the third antenna is arranged within the wireless device.	<p>Dou expressly or inherently discloses this claim element.</p> <p>See, e.g., claim element 4, 10[a]</p>
Claim 12		
12	The wireless device of claim 7, wherein the first side of the ground	<p>Dou expressly or inherently discloses this claim element.</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	plane rectangle is a short side of the ground plane rectangle.	<p>See, e.g.,</p>  <p>FIG. 2A</p>  <p>FIG. 2B</p>  <p>FIG. 3A</p>  <p>FIG. 3B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		Figures 2A-B, 3A-B
Claim 13		
13[pre]	A wireless device comprising:	To the extent the preamble is limiting, Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[pre] and 7[pre]
13[a]	a ground plane;	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[a], 7[a]
13[b]	a first antenna	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[b], 7[b]
13[c]	proximate to a first side of a ground plane rectangle enclosing the ground plane,	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[c], 7[c]

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
13[d]	the first antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[d], 7[d]
13[e]	a minimum-sized parallelepiped completely enclosing a volume of the first antenna,	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 7[e]
13[f]	the minimum-sized parallelepiped having a face with a largest area;	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , 7[f]
13[g]	a second antenna proximate to a second side of the ground plane rectangle	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[g], 7[g]
13[h]	configured to receive signals from at least two frequency bands of	Dou expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	the at least three frequency bands,	<i>See, e.g.</i> , claim element 1[h], 7[h]
13[i]	wherein the first antenna has a first contour defined as a perimeter of any portions of the first antenna arranged in the face, perimeters of any closed apertures of any portions of the first antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[e], 7[e]
13[j]	wherein the first contour has a level of complexity defined by complexity factor F_{21}	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[f], 7[j]

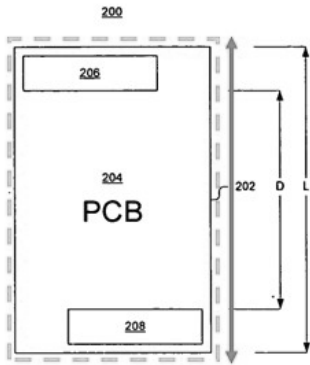
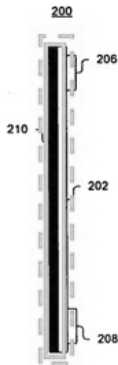
Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	having a value of at least 1.20 and	
13[k]	complexity factor F_{32} having a value of at least 1.35; and	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[f], 7[k]
13[l]	<p>wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at</p>	<p>Dou expressly or inherently discloses this claim element.</p> <p><i>See, e.g.</i>, claim element 1[f], 7[l]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	<p>least a point of the first contour,</p> <p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are double the widths and heights of the cells of the grid G2, and</p> <p>the grid G3 being aligned with the grid G2, the cells of the grid</p>	

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
	G3 having widths and heights that respectively are half the widths and heights of the cells of the grid G2, and	
13[m]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[k], 7[m]
Claim 14		
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 8
Claim 15		

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
15	The wireless device of claim 13, wherein the first antenna is planar.	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[b]
Claim 17		
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 9
Claim 18		
18[a]	The wireless device of claim 13, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and	Dou expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[h], 4, 10[a]

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
18[b]	the third antenna is arranged within the wireless device.	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 4, 10[a], 10[b], 18[a]
Claim 19		
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 12
Claim 20		
20	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a long side of the ground plane rectangle.	Dou expressly or inherently discloses this claim element. <i>See, e.g.,</i>

Claim No.	U.S. Patent No. 12,095,149 B2	Dou
		<div data-bbox="659 373 966 735"></div> <div data-bbox="720 774 823 808">FIG. 2A</div> <div data-bbox="1050 373 1167 735"></div> <div data-bbox="1060 774 1163 808">FIG. 2B</div> <div data-bbox="632 855 795 889">Figures 2A-B</div>

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 12,095,149 B2
BASED ON CHINESE PATENT NO. 2,765,337 TO WEI (“WEI”)

Based upon Plaintiff’s Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendants’ accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious some or all of the asserted claims. These invalidity contentions are not an admission by the Defendants that the accused products are covered by or infringe claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, and 20 (the “’149 Asserted Claims”)¹, particularly when these claims are properly construed and applied.

AIA law applies because the application that issued as the ’149 Patent was filed on June 22, 2023, after the AIA came into force on March 16, 2013.

Chinese Patent No. 2,765,337. (“Wei”) was filed on February 6, 2005, and was granted on March 15, 2006. This patent is prior art under at least 35 U.S.C. § 102(e), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 12,095,149 (the “’149 Patent”), are invalid as anticipated by Wei.

To the extent that Wei is found not to anticipate one or more of the asserted claims of the ’149 Patent, these claims are invalid as obvious in view of Wei alone or as modified in view of or in combination with other prior art references disclosed in Defendants’ Invalidity Contentions and accompanying charts, including without limitation as set forth below.

- U.S. Patent Application No. 2007/0200773 to Dou et al. (“Dou”) was filed on February 24, 2006, published on August 30, 2007, and issued as U.S. Patent No. 7,548,208 on June 16, 2009. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- PCT Publication No. 2004/042868 to Castany et al. (“Castany868”) was filed on November 7, 2002 and published on May 21, 2004, on August 30, 2007. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- U.S. Patent No. 6,943,746 to Talvitie et al. (“Talvitie”) was filed on October 23, 2003, published on July 15, 2004, and issued on September 13, 2005. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).

¹ Defendants understand that, by not charting claims 6, 11, and 16 in its Infringement Contentions, Plaintiff does not assert these claims against Defendants.

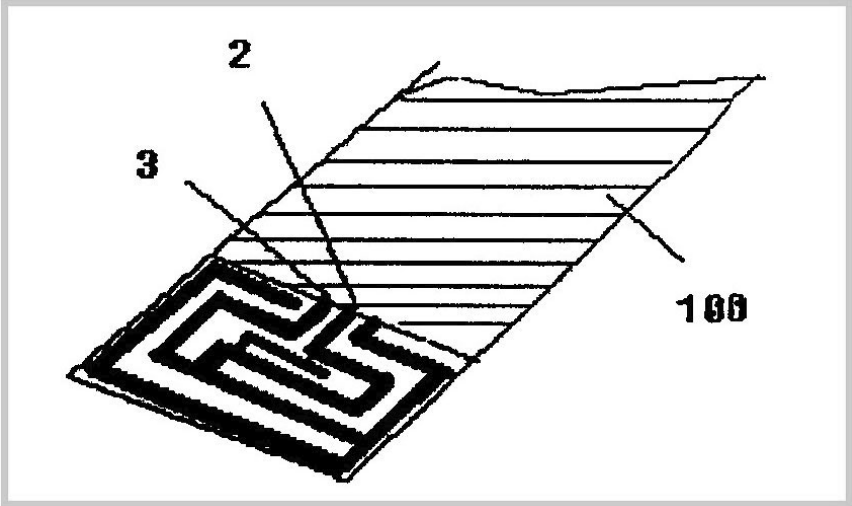
Exhibit – F – 02

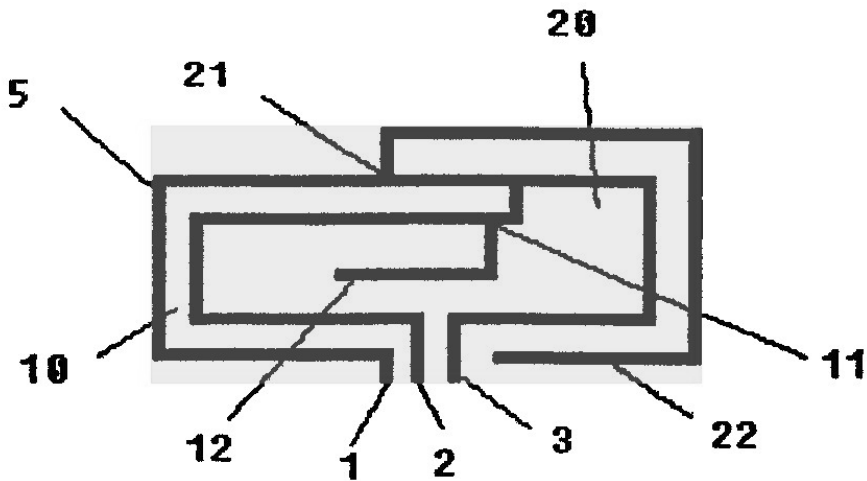
- U.S. Patent Application No. 2002/0238433 to Chou (“Chou”) was filed on March 1, 2005, published on October 26, 2006, and issued as U.S. Patent No. 7,129,898 on October 31, 2006. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- Microstrip Sierpinski Carpet Antenna Using Transmission Line Feeding by Mohamad Kamal A. Rahim, et al., Asia-Pacific Microwave Conference Proceedings, (“Rahim”) published in December 2005. This paper/book is prior art under at least 35 U.S.C. § 102(a) and 103(a).

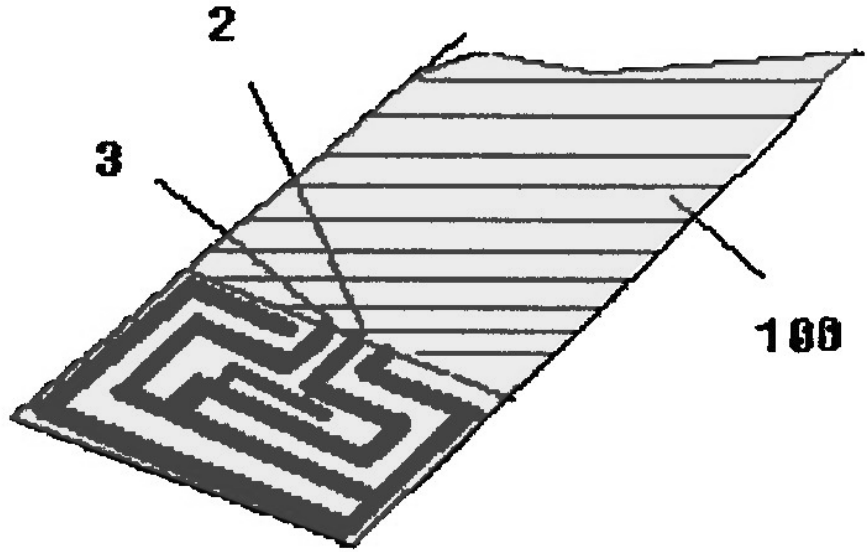
These invalidity contentions are not an admission that the Defendants concede or acquiesce to any claim construction implied or suggested by Plaintiff’s Complaint or Infringement Contentions. Nor are Defendants asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature. Defendants reserve the right to update their constructions and contentions in view of this Court’s claim construction order.²

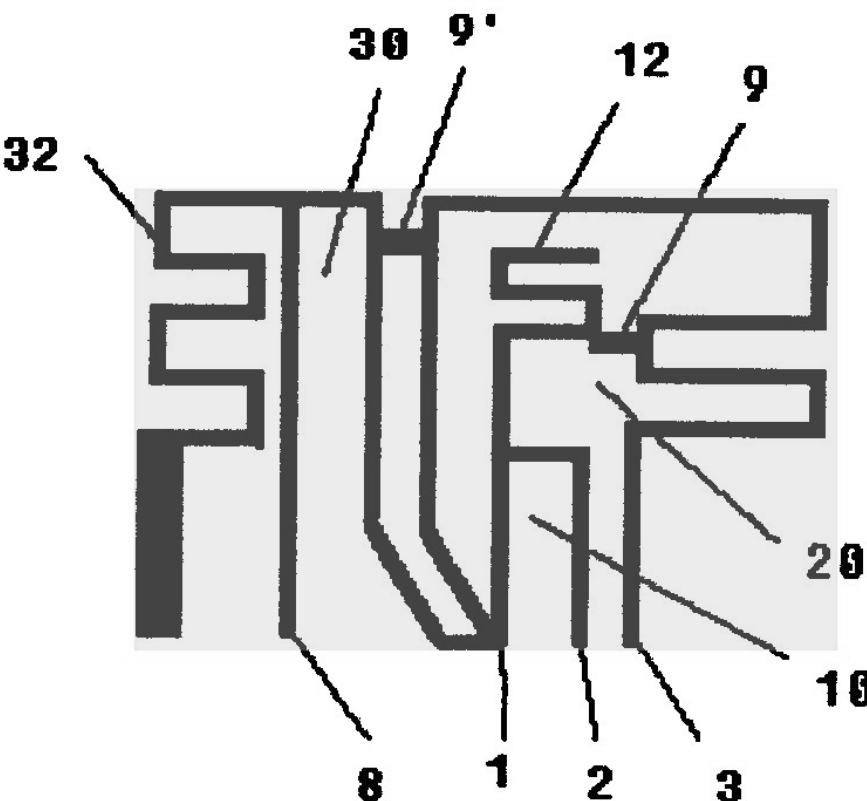
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
Claim 1		
1[pre]	A wireless device comprising:	<p>To the extent the preamble is limiting, Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“This utility model relates to an antenna of a mobile terminal (such as a mobile phone, a mobile personal digital assistant (PDA), a mobile smartphone, a mobile point of sales (POS) machine, or a wide local area network (WLAN) terminal), and in particular, to a wide-band multi-loop mobile terminal antenna with a high gain.”</p> <p>Wei at 6:4-7</p> <p>“A technical problem to be solved by this utility model is to overcome the shortcomings of the existing art, and a wide-band multi-loop mobile terminal antenna is provided. The antenna can cover a plurality of</p>

² Defendants incorporate herein any related work performed by or on behalf of an author or an inventor in the United States under 35 U.S.C. § 102(g)(2). Defendants reserve the right to supplement and/or alter this chart based on further investigation and ongoing discovery.

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>frequency bands and implement multi-band resonance, so that a mobile terminal (such as a mobile phone) with the antenna can be sold and used in a global market. This facilitates material management of a manufacturer and helps the manufacturer to reduce production costs. Moreover, good matching in a plurality of frequency bands and a plurality of usage scenarios can be implemented. In addition, the antenna has the characteristics of high efficiency and high gain, thereby improving call quality, enlarging a signal coverage region, and prolonging call duration and standby time.”</p> <p>Wei at 7:24-32</p>  <p>Wei at Figure 2B</p>
1[a]	a ground plane ;	Wei expressly or inherently discloses this claim element.

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		<p><i>See, e.g.,</i></p> <p>“The so-called "ground point" means a physical connection point between an antenna and a reference ground plane of a mobile terminal mainboard, namely, an end point of a signal loop of this utility model. The ground point is connected to a reference ground point of a feed point through a conductor, thus forming a loop. An antenna provided by this utility model has a plurality of ground points, and the ground points are connected through metal conductors (namely, ground planes).”</p> <p>Wei at 14:7-12</p>  <p>Wei at Figure 2A</p>

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		 <p data-bbox="630 938 840 971">Wei at Figure 2B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="617 331 1929 1201"><p>The diagram shows a cross-sectional view of a mechanical assembly. It features a central vertical channel (1) flanked by two main vertical walls (8 and 2). On the left, there is a complex stepped structure (32). On the right, there is another stepped structure (20) with a horizontal ledge (10). Various internal features and surfaces are labeled with numbers: 9 and 9' at the top, 12 on the right wall, 30 on the left wall, 3 at the bottom right, and 10 at the bottom right corner. The entire assembly is shown within a rectangular frame.</p></div> <p data-bbox="617 1201 819 1242">Wei at Figure 9</p>

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		<p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>"FIG. 2B illustrates a side view of the wireless device 200 of FIG. 2A. As shown, the wireless device 200 may comprise a ground plane 210. In various implementations, the ground plane 210 may improve antenna performance in talk position and reduce SAR. As shown, the ground plane 210 may extend underneath the first internal antenna 206 and the second internal antenna 208. The ground plane 210 may be required underneath the second internal antenna 208, for example, if a key pad is positioned at the edge of the PCB 204 and demands a ground layer underneath for its circuitry. In this embodiment, the first internal antenna 206 and the second antenna 208 may each comprise a planar inverted F-antenna, for example, including at least one read port and one or more ground ports. The embodiments are not limited in this context."</p> <p>Dou at [0029]</p> <p>"FIG. 3B illustrates a side view of the wireless device 300 of FIG. 3A. As shown, the wireless device 300 may comprise a ground plane 310 to improve antenna performance in talk position and reduce SAR. As shown, the ground plane 310 does not extend underneath the second internal antenna 308. In this embodiment, the second internal antenna 208 may be separated from the ground plane 310 by a clearance distance (C) that is no less than 5 mm (>5 mm). The first internal antenna 206 may comprise, for example, a planar inverted F-antenna. The second internal antenna 208 may comprise, for example, a monopole-</p>

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Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>antenna, an inverted-L antenna, a meandered monopole, a printed helical antenna, a dipole antenna, a balanced antenna, or other suitable antenna. The embodiments are not limited in this context.”</p> <p>Dou at [0034]</p>

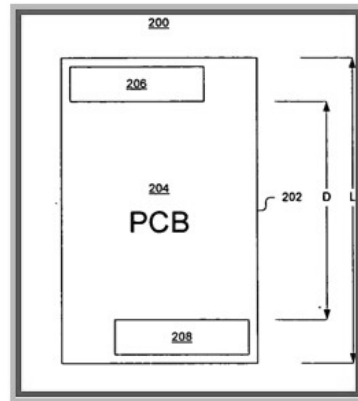


FIG. 2A

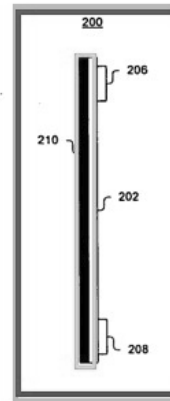


FIG. 2B

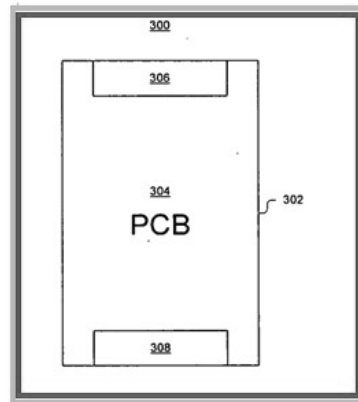


FIG. 3A

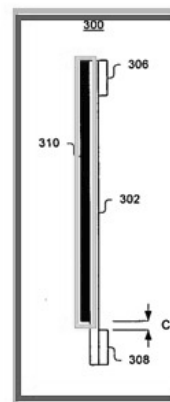
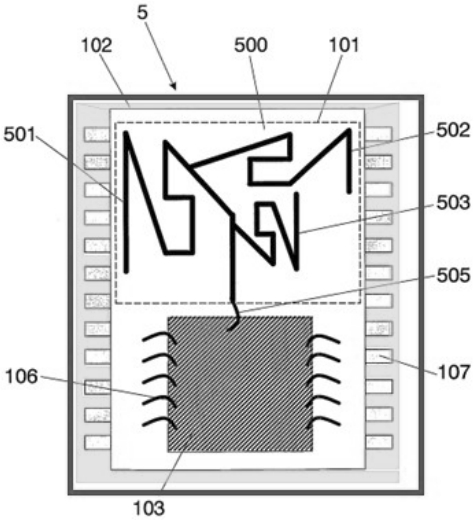


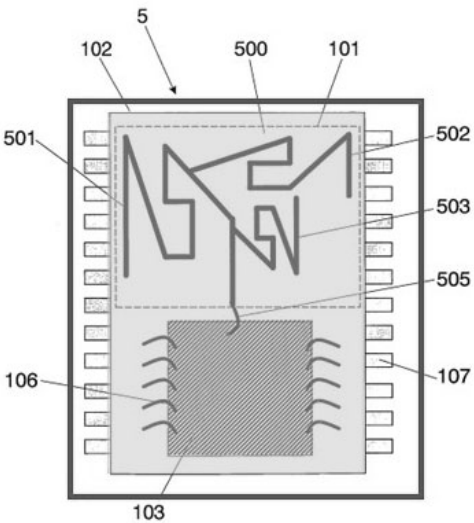
FIG. 3B

Dou at Figures 2B and 3B

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>“Other embodiments where the antenna structure is split on several parallel layers consists on an active-parasitic arrangement. That is, the package includes a plurality of dielectric layers within one or more substrates of the package, wherein the package includes at least a first conducting pattern for the antenna in a first of the layers, the first conducting pattern on the first layer being coupled or connected to the semiconductor die. Such a first conducting pattern that is fed by the die is the active element of the antenna arrangement. In this arrangement, the package includes at least a second conducting pattern on at least a second layer of any of the substrates, the second conducting pattern being capacitively or inductively coupled to the first conducting pattern of the antenna, the second conducting pattern acting as a parasitic element for the antenna. As an example, the antennas on the package embodiments shown in Figures 1-6, 11-15 and 17-22 could become the active antenna in such an active-parasitic antenna arrangement, wherein at least an additional antenna pattern on a parallel layer on the same or other substrate would act as the parasitic element or elements of the antenna structure. The effect of such parasitic elements is primarily an increase in the bandwidth and efficiency of the antenna, together with a finer tuning of the input impedance to match the output of the output amplifier connected to the antenna.”</p> <p>Castany868 at 13:26-14:9</p> <p>“Figure 5 shows a multibranch antenna structure on a package 5, where several curves, with not necessarily the same lengths, intersect each other at some points. In particular, the antenna 500 includes three arms 501 , 502, 503, each of them being in the form of a curve according to the present invention. In this particular example the antenna takes the form of a monopole as in Figure 1 , with a single feeding port connected to the die by means of connection 105 and one or more connections within terminals 107 connected to an external ground plane.”</p> <p>Castany868 at 17:6-12</p> <p>“Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to</p>

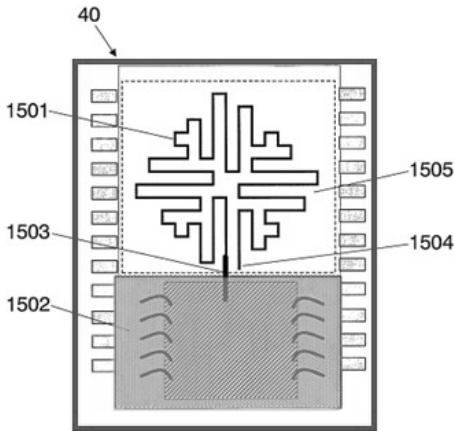
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>an external ground plane or ground counterpoise by means of at least one of the terminals of the package such as for instance 753.” Castany868 at 17:30-18:3</p> <p>“When more than 50% of the area below 101 is filled with a conducting material, the antenna becomes a microstrip or patch antenna according to the present invention, the conducting material being the ground for the microstrip or patch antenna. The antenna also becomes a planar inverted F antenna (PIFA), if additionally, at least one short to ground is placed at any point within the conducting antenna pattern. In the case of either a microstrip or patch arrangement, or in the PIFA case, the ground covering more than 50% or the area underneath the antenna is preferred. Such a ground can be included in any of the layers of a substrate 102 supporting the antenna and/or the chip 103, or alternatively it can be included in the external substrate or PCB supporting the package.”</p> <p>Castany868 at 19:1-11</p> <p>“Figure 15 displays a package [40] including a monopole antenna 1501. In this example, a part of the grounding plane or ground counterpoise 1502 is placed on the same layer as the antenna, in such a way that it does not overlap the rectangular area 1505 in which the monopole arm 1501 is enclosed. The antenna is fed through one conductor 1503. In this particular embodiment, it is shown how the tip of the monopole 1504 can be put close to the ground plane 1502. This would provide some capacitive loading to the antenna that contributes to the overall antenna miniaturization.” Castany868 at 23:18-25</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="659 373 1129 889"></div> <p data-bbox="863 889 940 922">FIG.5</p> <p data-bbox="630 971 911 1003">Castany868 at Figure 5</p>

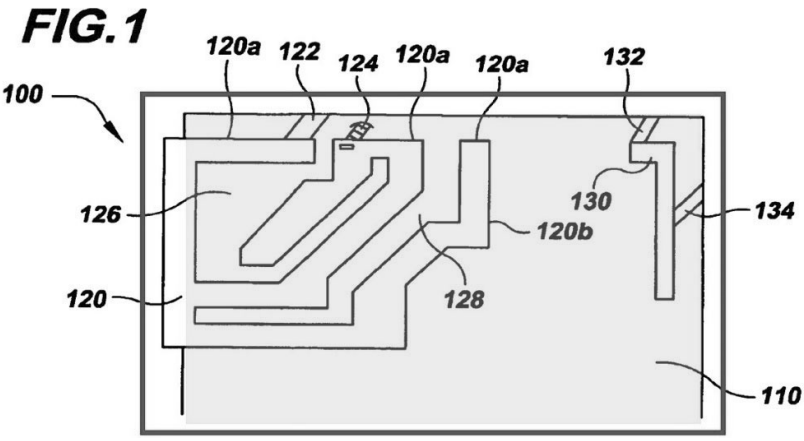
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="659 354 1129 873"></div> <p data-bbox="863 873 940 906">FIG.5</p> <p data-bbox="630 963 1050 995">Castany868 at Figure 5 (Alternate)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="640 365 1102 1185"><p>FIG. 7A and FIG. 7B are cross-sectional views of a device assembly. FIG. 7A shows a top view with a central cavity 700 containing a component 701. A dashed line 704 indicates a boundary. The assembly is surrounded by a frame 101. FIG. 7B shows a similar view with a central cavity 750 containing a component 751. A dashed line 754 indicates a boundary. The assembly is surrounded by a frame 101. Both figures show a central cavity with a component inside, surrounded by a frame. FIG. 7A includes labels 102, 701, 704, 700, 101, 702, 105, 106, 103, and 107. FIG. 7B includes labels 102, 751, 754, 750, 101, 752, 753, 105, 106, 103, and 107.</p></div> <p>Castany868 at Figures 7A and 7B</p>

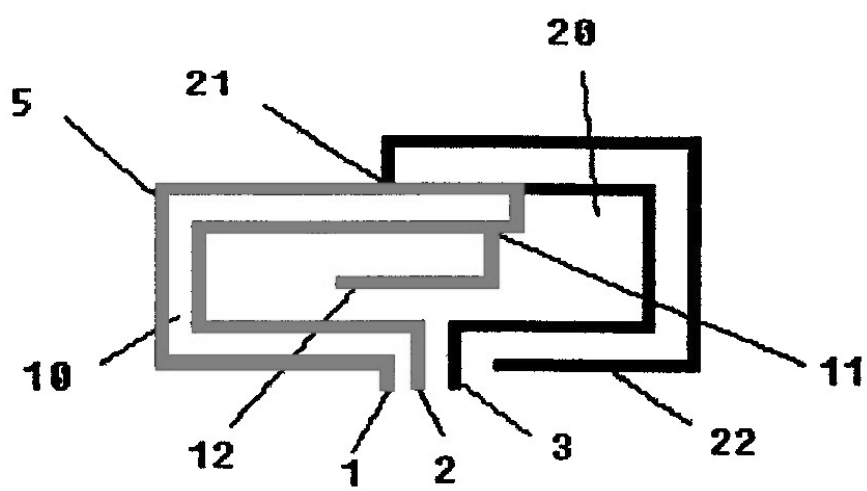
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="640 349 1102 1177"><p>FIG. 7A and FIG. 7B (Alternate) are cross-sectional views of a device. FIG. 7A shows a central cavity (700) with a top surface (701) and a bottom surface (702). A lower shaded region (106) is located below the cavity. The device is surrounded by a frame (101) with a top surface (102) and a bottom surface (103). A central vertical channel (704) is shown. FIG. 7B (Alternate) shows a similar device with a central cavity (750) and a lower shaded region (106). The device is surrounded by a frame (101) with a top surface (102) and a bottom surface (103). A central vertical channel (754) is shown. The device is also surrounded by a frame (75) with a top surface (751) and a bottom surface (752). A central vertical channel (753) is shown. The device is also surrounded by a frame (105) with a top surface (106) and a bottom surface (107).</p></div> <p>Castany868 at Figures 7A and 7B (Alternate)</p>

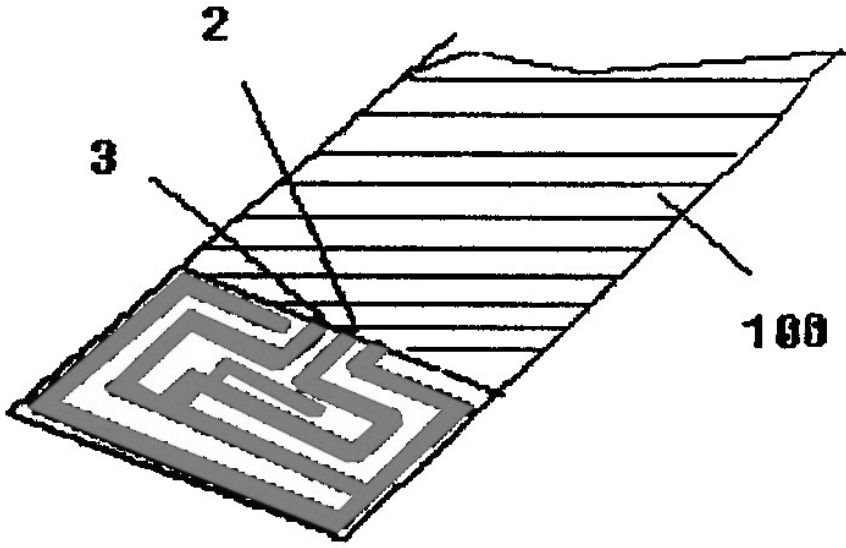
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="835 808 919 841">FIG.15</p> <p data-bbox="630 889 924 922">Castany868 at Figure 15</p> <p data-bbox="630 954 1911 1336">“Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120. The feed point 124 can be implemented as coaxial feed e.g. as a lead-through from the ground plane such that it resides at a substantial distance from the edge of the radiator. The feed point 124 can also be implemented by placing it at the edge of the radiator 120, in a similar manner to that of the ground point.”</p>

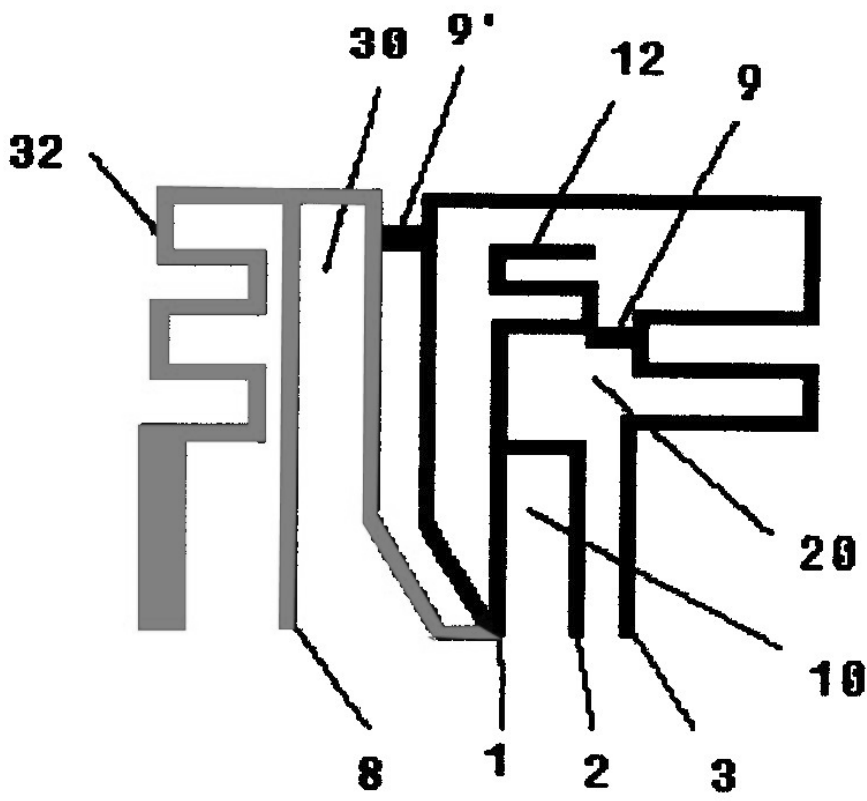
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>Talvitie at 3:47-65</p> <p>“The second radiator 130 is a narrow, planar radiator whose surface area in this embodiment is substantially smaller than that of the first radiator 120. The second radiator 130 also comprises a ground point 132 connecting the radiator 130 to a ground plane 110, and a feed point 134 feeding radiation power. The ground point 132 constituting a grounding line is located substantially at the edge of the radiator 130. The feed point 134 can be implemented as coaxial feed e.g. as a lead-through from the ground plane such that it resides at a substantial distance from the edge of the radiator. The feed point 134 can also be implemented by placing it at the edge of the radiator 130, in a similar manner to that of the ground point. The second radiator is configured to radiate within a frequency range at least partly overlapping with at least one frequency range, preferably with a higher frequency range, of the first radiator. As far as the operation of the present embodiments is concerned, the shape or location of the second radiator 130 with respect to the first radiator 120 is irrelevant; the only point is that both radiators are provided with a feed point of their own and, preferably but not necessarily, a common ground plane.”</p> <p>Talvitie at 4:47-67</p>

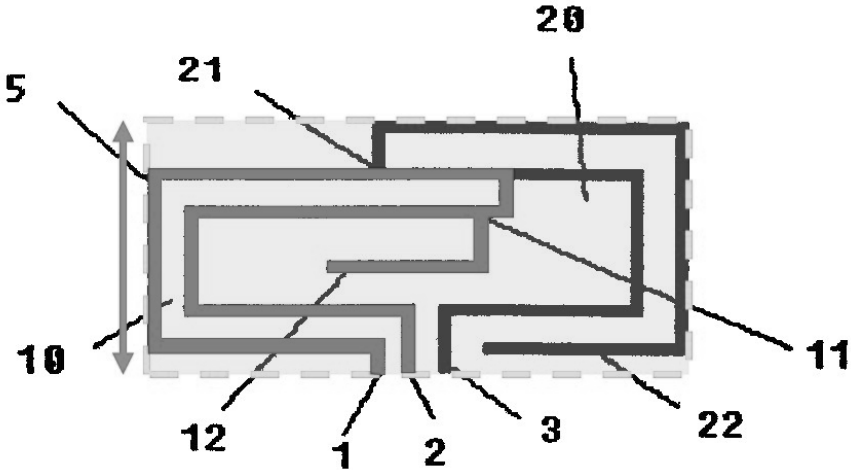
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>FIG. 1</p>  <p>Talvitie at Figure 1</p>
1[b]	a first planar antenna	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“With the development of the mobile communication industry, the requirements for a mobile terminal antenna are evolving toward multi-band operation (for example: GSM 800/900/1800/1900 Hz or WLAN 2.4 GHz/5.1 GHz/5.8 GHz), high gain, and adaptability to a plurality of usage scenarios (such as an open or closed state of a foldable phone, a handheld mode, a waist-mounted mode, or flat placement on a desktop). The existing mobile terminal antennas are categorized into two types: external antennas and internal antennas. The internal antennas are increasingly prevalent in mobile phones due to their aesthetic appearance, high portability, and improved resistance to damage from drops. The internal antennas include various planar inverted-F antennas (PIFAs) and monopole (or helical) antennas designed based on</p>

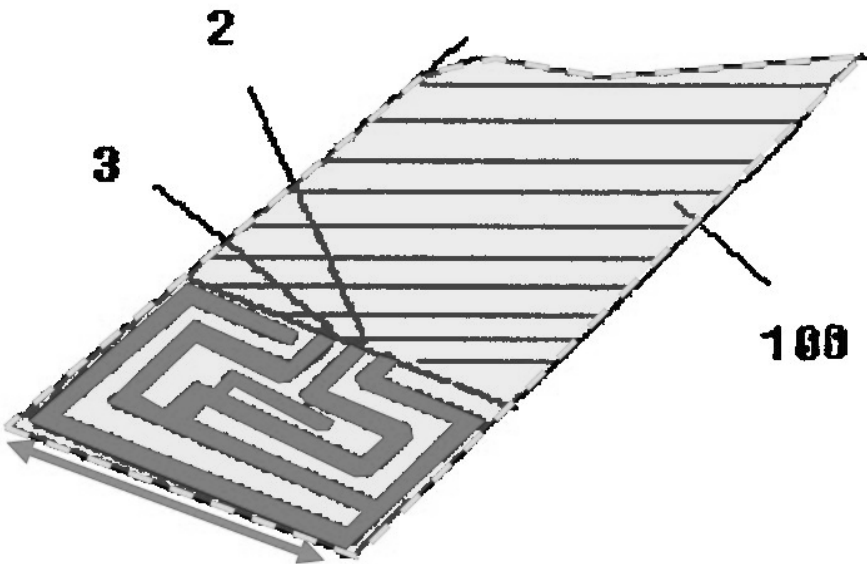
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>technologies similar to an external antenna technology. Since an internal antenna is required to have a small volume and a compact structure, it is difficult to achieve multi-band and high-gain performance, and even more challenging to implement good matching of a plurality of frequency bands under different states. For example, many internal antennas cover only two frequency bands such as GSM 900/GSM 1800 or GSM 800/GSM 1900, while some internal antennas may cover three frequency bands such as GSM 900/GSM 1800/GSM 1900 or GSM 800/GSM 1800/GSM 1900M. A manufacturer of whole mobile phones urgently desires to produce a quad-band mobile phone which can be sold in a global market. Without ability to develop and manufacture the quad-band mobile phones, manufacturers are compelled to offer two separate tri-band models to different markets. Consequently, two different versions need to be researched and developed for one model. This complicates production and material management, and hinders cost reduction.”</p> <p>Wei at 6:9-29</p> <p>“As shown in FIG. 2A, in a first preferred embodiment provided in this utility model, the metal conductor part includes two signal loops which are respectively a first signal loop 10 and a second signal loop 20. As shown in the figure, the first and second signal loops 10, 20 start from the same common feed point 1 and respectively terminate at two ground points 2, 3 (the numerals are the same below) with different physical positions. The second signal loop 20 completely surrounds the first signal loop 10, and the two signal loops have a common conductor 5.”</p> <p>Wei at 15:7-13</p> <p>“The antenna of this utility model is mounted on the mobile terminal mainboard 100. A positional relationship between the antenna and the mobile terminal mainboard 100 and a structure of a ground plane of the mobile terminal mainboard 100 may affect a frequency band characteristic of the antenna.”</p> <p>Wei at 18:1-4</p>

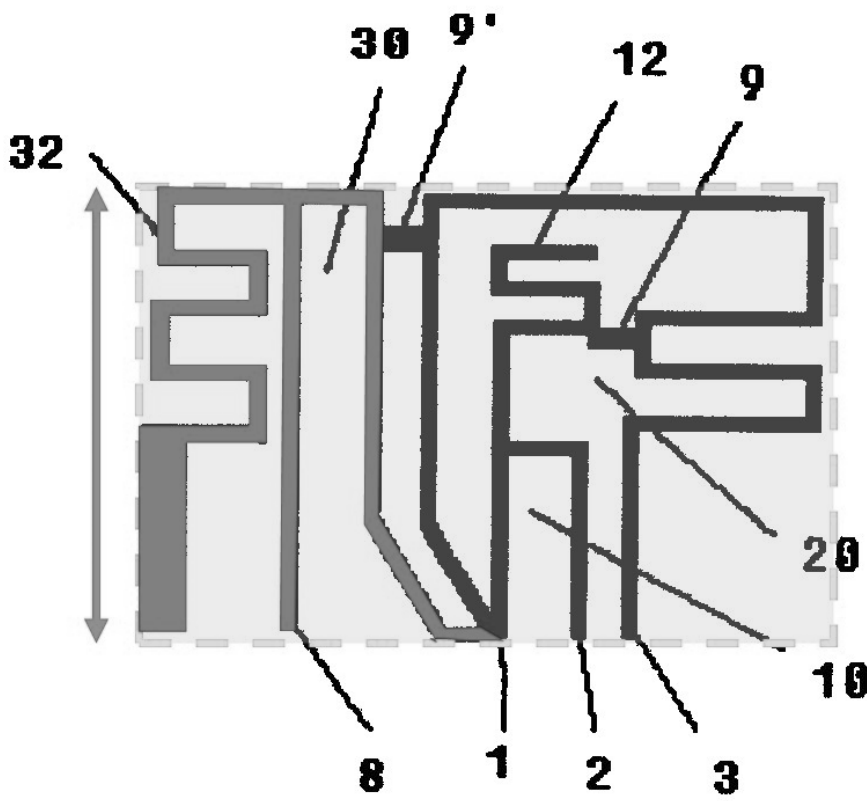
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 860 840 893">Wei at Figure 2A</p>

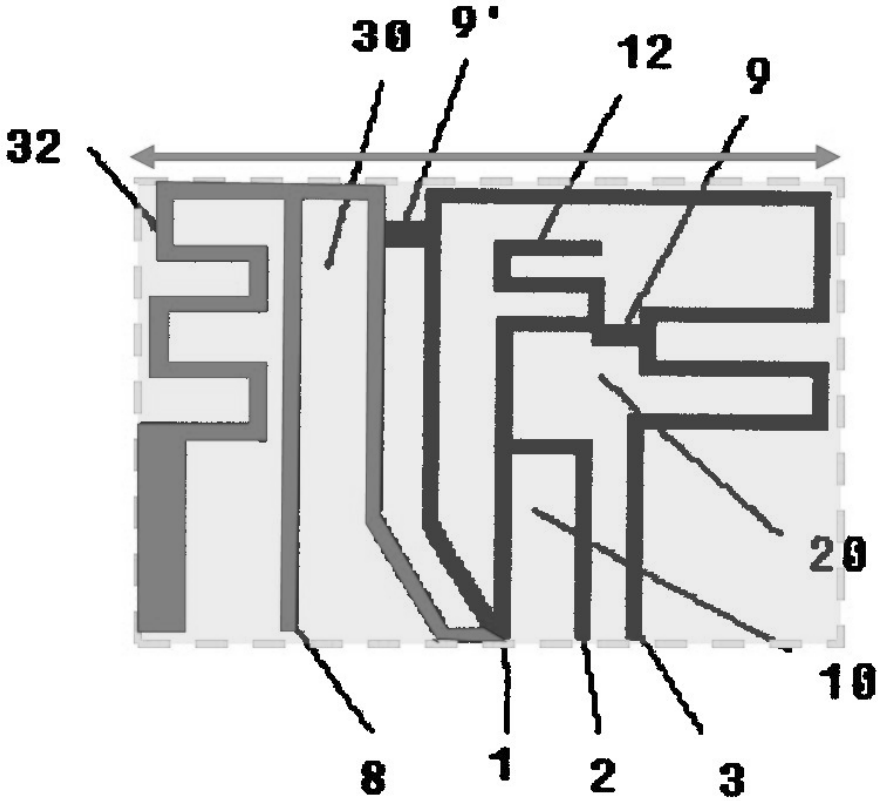
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2B</p> <p>“Referring to FIG. 9, in an eighth preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal loop 20, and a third signal loop 30. The three signal loops have no other common parts except the common feed point 1. The signal loops respectively terminate at ground points 2, 3, 8, and each of the first and third signal loops 10, 30 has one conductor branch 12, 32.”</p> <p>Wei at 16:25-29</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>The diagram shows a complex mechanical assembly with several interconnected components. The components are labeled with numbers: 1, 2, 3, 8, 9, 9', 10, 12, 20, 30, and 32. Component 32 is a large, grey, stepped structure on the left. Component 8 is a vertical bar extending from the bottom of 32. Component 9 is a vertical bar extending from the top of 8. Component 9' is a vertical bar extending from the top of 9. Component 12 is a horizontal bar extending from the top of 9'. Component 10 is a horizontal bar extending from the top of 12. Component 20 is a horizontal bar extending from the top of 10. Component 1 is a vertical bar extending from the bottom of 10. Component 2 is a vertical bar extending from the bottom of 1. Component 3 is a vertical bar extending from the bottom of 2. Component 30 is a horizontal bar extending from the top of 3. Component 9 is a vertical bar extending from the top of 30.</p> <p>Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
1[c]	[<i>the first planar antenna</i>] proximate to a first side of a ground plane rectangle enclosing the ground plane,	<p>Wei expressly or inherently discloses this claim element.</p> <p>See, e.g.,</p>  <p>Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="640 349 1501 909"></div> <p data-bbox="630 958 840 998">Wei at Figure 2B</p>

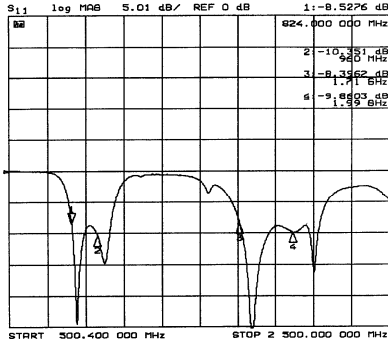
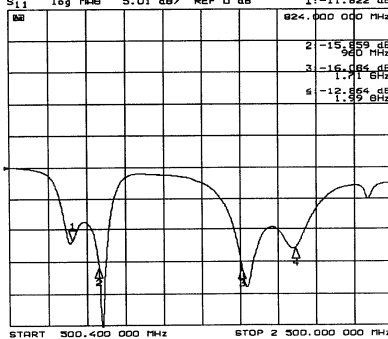
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9</p>

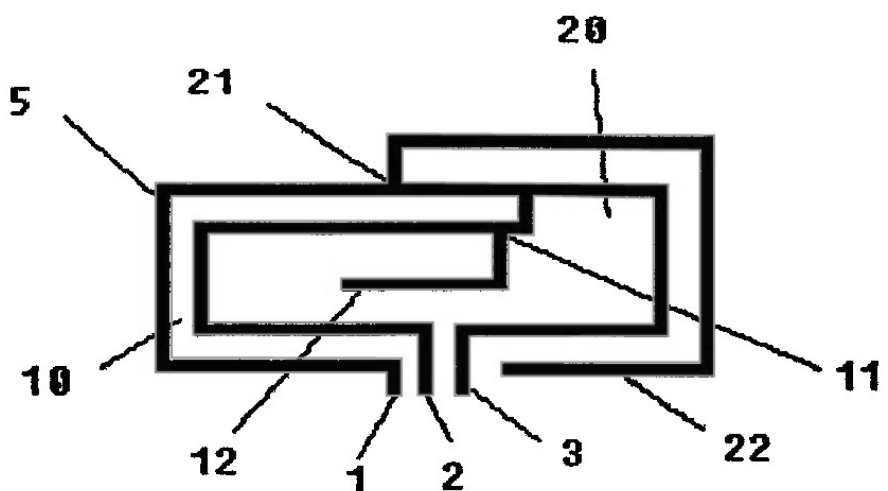
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9 (Alternative)</p>
1[d]	the first planar antenna being configured to	Wei expressly or inherently discloses this claim element.

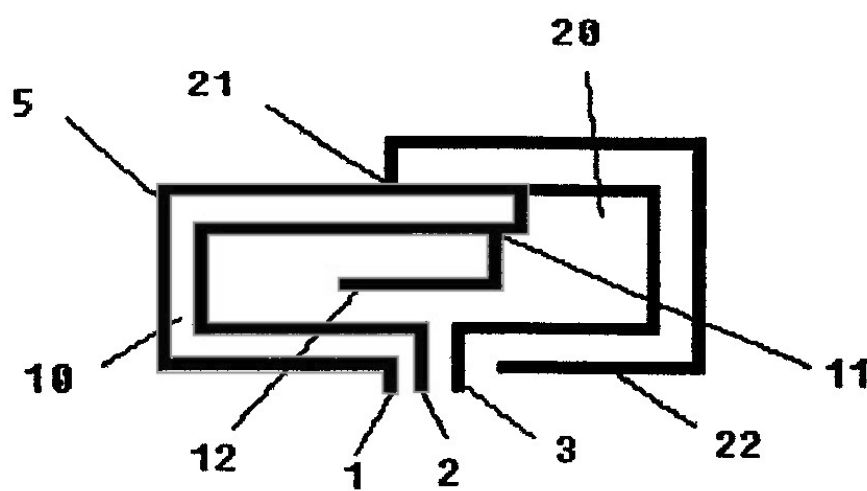
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	support at least three frequency bands of the electromagnetic spectrum,	<p><i>See, e.g.,</i></p> <p>“With the development of the mobile communication industry, the requirements for a mobile terminal antenna are evolving toward multi-band operation (for example: GSM 800/900/1800/1900 Hz or WLAN 2.4 GHz/5.1 GHz/5.8 GHz), high gain, and adaptability to a plurality of usage scenarios (such as an open or closed state of a foldable phone, a handheld mode, a waist-mounted mode, or flat placement on a desktop). The existing mobile terminal antennas are categorized into two types: external antennas and internal antennas. The internal antennas are increasingly prevalent in mobile phones due to their aesthetic appearance, high portability, and improved resistance to damage from drops. The internal antennas include various planar inverted-F antennas (PIFAs) and monopole (or helical) antennas designed based on technologies similar to an external antenna technology. Since an internal antenna is required to have a small volume and a compact structure, it is difficult to achieve multi-band and high-gain performance, and even more challenging to implement good matching of a plurality of frequency bands under different states. For example, many internal antennas cover only two frequency bands such as GSM 900/GSM 1800 or GSM 800/GSM 1900, while some internal antennas may cover three frequency bands such as GSM 900/GSM 1800/GSM 1900 or GSM 800/GSM 1800/GSM 1900M. A manufacturer of whole mobile phones urgently desires to produce a quad-band mobile phone which can be sold in a global market. Without ability to develop and manufacture the quad-band mobile phones, manufacturers are compelled to offer two separate tri-band models to different markets. Consequently, two different versions need to be researched and developed for one model. This complicates production and material management, and hinders cost reduction.”</p> <p>Wei at 6:9-29</p> <p>“FIG. 16A is a schematic diagram of test results of an application example of a wide-band multi-loop terminal antenna of this utility model. The antenna covers five frequency bands: GSM 800/900/1800/1900 and a universal mobile telecommunications system (UMTS).</p>

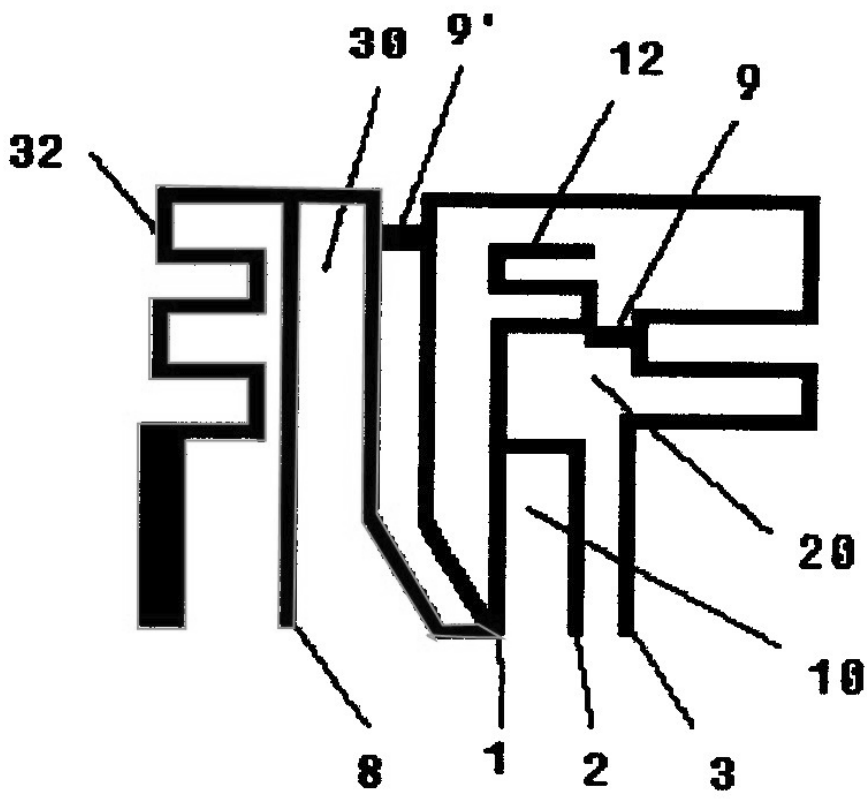
Exhibit – F – 02

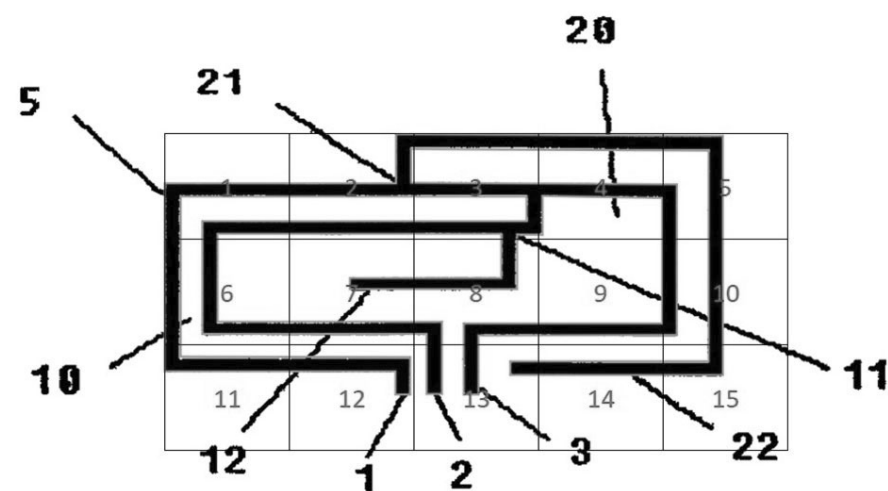
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>FIG. 16B is a schematic diagram of test results of another application example of a wide-band multi-loop terminal antenna of this utility model. The antenna has good matching in four frequency bands: GSM 850/GSM 900/GSM 1800/GSM 1900.”</p> <p>Wei at 19:8-18</p>

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		<div><p>CH1 S11 log MAG 5.01 dB/ REF 0 dB 1:-8.5276 dB 824.000 000 MHz</p><p>PRm 2:-10.381 dB 960 MHz</p><p>Cor 3:-8.3362 dB 1.71 MHz</p><p>4:-9.8603 dB 1.78 MHz</p></div>  <p>START 300.400 000 MHz STOP 2 300.000 000 MHz</p> <p>图16A</p> <div><p>CH1 S11 log MAG 5.01 dB/ REF 0 dB 1:-11.822 dB 824.000 000 MHz</p><p>PRm 2:-15.859 dB 960 MHz</p><p>Cor 3:-16.484 dB 1.71 MHz</p><p>4:-12.854 dB 1.59 MHz</p></div>  <p>START 300.400 000 MHz STOP 2 300.000 000 MHz</p> <p>图16B</p> <p>Wei at Figure 16A and 16B</p>

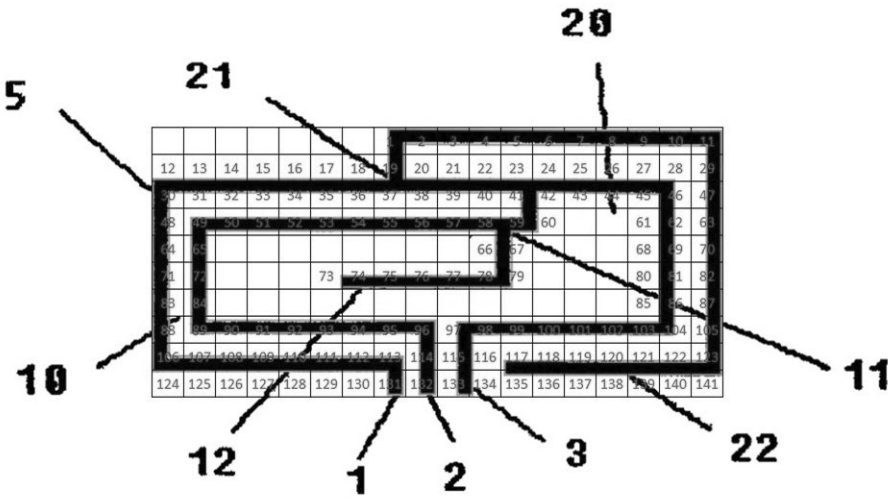
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
1[e]	the first planar antenna defining a first contour,	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>  <p>Wei at Figure 2A</p>

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		<div data-bbox="630 341 1491 828"></div> <p data-bbox="630 860 1008 909">Wei at Figure 2A (Alternative)</p>

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		 <p>The diagram shows a complex, multi-level structure with various labeled components. The labels include 32, 30, 9', 12, 9, 20, 10, 8, 1, 2, and 3. The structure appears to be a cross-section of a building or a similar architectural element, with multiple levels and internal components. The labels point to specific parts of the structure, such as the top edge (32), the main body (30), the internal structure (9', 12, 9, 20, 10), and the base (8, 1, 2, 3).</p> <p>Wei at Figure 9</p>
1[f]	wherein the first contour has a level of	Wei expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	complexity defined by complexity factor F21 having a value of at least 1.20 and complexity factor F32 having a value of at least 1.35; and	<p data-bbox="630 349 735 381"><i>See, e.g.,</i></p>  <p data-bbox="630 1006 1008 1039">Wei at Figure 2A Calculating N_1</p>

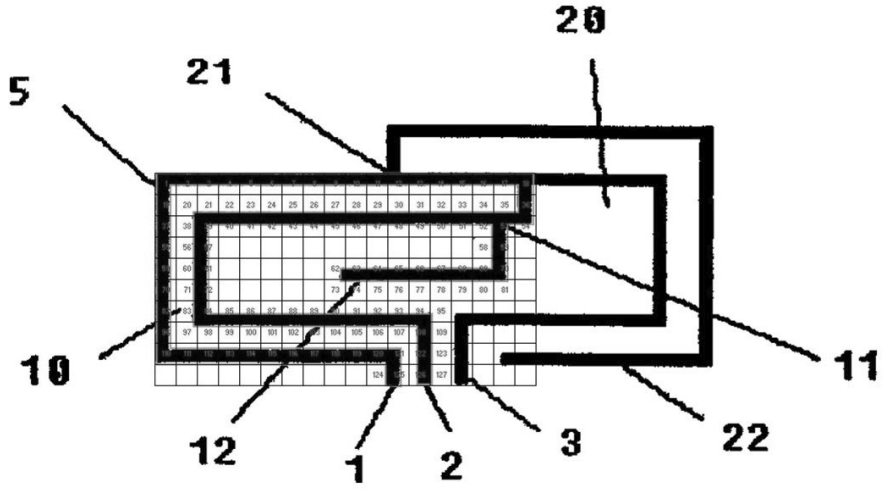
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>Wei at Figure 2A Calculating N_2</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A Calculating N_3</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> <p> $N_1 = 15;$ $N_2 = 43;$ and $N_3 = 141;$ </p> <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$ <p>solving for F_{21} results in</p>

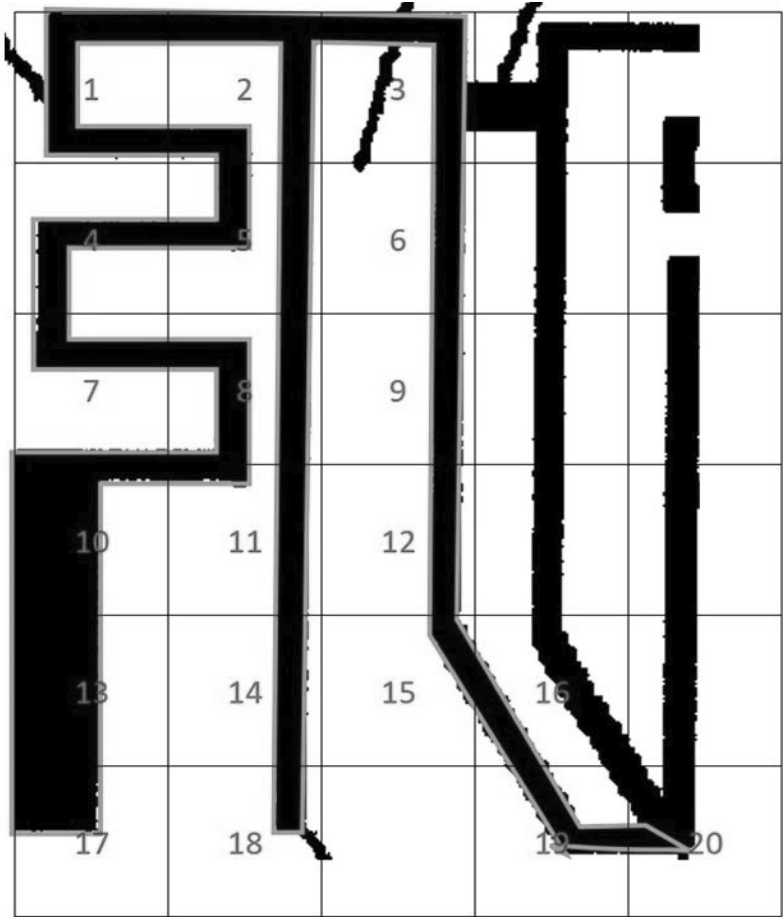
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		$F_{21} = - \frac{(\log_{10}(43) - \log_{10}(15))}{\log_{10} 1/2} = 1.5194$ <p>and</p> $1.20 \leq 1.5194$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(141) - \log_{10}(43))}{\log_{10} 1/2} = 1.7133$ <p>and</p> $1.7133 < 1.75$

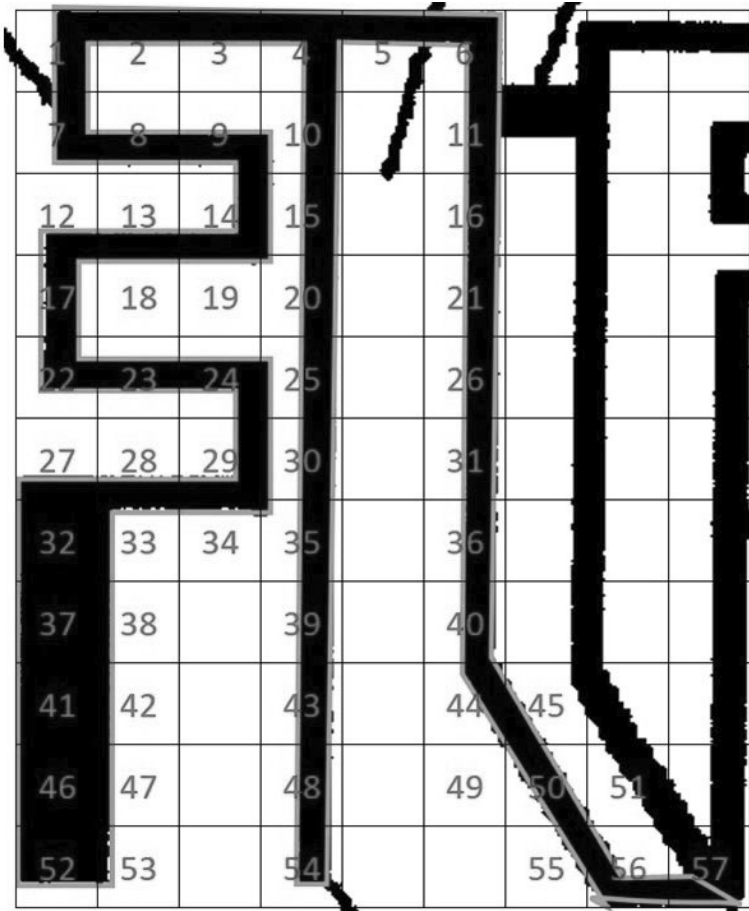
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 349 1522 836"><p>The diagram shows a complex, multi-layered geometric shape drawn on a grid. The shape is composed of several nested and overlapping rectangular and L-shaped segments. Various parts of the shape are labeled with numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 20, 21, and 22. These labels are connected to the corresponding parts of the shape by thin lines. The shape is centered on the grid, with a small square at the bottom left corner labeled 10. The overall shape is roughly rectangular, with a complex internal structure. The labels 20, 21, and 22 are located at the top, top-left, and bottom-right corners of the shape, respectively. The labels 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 are distributed throughout the internal structure of the shape.</p><p>Wei at Figure 2A (Alternative) Calculating N_1</p></div>

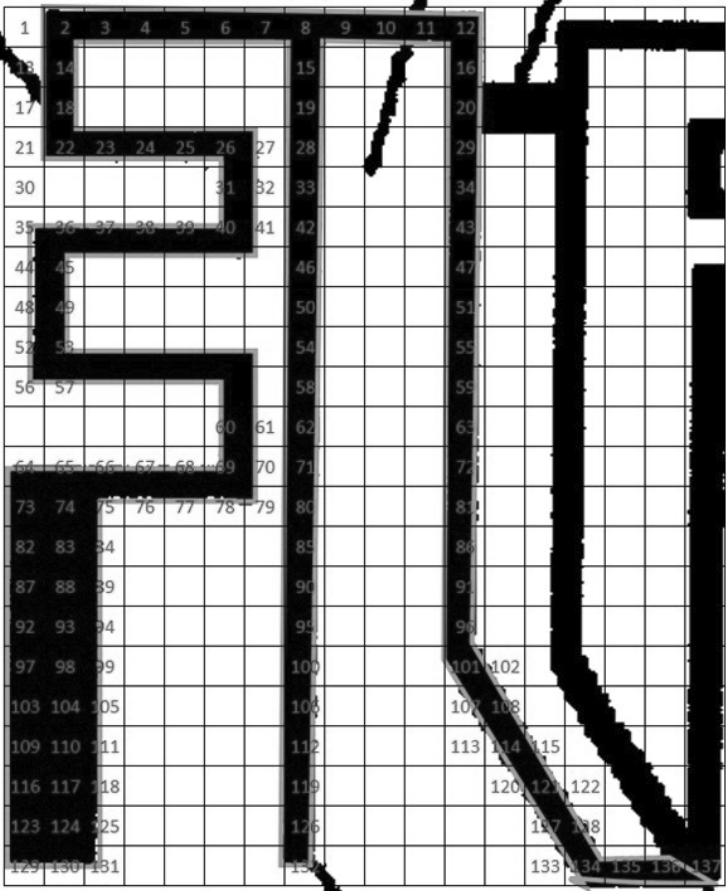
[illegible]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A (Alternative) Calculating N_3</p> <p>It would have been obvious to a person of ordinary skill in the art that, when</p> <p> $N_1 = 13;$ $N_2 = 39;$ and $N_3 = 127;$ </p> <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$ <p>solving for F_{21} results in</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		$F_{21} = - \frac{(\log_{10}(39) - \log_{10}(13))}{\log_{10} 1/2} = 1.5850$ <p>and</p> $1.20 \leq 1.5850$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(127) - \log_{10}(39))}{\log_{10} 1/2} = 1.7033$ <p>and</p> $1.7033 < 1.75$

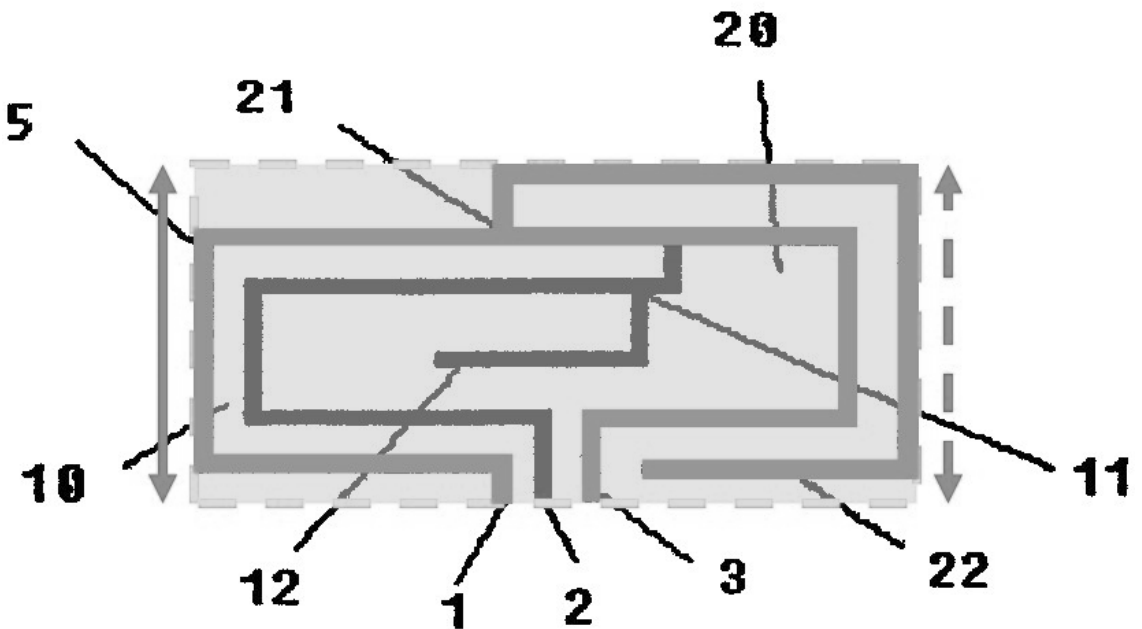
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="667 342 1444 1253"></div> <p data-bbox="632 1289 1003 1321">Wei at Figure 9 Calculating N_1</p>

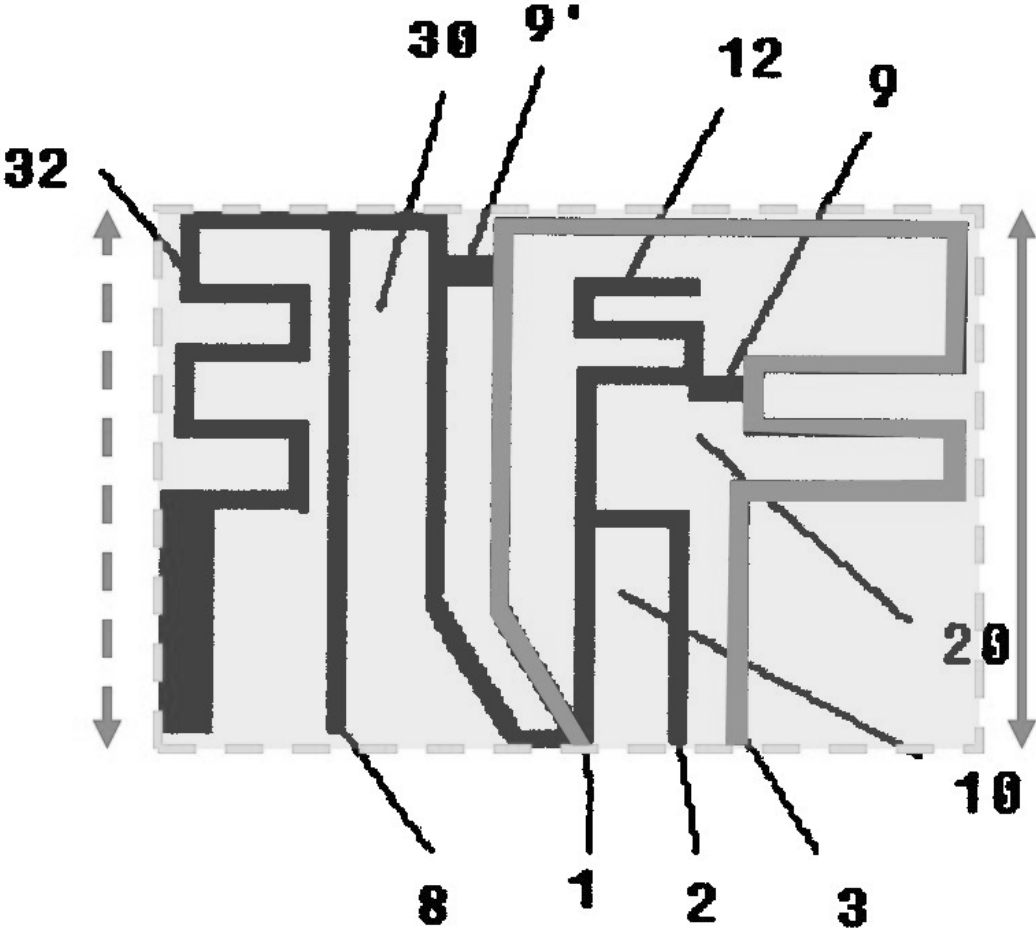
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9 Calculating N₂</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9 Calculating N_3</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>It would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 20;$ $N_2 = 57; \text{ and}$ $N_3 = 137;$ <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$ <p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(57) - \log_{10}(20))}{\log_{10} 1/2} = 1.5110$ <p>and</p> $1.20 \leq 1.5110$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(137) - \log_{10}(57))}{\log_{10} 1/2} = 1.2651$ <p>and</p>

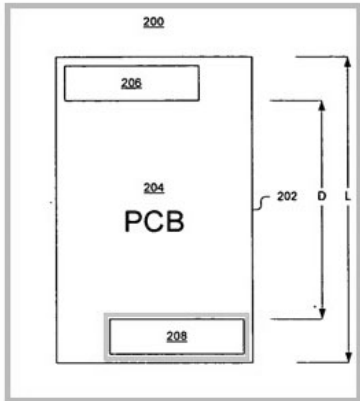
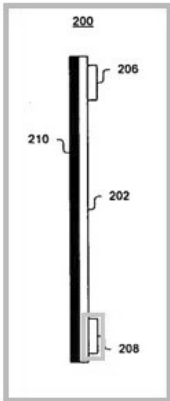
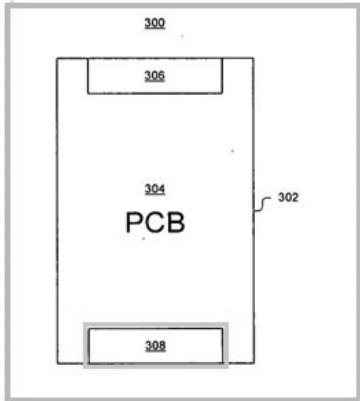
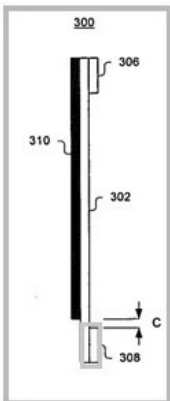
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p style="text-align: center;">1.2651 < 1.75</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>
1[g]	a second antenna proximate to a second side of the ground plane rectangle,	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>"As shown in FIG. 2A, in a first preferred embodiment provided in this utility model, the metal conductor part includes two signal loops which are respectively a first signal loop 10 and a second signal loop 20. As shown in the figure, the first and second signal loops 10, 20 start from the same common feed point 1 and respectively terminate at two ground points 2, 3 (the numerals are the same below) with different physical positions. The second signal loop 20 completely surrounds the first signal loop 10, and the two signal loops have a common conductor 5."</p> <p>Wei at 15:7-13</p> <p>"The antenna of this utility model is mounted on the mobile terminal mainboard 100. A positional relationship between the antenna and the mobile terminal mainboard 100 and a structure of a ground plane of the mobile terminal mainboard 100 may affect a frequency band characteristic of the antenna."</p> <p>Wei at 18:1-4</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A</p> <p>“Referring to FIG. 9, in an eighth preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal loop 20, and a third signal loop 30. The three signal loops have no other common parts except the common feed point 1. The signal loops respectively terminate at ground points 2, 3, 8, and each of the first and third signal loops 10, 30 has one conductor branch 12, 32.”</p> <p>Wei at 16:25-29</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 1299 819 1331">Wei at Figure 9</p>

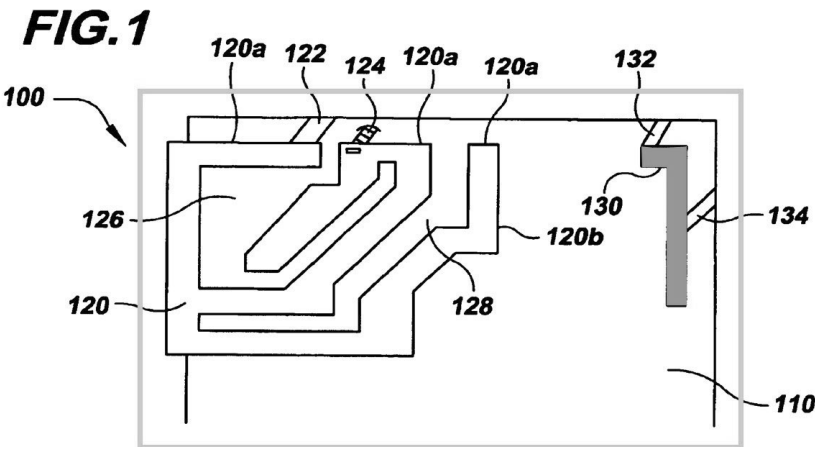
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p> <p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“As shown in FIG. 3A, the wireless device 300 may have an internal diversity antenna architecture comprising a first internal antenna 306 and a second internal antenna 308 disposed on the PCB 304 for achieving diversity. In this embodiment, the internal diversity antenna architecture may comprise a first internal antenna 306 located substantially at the top of the wireless device 300. For example., the first internal antenna 306 may be located substantially at the top of the housing 302 and/or the top of the PCB</p>

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		<p>304. The internal diversity antenna architecture may comprise a second internal antenna 308 located substantially at the bottom of the wireless device 300. For example, the second internal antenna 308 may be located substantially at the bottom of the housing 302 and/or the bottom of the PCB 304.”</p> <p>Dou at [0032]</p> <p>“As shown in FIG. 4A, the wireless device 400 may have an internal diversity antenna architecture comprising a first internal antenna 406 and a second internal antenna 408 disposed on the PCB 404 for achieving diversity. In this embodiment, the first internal antenna 406 may comprise a first feed point 412 and a first ground point 414, and the second internal antenna 408 may comprise a second feed point 416 and a second ground point 418. The first internal antenna 406 may be located substantially near the top of the wireless device 400, and the second internal antenna 408 may be located substantially near the bottom of the wireless device 400.</p> <p>Dou at [0036]</p>

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		<div data-bbox="667 363 1024 761"></div> <div data-bbox="766 773 873 805">FIG. 2A</div> <div data-bbox="1079 363 1247 761"></div> <div data-bbox="1108 773 1215 805">FIG. 2B</div> <div data-bbox="667 844 1024 1242"></div> <div data-bbox="766 1253 873 1286">FIG. 3A</div> <div data-bbox="1079 844 1247 1242"></div> <div data-bbox="1108 1253 1215 1286">FIG. 3B</div>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="659 399 1226 828"> <p style="text-align: center;">FIG. 4A FIG. 4B</p> </div> <p data-bbox="627 889 1098 922">Dou at Figures 2A-B, 3A-B, and 4A-B</p> <p data-bbox="627 954 1906 1263">“Although a multiband antenna such as for instance a multibranch antenna can be used within the package when several services or operating frequency bands are to be integrated in the same system, it is clear that other options within the present invention include arranging two or more antennas within the same package. For instance, those two or more antennas according to the present invention can be arranged in the same substrate layer, in different layers within the same substrate, in different substrates or even in the substrate and in the plastic casing of the package. One possible arrangement for a two antenna package includes two similar antennas wherein each one is fed independently, and wherein one conducting pattern is rotated 90° with respect to the other antenna pattern. This provides an effective means for integrating a polarization diversity communication system inside a single package.”</p> <p data-bbox="627 1295 905 1328">Castany868 at 30:1-12</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>“The invention is based on the unexpected discovery that when an antenna structure comprising two radiators matched for at least partly the same frequency range is used, at least one of the radiators being the above-mentioned groove plane antenna matched for several frequency ranges, considerable isolation is provided between the radiators. Such an antenna structure thus comprises at least one ground plane, at least a first and a second radiator located at a distance from the ground plane, both radiators being configured to provide at least one resonance frequency in order to provide at least one frequency band, and an isolating layer between the ground plane and the radiators.”</p> <p>Talvitie at 2:20-32</p> <p>“Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120.”</p> <p>Talvitie at 3:47-59</p> <p>“The antenna structure of FIG. 1 can preferably be configured to operate as an antenna structure for a multifrequency mobile station. ”</p> <p>Talvitie at 5:1-3</p>

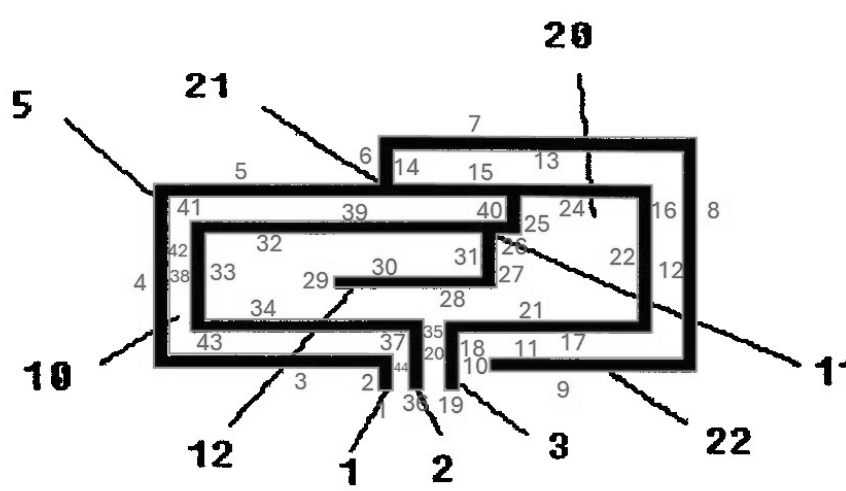
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>FIG. 1</p>  <p>Talvitie at Figure 1</p>
1[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	<p>Wei expressly or inherently discloses this claim element.</p> <p>See, e.g., claim element 1[d]</p>
1[i]	wherein the first contour is defined as a perimeter of the first planar antenna and	<p>Wei expressly or inherently discloses this claim element.</p> <p>See, e.g., claim element 1[f]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	perimeters of any closed apertures defined within the first planar antenna;	
1[j]	<p>wherein the complexity factors F21 and F32 are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N1 is a number of cells of a grid G1 that include at least a point of the first contour, N2 is a number of cells of a grid G2 that include at least a point of the first contour, and N3 is a number of cells of a grid G3 that include at least a point of the first contour, the grid G2 divides a minimum-sized rectangle</p>	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p>

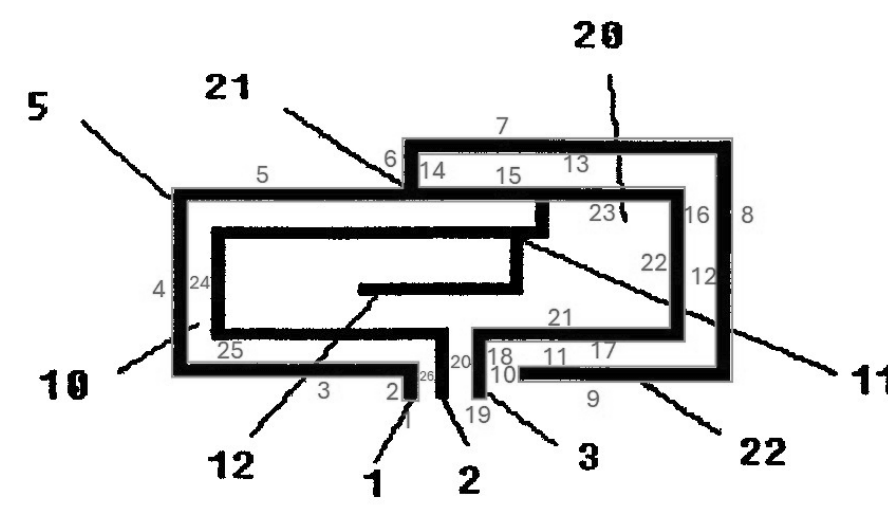
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>enclosing the first planar antenna into nine columns of equal width arranged along a long side of the minimum-sized rectangle and into an odd number of rows of equal height arranged along a short side of the minimum-sized rectangle, wherein the number of rows results in the cells of grid G2 being as square as possible, the grid G1 being aligned with a corner of the grid G2 to cover the minimum-sized rectangle, the cells of the grid G1 having widths and heights that respectively are Double the widths and heights of the cells of the grid G2, and</p>	
1[k]	wherein the level of complexity of the first	Wei expressly or inherently discloses this claim element.

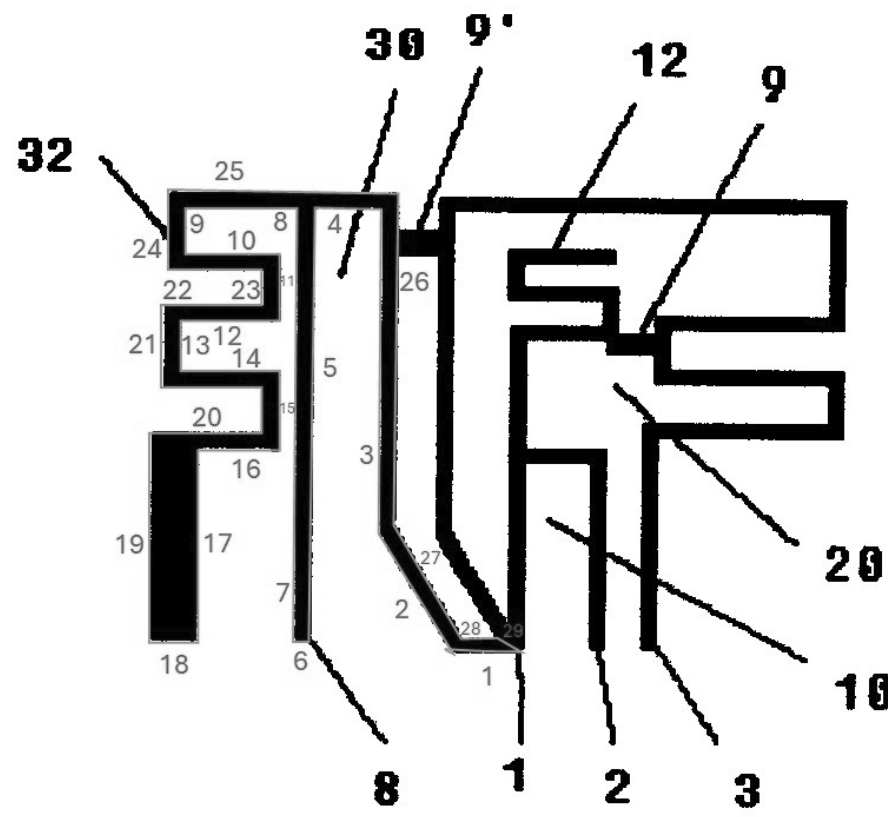
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>contour is configured to provide operation of the wireless device in the at least three frequency bands.</p>	<p><i>See, e.g.,</i></p> <p>“With the development of the mobile communication industry, the requirements for a mobile terminal antenna are evolving toward multi-band operation (for example: GSM 800/900/1800/1900 Hz or WLAN 2.4 GHz/5.1 GHz/5.8 GHz), high gain, and adaptability to a plurality of usage scenarios (such as an open or closed state of a foldable phone, a handheld mode, a waist-mounted mode, or flat placement on a desktop). The existing mobile terminal antennas are categorized into two types: external antennas and internal antennas. The internal antennas are increasingly prevalent in mobile phones due to their aesthetic appearance, high portability, and improved resistance to damage from drops. The internal antennas include various planar inverted-F antennas (PIFAs) and monopole (or helical) antennas designed based on technologies similar to an external antenna technology. Since an internal antenna is required to have a small volume and a compact structure, it is difficult to achieve multi-band and high-gain performance, and even more challenging to implement good matching of a plurality of frequency bands under different states. For example, many internal antennas cover only two frequency bands such as GSM 900/GSM 1800 or GSM 800/GSM 1900, while some internal antennas may cover three frequency bands such as GSM 900/GSM 1800/GSM 1900 or GSM 800/GSM 1800/GSM 1900M. A manufacturer of whole mobile phones urgently desires to produce a quad-band mobile phone which can be sold in a global market. Without ability to develop and manufacture the quad-band mobile phones, manufacturers are compelled to offer two separate tri-band models to different markets. Consequently, two different versions need to be researched and developed for one model. This complicates production and material management, and hinders cost reduction.”</p> <p>Wei at 6:9-29</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on</p>

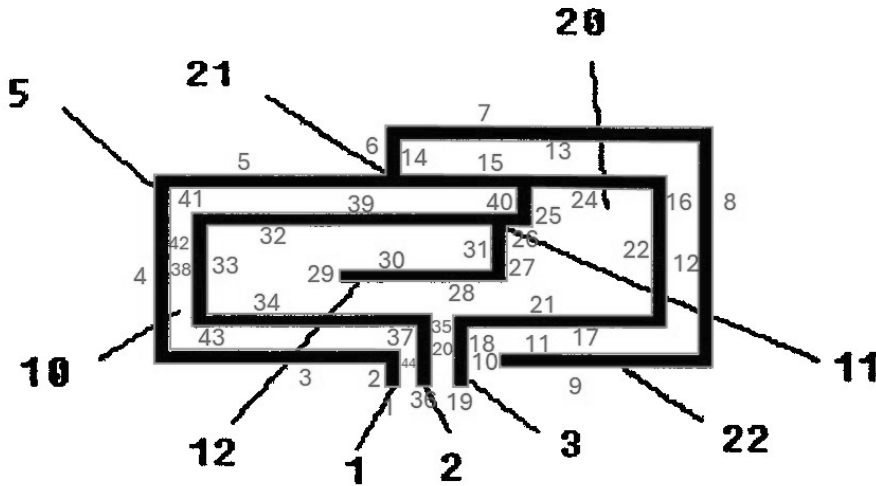
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>“Fractal antennas are antennas that have the shaped of fractal structures. The fractal antennas consist of geometrical shapes that are repeated. Each one of the shapes has unique attributes. By careful selection. Fractal antennas can be design in many shapes such as Sierpinski gasket, Sierpinski carpet, Koch island, Hilbert curve and Miskowski. In this paper a microstrip sierpinski carpet antenna has been designed and analyzed. The performance of the antenna has been investigated in term of the return loss and the radiation pattern.”</p> <p>Rahim at p. 1</p> <p>“A square microstrip Sierpinski Carpet antenna was constructed using fractal geometry for multiband operation. The measured results indicate that the antenna exhibits a good radiation and input return loss. This type of antenna is the best candidate for wireless communications for multiband operation.”</p> <p>Rahim at p. 4</p>
Claim 2		
2	The wireless device of claim 1, wherein the first antenna contour comprises at least 20 segments.	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

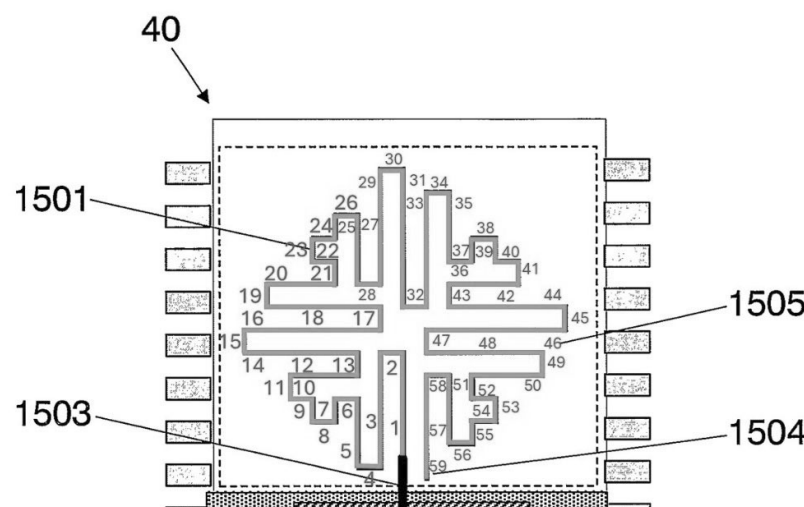
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 876 840 909">Wei at Figure 2A</p>

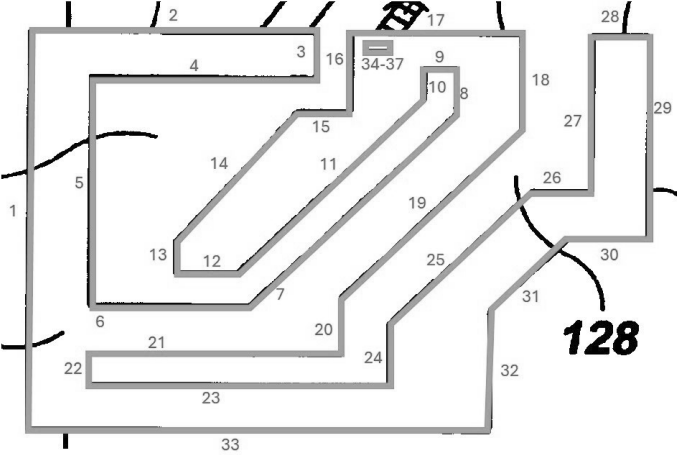
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 365 1514 844"></div> <p data-bbox="630 885 1003 922">Wei at Figure 2A (Alternative)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A (Second Alternative)</p>

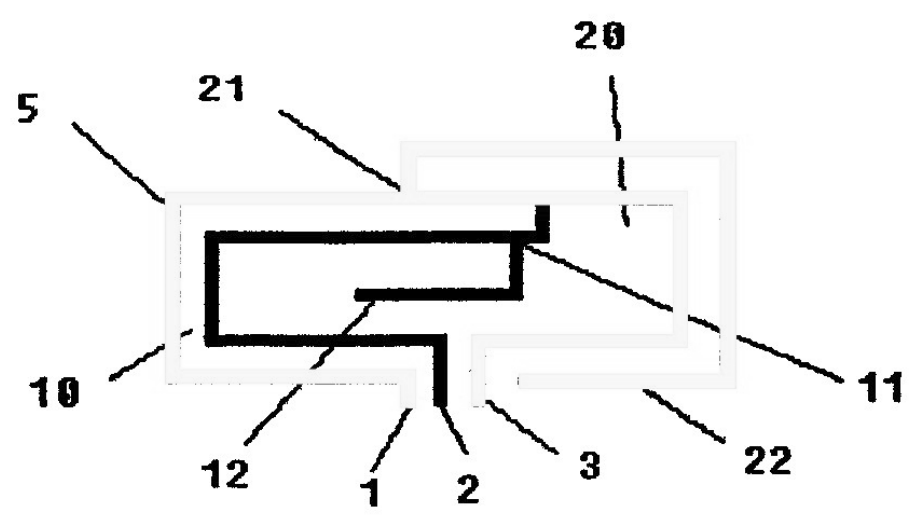
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9</p>
Claim 3		

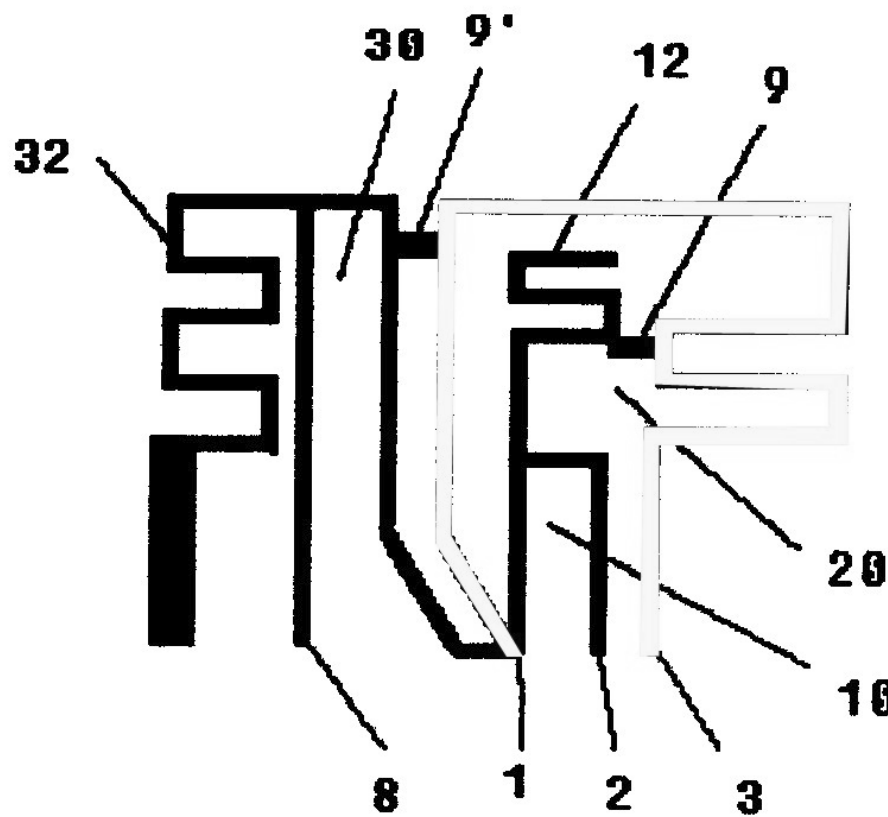
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
3	The wireless device of claim 2, wherein the perimeter of the first antenna contour comprises at least 35 segments.	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>  <p>Wei at Figure 2A</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidation Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p>  <p>Figure 15 is a schematic diagram of a mechanical assembly, likely a multi-story building or a large industrial structure, enclosed within a dashed rectangular boundary labeled 40. The assembly consists of numerous interconnected components, each labeled with a number from 1 to 59. The components are arranged in a complex, symmetrical pattern, suggesting a multi-level or multi-story structure. Labels 1501, 1503, 1504, and 1505 point to specific parts of the assembly, while label 40 points to the overall structure. The diagram is a technical drawing, likely a cross-section or a plan view, showing the internal structure and components of the assembly.</p> <p>Castany868 at Figure 15</p>

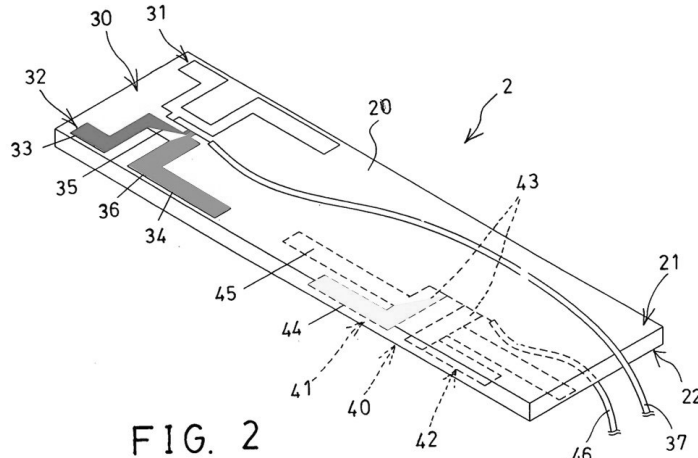
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Talvitie at Figure 1</p>
Claim 4		
4	The wireless device of claim 1, wherein the antenna system comprises a third antenna configured to receive signals employing a 4G	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i>

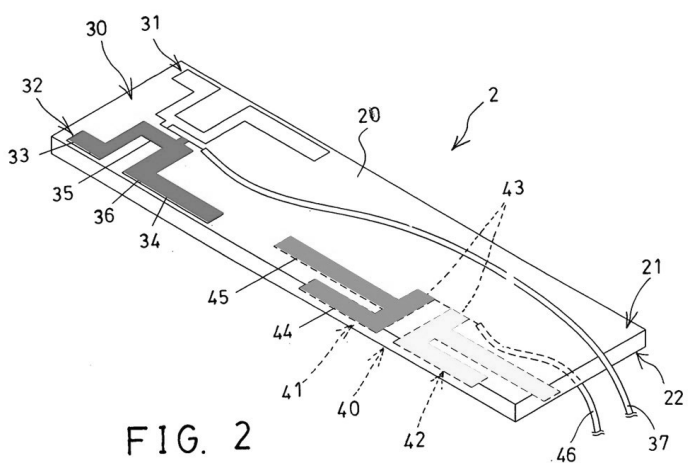
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	communication standard.	<p>Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A (Alternative)</p>

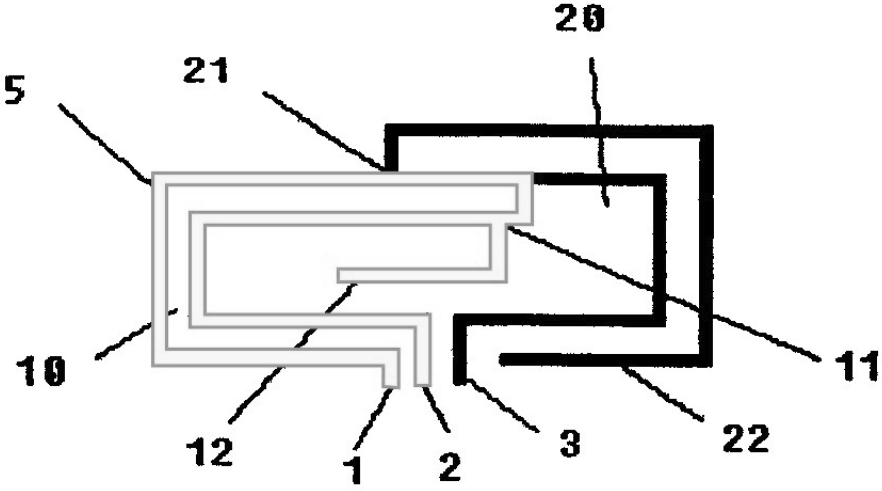
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>The diagram shows a complex mechanical assembly with several components labeled with numbers. The labels are: 1, 2, 3, 8, 9, 9', 10, 12, 20, 30, and 32. The assembly consists of a central vertical structure with various horizontal and angled components. The labels point to specific parts: 1 points to a central vertical shaft, 2 points to a horizontal component, 3 points to a vertical component, 8 points to a horizontal component, 9 points to a horizontal component, 9' points to a vertical component, 10 points to a horizontal component, 12 points to a horizontal component, 20 points to a horizontal component, 30 points to a horizontal component, and 32 points to a horizontal component.</p> <p>Wei at Figure 9</p>

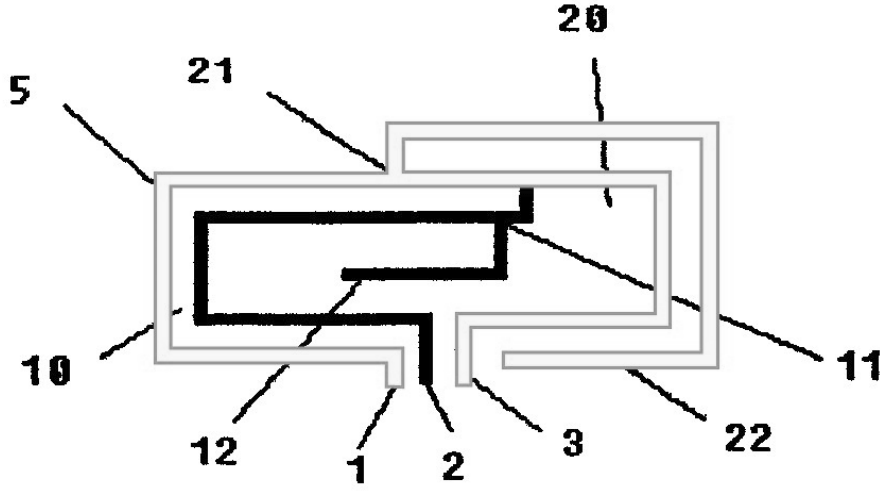
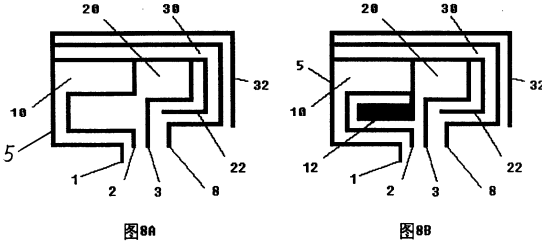
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p>

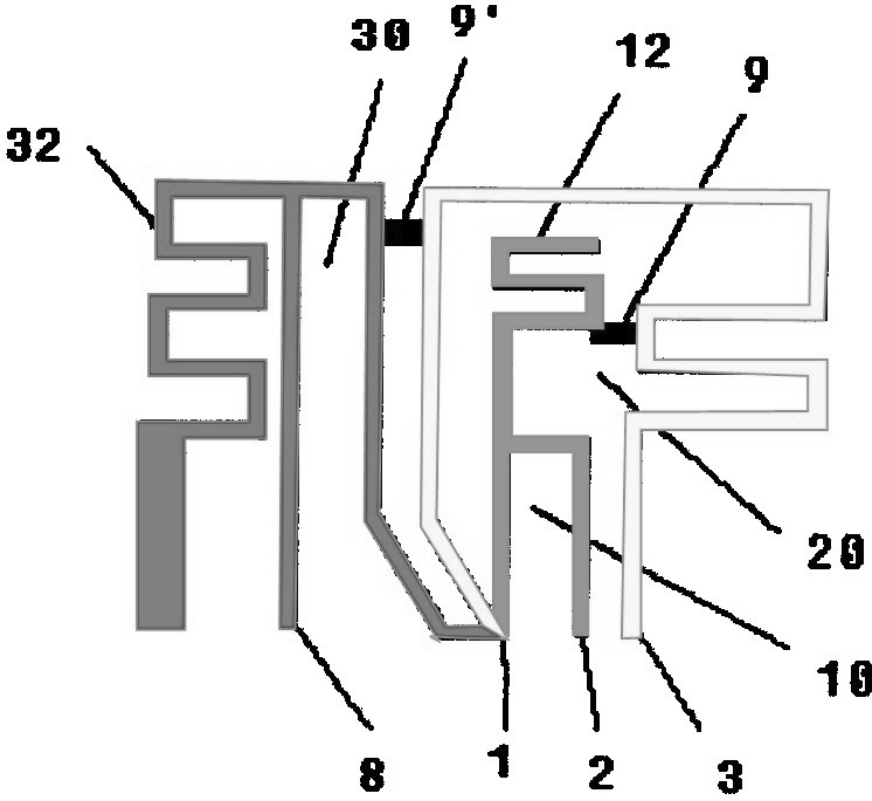
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p>  <p>FIG. 2</p> <p>Chou at Figure 2</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p style="text-align: center;">FIG. 2</p> <p>Chou at Figure 2 (Alternative)</p>
Claim 5		
5	<p>The wireless device of claim 4, wherein the third antenna defines an antenna contour comprising an entire perimeter of the third antenna, and wherein the antenna contour of the third antenna has a</p>	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim elements 1[e], 1[k], 1[l], 1[m], 4</p> <p>“Referring to FIG. 8A, in a seventh preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal loop 20, and a third signal loop 30. The three signal loops start from the common feed point 1 and terminate at respective ground points 2, 3, 8. The three signal loops have a common conductor 5. The first signal loop 10 does not have a conductor branch, and each of the second signal loop 20 and the third signal</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>level of complexity defined by complexity factor F21 having a value of at least 1.2 and a complexity factor F32 having a value of at least 1.35.</p>	<p>loop 30 has one conductor branch 22, 32. Referring to FIG. 8B, in an alternative form of this embodiment, each of the three signal loops 10, 20, 30 has one conductor branch 12, 22, 32.</p> <p>Referring to FIG. 9, in an eighth preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal loop 20, and a third signal loop 30. The three signal loops have no other common parts except the common feed point 1. The signal loops respectively terminate at ground points 2, 3, 8, and each of the first and third signal loops 10, 30 has one conductor branch 12, 32. Certainly, there may alternatively be another form to design the conductor branch according to a calculation result. One or each of two of the first signal loop 10, the second signal loop 20, and the third signal loop 30 has two conductor branches, and each of the other two signal loops or the other one signal loop has one conductor branch. A length of the conductor branch 12, 22, 32 is 0.1 to 80 mm. A distance from a connection point 11, 21, 31 of the conductor branch 12, 22, 32 and the signal loop to the feed point 1 is 10% to 90% of a total length of a conductor of the signal loop.</p> <p>As shown in FIG. 8C, in a further improvement on the seventh preferred embodiment, a part of the first signal loop 10 except the common conductor 5 and a part of the second signal loop 20 except the common conductor 5 are connected through one conductor connection sheet 9. The part of the second signal loop 20 except the common conductor 5 and a part of the third signal loop 30 except the common conductor 5 are connected through one conductor connection sheet 9'. Similarly, as shown in FIG. 9, in a further improvement on the eighth preferred embodiment, the first signal loop 10 and the second signal loop 20 are connected through one conductor connection sheet 9. The second signal loop 20 and the third signal loop 30 are connected through one conductor connection sheet 9'. Certainly, according to a design result and a calculation result, two signal loops may be completely designed to be connected through a plurality of conductor connection sheets.</p> <p>The metal conductor part of the antenna of this utility model may further include four or more signal loops. Referring to FIG. 10, in a ninth preferred embodiment provided in this utility model, the metal conductor part includes four signal loops which are respectively a first signal loop 10, a second signal loop 20, a third signal loop 30, and a fourth signal loop 40. The first, second, third, and fourth signal loops</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>respectively have independent ground points 2, 3, 8, 8', and each of the four signal loops has one conductor branch 12, 22, 32, 42.</p> <p>Referring to FIG. 11, in a tenth preferred embodiment provided in this utility model, the metal conductor part also includes four signal loops which are respectively a first signal loop 10, a second signal loop 20, a third signal loop 30, and a fourth signal loop 40. A difference from the ninth preferred embodiment is that the four signal loops have three ground points 2, 3, 8, where the third and fourth signal loops share the same ground point 8. The third signal loop does not have a conductor branch, and each of the first, second, and fourth signal loops has one conductor branch 12, 22, 42.”</p> <p>Wei at 16:17-17:26</p>  <p>Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 363 1520 850"><p>Figure 2A (Alternative) is a cross-sectional view of a device. It features a central channel (1) that is wider at the top (2) and tapers towards the bottom (3). The channel is surrounded by a series of nested, rectangular layers (5, 10, 11, 12, 20, 21, 22). The layers are arranged in a staggered fashion, with some layers (20, 21, 22) having a different thickness or material than others (5, 10, 11, 12). The device is shown in a perspective view, with the top surface (20) and the bottom surface (22) clearly visible. The central channel (1) is the primary feature, and the surrounding layers (5, 10, 11, 12, 20, 21, 22) are designed to provide structural support and protection.</p></div> <p data-bbox="630 899 1003 938">Wei at Figure 2A (Alternative)</p> <div data-bbox="646 1062 1184 1305"><p>Figure 8A and Figure 8B are alternative cross-sectional views of the device. Figure 8A shows a different arrangement of the layers (5, 10, 11, 12, 20, 21, 22) compared to Figure 2A. Figure 8B shows a further variation, with the central channel (1) having a different shape or width. Both figures illustrate the flexibility of the design and the various configurations that can be achieved while maintaining the core functionality of the device.</p></div>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p data-bbox="632 345 945 378">Wei at Figures 8A and 8B</p>  <p data-bbox="632 1279 819 1312">Wei at Figure 9</p>

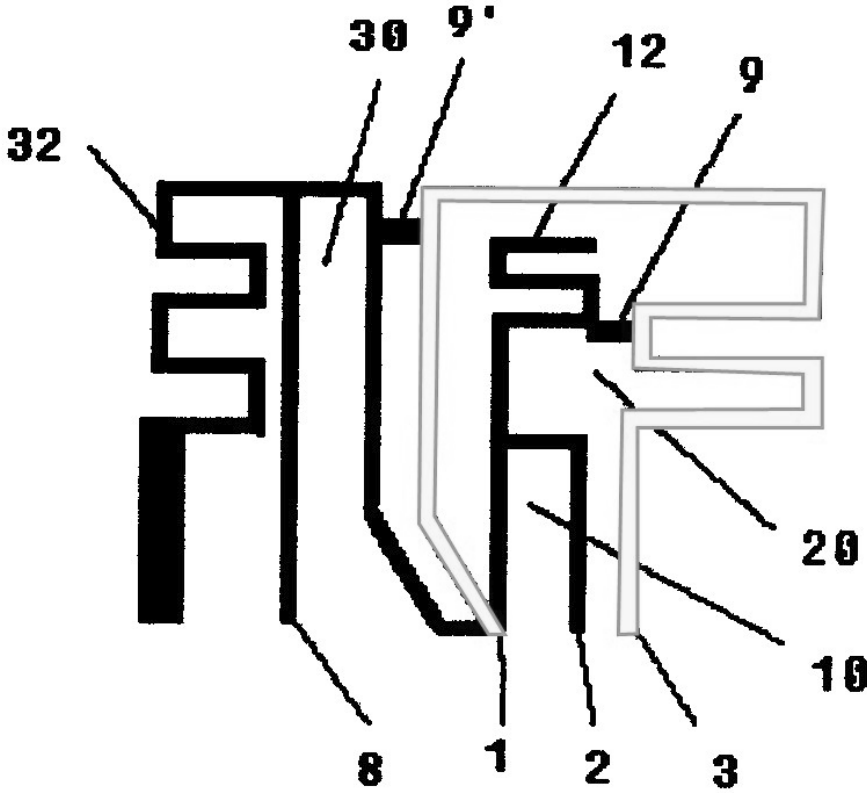
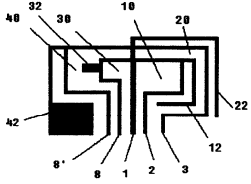
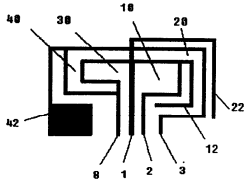
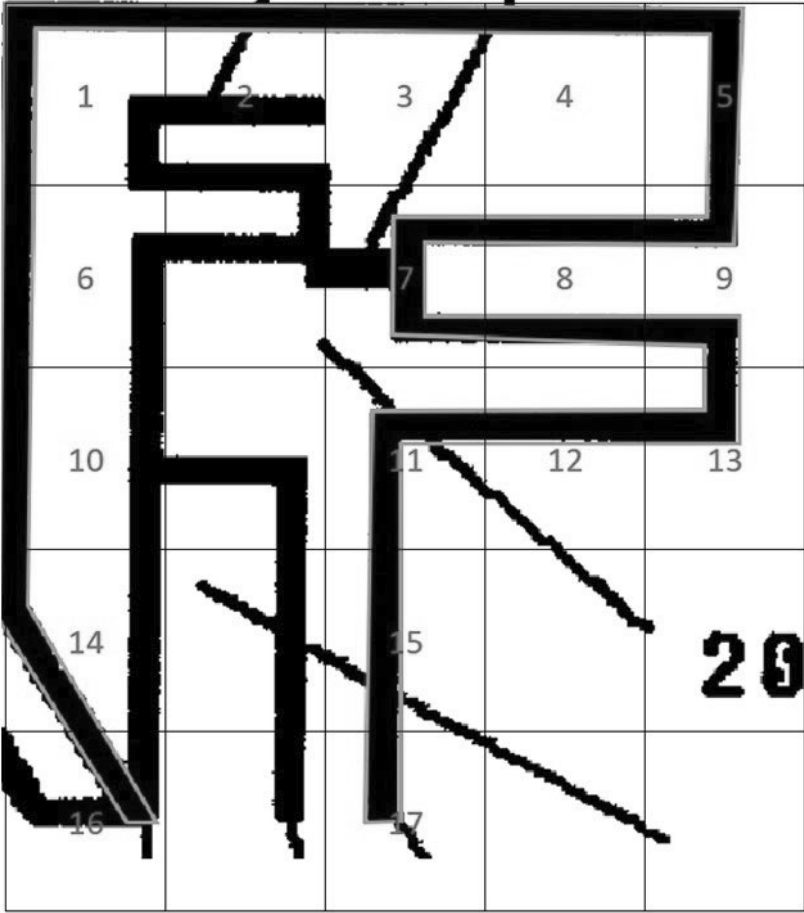
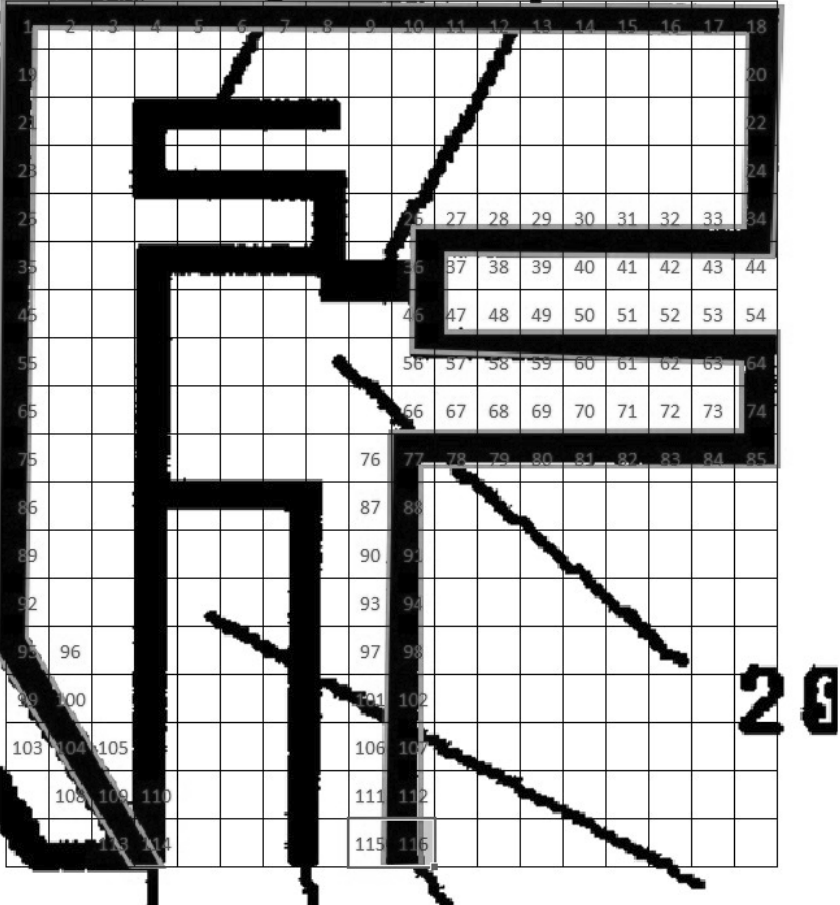
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9 (Alternative)</p>

Exhibit – F – 02

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div><p>图10</p><p>图11</p></div> <p>Wei at Figures 10, 11</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 345 1444 1252"></div> <p data-bbox="630 1295 1010 1328">Wei at Figure 9, Calculating N_1</p>

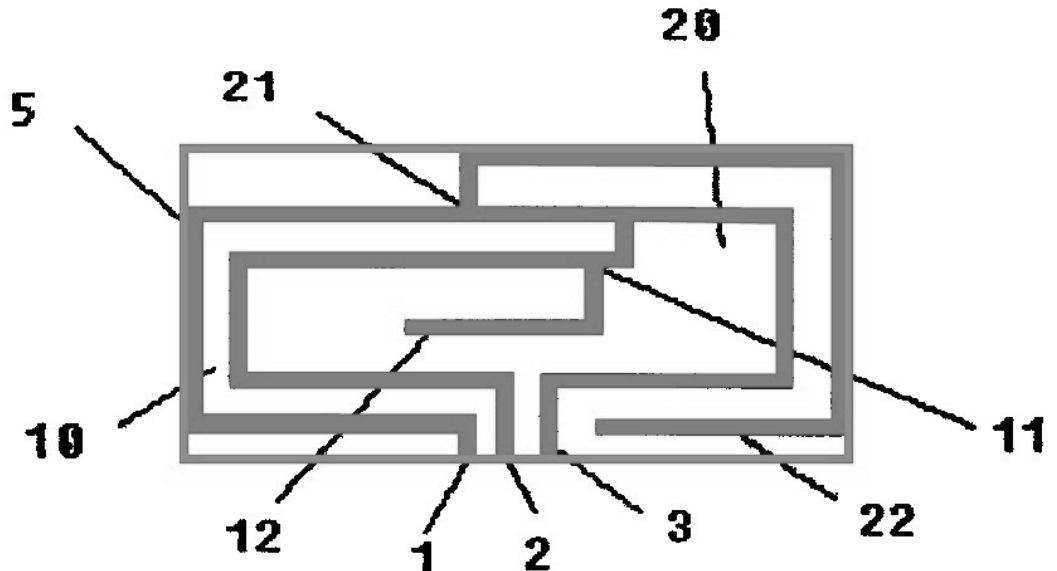
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 354 1459 1230"><p>A 9x9 grid with a thick black path and numbered cells. The path starts at (1,3), goes right to (1,6), down to (10,6), left to (10,3), down to (12,3), right to (12,6), down to (18,6), right to (18,9), down to (24,9), left to (24,6), down to (30,6), right to (30,3), down to (32,3), left to (32,1), down to (34,1), right to (34,3), down to (37,3), right to (37,4), up to (32,4), right to (32,5), down to (32,6), right to (32,7), down to (32,8), right to (32,9), up to (37,9), left to (37,8), up to (32,8), left to (32,7), up to (32,6), left to (32,5), up to (32,4), left to (32,3), up to (32,2), left to (32,1), up to (32,0), left to (32,-1), up to (32,0), left to (32,-1), up to (32,0), left to (32,-1). The path ends at (32,9). The path is labeled 20.</p></div> <p data-bbox="630 1271 1012 1304">Wei at Figure 9, Calculating N₂</p>

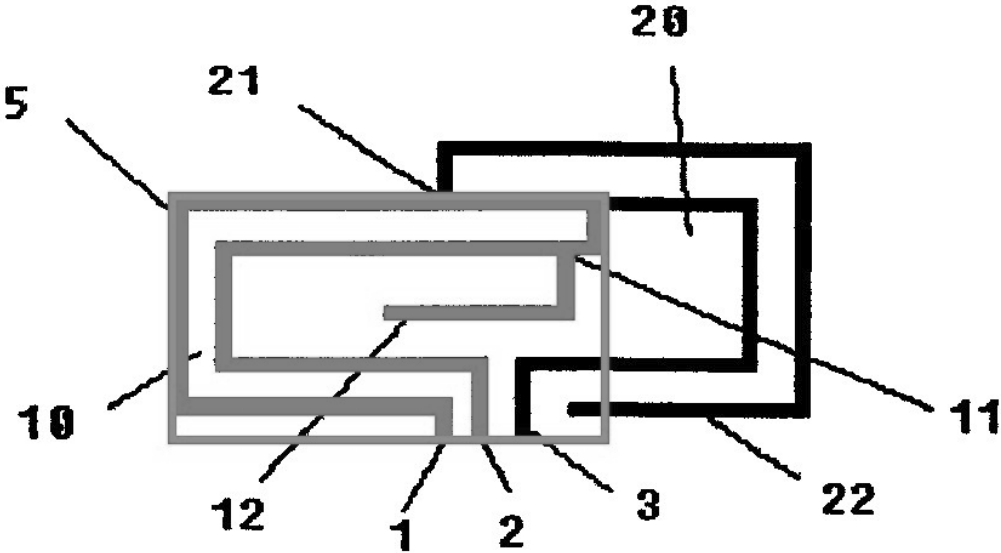
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9, Calculating N_3</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 17;$ $N_2 = 39; \text{ and}$ $N_3 = 116;$ <p>that given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(116) - \log_{10}(39))}{\log_{10} 1/2} = 1.5726$ <p>and</p> $1.35 \leq 1.5726$ <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>
Claim 7		

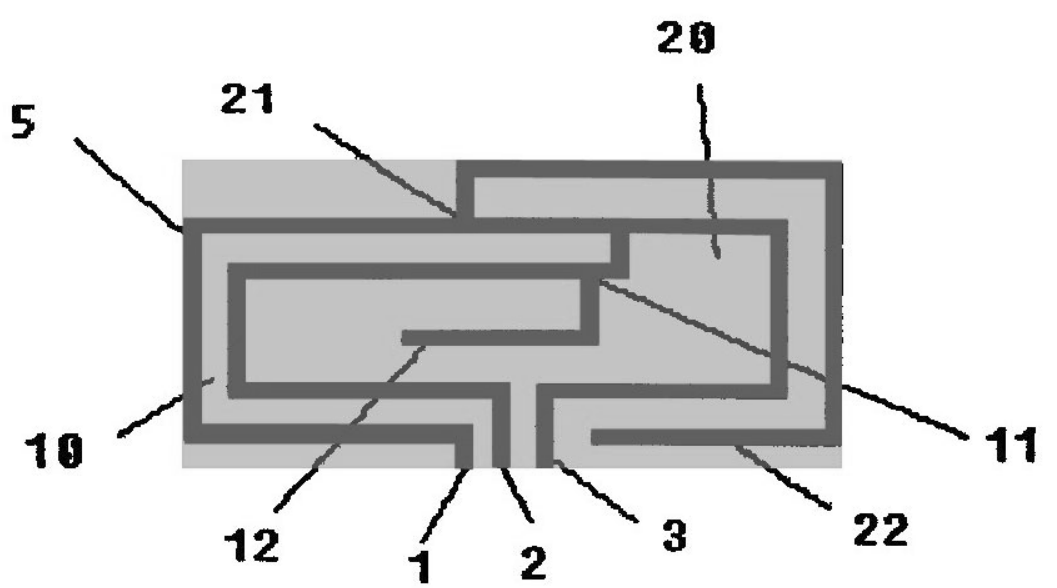
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
7[pre]	A wireless device comprising:	To the extent the preamble is limiting, Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[pre]
7[a]	a ground plane;	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[a]
7[b]	a first non-planar antenna	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[b] “With the development of the mobile communication industry, the requirements for a mobile terminal antenna are evolving toward multi-band operation (for example: GSM 800/900/1800/1900 Hz or WLAN 2.4 GHz/5.1 GHz/5.8 GHz), high gain, and adaptability to a plurality of usage scenarios (such as an open or closed state of a foldable phone, a handheld mode, a waist-mounted mode, or flat placement on a desktop). The existing mobile terminal antennas are categorized into two types: external antennas and internal antennas. The internal antennas are increasingly prevalent in mobile phones due to their aesthetic appearance, high portability, and improved resistance to damage from drops. The internal antennas include various planar inverted-F antennas (PIFAs) and monopole (or helical) antennas designed based on technologies similar to an external antenna technology. Since an internal antenna is required to have a small volume and a compact structure, it is difficult to achieve multi-band and high-gain performance, and even more challenging to implement good matching of a plurality of frequency bands under different states. For example, many internal antennas cover only two frequency bands such as GSM 900/GSM 1800 or GSM 800/GSM 1900, while some internal antennas may cover three frequency bands such as GSM 900/GSM 1800/GSM 1900 or GSM 800/GSM 1800/GSM 1900M. A manufacturer of whole mobile

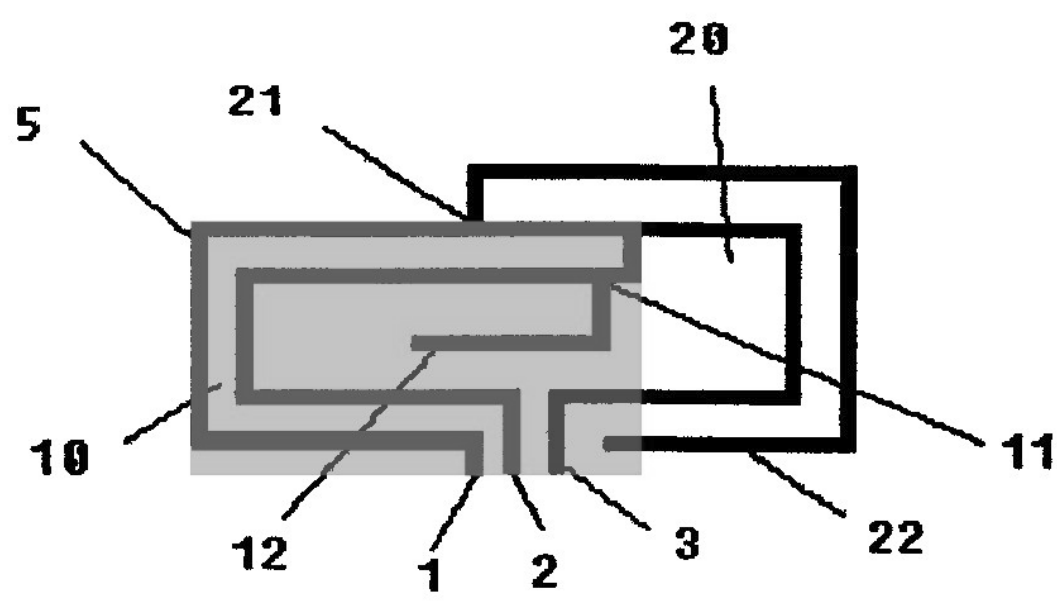
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>phones urgently desires to produce a quad-band mobile phone which can be sold in a global market. Without ability to develop and manufacture the quad-band mobile phones, manufacturers are compelled to offer two separate tri-band models to different markets. Consequently, two different versions need to be researched and developed for one model. This complicates production and material management, and hinders cost reduction.”</p> <p>Wei at 6:9-29</p>
7[c]	[<i>the first non-planar antenna</i>] proximate to a first side of a ground plane rectangle enclosing the ground plane,	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[c]</p>
7[d]	the first non-planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[d]</p>
7[e]	a minimum-sized parallelepiped	<p>Wei expressly or inherently discloses this claim element.</p>

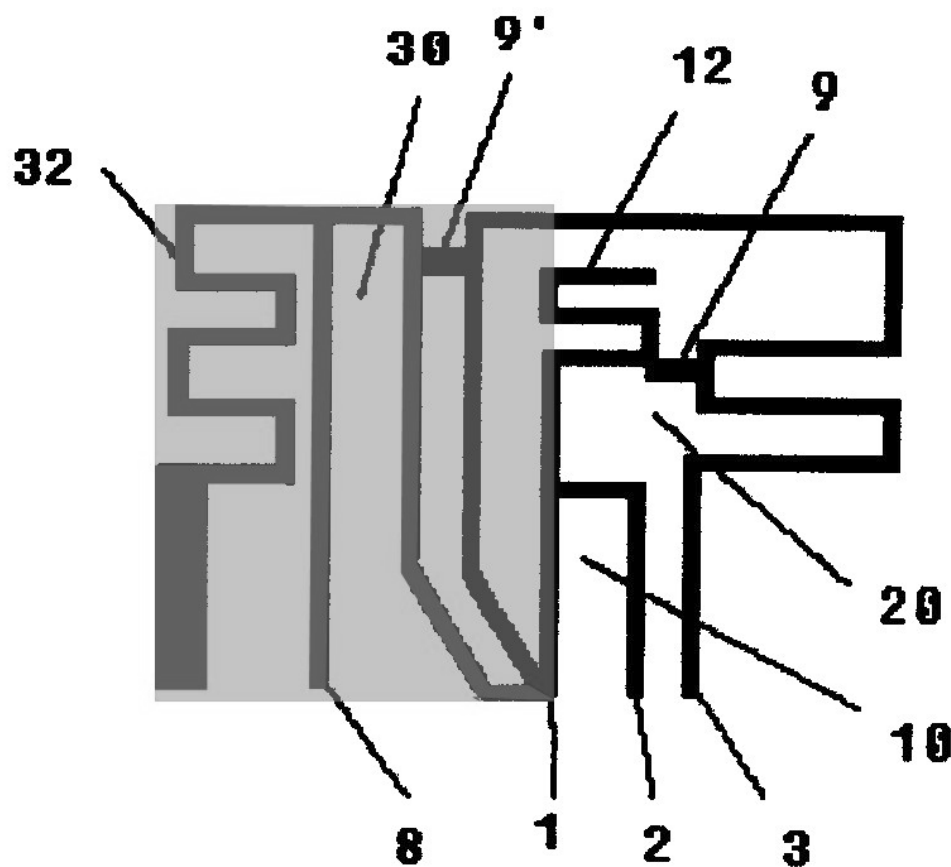
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	completely enclosing a volume of the first non-planar antenna,	<p data-bbox="617 345 743 378"><i>See, e.g.,</i></p>  <p data-bbox="617 1019 840 1052">Wei at Figure 2A</p>

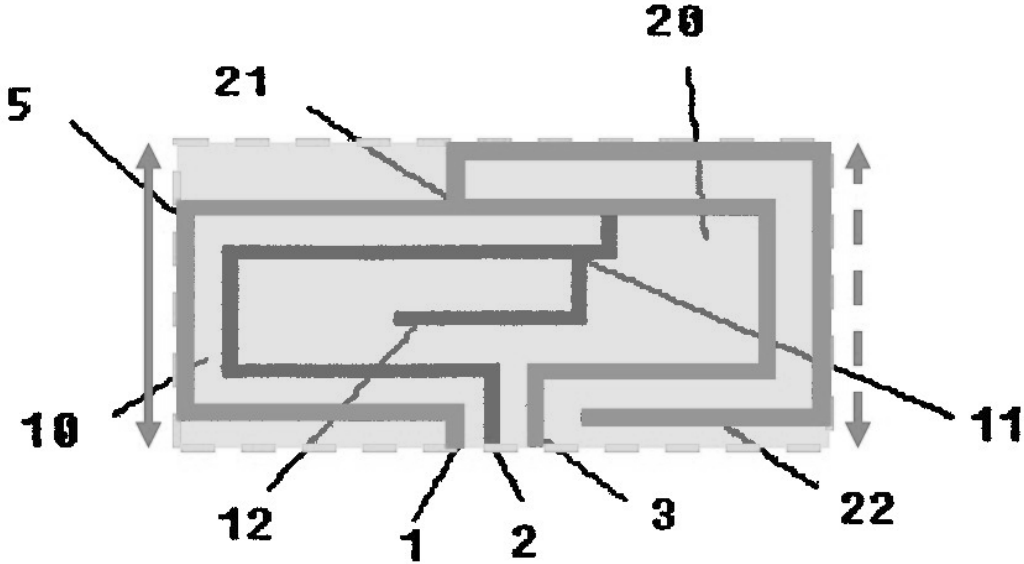
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 974 1003 1008">Wei at Figure 2A (Alternative)</p>

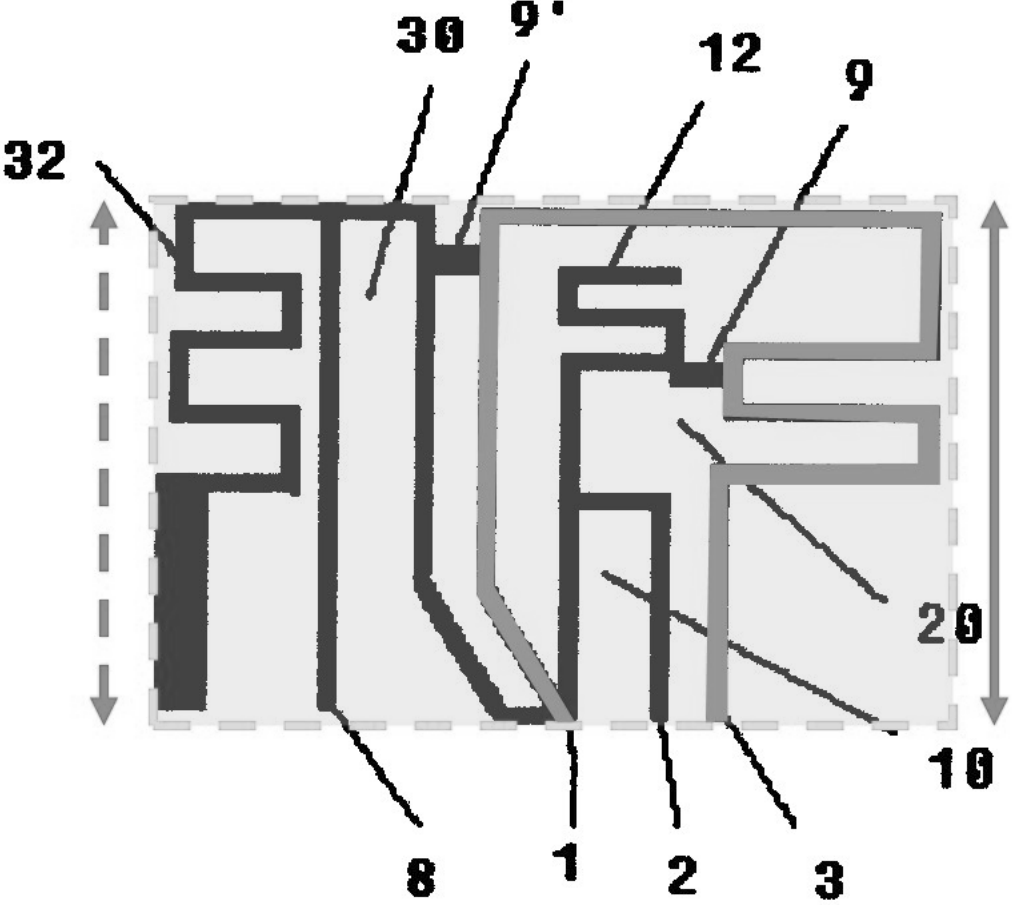
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 370 1608 1247"><p>The diagram shows a cross-sectional view of a multi-layered structure. It consists of several horizontal and vertical layers. Key components are labeled with numbers: 1, 2, 3, 8, 9, 9', 10, 12, 20, 30, and 32. A central vertical channel is formed by layers 1 and 8. To the right of this channel, there are several horizontal layers (9, 12, 20, 10) and vertical layers (3, 2, 1). A large, irregular shape on the left is labeled 32. A small rectangular area at the top left is labeled 30. A small rectangular area at the top right is labeled 9'. A small rectangular area at the bottom right is labeled 10. A small rectangular area at the bottom left is labeled 8. A small rectangular area at the top center is labeled 9. A small rectangular area at the bottom center is labeled 1. A small rectangular area at the bottom right is labeled 2. A small rectangular area at the bottom right is labeled 3. A small rectangular area at the bottom right is labeled 20. A small rectangular area at the bottom right is labeled 10. A small rectangular area at the bottom right is labeled 10.</p></div> <p data-bbox="630 1305 821 1338">Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
7[f]	the minimum-sized parallelepiped having a face with a largest area;	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>  <p>Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 2A (Alternative)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="630 357 1575 1218"></div> <p data-bbox="630 1266 819 1315">Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
7[g]	a second antenna proximate to a second side of the ground plane rectangle, and	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[g]</i></p>  <p>Wei at Figure 2A</p>

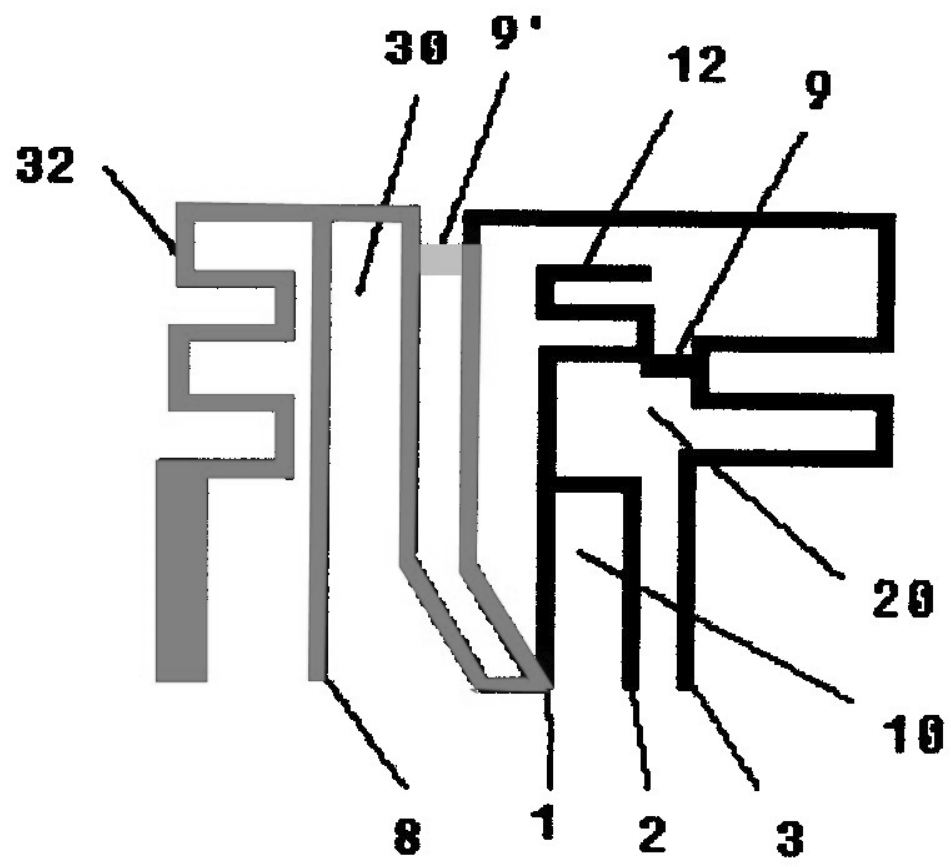
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 1291 819 1323">Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
7[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[h]
7[i]	wherein the first non-planar antenna has a first contour defined as a perimeter of any portions of the first non-planar antenna arranged in the face, perimeters of any closed apertures of any portions of the first non-planar antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first non-planar antenna that are not arranged in the face, and perimeters of any closed apertures of	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[e]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	the orthogonal projection;	
7[j]	wherein the first contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]
7[k]	complexity factor F_{32} having a value of at least 1.35;	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]
7[l]	<p>Wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first</p>	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>contour, N2 is a number of cells of a grid G2 that include at least a point of the first contour, and N3 is a number of cells of a grid G3 that include at least a point of the first contour,</p> <p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are double</p>	

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	the widths and heights of the cells of the grid G2, and	
7[m]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[k]
Claim 8		
8	The wireless device of claim 7, wherein the first non-planar antenna includes at least two antenna elements that are electromagnetically coupled.	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , “According to a design result, the signal loops may be further short-circuited through a conductor connection sheet, thus forming additional signal loops. In the first to third preferred embodiments, a part of the first signal loop 10 except the common conductor 5 and a part of the second signal loop 20 except the common conductor 5 may be connected through at least one conductor connection sheet 9. In the fourth preferred embodiment, the first signal loop 10 and the second signal loop 20 may be connected through at least one conductor connection sheet 9.” Wei at 16:9-15

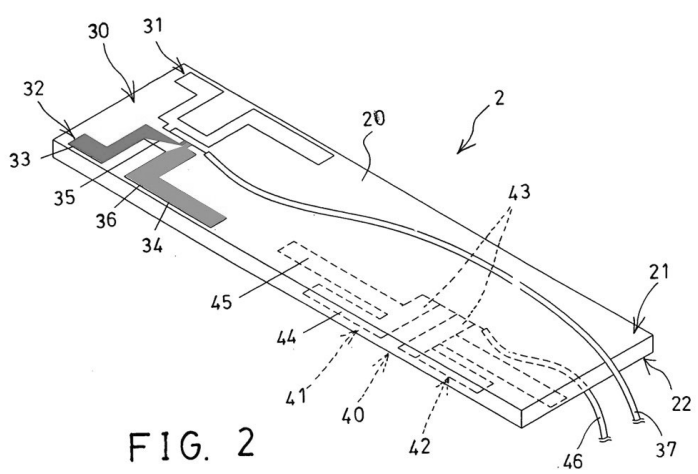
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>"Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package such as for instance 753. Also, the package will include at least another terminal within the set of terminals 107 to externally ground one of the RF voltage references of die 103. Two conducting parts of the antenna such as the active monopole 751 and the parasitic one 752 are coupled by means of a close proximity region 754 such that the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna."</p> <p>Castany868 at 17:30-18:9</p>

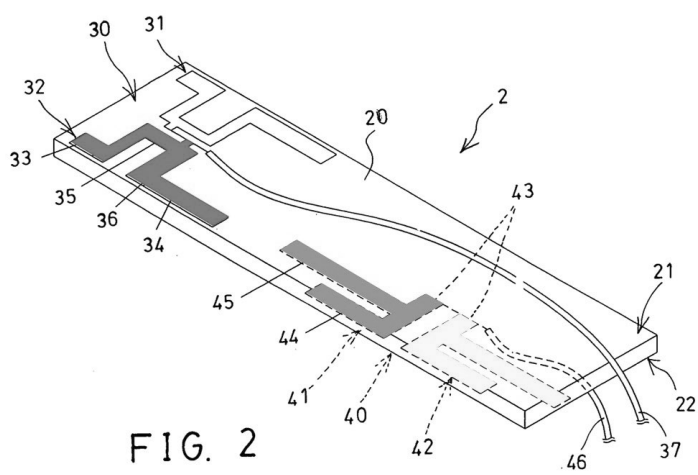
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="651 357 1113 1169"><p>FIG. 7A and FIG. 7B are schematic diagrams of a device. FIG. 7A shows a top-down view of a rectangular device with a central cavity. The cavity is defined by a thick, irregularly shaped border. Inside the cavity, there is a smaller, more complex shape. The device is surrounded by a series of small, rectangular components, likely pins or contacts, arranged in a grid. FIG. 7B is a similar view, showing the same device from a slightly different perspective or with different components. Both figures include various labels: 102, 704, 700, 101, 701, 702, 105, 106, 107, 103, 754, 750, 751, 752, 753, 75, 106, 103, and FIG. 7B.</p></div> <p>Figures 7A and 7B</p>

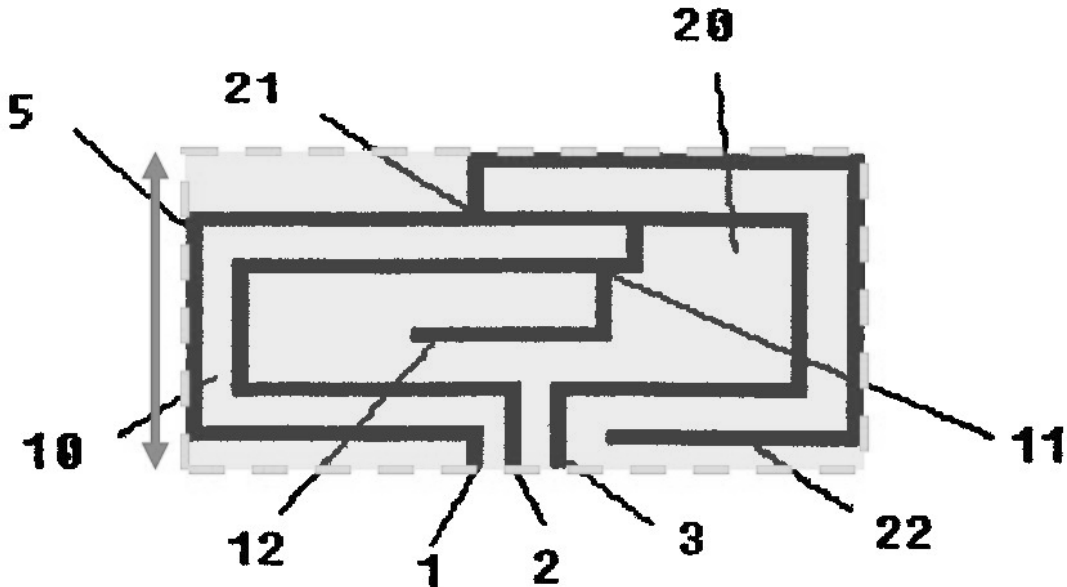
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
Claim 9		
9	The wireless device of claim 7, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	<p>Wei expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 13;$ $N_2 = 31; \text{ and}$ $N_3 = 71;$ <p>that given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(71) - \log_{10}(31))}{\log_{10} 1/2} = 1.1956$ <p>and</p> $1.1956 < 1.75$
Claim 10		
10[a]	The wireless device of claim 7, wherein a third	Wei expressly or inherently discloses this claim element.

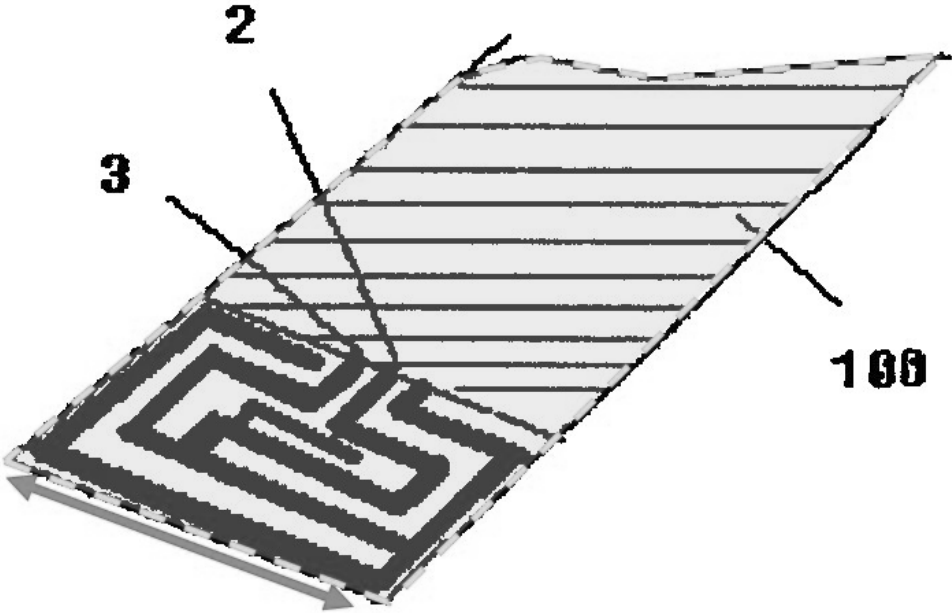
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and</p>	<p><i>See, e.g.</i>, claim element 1[h], 4</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.</i>,</p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p>  <p>FIG. 2</p> <p>Chou at Figure 2</p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<p>symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p>FIG. 2</p> <p>Chou at Figure 2</p>
10[b]	the third antenna is arranged within the wireless device.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 4, 10[a]
Claim 12		
12	The wireless device of claim 7, wherein the first side of the ground	Wei expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	plane rectangle is a short side of the ground plane rectangle.	<p data-bbox="630 349 745 381"><i>See, e.g.,</i></p>  <p data-bbox="630 1063 840 1096">Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 1023 840 1063">Wei at Figure 2B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 363 1608 1235"></div> <p data-bbox="630 1295 819 1328">Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
Claim 13		
13[pre]	A wireless device comprising:	To the extent the preamble is limiting, Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[pre] and 7[pre]
13[a]	a ground plane;	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[a], 7[a]
13[b]	a first antenna	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[b], 7[b]
13[c]	proximate to a first side of a ground plane rectangle enclosing the ground plane,	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[c], 7[c]
13[d]	the first antenna being configured to support at least three frequency	Wei expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	bands of the electromagnetic spectrum,	<i>See, e.g.</i> , claim element 1[d], 7[d]
13[e]	a minimum-sized parallelepiped completely enclosing a volume of the first antenna,	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 7[e]
13[f]	the minimum-sized parallelepiped having a face with a largest area;	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , 7[f]
13[g]	a second antenna proximate to a second side of the ground plane rectangle	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[g], 7[g]
13[h]	configured to receive signals from at least two frequency bands of the at least three frequency bands,	Wei expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[h], 7[h]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
13[i]	wherein the first antenna has a first contour defined as a perimeter of any portions of the first antenna arranged in the face, perimeters of any closed apertures of any portions of the first antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[e], 7[e]
13[j]	wherein the first contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f], 7[j]

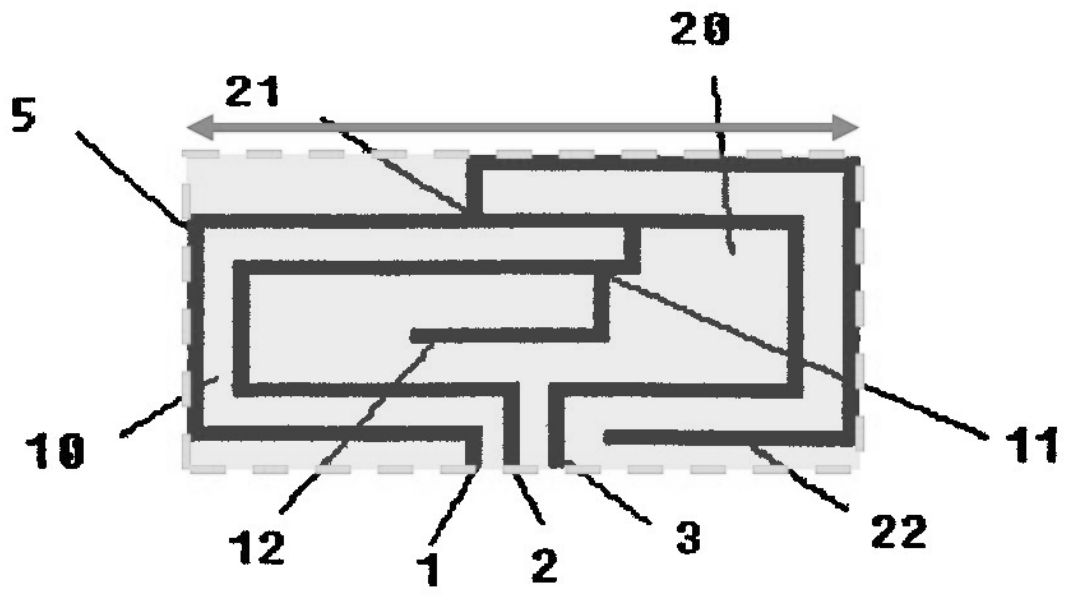
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
13[k]	complexity factor F_{32} having a value of at least 1.35; and	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f], 7[k]
13[l]	<p>wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,</p>	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f], 7[l]

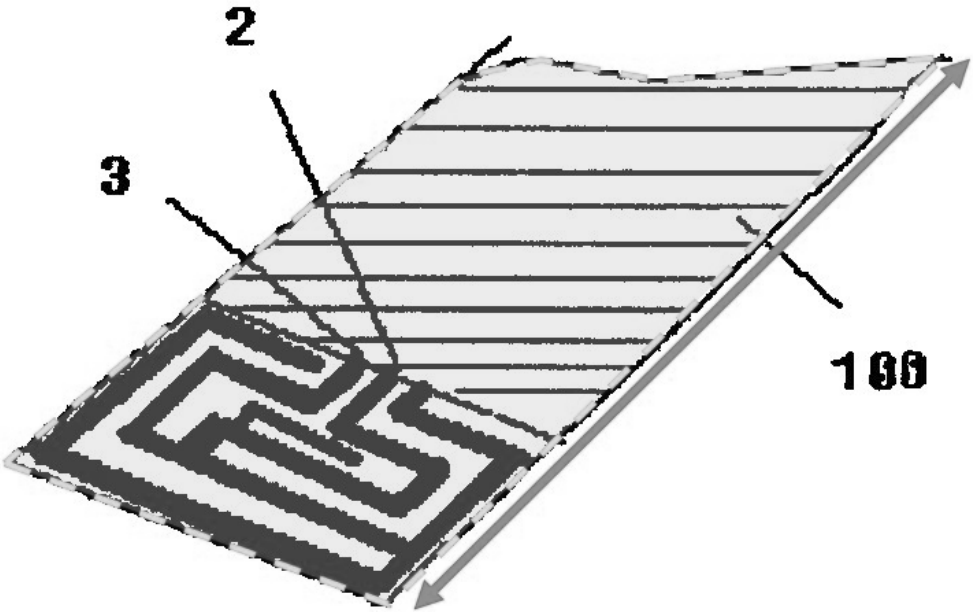
Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	<p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are Double the widths and heights of the cells of the grid G2, and</p> <p>the grid G3 being aligned with the grid G2, the cells of the grid G3 having widths and heights that respectively are half the</p>	

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
	widths and heights of the cells of the grid G2, and	
13[m]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[k], 7[m]
Claim 14		
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 8
Claim 15		
15	The wireless device of claim 13, wherein the first antenna is planar.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[b]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
Claim 17		
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 9
Claim 18		
18[a]	The wireless device of claim 13, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[h], 4, 10[a]
18[b]	the third antenna is arranged within the wireless device.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 4, 10[a], 10[b], 18[a]

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
Claim 19		
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 12
Claim 20		
20	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a long side of the ground plane rectangle.	Wei expressly or inherently discloses this claim element. <i>See, e.g.,</i>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		 <p data-bbox="630 974 840 1023">Wei at Figure 2A</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="646 363 1612 971"></div> <p data-bbox="630 1027 840 1060">Wei at Figure 2B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Wei
		<div data-bbox="630 357 1596 1234"></div> <p data-bbox="630 1282 819 1331">Wei at Figure 9</p>

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 12,095,149 B2
BASED ON PCT PUBLICATION NO. 2004/042868 TO CASTANY ET AL. (“CASTANY868”)

Based upon Plaintiff’s Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendants’ accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious some or all of the asserted claims. These invalidity contentions are not an admission by the Defendants that the accused products are covered by or infringe claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, and 20 (the “’149 Asserted Claims”)¹, particularly when these claims are properly construed and applied.

AIA law applies because the application that issued as the ’149 Patent was filed on June 22, 2023, after the AIA came into force on March 16, 2013.

PCT Publication No. 2004/042868 to Castany et al. (“Castany868”) was filed on November 7, 2002 and published on May 21, 2004, on August 30, 2007. This patent is prior art under at least 35 U.S.C. § 102(e), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 12,095,149 (the “’149 Patent”), are invalid as anticipated by Castany868.

To the extent that Castany868 is found not to anticipate one or more of the asserted claims of the ’149 Patent, these claims are invalid as obvious in view of Castany868 alone or as modified in view of or in combination with other prior art references disclosed in Defendants’ Invalidity Contentions and accompanying charts, including without limitation as set forth below.

- U.S. Patent Application No. 2007/0200773 to Dou et al. (“Dou”) was filed on February 24, 2006, published on August 30, 2007, and issued as U.S. Patent No. 7,548,208 on June 16, 2009. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- Chinese Patent No. 2,765,337. (“Wei”) was filed on February 6, 2005, and was granted on March 15, 2006. This patent is prior art under at least 35 U.S.C. §§ 102(a), 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- U.S. Patent No. 6,943,746 to Talvitie et al. (“Talvitie”) was filed on October 23, 2003, published on July 15, 2004, and issued on September 13, 2005. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).

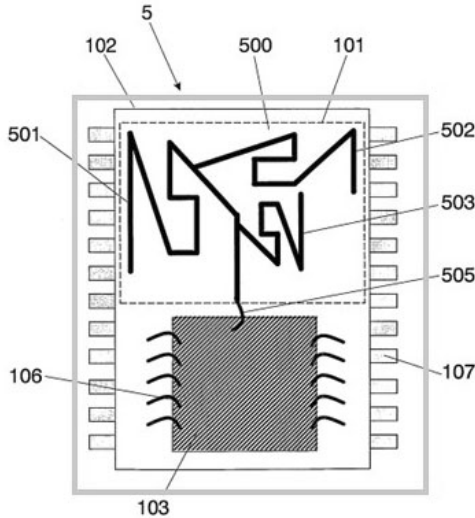
¹ Defendants understand that, by not charting claims 6, 11, and 16 in its Infringement Contentions, Plaintiff does not assert these claims against Defendants.

- U.S. Patent Application No. 2002/0238433 to Chou (“Chou”) was filed on March 1, 2005, published on October 26, 2006, and issued as U.S. Patent No. 7,129,898 on October 31, 2006. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- Microstrip Sierpinski Carpet Antenna Using Transmission Line Feeding by Mohamad Kamal A. Rahim, et al., Asia-Pacific Microwave Conference Proceedings, (“Rahim”) published in December 2005. This paper/book is prior art under at least 35 U.S.C. § 102(a) and 103(a).

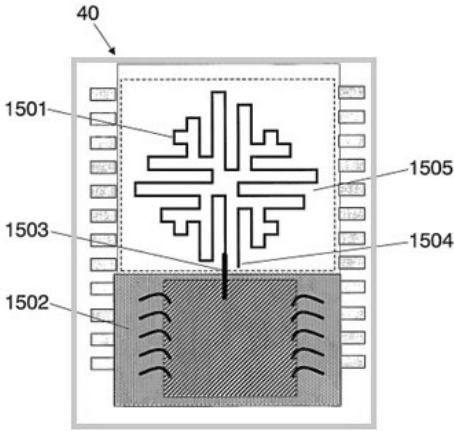
These invalidity contentions are not an admission that the Defendants concede or acquiesce to any claim construction implied or suggested by Plaintiff’s Complaint or Infringement Contentions. Nor are Defendants asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature. Defendants reserve the right to update their constructions and contentions in view of this Court’s claim construction order.²

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
Claim 1		
1[pre]	A wireless device comprising:	<p>To the extent the preamble is limiting, Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The present invention allows the integration of a full wireless system into a single component.</p> <p>There is a trend in the semiconductor industry towards the so-called System on Chip (SoC) and System on Package (SoP) concepts. This means integrating as many components of an electronic system as possible (processors, memories, logic gates, biasing circuitry, etc.) into a single semiconductor chip (or "die") (SoC) or at least into a single integrated circuit package (SoP). The full integration of systems or subsystems into a single chip or package provides many advantages in terms of cost, size, weight, consumption, performance and product design complexity.</p>

² Defendants incorporate herein any related work performed by or on behalf of an author or an inventor in the United States under 35 U.S.C. § 102(g)(2). Defendants reserve the right to supplement and/or alter this chart based on further investigation and ongoing discovery.

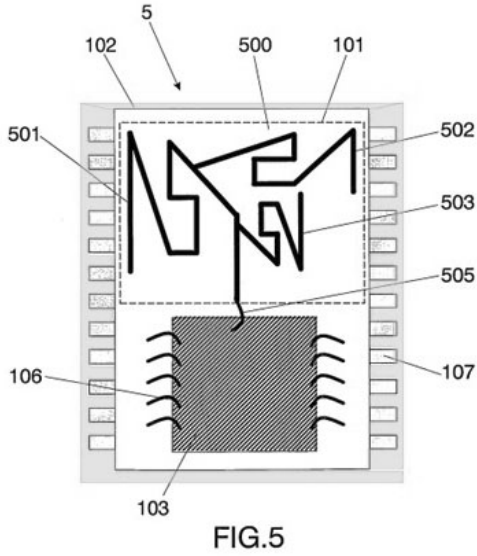
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Several electronics components for consumer applications, such as handsets, wireless devices, personal digital assistants (PDA) or personal computers are becoming more and more integrated into SoP/SoC products.</p> <p>The concept of integrating a full wireless system into a SoC/SoP device (FWSoc and FWSop) is especially attractive owing to the tremendous growth and success of cellular and wireless systems.”</p> <p>Castany868 at 1:16-21</p>  <p>FIG.5</p> <p>Castany868 at Figure 5</p>

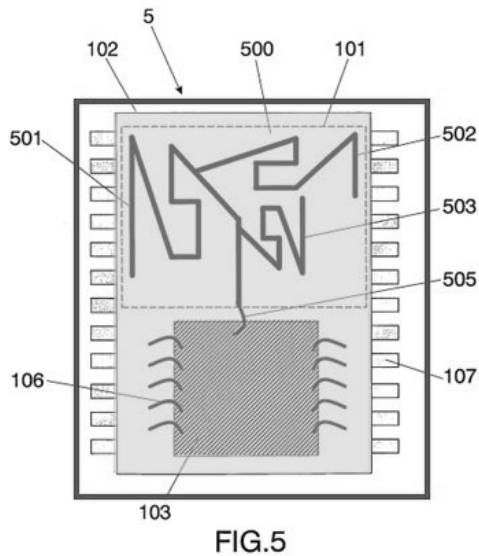
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 370 1113 1185"><p>FIG. 7A and FIG. 7B are schematic diagrams of a device. FIG. 7A shows a top-down view of a square device with a central cavity. The cavity is defined by a thick black line forming a stylized 'W' shape. A dashed line outlines the inner boundary of the cavity. A small circle labeled 704 is located at the top center of the cavity. The device has a central rectangular area labeled 105, which is shaded with diagonal lines. This central area is flanked by two vertical columns of small, rectangular protrusions labeled 106 and 107. The entire device is enclosed in a square frame labeled 101. FIG. 7B shows a similar top-down view of the device, but with a different internal structure. The central cavity is defined by a thick black line forming a stylized 'W' shape. A dashed line outlines the inner boundary of the cavity. A small circle labeled 754 is located at the top center of the cavity. The device has a central rectangular area labeled 105, which is shaded with diagonal lines. This central area is flanked by two vertical columns of small, rectangular protrusions labeled 106 and 107. The entire device is enclosed in a square frame labeled 101. The labels 102, 701, 702, 700, 101, 105, 106, 107, and 103 are used to identify various components in both figures.</p></div> <p>Castany868 at Figures 7A and 7B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="831 802 919 831">FIG. 15</p> <p data-bbox="630 886 924 915">Castany868 at Figure 15</p>
1[a]	a ground plane;	<p data-bbox="630 964 1402 993">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1029 739 1058"><i>See, e.g.,</i></p> <p data-bbox="630 1094 1898 1354">“Other embodiments where the antenna structure is split on several parallel layers consists on an active-parasitic arrangement. That is, the package includes a plurality of dielectric layers within one or more substrates of the package, wherein the package includes at least a first conducting pattern for the antenna in a first of the layers, the first conducting pattern on the first layer being coupled or connected to the semiconductor die. Such a first conducting pattern that is fed by the die is the active element of the antenna arrangement. In this arrangement, the package includes at least a second conducting pattern on at least a second layer of any of the substrates, the second conducting pattern being capacitively or inductively coupled to the first conducting pattern of the antenna, the second conducting pattern acting as a</p>

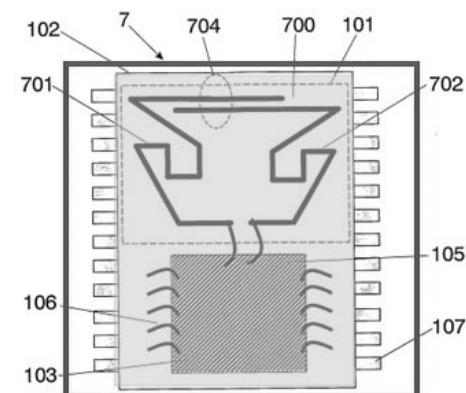
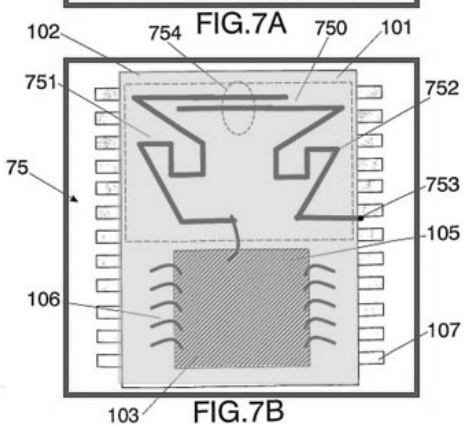
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>parasitic element for the antenna. As an example, the antennas on the package embodiments shown in Figures 1-6, 11-15 and 17-22 could become the active antenna in such an active-parasitic antenna arrangement, wherein at least an additional antenna pattern on a parallel layer on the same or other substrate would act as the parasitic element or elements of the antenna structure. The effect of such parasitic elements is primarily an increase in the bandwidth and efficiency of the antenna, together with a finer tuning of the input impedance to match the output of the output amplifier connected to the antenna.”</p> <p>Castany868 at 13:26-14:9</p> <p>“Figure 5 shows a multibranch antenna structure on a package 5, where several curves, with not necessarily the same lengths, intersect each other at some points. In particular, the antenna 500 includes three arms 501 , 502, 503, each of them being in the form of a curve according to the present invention. In this particular example the antenna takes the form of a monopole as in Figure 1 , with a single feeding port connected to the die by means of connection 105 and one or more connections within terminals 107 connected to an external ground plane.”</p> <p>Castany868 at 17:6-12</p> <p>“Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package such as for instance 753.”</p> <p>Castany868 at 17:30-18:3</p> <p>“When more than 50% of the area below 101 is filled with a conducting material, the antenna becomes a microstrip or patch antenna according to the present invention, the conducting material being the ground for the microstrip or patch antenna. The antenna also becomes a planar inverted F antenna (PIFA), if additionally, at least one short to ground is placed at any point within the conducting antenna pattern. In</p>

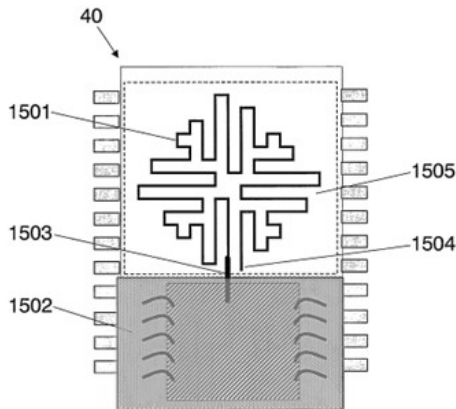
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>the case of either a microstrip or patch arrangement, or in the PIFA case, the ground covering more than 50% or the area underneath the antenna is preferred. Such a ground can be included in any of the layers of a substrate 102 supporting the antenna and/or the chip 103, or alternatively it can be included in the external substrate or PCB supporting the package.”</p> <p>Castany868 at 19:1-11</p> <p>“Figure 15 displays a package [40] including a monopole antenna 1501. In this example, a part of the grounding plane or ground counterpoise 1502 is placed on the same layer as the antenna, in such a way that it does not overlap the rectangular area 1505 in which the monopole arm 1501 is enclosed. The antenna is fed through one conductor 1503. In this particular embodiment, it is shown how the tip of the monopole 1504 can be put close to the ground plane 1502. This would provide some capacitive loading to the antenna that contributes to the overall antenna miniaturization.”</p> <p>Castany868 at 23:18-25</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="667 362 1140 914"><p data-bbox="877 881 951 914">FIG.5</p></div> <p data-bbox="630 963 911 995">Castany868 at Figure 5</p>

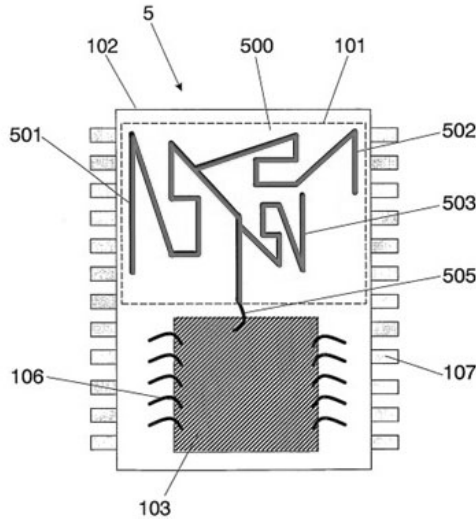
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 347 1121 899"><p data-bbox="856 867 932 899">FIG.5</p></div> <p data-bbox="630 954 1050 987">Castany868 at Figure 5 (Alternate)</p>

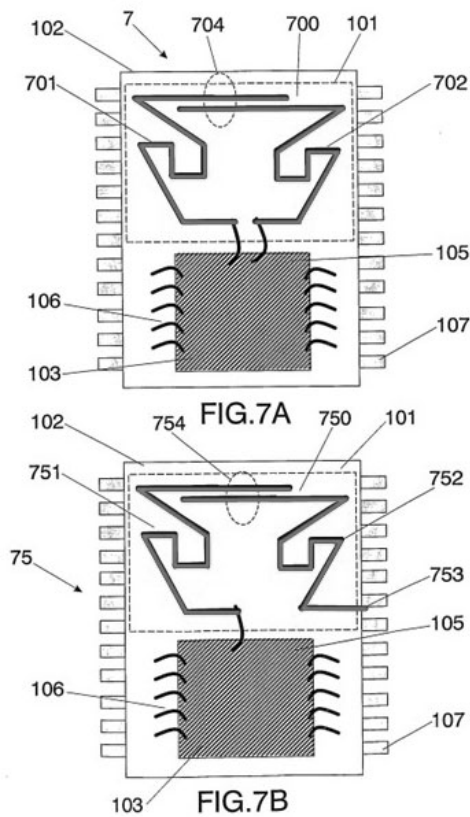
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="659 363 1121 1175"><p>FIG. 7A and FIG. 7B are cross-sectional views of a device assembly. FIG. 7A shows a top-down view of a central component (700) with a complex, multi-lobed shape, surrounded by a frame (101). The central component is connected to a base (103) via a series of vertical lines (106). The base is further connected to a lower layer (107) via a series of vertical lines (105). The entire assembly is enclosed within a frame (102). FIG. 7B shows a similar view, but with a different internal structure (750) and a different frame (751). The central component (750) is also connected to a base (103) via a series of vertical lines (106). The base is further connected to a lower layer (107) via a series of vertical lines (105). The entire assembly is enclosed within a frame (752). The labels 101, 102, 103, 105, 106, 107, 700, 701, 702, 704, 750, 751, 752, 753, 754, and 75 are used to identify various components and features.</p></div> <p>Castany868 at Figures 7A and 7B</p>

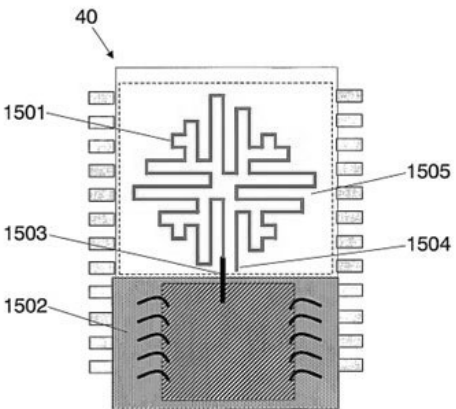
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="651 357 1113 747"><p>FIG. 7A</p></div> <div data-bbox="651 747 1113 1169"><p>FIG. 7B</p></div> <p>Castany868 at Figures 7A and 7B (Alternate)</p>

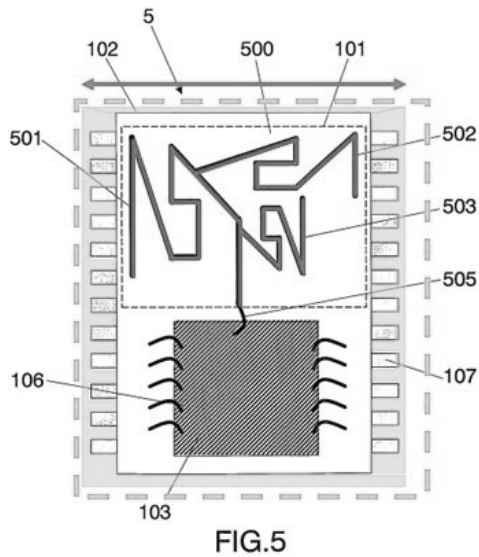
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="871 812 955 844">FIG.15</p> <p data-bbox="630 901 924 933">Castany868 at Figure 15</p>
1[b]	a first planar antenna	<p data-bbox="630 982 1407 1015">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1047 735 1079"><i>See, e.g.,</i></p> <p data-bbox="630 1112 1911 1274">“The present invention applies to several antenna topologies, both balanced and unbalanced. In particular, monopoles, dipoles, loops, folded and loaded monopoles and dipoles and their slot or aperture equivalents (slot monopoles, slot dipoles, slot loops, folded and loaded slot monopoles and dipoles) are some of the structures that can be arranged according to the present invention. Other structures include shorted and bent monopoles (L monopoles, IFA), multibranch structures, coupled monopoles and dipole antennas and</p>

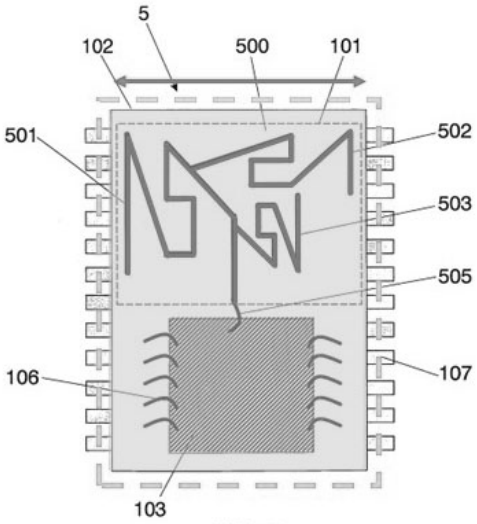
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>again their aperture equivalents. All of them would include the characteristic pattern built on a component of the integrated circuit package according to the present invention.</p> <p>Another possible antenna configuration is a microstrip or patch antenna, including their shorted versions (shorted patches and planar inverted F or PIFA structures); nevertheless for the planar cases a particular selection of the disclosed geometries should be considered to achieve the required degree of miniaturization. In particular, the characteristic pattern of the invention should include at least a curve with fifteen segments, with at least seven of the segments being shorter than one-twentieth of the longest free-space operating wavelength of the antenna. The rest of the general conditions that conform the essential geometric aspects of the invention, as described above, apply to the microstrip patch and their shorted versions as well.”</p> <p>Castany868 at 7:5-23</p> <p>“Figure 5 shows a multibranch antenna structure on a package 5, where several curves, with not necessarily the same lengths, intersect each other at some points. In particular, the antenna 500 includes three arms 501 , 502, 503, each of them being in the form of a curve according to the present invention. In this particular example the antenna takes the form of a monopole as in Figure 1 , with a single feeding port connected to the die by means of connection 105 and one or more connections within terminals 107 connected to an external ground plane.”</p> <p>Castany868 at 17:6-12</p> <p>“Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>such as for instance 753.” Castany868 at 17:30-18:3</p> <p>“Figure 15 displays a package [40] including a monopole antenna 1501. In this example, a part of the grounding plane or ground counterpoise 1502 is placed on the same layer as the antenna, in such a way that it does not overlap the rectangular area 1505 in which the monopole arm 1501 is enclosed. The antenna is fed through one conductor 1503. In this particular embodiment, it is shown how the tip of the monopole 1504 can be put close to the ground plane 1502. This would provide some capacitive loading to the antenna that contributes to the overall antenna miniaturization.” Castany868 at 23:18-25</p>  <p style="text-align: center;">FIG.5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p data-bbox="632 345 909 378">Castany868 at Figure 5</p>  <p data-bbox="632 1287 1035 1320">Castany868 at Figures 7A and 7B</p> <p>The image contains three technical diagrams of a device. The top diagram is Figure 5, showing a cross-section of a device with a central cavity. It features a top layer (700) with a central opening (704) and a bottom layer (106) with a central opening (105). The device is surrounded by a frame (101) and has various components labeled with numbers: 102, 701, 702, 105, 106, 103, 107, and 7. Below Figure 5 are two more diagrams, FIG. 7A and FIG. 7B, which show similar cross-sections but with different internal structures. FIG. 7A shows a central cavity (754) and a bottom layer (750) with a central opening (752). FIG. 7B shows a central cavity (75) and a bottom layer (106) with a central opening (105). Both FIG. 7A and FIG. 7B are surrounded by a frame (101) and have various components labeled with numbers: 102, 751, 752, 753, 105, 106, 103, and 107.</p>

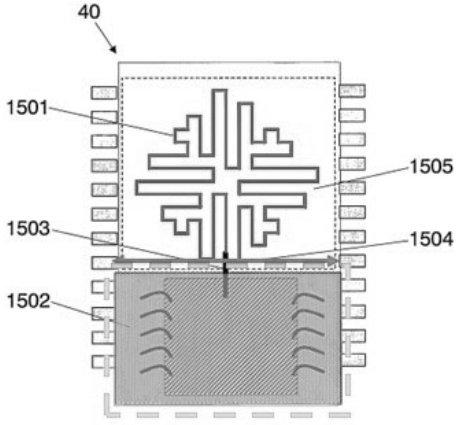
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="840 795 934 828">FIG.15</p> <p data-bbox="630 885 924 917">Castany868 at Figure 15</p>
1[c]	<p data-bbox="310 966 606 1169"><i>[the first planar antenna]</i> proximate to a first side of a ground plane rectangle enclosing the ground plane,</p>	<p data-bbox="630 966 1402 998">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1031 735 1063"><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 358 1121 911"><p data-bbox="856 878 932 911">FIG. 5</p></div> <p data-bbox="630 959 911 992">Castany868 at Figure 5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="640 365 1113 885"></div> <p data-bbox="846 885 919 917">FIG.5</p> <p data-bbox="630 958 1050 998">Castany868 at Figure 5 (Alternate)</p>

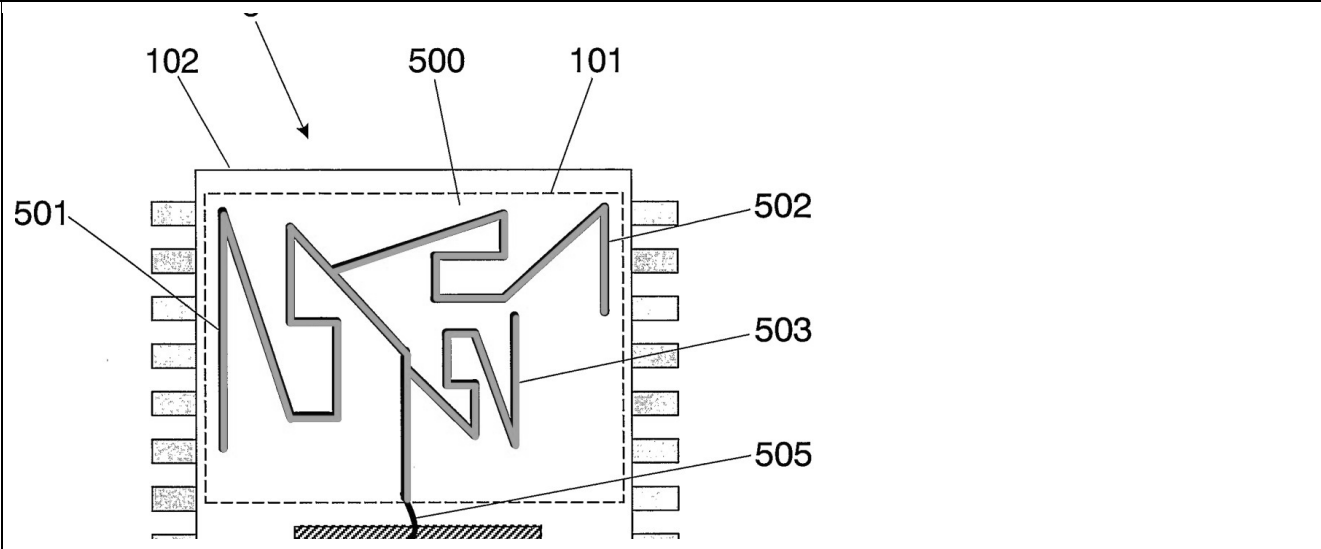
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 354 1104 1166"><p>The figure contains two technical drawings, FIG. 7A and FIG. 7B, showing a cross-sectional view of a device. FIG. 7A is the top drawing, showing a central rectangular component (105) with a textured surface, surrounded by a frame (103). Above the frame is a complex, zig-zag shaped structure (701) with a central opening (704). The entire assembly is enclosed in a larger frame (101). FIG. 7B is the bottom drawing, showing a similar assembly but with a different central component (106) and a different frame (107). The zig-zag structure (751) is also present. Labels 102, 7, 700, 101, 702, 105, 106, 103, 754, 750, 751, 752, 753, 105, 106, 107, and 103 are used to identify various parts of the device.</p></div> <p>Castany868 at Figures 7A and 7B</p>

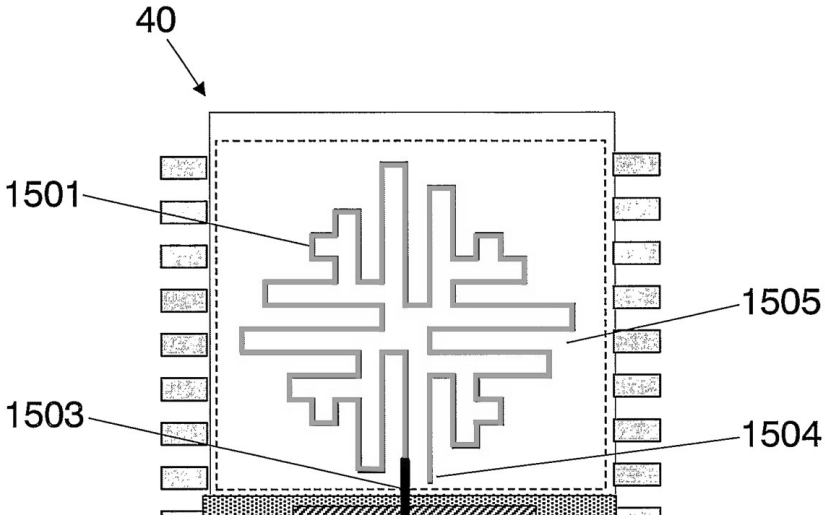
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="640 357 1102 1177"><p>FIG. 7A</p><p>FIG. 7B</p></div> <p>Castany868 at Figures 7A and 7B (Alternate)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p style="text-align: center;">FIG.15</p> <p>Castany868 at Figure 15</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSITA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>
1[d]	the first planar antenna being configured to	Castany868 expressly or inherently discloses this claim element.

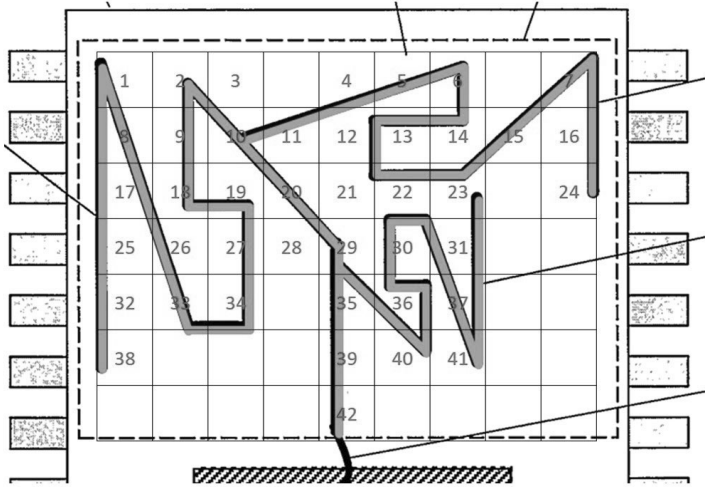
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	support at least three frequency bands of the electromagnetic spectrum,	<p><i>See, e.g.,</i></p> <p>“the antennas on the package embodiments shown in Figures 1-6, 11-15 and 17-22 could become the active antenna in such an active-parasitic antenna arrangement, wherein at least an additional antenna pattern on a parallel layer on the same or other substrate would act as the parasitic element or elements of the antenna structure. The effect of such parasitic elements is primarily an increase in the bandwidth and efficiency of the antenna, together with a finer tuning of the input impedance to match the output of the output amplifier connected to the antenna.”</p> <p>Castany868 at 14:2-9</p> <p>“Figure 5 shows a multibranch antenna structure on a package 5, where several curves, with not necessarily the same lengths, intersect each other at some points. In particular, the antenna 500 includes three arms 501, 502, 503, each of them being in the form of a curve according to the present invention. In this particular example the antenna takes the form of a monopole as in Figure 1, with a single feeding port connected to the die by means of connection 105 and one or more connections within terminals 107 connected to an external ground plane. By adjusting the number and length of the antenna arms the frequency response of the antenna can be tailored. In general, for a wide-band behavior, the length from the tips of the arms to the feeding point of the antenna will be similar. For a multiband response with no overlapping between frequency bands, the length of each arm is associated mainly with the center frequency of a particular band within the antenna response. Such a multibranch arrangement is also compatible with, but not limited to, a dipole, an inverted F antenna, or a slot antenna.”</p> <p>Castany868 at 17:6-19</p> <p>“Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>such as for instance 753.” Castany868 at 17:30-18:3</p> <p>“Figure 15 displays a package [40] including a monopole antenna 1501. In this example, a part of the grounding plane or ground counterpoise 1502 is placed on the same layer as the antenna, in such a way that it does not overlap the rectangular area 1505 in which the monopole arm 1501 is enclosed. The antenna is fed through one conductor 1503. In this particular embodiment, it is shown how the tip of the monopole 1504 can be put close to the ground plane 1502. This would provide some capacitive loading to the antenna that contributes to the overall antenna miniaturization.” Castany868 at 23:18-25</p>
1[e]	the first planar antenna defining a first contour,	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

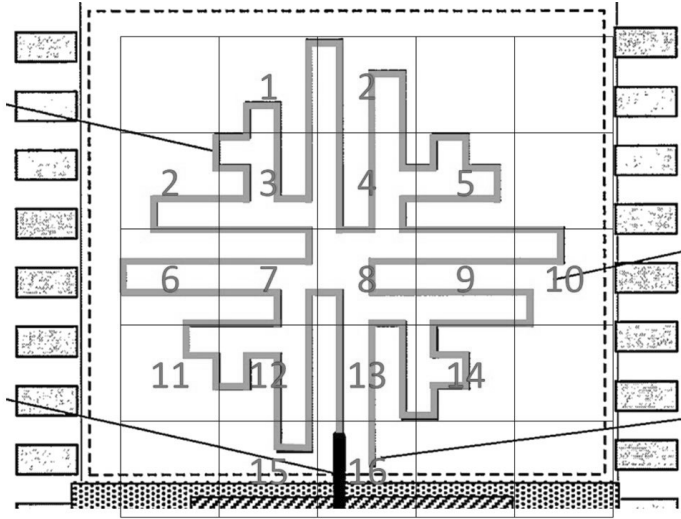
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="617 331 1929 876"></div> <p data-bbox="617 876 1929 963">Castany868 at Figure 5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>Castany868 at Figure 15</p>
1[f]	<p>wherein the first contour has a level of complexity defined by complexity factor F21 having a value of at least 1.20 and complexity factor F32 having a value of at least 1.35; and</p>	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Castany868 at Figure 5, Calculating N_1</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="730 358 1430 841"></div> <p data-bbox="632 885 1102 917">Castany868 at Figure 5, Calculating N₂</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Figure 5 is a diagram illustrating the calculation of N_3. It shows a grid with a path of numbered points (1-117) and a dashed line. The path starts at point 1, moves to point 2, then to point 3, and continues through points 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117. The path is shown as a solid line, and the dashed line represents the boundary of the grid. The grid is labeled with 'Castany868' at the top right.</p>
		Castany868 at Figure 5, Calculating N_3

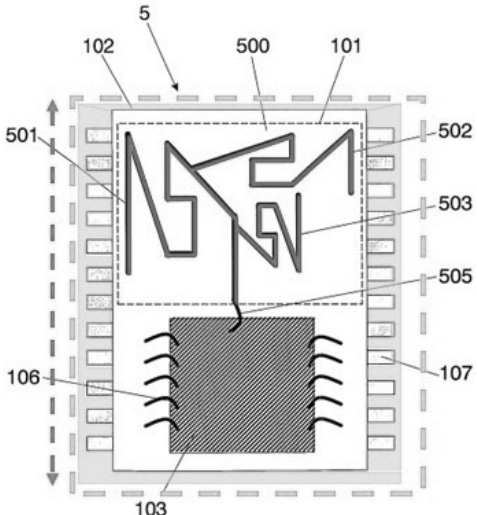
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="743 342 1419 857"></div> <p data-bbox="632 889 1115 922">Castany868 at Figure 15, Calculating N_1</p>

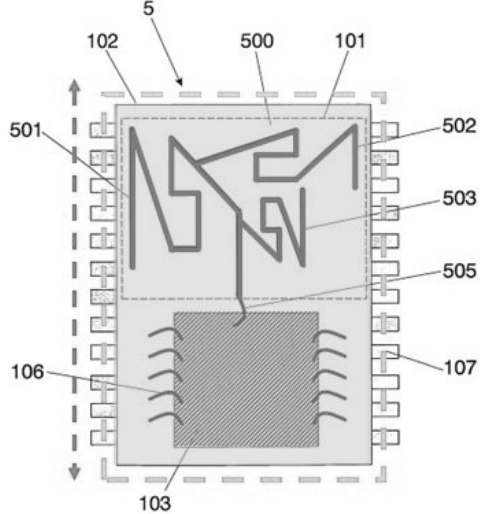
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Castany868 at Figure 15, Calculating N_2</p>

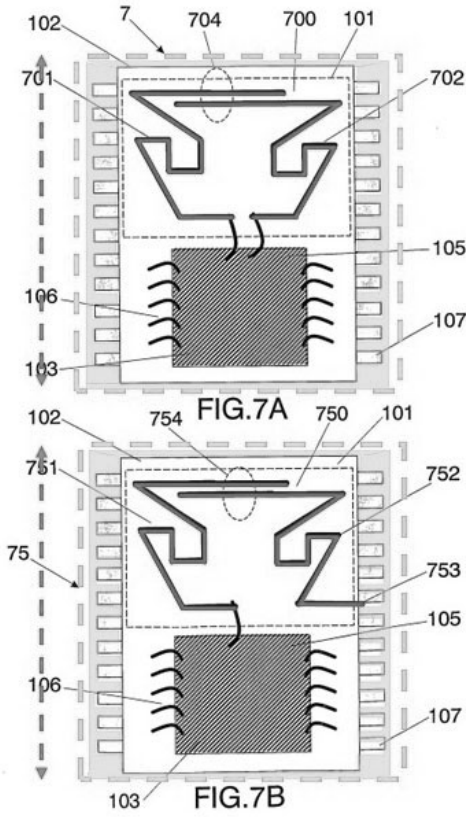
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Castany868 at Figure 15, Calculating N_3</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 13;$ $N_2 = 42; \text{ and}$ $N_3 = 121;$ <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(42) - \log_{10}(13))}{\log_{10} 1/2} = 1.6919$ <p>and</p> $1.20 \leq 1.6919$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(121) - \log_{10}(42))}{\log_{10} 1/2} = 1.5265$ <p>and</p> $1.35 \leq 1.5265$ <p>Still further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 16;$ $N_2 = 58; \text{ and}$ $N_3 = 195;$ <p>that given</p>

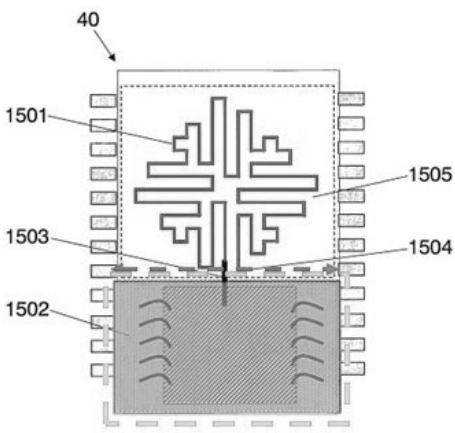
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		$F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$ <p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(58) - \log_{10}(16))}{\log_{10} 1/2} = 1.8580$ <p>and</p> $1.20 \leq 1.8580$ <p>Additionally, given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(195) - \log_{10}(58))}{\log_{10} 1/2} = 1.7493$ <p>and</p> $1.35 \leq 1.7493$
1[g]	a second antenna proximate to a second	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	side of the ground plane rectangle,	<p>“Although a multiband antenna such as for instance a multibranch antenna can be used within the package when several services or operating frequency bands are to be integrated in the same system, it is clear that other options within the present invention include arranging two or more antennas within the same package. For instance, those two or more antennas according to the present invention can be arranged in the same substrate layer, in different layers within the same substrate, in different substrates or even in the substrate and in the plastic casing of the package. One possible arrangement for a two antenna package includes two similar antennas wherein each one is fed independently, and wherein one conducting pattern is rotated 90° with respect to the other antenna pattern. This provides an effective means for integrating a polarization diversity communication system inside a single package.”</p> <p>Castany 30:1-12</p>  <p>FIG.5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p data-bbox="632 349 911 381">Castany868 at Figure 5</p>  <p data-bbox="856 945 932 977">FIG. 5</p> <p data-bbox="632 1031 1050 1063">Castany868 at Figure 5 (Alternate)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>FIG. 7A</p> <p>FIG. 7B</p> <p>Castany868 at Figures 7A and 7B</p>

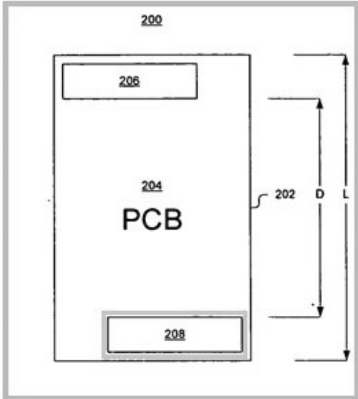
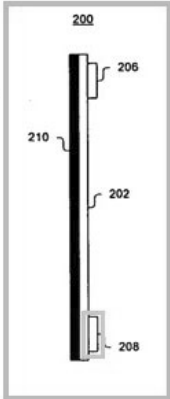
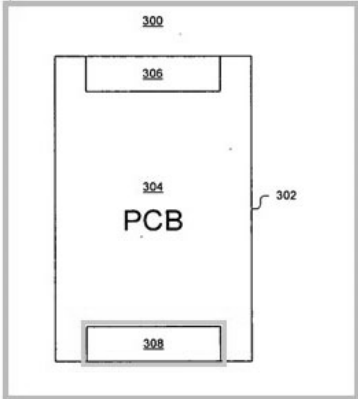
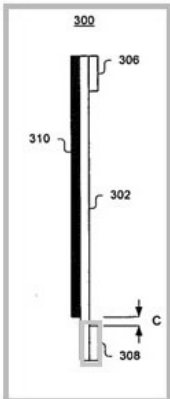
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>FIG. 7A and FIG. 7B (Alternate) are cross-sectional views of a device. FIG. 7A shows a central cavity (700) with a top surface (701) and a bottom surface (702). The cavity is surrounded by a structure (101) with a top surface (102) and a bottom surface (103). The structure (101) has a central portion (105) and side portions (106, 107). FIG. 7B (Alternate) shows a similar structure with a central cavity (750) and a top surface (751). The cavity is surrounded by a structure (101) with a top surface (102) and a bottom surface (103). The structure (101) has a central portion (105) and side portions (106, 107). The top surface (751) of the cavity in FIG. 7B is shown with a dashed line, indicating it is an alternate view.</p>
		Castany868 at Figures 7A and 7B (Alternate)

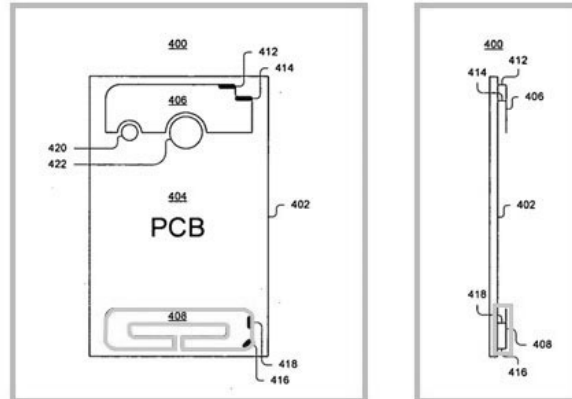
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p style="text-align: center;">FIG.15</p> <p>Castany868 at Figure 15</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSITA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“As shown in FIG. 3A, the wireless device 300 may have an internal diversity antenna architecture comprising a first internal antenna 306 and a second internal antenna 308 disposed on the PCB 304 for achieving diversity. In this embodiment, the internal diversity antenna architecture may comprise a first internal antenna 306 located substantially at the top of the wireless device 300. For example., the first internal antenna 306 may be located substantially at the top of the housing 302 and/or the top of the PCB 304. The internal diversity antenna architecture may comprise a second internal antenna 308 located substantially at the bottom of the wireless device 300. For example, the second internal antenna 308 may be located substantially at the bottom of the housing 302 and/or the bottom of the PCB 304.”</p> <p>Dou at [0032]</p> <p>“As shown in FIG. 4A, the wireless device 400 may have an internal diversity antenna architecture comprising a first internal antenna 406 and a second internal antenna 408 disposed on the PCB 404 for achieving diversity. In this embodiment, the first internal antenna 406 may comprise a first feed point 412 and a first ground point 414, and the second internal antenna 408 may comprise a second feed point 416 and a second ground point 418. The first internal antenna 406 may be located substantially near the top of</p>

Exhibit – F – 03

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>the wireless device 400, and the second internal antenna 408 may be located substantially near the bottom of the wireless device 400.</p> <p>Dou at [0036]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="669 365 1024 761"></div> <div data-bbox="766 774 873 807">FIG. 2A</div> <div data-bbox="1079 365 1247 761"></div> <div data-bbox="1108 774 1215 807">FIG. 2B</div> <div data-bbox="669 846 1024 1242"></div> <div data-bbox="766 1255 873 1287">FIG. 3A</div> <div data-bbox="1079 846 1247 1242"></div> <div data-bbox="1108 1255 1215 1287">FIG. 3B</div>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="659 399 1226 829">  <p data-bbox="785 802 890 829">FIG. 4A</p> <p data-bbox="1100 802 1205 829">FIG. 4B</p> </div> <p data-bbox="630 889 1096 922">Dou at Figures 2A-B, 3A-B, and 4A-B</p> <p data-bbox="630 954 1927 1161">“As shown in FIG. 2A, in a first preferred embodiment provided in this utility model, the metal conductor part includes two signal loops which are respectively a first signal loop 10 and a second signal loop 20. As shown in the figure, the first and second signal loops 10, 20 start from the same common feed point 1 and respectively terminate at two ground points 2, 3 (the numerals are the same below) with different physical positions. The second signal loop 20 completely surrounds the first signal loop 10, and the two signal loops have a common conductor 5.”</p> <p data-bbox="630 1193 810 1226">Wei at 15:7-13</p>

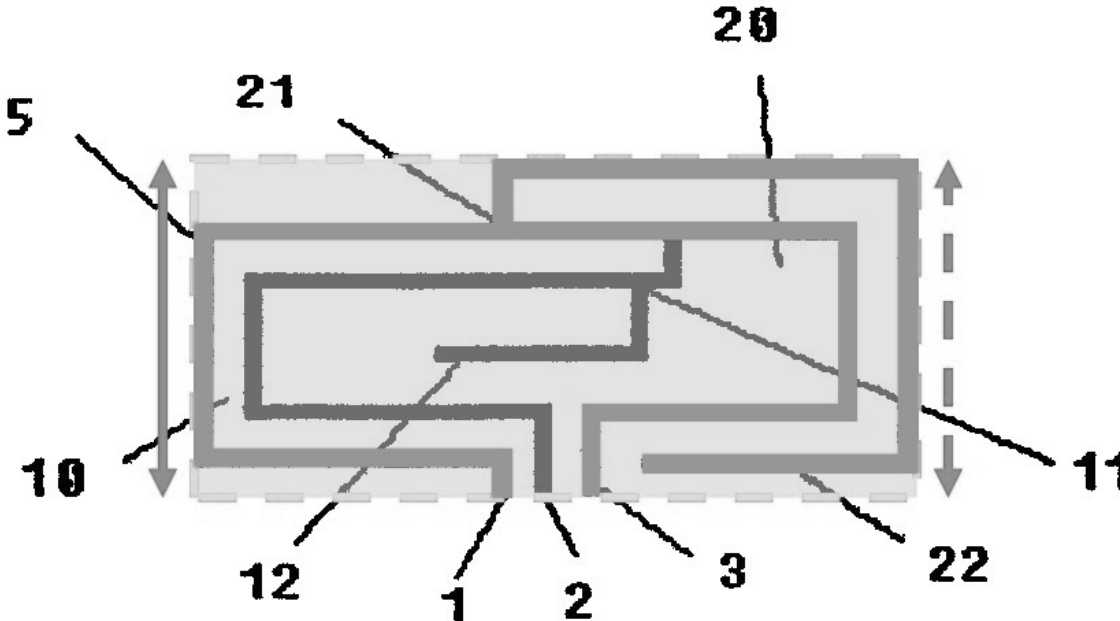
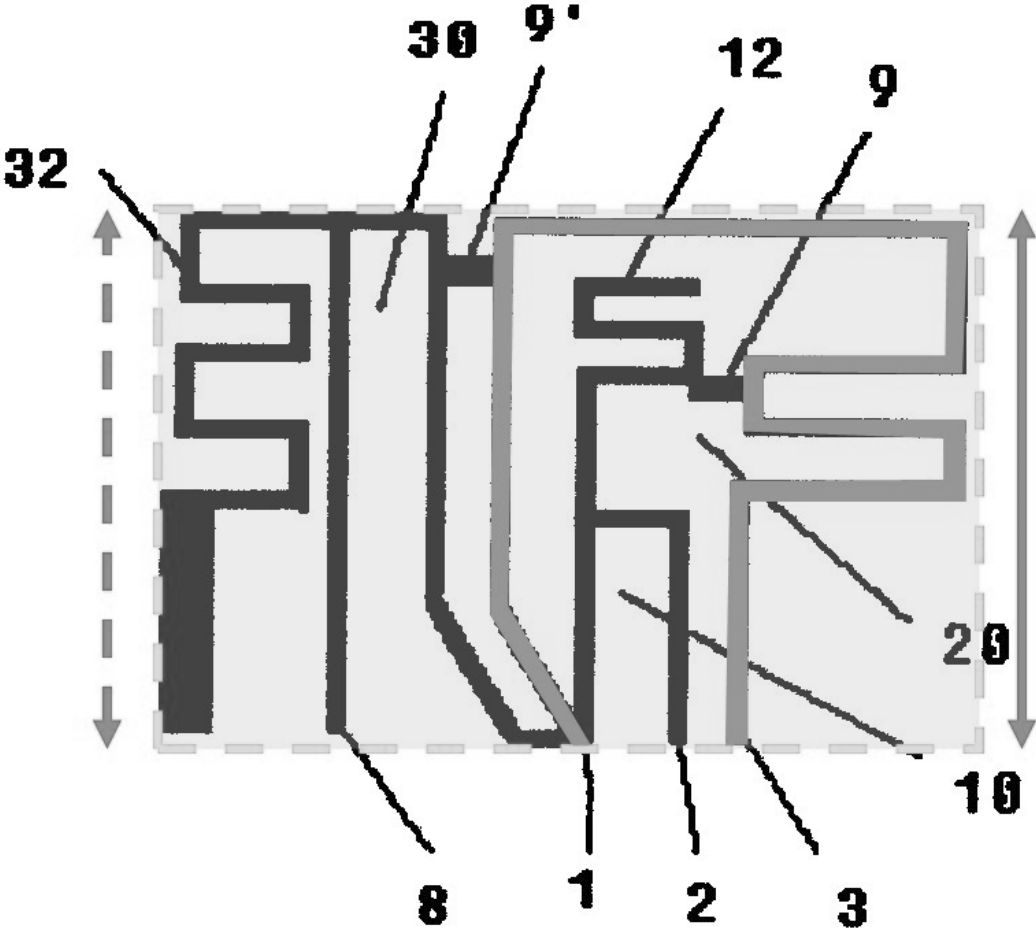
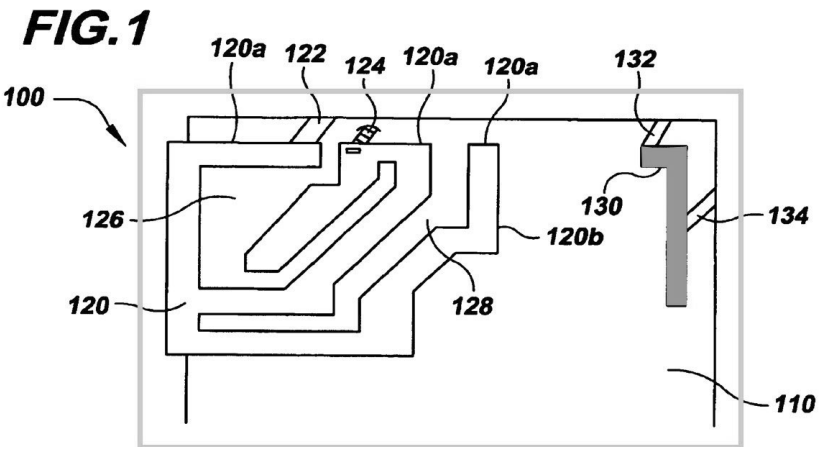
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>“The antenna of this utility model is mounted on the mobile terminal mainboard 100. A positional relationship between the antenna and the mobile terminal mainboard 100 and a structure of a ground plane of the mobile terminal mainboard 100 may affect a frequency band characteristic of the antenna.”</p> <p>Wei at 18:1-4</p>  <p>Wei at Figure 2A</p> <p>“Referring to FIG. 9, in an eighth preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal</p>

Exhibit – F – 03

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>loop 20, and a third signal loop 30. The three signal loops have no other common parts except the common feed point 1. The signal loops respectively terminate at ground points 2, 3, 8, and each of the first and third signal loops 10, 30 has one conductor branch 12, 32.”</p> <p>Wei at 16:25-29</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 345 1675 1271"></div> <p data-bbox="630 1299 819 1331">Wei at Figure 9</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>“The invention is based on the unexpected discovery that when an antenna structure comprising two radiators matched for at least partly the same frequency range is used, at least one of the radiators being the above-mentioned groove plane antenna matched for several frequency ranges, considerable isolation is provided between the radiators. Such an antenna structure thus comprises at least one ground plane, at least a first and a second radiator located at a distance from the ground plane, both radiators being configured to provide at least one resonance frequency in order to provide at least one frequency band, and an isolating layer between the ground plane and the radiators.”</p> <p>Talvitie at 2:20-32</p> <p>“Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120.”</p> <p>Talvitie at 3:47-59</p> <p>“The antenna structure of FIG. 1 can preferably be configured to operate as an antenna structure for a multifrequency mobile station. ”</p> <p>Talvitie at 5:1-3</p>

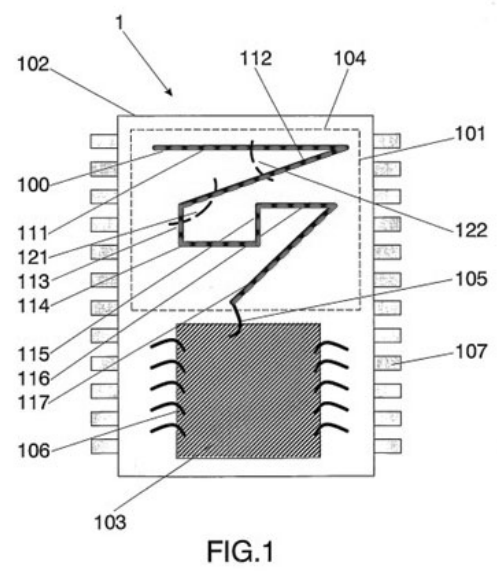
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>FIG. 1</p>  <p>Talvitie at Figure 1</p>
1[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[d]</i></p>
1[i]	wherein the first contour is defined as a	<p>Castany868 expressly or inherently discloses this claim element.</p>

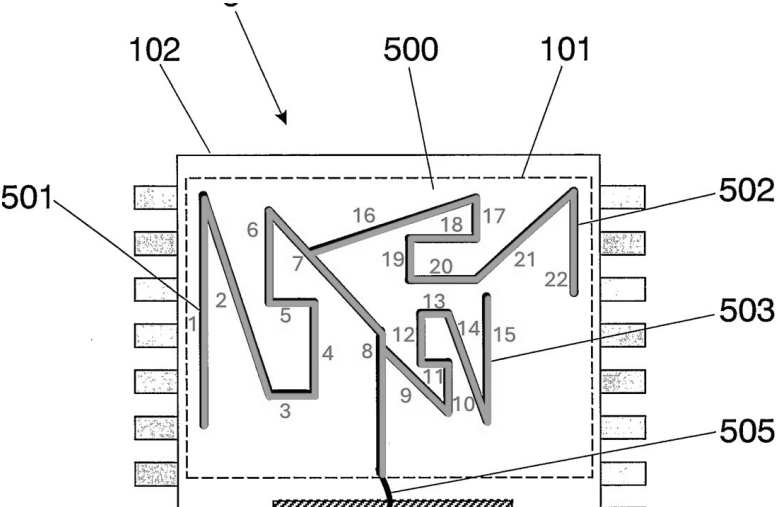
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	perimeter of the first planar antenna and perimeters of any closed apertures defined within the first planar antenna;	<i>See, e.g.,</i> claim element 1[f]
1[j]	<p>wherein the complexity factors F21 and F32 are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N1 is a number of cells of a grid G1 that include at least a point of the first contour, N2 is a number of cells of a grid G2 that include at least a point of the first contour, and N3 is a number of cells of a grid G3 that include at least a point of the first contour, the grid G2</p>	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p>

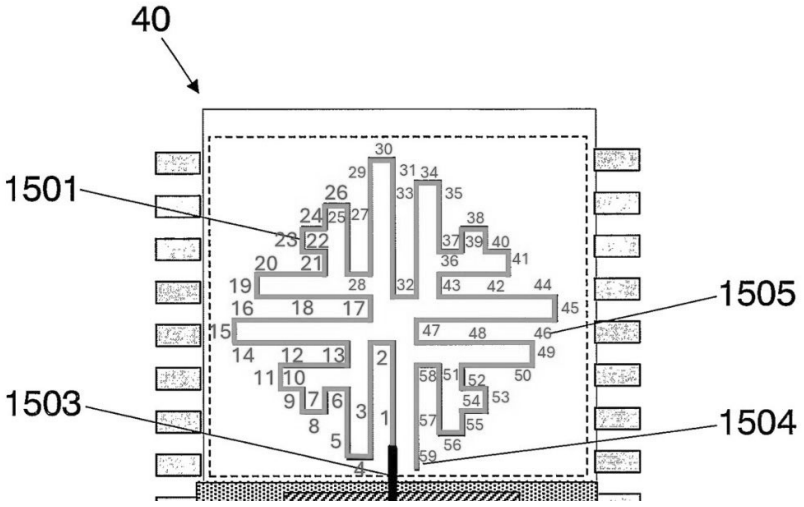
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	<p>divides a minimum-sized rectangle enclosing the first planar antenna into nine columns of equal width arranged along a long side of the minimum-sized rectangle and into an odd number of rows of equal height arranged along a short side of the minimum-sized rectangle, wherein the number of rows results in the cells of grid G2 being as square as possible, the grid G1 being aligned with a corner of the grid G2 to cover the minimum-sized rectangle, the cells of the grid G1 having widths and heights that respectively are Double the widths and heights of the cells of the grid G2, and</p>	

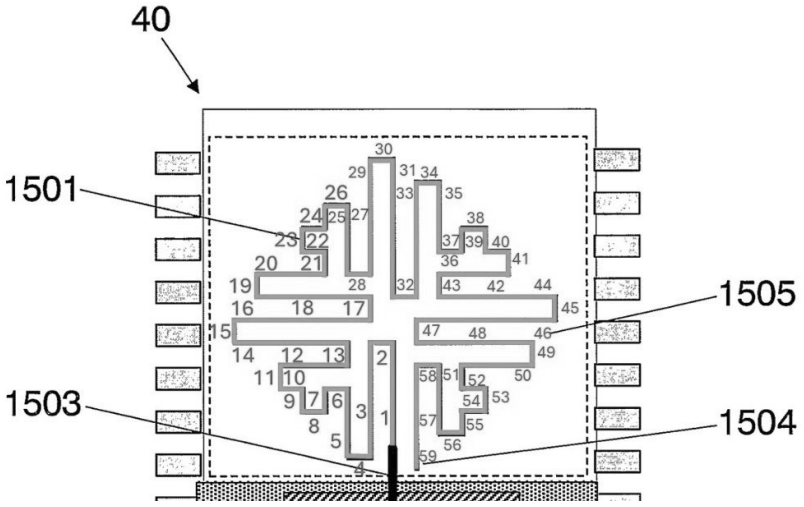
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
1[k]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“Some antenna miniaturization techniques rely basically on the antenna geometry to achieve a substantial resonant frequency reduction while keeping efficient radiation. For instance patent WO/0154225 discloses a set of space-filling antenna geometries (SFC) that are suitable for this purpose. Another advantage of such SFC geometries is that in some cases they feature a multiband response.”</p> <p>Castany868 at 3:33-4:3</p> <p>“In some embodiments, SFC geometries can be used to shape a portion of the antenna included in the package, as long as the antenna geometry is arranged within the package according to the present invention.”</p> <p>Castany868 at 6:18-20</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>“Fractal antennas are antennas that have the shaped of fractal structures. The fractal antennas consist of geometrical shapes that are repeated. Each one of the shapes has unique attributes. By careful selection.</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>Fractal antennas can be design in many shapes such as Sierpinski gasket, Sierpinski carpet, Koch island, Hilbert curve and Miskowski. In this paper a microstrip sierpinski carpet antenna has been designed and analyzed. The performance of the antenna has been investigated in term of the return loss and the radiation pattern.”</p> <p>Rahim at p. 1</p> <p>“A square microstrip Sierpinski Carpet antenna was constructed using fractal geometry for multiband operation. The measured results indicate that the antenna exhibits a good radiation and input return loss. This type of antenna is the best candidate for wireless communications for multiband operation.”</p> <p>Rahim at p. 4</p>
Claim 2		
2	The wireless device of claim 1, wherein the first antenna contour comprises at least 20 segments.	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“Figure 1 shows one embodiment according to the present invention. The package layout is arranged such that the die 103 is displaced with respect to the center of the substrate 102 to allocate the antenna 100 in the area 101. According to the present invention, the maximum side length of rectangular area 101 is the longest operating wavelength for the antenna divided by five. This particular embodiment includes a monopole antenna with a single radiating arm 100. The arm is formed by five or more segments (seven segments 111 through 117 in this particular example)”</p> <p>Castany868 at 14:21-28</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="651 349 1144 917"><p data-bbox="850 876 934 917">FIG.1</p></div> <p data-bbox="630 974 1239 1015">Castany868 at Figure 1, Showing Seven Segments</p>

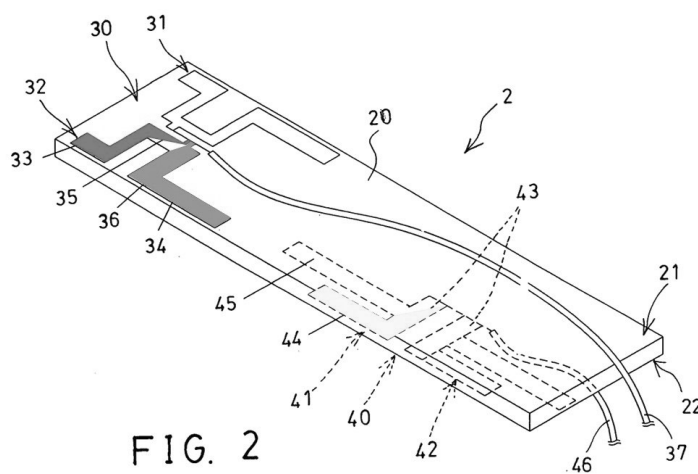
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="617 331 1929 860"><p>The diagram shows a complex, multi-segmented geometric shape, likely a stylized letter 'N' or a similar symbol, composed of 22 numbered segments (1 through 22). The shape is enclosed within a dashed rectangular boundary. Labels 101, 102, 500, 501, 502, 503, and 505 point to various parts of the shape and its surrounding context. Segment 1 is the left vertical stroke, segment 2 is the top horizontal stroke, segment 3 is the bottom horizontal stroke, segment 4 is the right vertical stroke, segment 5 is the top horizontal stroke of the inner loop, segment 6 is the left vertical stroke of the inner loop, segment 7 is the top horizontal stroke of the inner loop, segment 8 is the right vertical stroke of the inner loop, segment 9 is the bottom horizontal stroke of the inner loop, segment 10 is the left vertical stroke of the inner loop, segment 11 is the top horizontal stroke of the inner loop, segment 12 is the right vertical stroke of the inner loop, segment 13 is the bottom horizontal stroke of the inner loop, segment 14 is the left vertical stroke of the inner loop, segment 15 is the top horizontal stroke of the inner loop, segment 16 is the right vertical stroke of the inner loop, segment 17 is the bottom horizontal stroke of the inner loop, segment 18 is the left vertical stroke of the inner loop, segment 19 is the top horizontal stroke of the inner loop, segment 20 is the right vertical stroke of the inner loop, segment 21 is the bottom horizontal stroke of the inner loop, and segment 22 is the left vertical stroke of the inner loop. The shape is positioned between two vertical bars, 501 on the left and 502 on the right. A horizontal bar, 503, is located below the shape. A vertical bar, 505, is located to the right of the shape. A horizontal bar, 102, is located above the shape. A vertical bar, 500, is located to the left of the shape. A horizontal bar, 101, is located below the shape.</p></div> <p data-bbox="617 876 1302 917">Castany868 at Figure 5, Counting at Least 20 Segments</p>

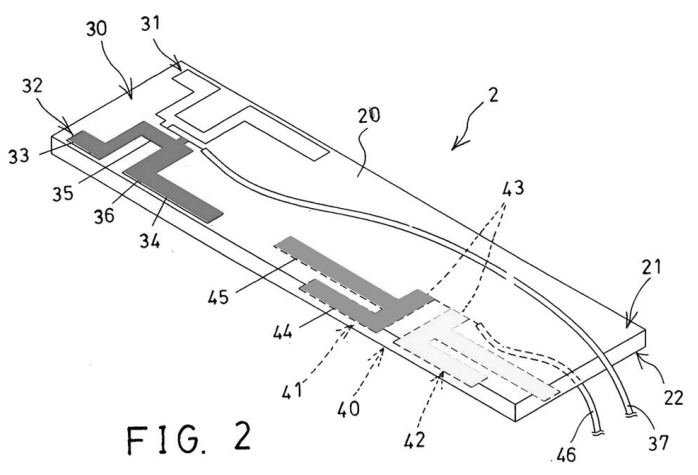
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>Castany868 at Figure 15, Counting at Least 20 Segments</p>
Claim 3		
3	The wireless device of claim 2, wherein the perimeter of the first antenna contour comprises at least 35 segments.	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 2</i></p>

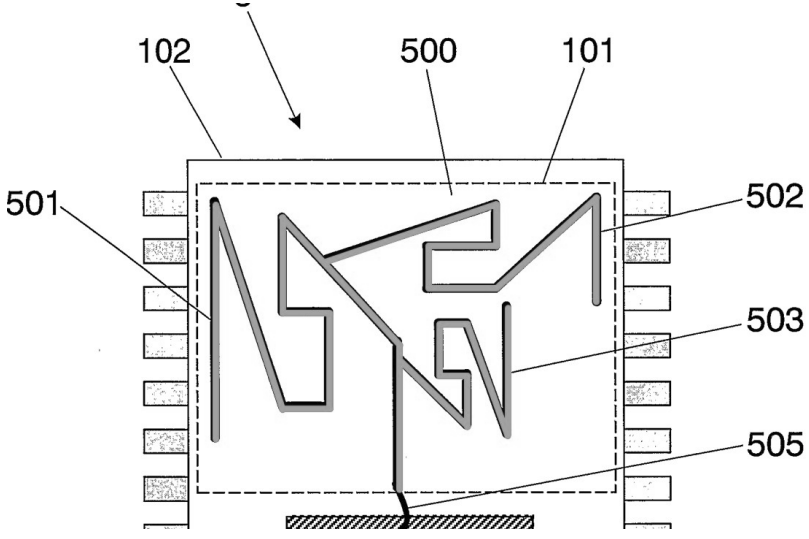
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="630 876 1312 909">Castany868 at Figure 15, Counting at Least 35 Segments</p>
Claim 4		
4	The wireless device of claim 1, wherein the antenna system comprises a third antenna configured to receive signals employing a 4G communication standard.	<p data-bbox="630 1031 1407 1063">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1096 745 1128"><i>See, e.g.,</i></p> <p data-bbox="630 1161 1911 1364">“Although a multiband antenna such as for instance a multibranch antenna can be used within the package when several services or operating frequency bands are to be integrated in the same system, it is clear that other options within the present invention include arranging two or more antennas within the same package. For instance, those two or more antennas according to the present invention can be arranged in the same substrate layer, in different layers within the same substrate, in different substrates or even in the substrate and in the plastic casing of the package. One possible arrangement for a two antenna package</p>

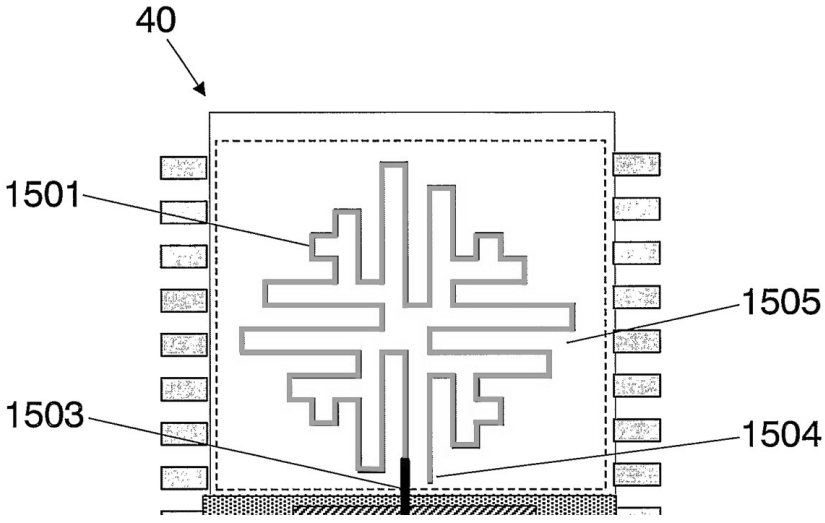
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>includes two similar antennas wherein each one is fed independently, and wherein one conducting pattern is rotated 90° with respect to the other antenna pattern. This provides an effective means for integrating a polarization diversity communication system inside a single package.</p> <p>For instance, the present invention enables packaging a system operating within the 0.5 to 5.5 GHz frequency band in an area smaller than 10 x 10 mm.”</p> <p>Castany868 at 30:1-17</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSITA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>It would have been obvious to a person of ordinary skill in the art that the 4G LTE Bands 1-54, 65-76, 103, and 106 are between 500 and 5500 MHz, and as such operating within the 0.5 to 5.5 GHz frequency band is operating on frequency bands associated with a 4G communication standard.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p data-bbox="630 349 808 381">Chou at [0033]</p>  <p data-bbox="861 844 997 885">FIG. 2</p> <p data-bbox="630 958 829 990">Chou at Figure 2</p>

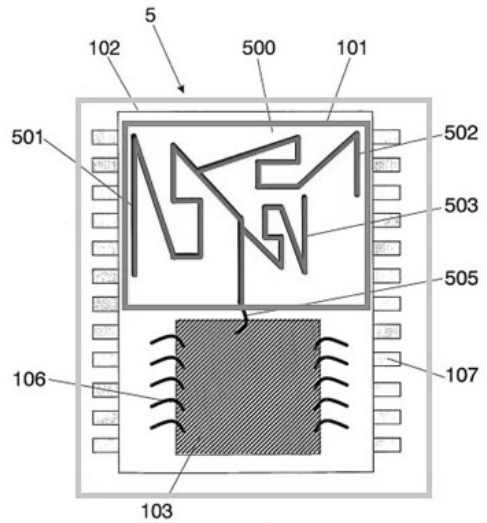
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>FIG. 2</p> <p>Chou at Figure 2 (Alternative)</p>
Claim 5		
5	<p>The wireless device of claim 4, wherein the third antenna defines an antenna contour comprising an entire perimeter of the third antenna, and wherein the antenna contour of the third antenna has a</p>	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim elements 1[e], 1[k], 1[l], 1[m], 4</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	level of complexity defined by complexity factor F21 having a value of at least 1.2 and a complexity factor F32 having a value of at least 1.35.	 <p>The diagram shows a complex, winding path within a rectangular frame. The path is defined by a solid line and is surrounded by a dashed line. The path starts at the bottom left, moves up, then right, then up again, and continues in a series of loops and turns. The path is labeled with reference numerals: 102 points to the top left corner of the frame; 500 points to the top center of the frame; 101 points to the top right corner of the frame; 501 points to the left side of the frame; 502 points to the right side of the frame; 503 points to the bottom right corner of the frame; and 505 points to the bottom center of the frame. The path is shown in a perspective view, with a shaded area at the bottom indicating a base or ground plane.</p> <p>Castany868 at Figure 5</p>

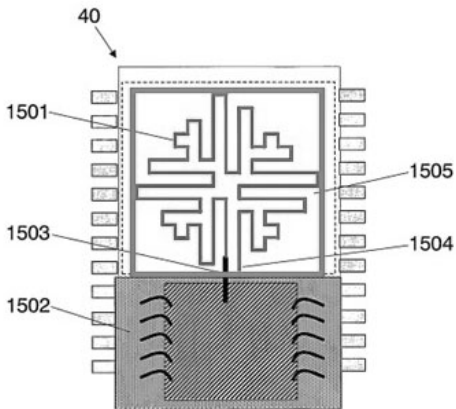
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>Castany868 at Figure 15</p>
Claim 7		
7[pre]	A wireless device comprising:	To the extent the preamble is limiting, Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[pre]
7[a]	a ground plane;	Castany868 expressly or inherently discloses this claim element.

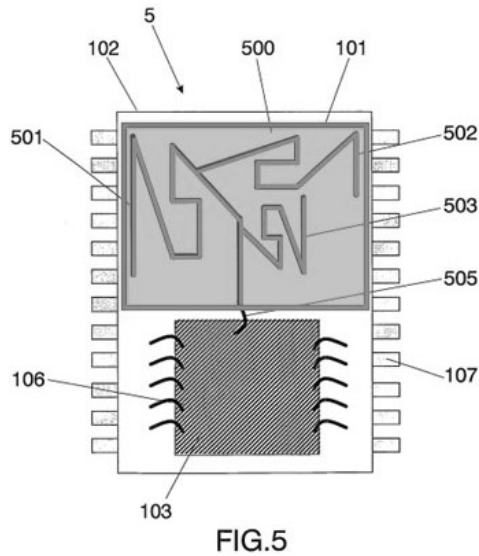
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<i>See, e.g.</i> , claim element 1[a]
7[b]	a first non-planar antenna	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.</i>, claim element 1[b]</p> <p>“The present invention applies to several antenna topologies, both balanced and unbalanced. In particular, monopoles, dipoles, loops, folded and loaded monopoles and dipoles and their slot or aperture equivalents (slot monopoles, slot dipoles, slot loops, folded and loaded slot monopoles and dipoles) are some of the structures that can be arranged according to the present invention. Other structures include shorted and bent monopoles (L monopoles, IFA), multibranch structures, coupled monopoles and dipole antennas and again their aperture equivalents. All of them would include the characteristic pattern built on a component of the integrated circuit package according to the present invention.</p> <p>Another possible antenna configuration is a microstrip or patch antenna, including their shorted versions (shorted patches and planar inverted F or PIFA structures); nevertheless for the planar cases a particular selection of the disclosed geometries should be considered to achieve the required degree of miniaturization. In particular, the characteristic pattern of the invention should include at least a curve with fifteen segments, with at least seven of the segments being shorter than one-twentieth of the longest free-space operating wavelength of the antenna. The rest of the general conditions that conform the essential geometric aspects of the invention, as described above, apply to the microstrip patch and their shorted versions as well.”</p> <p>Castany868 at 7:5-23</p> <p>“It is noted that, according to the present invention, the antenna structure is not limited to a planar structure, because the package can include several portions or parts of the antenna in multiple layers or components of the package. The layers can be optionally interconnected by means of several vias and</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>viaholes. A preferred arrangement in several embodiments comprises repeating a similar antenna pattern on two or more layers within at least one of the package substrates, and interconnect such similar conducting patterns for the antenna at one or more points. Typically a preferred point for interconnecting such similar layers will be the feeding point. This way the current splits symmetrically on every layer so that the ohmic resistance of the overall antenna is lower and the antenna is more efficient. A simple, low-cost version of such an arrangement comprises a package including a single substrate, the substrate including an conducting antenna pattern at both sides, the patterns being connected by at least one via.”</p> <p>Castany868 at 13:6-18</p>
7[c]	[<i>the first non-planar antenna</i>] proximate to a first side of a ground plane rectangle enclosing the ground plane,	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[c]</p>
7[d]	the first non-planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[d]</p>
7[e]	a minimum-sized parallelepiped	<p>Castany868 expressly or inherently discloses this claim element.</p>

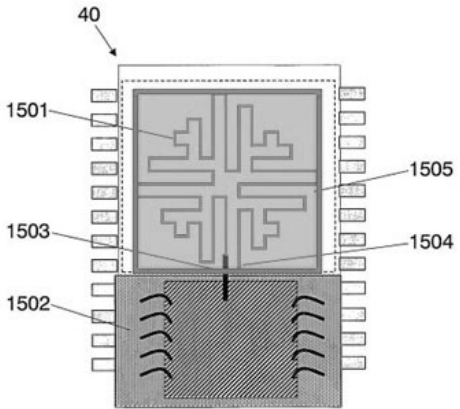
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	completely enclosing a volume of the first non-planar antenna,	<p data-bbox="630 349 745 381"><i>See, e.g.,</i></p>  <p data-bbox="861 950 945 982">FIG. 5</p> <p data-bbox="630 1031 913 1063">Castany868 at Figure 5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>FIG. 7A and FIG. 7B are cross-sectional views of a device assembly. FIG. 7A shows a top view with components 101, 102, 103, 105, 106, 107, 700, 701, 702, 704, and 7. FIG. 7B shows a bottom view with components 101, 102, 103, 105, 106, 107, 750, 751, 752, 753, 754, and 75.</p>
		Castany868 at Figures 7A and 7B

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="850 812 934 844">FIG.15</p> <p data-bbox="630 893 924 925">Castany868 at Figure 15</p>
7[f]	the minimum-sized parallelepiped having a face with a largest area;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="667 363 1142 915"><p data-bbox="877 883 953 915">FIG.5</p></div> <p data-bbox="630 971 911 1003">Castany868 at Figure 5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="646 365 1113 1177"><p>FIG.7A</p><p>FIG.7B</p></div> <p>Castany868 at Figures 7A and 7B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="835 803 919 836">FIG. 15</p> <p data-bbox="630 885 934 917">Castany868 at Figures 15</p>
7[g]	a second antenna proximate to a second side of the ground plane rectangle, and	<p data-bbox="630 966 1402 998">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1031 970 1063"><i>See, e.g.,</i> claim element 1[g]</p>
7[h]	wherein the second antenna is configured to receive signals from at least two frequency	<p data-bbox="630 1174 1402 1206">Castany868 expressly or inherently discloses this claim element.</p> <p data-bbox="630 1239 970 1271"><i>See, e.g.,</i> claim element 1[h]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	bands of the at least three frequency bands;	
7[i]	wherein the first non-planar antenna has a first contour defined as a perimeter of any portions of the first non-planar antenna arranged in the face, perimeters of any closed apertures of any portions of the first non-planar antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first non-planar antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[e]
7[j]	wherein the first contour has a level of complexity defined by	Castany868 expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	complexity factor F_{21} having a value of at least 1.20 and	<i>See, e.g.,</i> claim element 1[f]
7[k]	complexity factor F_{32} having a value of at least 1.35;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[f]
7[l]	<p>Wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a</p>	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	<p>grid G3 that include at least a point of the first contour,</p> <p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are Double the widths and heights of the cells of the grid G2, and</p>	

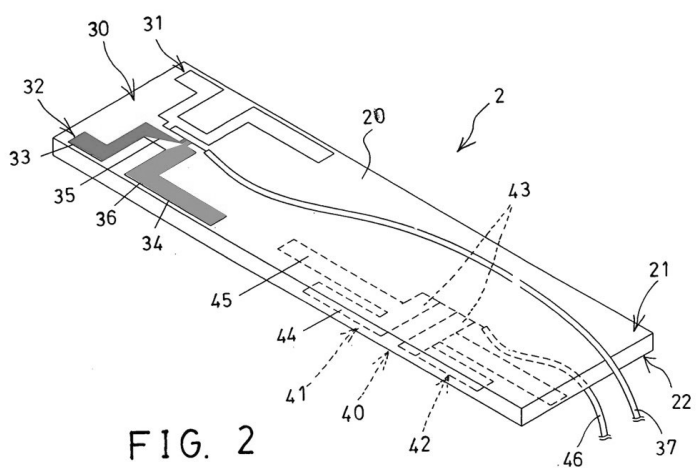
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
7[m]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[k]
Claim 8		
8	The wireless device of claim 7, wherein the first non-planar antenna includes at least two antenna elements that are electromagnetically coupled.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> “Package 7 in Figure 7A includes coupled dipole antenna 700 with two arms 701 and 702 which are coupled together by means of a close proximity region 704. According to the present invention, the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna. Figure 7B discloses another embodiment where the package 75 includes an active monopole 751 and a parasitic monopole 752, the parasitic monopole being grounded to an external ground plane or ground counterpoise by means of at least one of the terminals of the package such as for instance 753. Also, the package will include at least another terminal within the set of terminals 107 to externally ground one of the RF voltage references of die 103. Two conducting parts of the antenna such as the active monopole 751 and the parasitic one 752 are coupled by means of a close proximity region 754 such that the minimum distance between conductors in 704 should be less than one-tenth of the longest free-space operating wavelength of the antenna.” Castany868 at 17:30-18:9

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="651 357 1113 1169"><p>FIG. 7A and FIG. 7B are schematic diagrams of a device. FIG. 7A shows a top-down view of a rectangular frame (102) containing a central cavity (700). The cavity is defined by a complex, multi-lobed boundary (701, 702). A central feature (704) is located within the cavity. The frame is surrounded by a series of small, rectangular components (101, 103, 105, 106, 107). FIG. 7B shows a similar view, but with a different central feature (754) and a different arrangement of the peripheral components (751, 752, 753, 105, 106, 107). The frame (102) and the central cavity (750) are also labeled in FIG. 7B.</p></div> <p>Figures 7A and 7B</p>

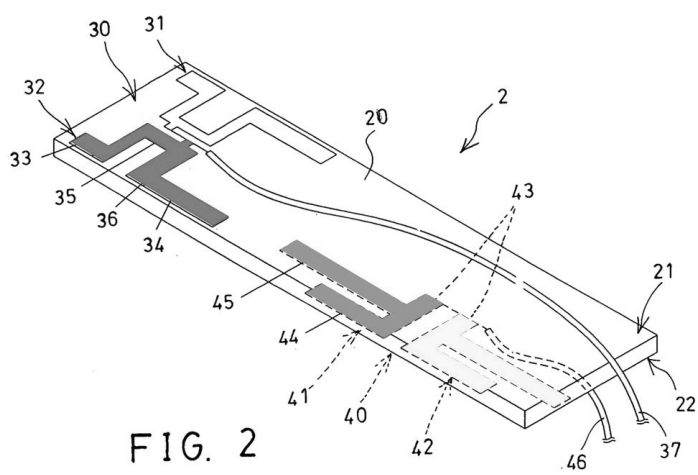
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
Claim 9		
9	The wireless device of claim 7, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g., claim element 1[f]</i></p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 13;$ $N_2 = 42; \text{ and}$ $N_3 = 121;$ <p>that given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(121) - \log_{10}(42))}{\log_{10} 1/2} = 1.5265$ <p>and</p> $1.5265 < 1.75$ <p>Still further, it would have been obvious to a person of ordinary skill in the art that, when</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p> $N_1 = 16;$ $N_2 = 58;$ and $N_3 = 195;$ that given $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ solving for F_{32} results in $F_{32} = - \frac{(\log_{10}(195) - \log_{10}(58))}{\log_{10} 1/2} = 1.7493$ and $1.7493 < 1.75$ </p>
Claim 10		
10[a]	The wireless device of claim 7, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[h], 4</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="840 763 1008 828">FIG. 2</p> <p data-bbox="630 876 840 925">Chou at Figure 2</p> <p data-bbox="630 941 1927 1201">“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p data-bbox="630 1218 840 1266">Chou at [0028]</p> <p data-bbox="630 1282 1927 1354">“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<p>antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p> <p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p data-bbox="861 779 987 820">FIG. 2</p> <p data-bbox="630 885 840 917">Chou at Figure 2</p>
10[b]	the third antenna is arranged within the wireless device.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g., claim element 4, 10[a]</i>
Claim 12		
12	The wireless device of claim 7, wherein the first side of the ground	Castany868 expressly or inherently discloses this claim element.

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	plane rectangle is a short side of the ground plane rectangle.	<i>See, e.g.</i> , claim element 1[c]
Claim 13		
13[pre]	A wireless device comprising:	To the extent the preamble is limiting, Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[pre] and 7[pre]
13[a]	a ground plane;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[a], 7[a]
13[b]	a first antenna	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[b], 7[b]
13[c]	proximate to a first side of a ground plane rectangle enclosing the ground plane,	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[c], 7[c]

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
13[d]	the first antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[d], 7[d]
13[e]	a minimum-sized parallelepiped completely enclosing a volume of the first antenna,	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 7[e]
13[f]	the minimum-sized parallelepiped having a face with a largest area;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , 7[f]
13[g]	a second antenna proximate to a second side of the ground plane rectangle	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[g], 7[g]

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
13[h]	configured to receive signals from at least two frequency bands of the at least three frequency bands,	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[h], 7[h]
13[i]	wherein the first antenna has a first contour defined as a perimeter of any portions of the first antenna arranged in the face, perimeters of any closed apertures of any portions of the first antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[e], 7[e]
13[j]	wherein the first contour has a level of complexity defined by	Castany868 expressly or inherently discloses this claim element.

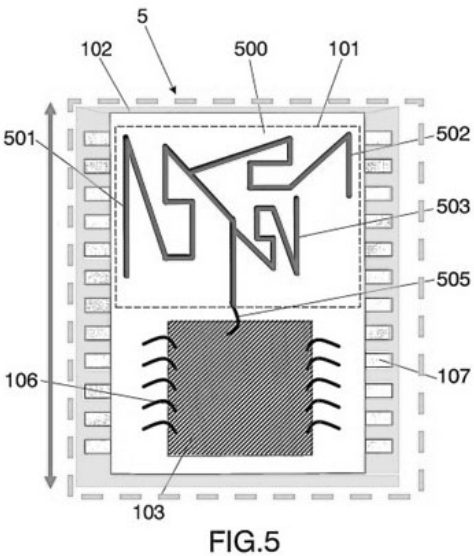
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	complexity factor F_{21} having a value of at least 1.20 and	<i>See, e.g.</i> , claim element 1[f], 7[j]
13[k]	complexity factor F_{32} having a value of at least 1.35; and	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[f], 7[k]
13[l]	<p>wherein the complexity factors F_{21} and F_{32} are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a</p>	<p>Castany868 expressly or inherently discloses this claim element.</p> <p><i>See, e.g.</i>, claim element 1[f], 7[l]</p>

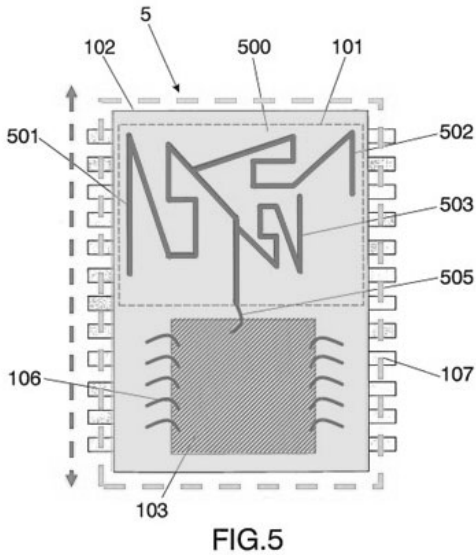
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	<p>grid G3 that include at least a point of the first contour,</p> <p>the grid G2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G2 being as square as possible,</p> <p>the grid G1 being aligned with a corner of the grid G2 to cover the face, the cells of grid G1 having widths and heights that respectively are Double the widths and heights of the cells of the grid G2, and</p> <p>the grid G3 being aligned with the grid</p>	

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
	G2, the cells of the grid G3 having widths and heights that respectively are half the widths and heights of the cells of the grid G2, and	
13[m]	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 1[k], 7[m]
Claim 14		
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 8
Claim 15		

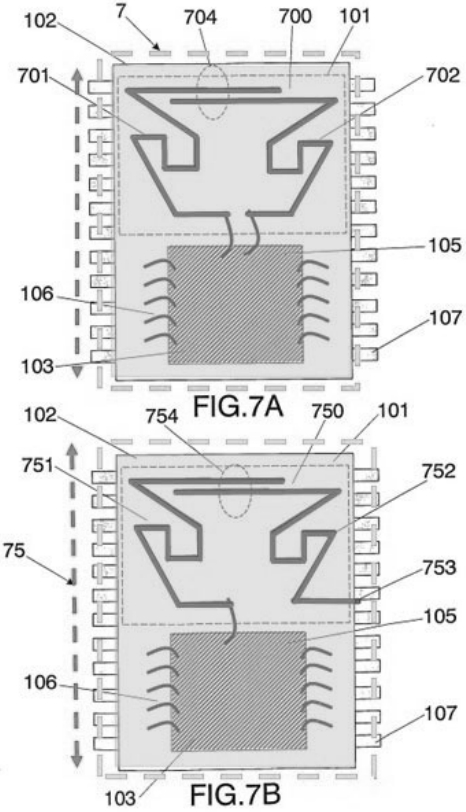
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
15	The wireless device of claim 13, wherein the first antenna is planar.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[b]
Claim 17		
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 9
Claim 18		
18[a]	The wireless device of claim 13, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.</i> , claim element 1[h], 4, 10[a]

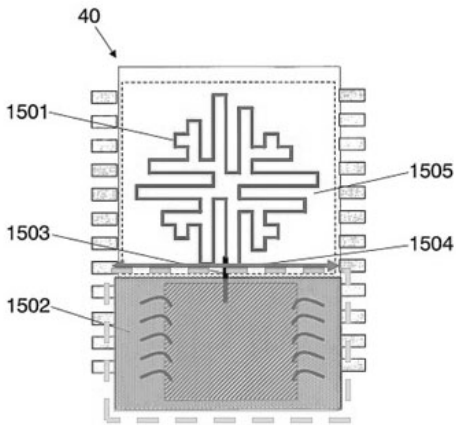
Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
18[b]	the third antenna is arranged within the wireless device.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 4, 10[a], 10[b], 18[a]
Claim 19		
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i> claim element 12
Claim 20		
20	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a long side of the ground plane rectangle.	Castany868 expressly or inherently discloses this claim element. <i>See, e.g.,</i>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="659 354 1129 906"></div> <p data-bbox="630 954 911 987">Castany868 at Figure 5</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="653 371 1125 922"><p data-bbox="863 889 936 922">FIG.5</p></div> <p data-bbox="632 979 1050 1011">Castany868 at Figure 5 (Alternate)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="653 362 1119 1170"><p>FIG. 7A</p><p>FIG. 7B</p></div> <p>Castany868 at Figures 7A and 7B</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		 <p>FIG. 7A</p> <p>FIG. 7B</p> <p>Castany868 at Figures 7A and 7B (Alternate)</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Castany868
		<div data-bbox="661 365 1113 787"></div> <p data-bbox="846 813 936 846">FIG.15</p> <p data-bbox="630 902 926 935">Castany868 at Figure 15</p>

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 12,095,149 B2
BASED ON U.S. PATENT NO. 6,943,746 TO TALVITIE ET AL. (“TALVITIE”)

Based upon Plaintiff’s Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendants’ accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious some or all of the asserted claims. These invalidity contentions are not an admission by the Defendants that the accused products are covered by or infringe claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, and 20 (the “’149 Asserted Claims”)¹, particularly when these claims are properly construed and applied.

AIA law applies because the application that issued as the ’149 Patent was filed on June 22, 2023, after the AIA came into force on March 16, 2013.

U.S. Patent No. 6,943,746 to Talvitie et al. (“Talvitie”) was filed on October 23, 2003, published on July 15, 2004, and issued on September 13, 2005. This patent is prior art under at least 35 U.S.C. § 102(e), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 12,095,149 (the “’149 Patent”), are invalid as anticipated by Talvitie.

To the extent that Talvitie is found not to anticipate one or more of the asserted claims of the ’149 Patent, these claims are invalid as obvious in view of Talvitie alone or as modified in view of or in combination with other prior art references disclosed in Defendants’ Invalidity Contentions and accompanying charts, including without limitation as set forth below.

- U.S. Patent Application No. 2007/0200773 to Dou et al. (“Dou”) was filed on February 24, 2006, published on August 30, 2007, and issued as U.S. Patent No. 7,548,208 on June 16, 2009. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- Chinese Patent No. 2,765,337. (“Wei”) was filed on February 6, 2005, and was granted on March 15, 2006. This patent is prior art under at least 35 U.S.C. §§ 102(a), 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- PCT Publication No. 2004/042868 to Castany et al. (“Castany868”) was filed on November 7, 2002 and published on May 21, 2004, on August 30, 2007. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).

¹ Defendants understand that, by not charting claims 6, 11, and 16 in its Infringement Contentions, Plaintiff does not assert these claims against Defendants.

- U.S. Patent Application No. 2002/0238433 to Chou (“Chou”) was filed on March 1, 2005, published on October 26, 2006, and issued as U.S. Patent No. 7,129,898 on October 31, 2006. This patent is prior art under at least 35 U.S.C. § 102(e), 103(a), and AIA 35 U.S.C. §102(a)(1).
- Microstrip Sierpinski Carpet Antenna Using Transmission Line Feeding by Mohamad Kamal A. Rahim, et al., Asia-Pacific Microwave Conference Proceedings, (“Rahim”) published in December 2005. This paper/book is prior art under at least 35 U.S.C. § 102(a) and 103(a).

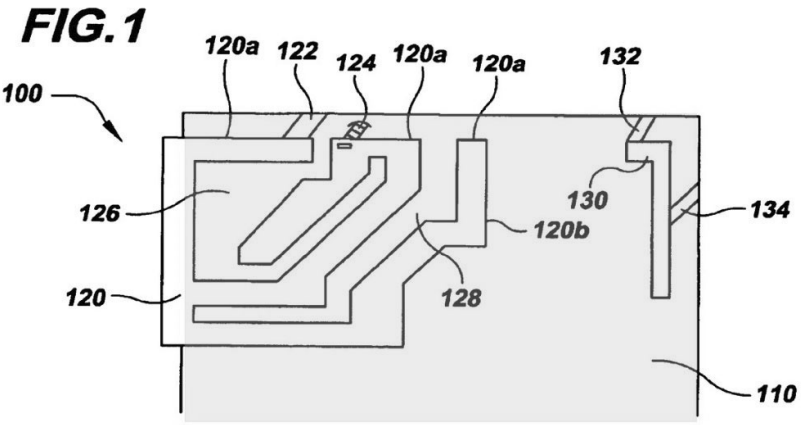
These invalidity contentions are not an admission that the Defendants concede or acquiesce to any claim construction implied or suggested by Plaintiff’s Complaint or Infringement Contentions. Nor are Defendants asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature. Defendants reserve the right to update their constructions and contentions in view of this Court’s claim construction order.²

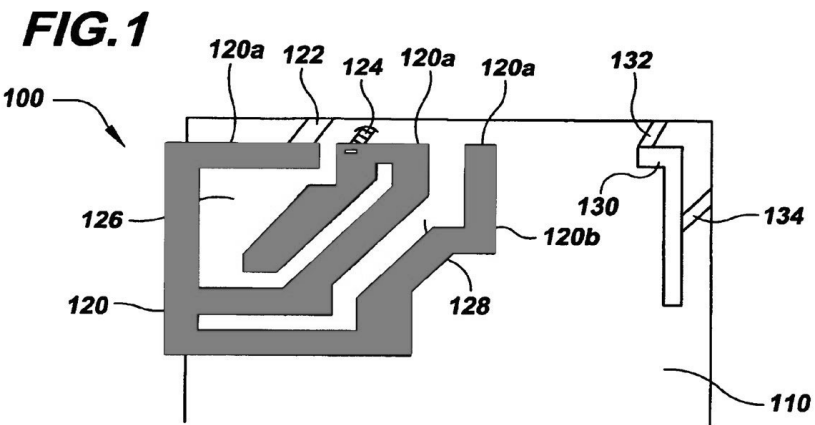
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
Claim 1		
1[pre]	A wireless device comprising:	<p>To the extent the preamble is limiting, Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The invention relates to antenna structures, and particularly to internal antennas used in radio devices, such as mobile stations.”</p> <p>Talvitie at 1:6-9</p> <p>“A radio device according to an embodiment comprises the above-described antenna structure for delivering a radio-frequency signal”</p>

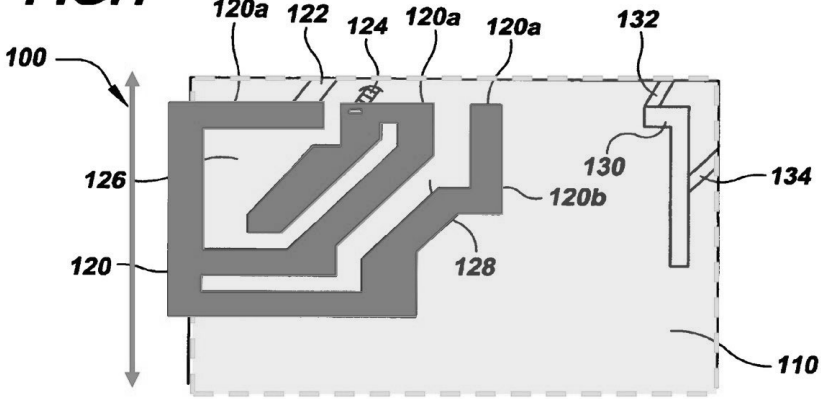
² Defendants incorporate herein any related work performed by or on behalf of an author or an inventor in the United States under 35 U.S.C. § 102(g)(2). Defendants reserve the right to supplement and/or alter this chart based on further investigation and ongoing discovery.

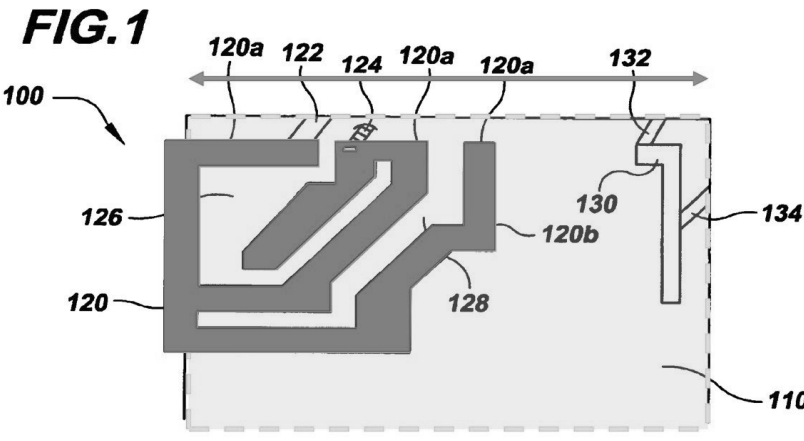
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>Talvitie at 2:51-52</p> <p>“The antenna structure of FIG. 1 can preferably be configured to operate as an antenna structure for a multifrequency mobile station.”</p> <p>Talvitie at 5:1-3</p> <div data-bbox="672 643 1478 1075"> <p>FIG. 1</p> </div> <p>Talvitie at Figure 1</p>
1[a]	a ground plane;	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

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		<p>“Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120. The feed point 124 can be implemented as coaxial feed e.g. as a lead-through from the ground plane such that it resides at a substantial distance from the edge of the radiator. The feed point 124 can also be implemented by placing it at the edge of the radiator 120, in a similar manner to that of the ground point.”</p> <p>Talvitie at 3:47-65</p> <p>“The second radiator 130 is a narrow, planar radiator whose surface area in this embodiment is substantially smaller than that of the first radiator 120. The second radiator 130 also comprises a ground point 132 connecting the radiator 130 to a ground plane 110, and a feed point 134 feeding radiation power. The ground point 132 constituting a grounding line is located substantially at the edge of the radiator 130. The feed point 134 can be implemented as coaxial feed e.g. as a lead-through from the ground plane such that it resides at a substantial distance from the edge of the radiator. The feed point 134 can also be implemented by placing it at the edge of the radiator 130, in a similar manner to that of the ground point. The second radiator is configured to radiate within a frequency range at least partly overlapping with at least one frequency range, preferably with a higher frequency range, of the first radiator. As far as the operation of the present embodiments is concerned, the shape or location of the second radiator 130 with respect to the first radiator 120 is irrelevant; the only point is that both radiators are provided with a feed point of their own and, preferably but not necessarily, a common ground plane.”</p> <p>Talvitie at 4:47-67</p>

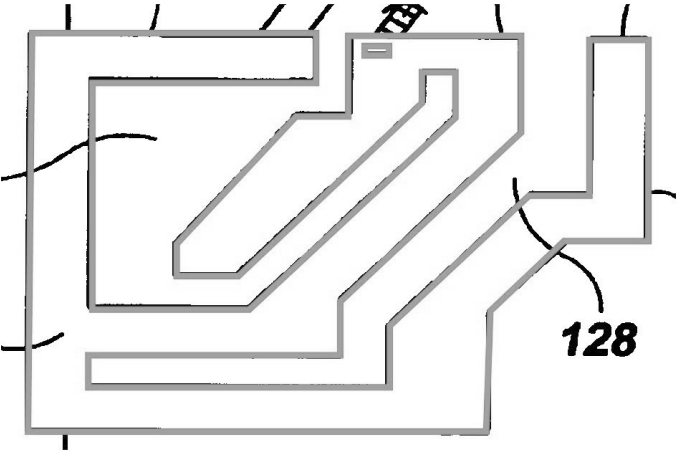
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>FIG. 1</p>  <p>Talvitie at Figure 1</p>
1[b]	a first planar antenna	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power</p>

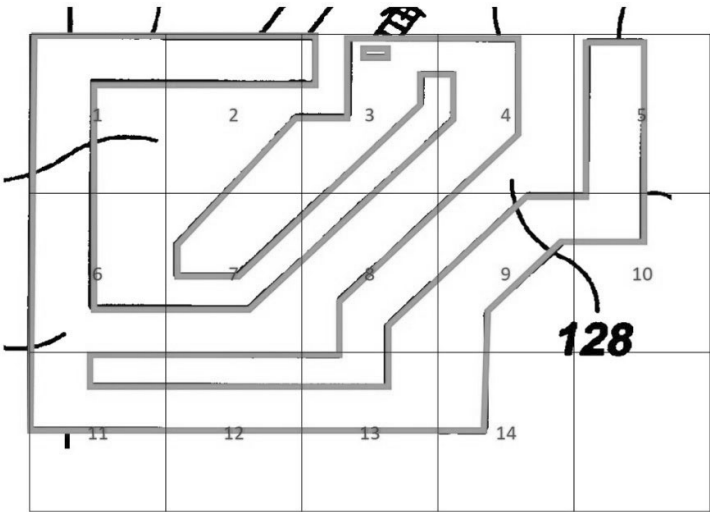
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120.”</p> <p>Talvitie at 3:47-59</p> <p>FIG. 1</p>  <p>Talvitie at Figure 1</p>
1[c]	[the first planar antenna] proximate to a first side of a ground plane rectangle enclosing the ground plane,	<p>Talvitie expressly or inherently discloses this claim element.</p> <p>See, e.g.,</p>

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		<p data-bbox="701 418 831 464">FIG. 1</p>  <p data-bbox="630 889 861 922">Talvitie at Figure 1</p>

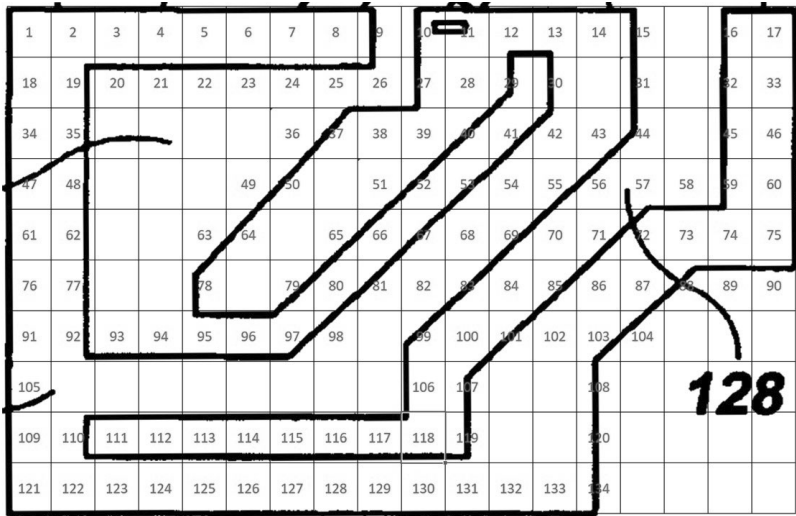
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>FIG. 1</p>  <p>Talvitie at Figure 1 (Alternative)</p>
1[d]	the first planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The antenna structure further comprises separate feed points for the at least two radiators, the radiators are grounded by a ground point to at least some ground plane, and at least the first radiator is a groove plane antenna configured to provide at least two frequency bands, preferably at least one lower frequency band and at least one higher frequency band”</p> <p>Talvitie at 2:33-39</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>“The antenna structure of FIG. 1 can preferably be configured to operate as an antenna structure for a multifrequency mobile station. An example of a multifrequency mobile station is a mobile station configured to support EGSM 900 (880 to 960 MHz), GSM 1900 (1850 to 1990 MHz), WCDMA 2000 (1920 to 2170 MHz) systems and frequency ranges.”</p> <p>Talvitie at 5:1-6</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>It would have been obvious to a person of ordinary skill in the art that disclosing at least two frequency bands discloses a third or more frequency bands.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p>
1[e]	the first planar antenna defining a first contour,	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>

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		 <p data-bbox="632 889 863 922">Talvitie at Figure 1</p>
1[f]	<p data-bbox="310 971 590 1279">wherein the first contour has a level of complexity defined by complexity factor F21 having a value of at least 1.20 and complexity factor F32 having a value of at least 1.35; and</p>	<p data-bbox="632 971 1360 1003">Talvitie expressly or inherently discloses this claim element.</p> <p data-bbox="632 1036 737 1068"><i>See, e.g.,</i></p>

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<div data-bbox="716 342 1421 850"></div> <p data-bbox="630 885 1037 917">Talvite at Figure 1 Calculating N_1</p>

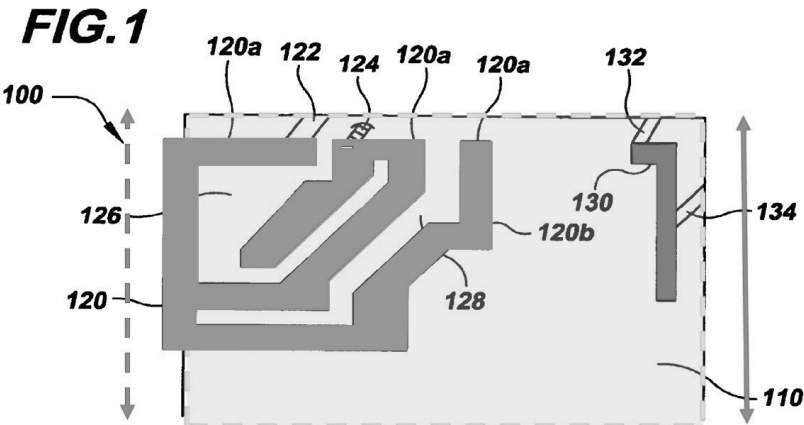
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<div data-bbox="751 375 1415 813"><p>The diagram shows a 40-cell grid arranged in 8 rows and 5 columns. The cells are numbered 1 through 40. A winding path is drawn through the grid, starting at cell 1, moving right to 2, 3, 4, then down to 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, and finally 40. A large number '128' is written in the bottom right corner of the grid, with a line pointing to cell 33. There are also some handwritten marks at the top of the grid, including a small square and some lines.</p></div> <p data-bbox="630 881 1039 914">Talvite at Figure 1 Calculating N₂</p>

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		<div></div> <p>Talvite at Figure 1 Calculating N_3</p> <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> <p>$N_1 = 14$; $N_2 = 40$; and $N_3 = 134$;</p> <p>that given</p> $F_{21} = - \frac{(\log_{10}(N_2) - \log_{10}(N_1))}{\log_{10} 1/2}$

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		<p>solving for F_{21} results in</p> $F_{21} = - \frac{(\log_{10}(40) - \log_{10}(14))}{\log_{10} 1/2} = 1.5146$ <p>and</p> $1.20 \leq 1.5146$ <p>Further, it would have been obvious to a person of ordinary skill in the art that, when</p> $N_1 = 14;$ $N_2 = 40; \text{ and}$ $N_3 = 134;$ <p>that given</p> $F_{32} = - \frac{(\log_{10}(N_3) - \log_{10}(N_2))}{\log_{10} 1/2}$ <p>solving for F_{32} results in</p> $F_{32} = - \frac{(\log_{10}(134) - \log_{10}(40))}{\log_{10} 1/2} = 1.7442$ <p>and</p> $1.35 \leq 1.7442$
1[g]	a second antenna proximate to a second	Talvitie expressly or inherently discloses this claim element.

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	side of the ground plane rectangle,	<p><i>See, e.g.,</i></p> <p>“The invention is based on the unexpected discovery that when an antenna structure comprising two radiators matched for at least partly the same frequency range is used, at least one of the radiators being the above-mentioned groove plane antenna matched for several frequency ranges, considerable isolation is provided between the radiators. Such an antenna structure thus comprises at least one ground plane, at least a first and a second radiator located at a distance from the ground plane, both radiators being configured to provide at least one resonance frequency in order to provide at least one frequency band, and an isolating layer between the ground plane and the radiators.”</p> <p>Talvitie at 2:20-32</p> <p>“Referring to FIG. 1, a preferred embodiment will be described in the following. FIG. 1 shows a planar antenna structure called a PIFA (Planar Inverted F Antenna) antenna structure 100 comprising a ground plane 110, a first radiator 120 and a second radiator 130. The radiators 120, 130 are located at a distance from the ground plane 110 such that air or another dielectric material is, as an isolating material, provided between the ground plane 110 and the radiators 120, 130. The first radiator 120 is a “groove plane antenna” which is connected to the ground plane 110 by a ground point 122 and to which radiation power is fed from a feed point 124. The ground point 122 constituting a grounding line is located substantially at the edge of the radiator 120.”</p> <p>Talvitie at 3:47-59</p> <p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p> <p>“The antenna structure of FIG. 1 can preferably be configured to operate as an antenna structure for a multifrequency mobile station. ”</p>

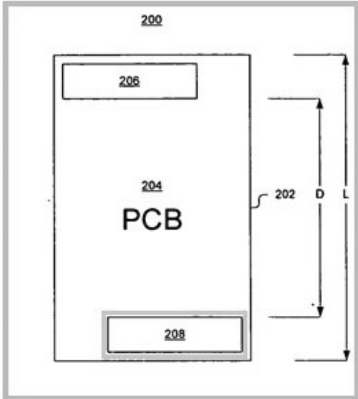
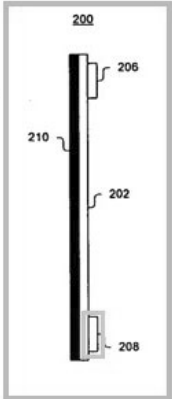
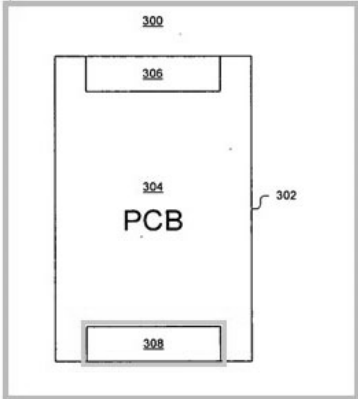
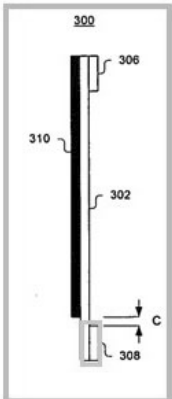
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		<p>Talvitie at 5:1-3</p> <p>FIG. 1</p> <p>Talvitie at Figure 1</p>

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		<p>FIG. 1</p>  <p>Talvitie at Figure 1 (Alternative)</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSITA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p>

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		<p>“As shown in FIG. 2A, the wireless device 200 may have an internal diversity antenna architecture comprising a first internal antenna 206 and a second internal antenna 208 disposed on the PCB 204 for achieving diversity. In various embodiments, the first internal antenna 206 and the second internal antenna 208 may remain in a fixed position internal to the housing 202 in order to eliminate the need for an external antenna and reduce the overall size and bulkiness of the wireless device 200. In one embodiment, the internal diversity antenna architecture may comprise a first internal antenna 206 located substantially near the top of the wireless device 200. For example, the first internal antenna 206 may be located substantially near the top of the housing 202 and/or the top of the PCB 204. The internal diversity antenna architecture may comprise a second internal antenna 208 located substantially near the bottom of the wireless device 200. For example, the second internal antenna 208 may be located substantially near the bottom of the housing 202 and/or the bottom of the PCB 204.”</p> <p>Dou at [0017]</p> <p>“As shown in FIG. 3A, the wireless device 300 may have an internal diversity antenna architecture comprising a first internal antenna 306 and a second internal antenna 308 disposed on the PCB 304 for achieving diversity. In this embodiment, the internal diversity antenna architecture may comprise a first internal antenna 306 located substantially at the top of the wireless device 300. For example., the first internal antenna 306 may be located substantially at the top of the housing 302 and/or the top of the PCB 304. The internal diversity antenna architecture may comprise a second internal antenna 308 located substantially at the bottom of the wireless device 300. For example, the second internal antenna 308 may be located substantially at the bottom of the housing 302 and/or the bottom of the PCB 304.”</p> <p>Dou at [0032]</p> <p>“As shown in FIG. 4A, the wireless device 400 may have an internal diversity antenna architecture comprising a first internal antenna 406 and a second internal antenna 408 disposed on the PCB 404 for achieving diversity. In this embodiment, the first internal antenna 406 may comprise a first feed point 412 and a first ground point 414, and the second internal antenna 408 may comprise a second feed point 416 and a second ground point 418. The first internal antenna 406 may be located substantially near the top of</p>

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		<p>the wireless device 400, and the second internal antenna 408 may be located substantially near the bottom of the wireless device 400.</p> <p>Dou at [0036]</p>

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		<div data-bbox="669 365 1024 761"><p>FIG. 2A</p></div> <div data-bbox="1079 365 1249 761"><p>FIG. 2B</p></div> <div data-bbox="669 846 1024 1242"><p>FIG. 3A</p></div> <div data-bbox="1079 846 1249 1242"><p>FIG. 3B</p></div>

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		<div data-bbox="659 399 1016 797"> </div> <div data-bbox="779 800 882 828">FIG. 4A</div> <div data-bbox="1062 399 1234 797"> </div> <div data-bbox="1092 800 1197 828">FIG. 4B</div> <p data-bbox="627 889 1098 922">Dou at Figures 2A-B, 3A-B, and 4A-B</p> <p data-bbox="627 954 1927 1161">“As shown in FIG. 2A, in a first preferred embodiment provided in this utility model, the metal conductor part includes two signal loops which are respectively a first signal loop 10 and a second signal loop 20. As shown in the figure, the first and second signal loops 10, 20 start from the same common feed point 1 and respectively terminate at two ground points 2, 3 (the numerals are the same below) with different physical positions. The second signal loop 20 completely surrounds the first signal loop 10, and the two signal loops have a common conductor 5.”</p> <p data-bbox="627 1190 810 1222">Wei at 15:7-13</p>

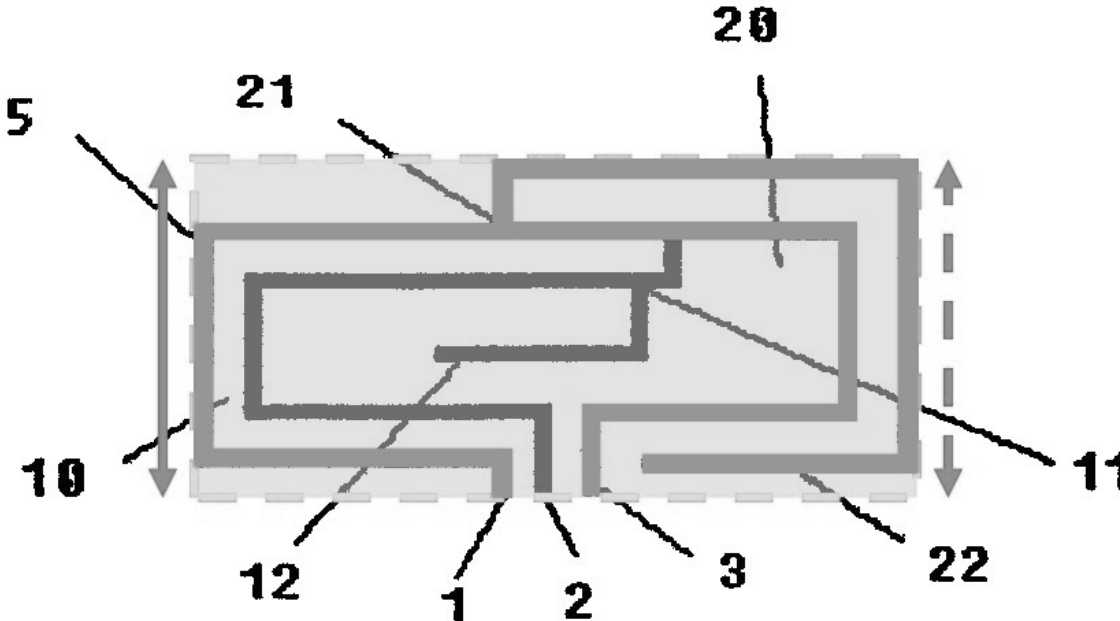
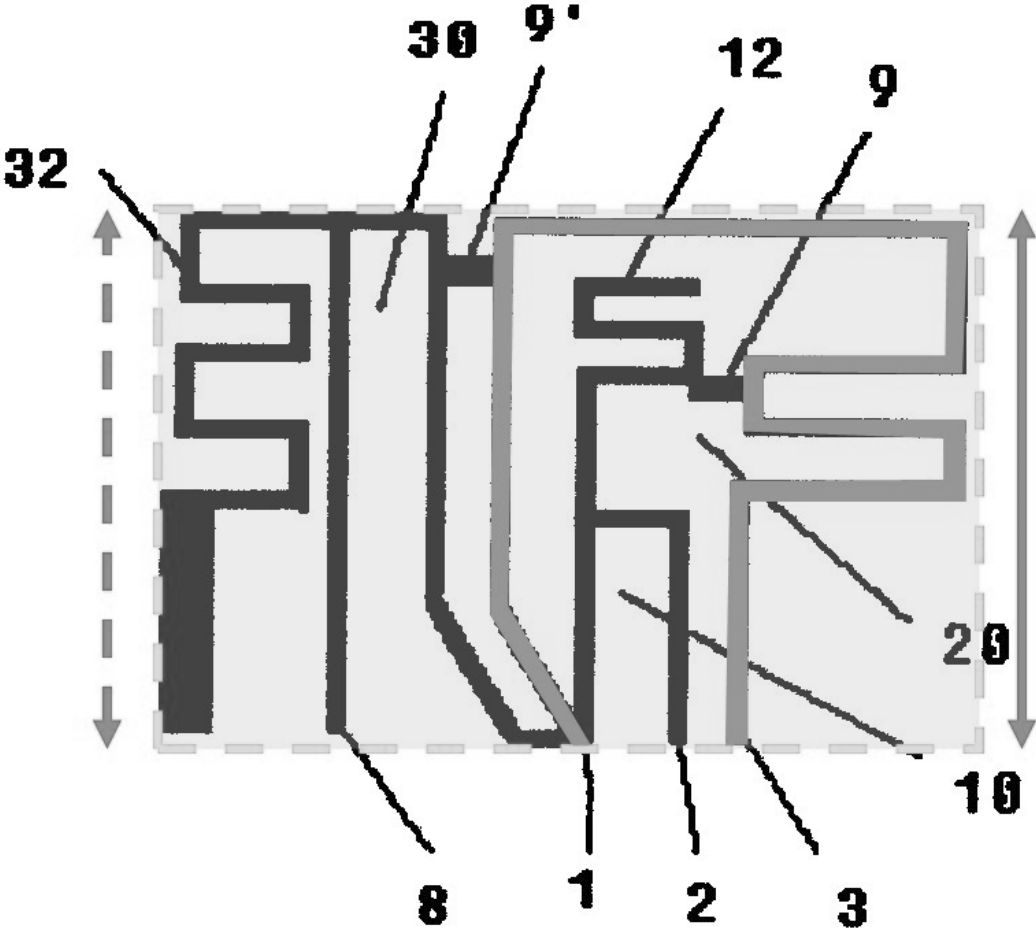
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p data-bbox="630 349 1911 446">“The antenna of this utility model is mounted on the mobile terminal mainboard 100. A positional relationship between the antenna and the mobile terminal mainboard 100 and a structure of a ground plane of the mobile terminal mainboard 100 may affect a frequency band characteristic of the antenna.”</p> <p data-bbox="630 479 798 511">Wei at 18:1-4</p>  <p data-bbox="630 1218 840 1250">Wei at Figure 2A</p> <p data-bbox="630 1282 1911 1347">“Referring to FIG. 9, in an eighth preferred embodiment provided in this utility model, the metal conductor part includes three signal loops which are respectively a first signal loop 10, a second signal</p>

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		<p>loop 20, and a third signal loop 30. The three signal loops have no other common parts except the common feed point 1. The signal loops respectively terminate at ground points 2, 3, 8, and each of the first and third signal loops 10, 30 has one conductor branch 12, 32.”</p> <p>Wei at 16:25-29</p>

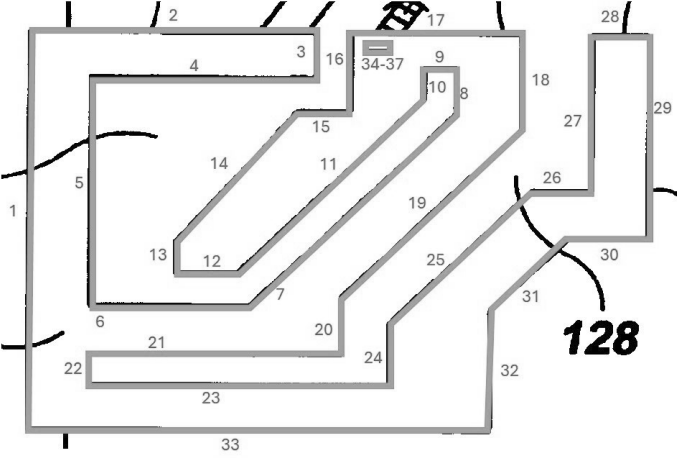
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		 <p data-bbox="630 1299 819 1331">Wei at Figure 9</p>

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		<p>“Although a multiband antenna such as for instance a multibranch antenna can be used within the package when several services or operating frequency bands are to be integrated in the same system, it is clear that other options within the present invention include arranging two or more antennas within the same package. For instance, those two or more antennas according to the present invention can be arranged in the same substrate layer, in different layers within the same substrate, in different substrates or even in the substrate and in the plastic casing of the package. One possible arrangement for a two antenna package includes two similar antennas wherein each one is fed independently, and wherein one conducting pattern is rotated 90° with respect to the other antenna pattern. This provides an effective means for integrating a polarization diversity communication system inside a single package.”</p> <p>Castany868 at 30:1-12</p>
1[h]	wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[d]</p> <p>“The second radiator is configured to radiate within a frequency range at least partly overlapping with at least one frequency range, preferably with a higher frequency range, of the first radiator.”</p> <p>Talvitie at 4:59-62</p>
1[i]	wherein the first contour is defined as a perimeter of the first planar antenna and perimeters of any closed apertures	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p>

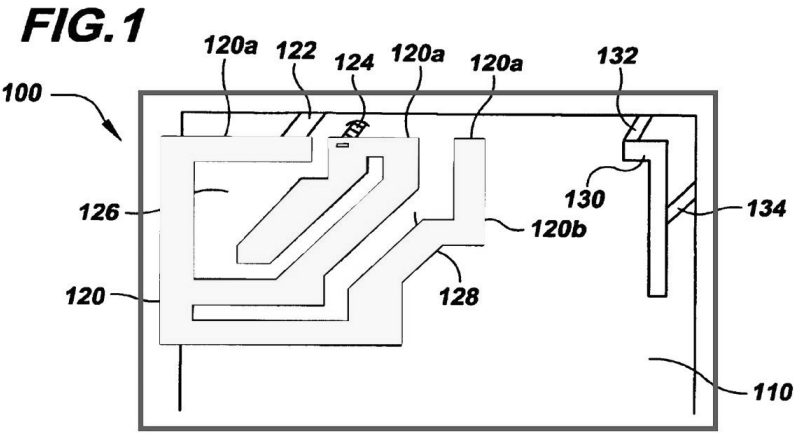
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	defined within the first planar antenna;	
1[j]	<p>wherein the complexity factors F21 and F32 are given by:</p> $F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)}$ $F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)}$ <p>where N1 is a number of cells of a grid G1 that include at least a point of the first contour, N2 is a number of cells of a grid G2 that include at least a point of the first contour, and N3 is a number of cells of a grid G3 that include at least a point of the first contour, the grid G2 divides a minimum-sized rectangle enclosing the first planar antenna into nine</p>	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim element 1[f]</p>

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	<p>columns of equal width arranged along a long side of the minimum-sized rectangle and into an odd number of rows of equal height arranged along a short side of the minimum-sized rectangle, wherein the number of rows results in the cells of grid G2 being as square as possible, the grid G1 being aligned with a corner of the grid G2 to cover the minimum-sized rectangle, the cells of the grid G1 having widths and heights that respectively are double the widths and heights of the cells of the grid G2, and</p>	
1[k]	<p>wherein the level of complexity of the first contour is configured to provide operation</p>	<p>Talvitie expressly or inherently discloses this claim element. <i>See, e.g.,</i></p>

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	of the wireless device in the at least three frequency bands.	<p>“The planar radiator 120 is provided with a first groove 126 and a second groove 128, which are sections containing no electrically conductive material. Such a groove plane antenna structure is suitable for use in more than one frequency range.”</p> <p>Talvitie at 3:66-4:3</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See, e.g.,</i></p> <p>“Fractal antennas are antennas that have the shaped of fractal structures. The fractal antennas consist of geometrical shapes that are repeated. Each one of the shapes has unique attributes. By careful selection. Fractal antennas can be design in many shapes such as Sierpinski gasket, Sierpinski carpet, Koch island, Hilbert curve and Miskowski. In this paper a microstrip sierpinski carpet antenna has been designed and analyzed. The performance of the antenna has been investigated in term of the return loss and the radiation pattern.”</p> <p>Rahim at p. 1</p> <p>“A square microstrip Sierpinski Carpet antenna was constructed using fractal geometry for multiband operation. The measured results indicate that the antenna exhibits a good radiation and input return loss. This type of antenna is the best candidate for wireless communications for multiband operation.”</p>

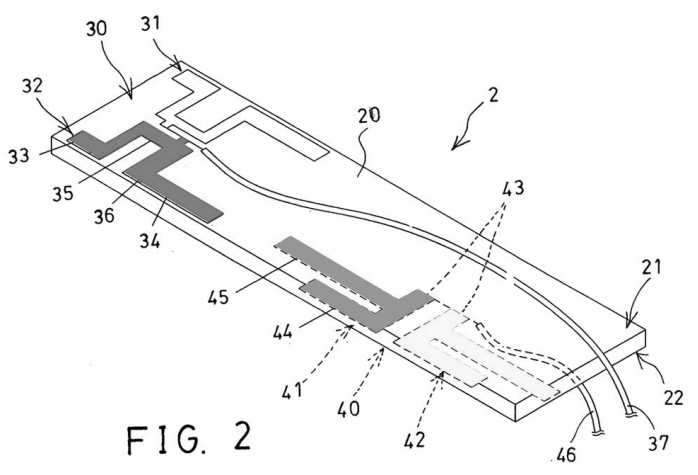
Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		Rahim at p. 4
Claim 2		
2	The wireless device of claim 1, wherein the first antenna contour comprises at least 20 segments.	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i></p>  <p>Talvitie at Figure 1</p>
Claim 3		

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
3	The wireless device of claim 2, wherein the perimeter of the first antenna contour comprises at least 35 segments.	Talvitie expressly or inherently discloses this claim element. <i>See, e.g.,</i> Claim Element 2
Claim 4		
4	The wireless device of claim 1, wherein the antenna system comprises a third antenna configured to receive signals employing a 4G communication standard.	Talvitie expressly or inherently discloses this claim element. <i>See, e.g.,</i> “at least a first and a second radiator located at a distance from the ground plane and grounded by a ground point to the ground plane” Talvitie at claim 1 “As far as the operation of the present embodiments is concerned, the shape or location of the second radiator 130 is irrelevant” Talvitie at 4:62-65

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		<p>FIG. 1</p>  <p>Talvitie at Figure 1</p> <p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff's apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants' Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants' Invalidity Contentions Cover Pleading.</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>To the extent that this reference does not expressly disclose this claim limitation, in light of Plaintiff’s apparent claim construction and infringement positions with respect to the Accused Products, a POSA would have understood it to implicitly disclose it or would have found the claim limitation obvious.</p> <p>Additionally, it would have been obvious to a person of ordinary skill in the art to modify this reference with any one or more of the references disclosed in Defendants’ Invalidity Contentions based on knowledge of one of ordinary skill in the art and for the reasons articulated in Defendants’ Invalidity Contentions Cover Pleading.</p> <p><i>See e.g.,</i></p> <p>“It is preferable that the antenna members 31, 32 of the antenna device 30 each includes two antenna segments 33, 34 disposed up and down relative to each other, and an intermediate and/or C-shaped antenna segment 35 disposed between the antenna segments 33, 34, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 33, 34, 35 of the two antenna members 31, 32 are disposed side by side and/or parallel to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different lateral directions 39 relative to each other, or away from each other.”</p> <p>Chou at [0028]</p> <p>“Similarly, the antenna members 41, 42 of the antenna device 40 each includes a base antenna segment 43 disposed up and down relative to each other, and two antenna segments 44, 45 extended from the base antenna segment 43 and parallel to each other, for receiving and transmitting signals of different frequencies, for example. It is further preferable that the antenna segments 43, 44, 45 of the two antenna members 41, 42 are disposed up and down relative to each other, or arranged in mirror symmetric relative to each other, for receiving and transmitting signals toward different vertical directions 49 relative to each other, or away from each other.”</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		<p>Chou at [0030]</p> <p>“Furthermore, each of the antenna devices 30, 40 may include two or more antenna segments 33, 34, 35; and 43, 44, 45 respectively, for receiving and transmitting signals of different frequencies, and thus for allowing the antenna devices 30, 40 to receive and transmit signals of various frequencies. There will be no dead ends or dead corners formed or generated by the antenna devices 30, 40.”</p> <p>Chou at [0033]</p> <p>FIG. 2</p> <p>Chou at Figure 2</p>

Claim No.	U.S. Patent No. 12,095,149 B2	Talvitie
		 <p>FIG. 2</p> <p>Chou at Figure 2 (Alternative)</p>
Claim 5		
5	<p>The wireless device of claim 4, wherein the third antenna defines an antenna contour comprising an entire perimeter of the third antenna, and wherein the antenna contour of the third antenna has a</p>	<p>Talvitie expressly or inherently discloses this claim element.</p> <p><i>See, e.g.,</i> claim elements 1[e], 1[k], 1[l], 1[m], 4</p>