UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GEOTAB INC. AND GEOTAB USA, INC.
Petitioners,

v.

FRACTUS, S.A.,
Patent Owner.

Case No. IPR2025-01026
Patent 11,031,677

PATENT OWNER'S RESPONSE

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Ex. 2007	Declaration of Mark J. DeBoy
Ex. 2008	DECLARATION IN SUPPORT OF PATENT OWNER'S MOTION FOR *PRO HAC VICE* ADMISSION OF LARRY L. SHATZER
Ex. 2009	RESERVED
Ex. 2010	Declaration of Hossein Hashemi, Ph.D.
Ex. 2011	Jack H. Winters, "Smart Antennas for Wireless Systems," IEEE Personal Communications, February 1998

Ex. 2012	3GPP TSG RAN Meeting #26, Document No. RP-040496, "Report of the 3GPP TSG RAN Long Term Evolution Work Shop," 2 -3 November 2004, Toronto, Canada"
Ex. 2013	3GPP TSG-RAN meeting #28, Document No. RP-050371, "Presentation of Specification to TSG or WG," Québec City, Quebec, 1–3 June 2005
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Ex. 2015	Hannes Ekstrom, et al. "Technical Solutions for the 3G long-term evolution," IEEE Communications Magazine • March 2006
Ex. 2016	Takehiro Nakamura, et al., "Super 3G Technology Trends, Part 1: Super 3G Overview and Standardization Activities," NTT DoCoMo Technical Journal Vol. 8, No. 1
Ex. 2017	Federal Communications Commission Report and Order FCC 97-421, "In the Matter of Reallocation of Television Channels 60-69, the 746-806 MHz Band," Adopted December 31, 1997, Released January 6, 1998
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Ex. 2026	FCC 700 MHz Band Auction #73 Bid Winners.
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I. INTRODUCTION

Fractus, S.A. ("Patent Owner") submits that the institution of *inter partes* review ("IPR") of claims 1-20 of U.S. Patent No. 11,031,677 ("the '677 Patent") was in error. Patent Owner respectfully submits that none of the grounds presented by Geotab, Inc. and Geotab USA, Inc. ("Petitioners") in the Petition prove, by a preponderance of the evidence, that any claim of the '677 Patent is unpatentable.

The Board determined in the Institution Decision (Paper 20) that Grounds 1 and 2 in the Petition failed to meet even the lower institution standard of a reasonable likelihood that any claim of the '677 Patent was unpatentable and there is no reason for the Board to depart from that conclusion now. Institution Decision at 50, 52. Ground 3, the sole ground in the Petition that purportedly met the institution standard, relies on incorrect facts and is the result of an incorrect legal analysis. An application of both the correct facts and the appropriate legal analysis demonstrates that the art relied upon in Ground 3 is ***not*** prior art to the '677 Patent.

Specifically, Ground 3 purports to show the invalidity of claims 1-5 and 12-20 of the '677 Patent based on a pre-grant publication of an application within the '677 Patent's own priority chain, U.S. Patent Publication No. 2008/0018543 to Baliarda *et al*. ("Baliarda"), the pre-grant publication of U.S. Application No. 11/614,429 (the "'429 Application"). Baliarda and the '677 Patent share an identical

disclosure. Petition at 97. The Institution Decision determined that the '677 Patent is not entitled to its priority date, or even the priority date of Baliarda because:

> Claim 1 requires a "first antenna" configured to "support at least three frequency bands" including "at least one" frequency band "associated with a 4G communication standard." Ex. 1001, 42:50–57. Claim 12 requires a "first antenna" configured to "transmit and receive signals from a 4G communication standard" and a "second antenna" configured to "receive signals from a 4G communication standard." *Id*. at 44:20–25.
>
> …
>
> [B]ased on the current record, Petitioner demonstrates a reasonable likelihood that as of the '429 application's December 21, 2006, filing date, ***the '429 application did not "reasonably convey[] to those skilled in the art that the inventor had possession" of "an antenna configured to send or receive signals in the 698-806 MHz spectrum***," including LTE band 12 IPR2025-01026 Patent 11,031,677 B2 that Patent Owner relies on in the Geotab litigation, for "communication with any '4G communication standard' ***because those frequencies were not usable for any mobile device communications at the time of filing."*** See Pet. 94 (emphasis omitted); Ex. 1007 ¶¶ 310, 312–313, 316–317; Ex. 1045, 1, 3; Ariad, 598 F.3d at 1351.

Institution Decision at 63-65 (emphasis added).

Accordingly, the Institution Decision reached a factual determination that as of December 21, 2006, the Person of Ordinary Skill in the Art ("POSITA") would

not have understood from the disclosure of the '429 Application that frequencies associated with "4G communication standards" included the 698-806 MHz frequency band. It is this determination that is factually and legally incorrect.

With regard to the factual errors, it was well understood as of December 21, 2006 that the 698-806 MHz frequency band was going to be used for "3G and other advanced services ... or other high-speed wireless standards," which both Parties agree are included in the construction of "4G communication standard." Institution Decision at 25-26. Specifically, on January 6, 1998, the Federal Communications Commission ("FCC") issued an order stating that the 746-806 MHz frequency band ("the Upper 700 MHz Band") was being reallocated for commercial use because it was "located near spectrum now used for cellular telephone and other land mobile services, and it could be used to expand the capacities of these services." EX2017 at 22960-61 Reallocation of TV Channels 60–69, the 746–806 MHz Band, 63 Fed. Reg. 6669 (February 10, 1998).

Later, on January 18, 2002, the FCC issued an order (subsequently published in the Federal Register on February 6, 2002) allocating the 698-746 MHz frequency band ("the Lower 700 MHz Band") to:

> [A]llow the provision of services to the public that could include mobile and other digital new broadcast operations, fixed and ***mobile wireless commercial services (including FDD- and TDD-based***

> ***services),*** as well as fixed and mobile wireless uses for private, internal radio needs. The record in this proceeding demonstrates demand for expanded wireless services in the Lower 700 MHz Band, particularly in non-urban areas, for uses ranging from ***the implementation of next generation applications and extensions of existing mobile and fixed networks to the implementation of various innovative stand-alone technologies***.

EX2018 at ¶ 70 (emphasis added); *see also* Reallocation and Service Rules for the 698–746 MHz Spectrum Band (Television Channels 52–59), 67 Fed. Reg. 5491, 5496 (February 6, 2002).

The use of these frequencies for cellular communications, particularly for "implementation of next generation applications," therefore, was not speculative. Indeed, in the fall of 2002, licenses for use of portions of the Lower 700 MHz Band had been auctioned, with winning bids going to cellular communications companies. EX2019, EX2020.

The POSITA, being well aware of these FCC regulations and auctions, would have readily understood that "4G communication standards," which included "3G and other advanced services ... or other high-speed wireless standards," would operate in the Upper and Lower 700 MHz Frequency Bands. *See Rivera v. Int'l Trade Comm'n,* 857 F.3d 1315, 1322 (Fed. Cir. 2017) ("The knowledge of ordinary artisans may be used to inform what is actually in the specification."). Accordingly, the

Institution Decision was in error where is states that "the '429 application did not reasonably convey to those skilled in the art that the inventor had possession of an antenna configured to send or receive signals in the 698-806 MHz spectrum." Institution Decision at 65 (internal quotations omitted).

With regard to the legal errors, the panel applied the wrong legal analysis in reaching its conclusion regarding whether or not the '429 Application reasonably conveyed to those skilled in the art that the inventor had possession of the full scope of the claimed subject matter as of the filing date. Specifically, instead of looking to the sufficiency of the examples disclosed in the '429 Patent, the panel simply looked to see if the specific 698-806 MHz spectrum was disclosed in the application. Institution Decision at 63-67. This was legal error. *ABS Glob., Inc. v. Inguran, LLC*, 914 F.3d 1054, 1075 (7th Cir. 2019) ("[T]he specification need not feature a written description of every specific variant within the scope of the claim. Indeed, it would make little sense for a written description requirement explicitly to include every possible iteration of the broader invention. To do so would encourage patentholders to write out potentially infinite possibilities."). Instead, the panel should have considered the numerous examples of "4G communication standards" disclosed in the '429 Application and evaluate whether these examples were sufficient to reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date. Further, the panel should have considered

the knowledge of ordinary artisans to inform what is actually in the specification. *Rivera* 857 F.3d at 1322.

With the correct factual background and applying the correct legal analysis, it is undisputable that the ‘429 Patent reasonably conveyed to those skilled in the art that the inventor had possession of the full scope of claimed subject matter as of the earliest priority date for the ‘677 Patent. Therefore, the ‘677 Patent is entitled to its priority date, Baliarda is not prior art to the ‘677 Patent, and Baliarda cannot possibly invalidate any claim of the ‘677 Patent.

II. BACKGROUND

A. The '677 Patent

The '677 Patent is entitled "Multiple-Body-Configuration Multimedia and Smartphone Multifunction Wireless Devices," and issued on June 8, 2021. EX1001 at 1. The '677 Patent issued from U.S. Patent Application No. 16/832,820, filed on March 27, 2020, which is a continuation of U.S. Patent Application No. 15/856,626, filed on December 28, 2017 (now U.S. Patent No. 10,644,380), which is a continuation of U.S. Patent Application No. 14/738,090, filed on June 12, 2015 (now U.S. Patent No. 9,899,727), which is a continuation of U.S. Patent Application No. 14/246,491, filed on April 7, 2014 (now U.S. Patent No. 9,099,773), which is a continuation of the ‘429 Application, filed on December 21, 2006 (now U.S. Patent No. 8,738,103), claiming benefit of U.S. Provisional Patent Application No.

60/831,544, filed on July 18, 2006 and U.S. Provisional Patent Application No. 60/856,410, filed on November 3, 2006.

The subject matter disclosed in the '677 Patent is the same as that disclosed in its priority application Baliarda, *i.e.,* no continuation-in-part applications exist in the priority chain, and no new subject matter was ever added at any point in the priority chain. *E.g.,* Petition at 97.

The '677 Patent describes a wireless device having a multiband antenna system with two or more antennas, at least one of which has a complex shape that can be characterized by a set of complexity factors that relate to different structural and functional features of the antenna. By overlaying different-sized grids on a contour of an antenna and evaluating the number of cells within the grid spanned by the contour, attributes of the antenna's complexity can be determined. For example, a complexity factor F_{21}, determined from the cell counts from grids with large-sized and medium-sized cells, characterizes the complexity and degree of convolution of features of the antenna contour that appear when the contour is viewed at relatively coarser levels of scale. EX1001 at 19:15-18. Consequently, complexity factor F_{21} tends to increase with the number of antenna portions within the structure of the antenna system, typically associated with more frequency bands or radiation modes. *Id*. at 19:37-49. A complexity factor F_{32}, determined from the cell counts from grids with medium-sized and small-sized cells, characterizes the complexity and degree

of convolution of features of the antenna contour that appear when the contour is viewed at relatively finer levels of scale. *Id*. at 20:5-9. Consequently, complexity factor F_{32} tends to increase when the antenna contour includes a highly convoluted curve and reveals the degree of miniaturization achieved by the antenna system. *Id*. at 20:16-27. Evaluating an antenna using such complexity factors reveals its suitability for specific applications. *See, e.g.*, *Id*. at 21:23-26:53.

The claims of the '677 Patent recite wireless devices including antenna systems with at least two antennas and which include antenna structures that meet specific complexity factor requirements in distinctive combinations with particular frequency bands that are supported by the antenna systems. As will be evident from the arguments herein, the patentability of the subject matter of these claims is reinforced by Petitioners' failure to identify prior art that establishes anticipation or obviousness.

B. Technical Background – Antenna Diversity Techniques

Spatial diversity is a technique in wireless communications that uses multiple antennas to improve signal reliability and performance by mitigating the effects of multipath fading and other interference. EX2028 at ¶ 3. Multipath fading occurs when a wireless signal propagates along multiple different paths of differing lengths because of interactions with obstacles, resulting in portions of the signal energy arriving at a receiver with different phases slightly offset in time, which causes

constructive and destructive interference. *Id.* Such interference is spatially dependent – it varies from one spot to another based on the relative phases of the different-path-length versions of the same signal at different locations. *Id.* Locations separated by a small fraction of the wavelength of the wireless signal tend to experience similar fading and interference characteristics. *Id.* By providing sufficient spacing between two or more antennas transmitting and/or receiving the same signal at a given wavelength, the likelihood increases that at least one receiving antenna will be positioned at a location where the multipath or other interference is relatively low, thereby improving overall signal quality and reliability. *Id.* In general, having at least a quarter-wavelength spacing between antennas is considered acceptable to provide adequate spatial diversity between antennas. *Id.* at ¶¶ 3-4.

Unlike spatial diversity, polarization diversity involves the relative orientation of two or more antennas rather than their spacing. *Id.* at ¶ 5. Electromagnetic waves, such as wireless communication signals, may propagate with the electric field vector oscillating in the vertical direction (vertical polarization), or with the electric field vector oscillating in the horizontal direction (horizontal polarization), or with a combination of both vertical and horizontal polarization. *Id.* Scattering caused, for example, by obstacles in a signal path, may result in vertically and horizontally polarized wireless signals experiencing different signal attenuation over the signal path. *Id.* Polarization diversity mitigates the impact of either vertically or

horizontally polarized signals being highly attenuated by using two antennas with different polarizations so that at least one polarization of a signal can be received with an acceptable amplitude. *Id.* Because the orientation of an antenna impacts the polarization of the signals it transmits and receives, one way to achieve polarization diversity is to orient two similar antennas at 90° relative to each other. *Id.* On the other hand, two identically shaped antennas oriented in parallel would exhibit similar polarization, and therefore, would not provide polarization diversity. *Id*.

Antenna pattern diversity is a technique used in wireless communication systems to improve signal reliability by exploiting differences in radiation patterns. Every antenna has a specific radiation pattern—meaning it transmits and receives electromagnetic energy more strongly in certain directions. *Id.* at ¶ 6. As the receiving device moves (rotational and/or translational movement), a transmitting device may be located at an angle relative to the antenna that corresponds to a null in the antenna's radiating pattern, causing signal loss. *Id*. By having two or more antennas whose radiation patterns are different or differently oriented, the nulls of the antennas lie in different directions/orientations, and the likelihood of a receiving a signal from the transmitter at at least one of the antennas is improved. *Id*. When using two (or more) different patterns with nulls oriented in different directions, it is unlikely that all patterns experience signal loss at the same time, improving overall link robustness. *Id*.

Pattern diversity may be implemented by integrating multiple antennas into the device, each shaped differently to produce distinct radiation patterns. *Id.* at ¶ 7. The system then uses a switching or combining algorithm to select the antenna with the strongest signal (selection diversity) or combine signals from multiple antennas (maximal-ratio combining). *Id.* On the other hand, two identical, similarly oriented antennas will exhibit the same radiation pattern, and therefore, will not provide pattern diversity. *Id*.

C. Historical Background

The transition from analog to digital television in the United States was rooted in technological innovation and spectrum policy reform during the 1990s. Under the oversight of the FCC, broadcasters began moving from the long-standing analog broadcast system toward the digital standard, which enabled high-definition video, multicasting, and more efficient spectrum use. EX2017 at 22953, 22983; 63 Fed. Reg. 66671. This transition from analog to digital television transmission allowed for the eventual recovery of valuable UHF spectrum once analog transmissions ceased. EX2017 at 22953.

A key fiscal and policy driver of that recovery was the Balanced Budget Act of 1997. EX2017 at 22955; 63 Fed. Reg. 6669. The law directed the FCC to auction portions of the reclaimed broadcast spectrum and applied the anticipated revenues toward deficit reduction. EX2017 at 22953. Crucially, even before the final analog

shutoff occurred, the Act mandated that spectrum in the 746–806 MHz range (television channels 60–69, the Upper 700 MHz band) be cleared and reassigned. *Id.*; 63 Fed. Reg. 6669. In response, the FCC reallocated 24 MHz of this band to public safety services and designated the remaining 36 MHz for commercial wireless licensing, establishing the band plan that would later support nationwide mobile broadband and interoperable emergency communications. EX2017 at 22953*;* 63 Fed. Reg. 6670. The Lower 700 MHz band (698–746 MHz, channels 52–59) was likewise reallocated in advance of the completed digital transition. EX2018 at ¶ 2.

Beginning in 2002, the FCC conducted auctions of licenses in these bands, even though incumbent broadcasters had not yet ceased operations in the recovered spectrum. EX2019, EX2020; *see also* EX2021, EX2022. These early auctions signaled the federal government's commitment to repurposing broadcast spectrum for wireless services well before 2006, and they helped shape the emerging 4G ecosystem. Thus, the reallocation of both Upper and Lower 700 MHz bands was largely structured and underway years before the 2006 priority date for the '677 Patent and years before the 2009 analog television shutoff, reflecting a deliberate strategy to convert broadcast spectrum into mobile and public safety infrastructure.

D. Petitioners' Art

i. Dou

U.S. Patent Application No. 11/361,860 to Dou *et al.*, entitled "Internal Diversity Antenna Architecture" ("Dou" or EX1013), was filed on February 24, 2006, and was published as U.S. Patent Publication No. 2007/0200773 on August 30, 2007. Dou is generally directed to an antenna architecture that includes first and second antennas located near opposite ends of a printed circuit board (PCB) such that the spacing between two antennas provides spatial diversity. EX2010 at ¶ 36. Fig. 2A of Dou shows an internal diversity antenna structure comprising first and second internal antennas 206, 208 on a PCB 204 within a wireless device 200. The first internal antenna 206 is positioned near the top edge of the PCB 204, and the second internal antenna 208 is positioned near the bottom edge of the PCB 204. EX1013 at ¶ [0017]. Dou explains that:

> 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.

Id. at ¶ [0022], (emphasis added). *See also id*. at ¶¶ [0032], [0036] (describing other internal diversity embodiments); EX2010 at ¶ 36.

Consistent with generally accepted spacing requirements to achieve spatial diversity (*see* Section II.B, *supra*), Dou specifies the following spacing dimensions:

> In the embodiment shown in FIG. 2A, for example, the length (L) of the wireless device 200 may be greater than 0.3 wavelength (>0.3λ) of the lowest frequency, ***and the first internal antenna 206 and the second internal antenna 208 may be separated by a distance (D) that is no less than the quarter wavelength (>=λ/4) of the lowest frequency***.

Id. at ¶ [0024], (emphasis added). *See also* EX2010 at ¶ 37.

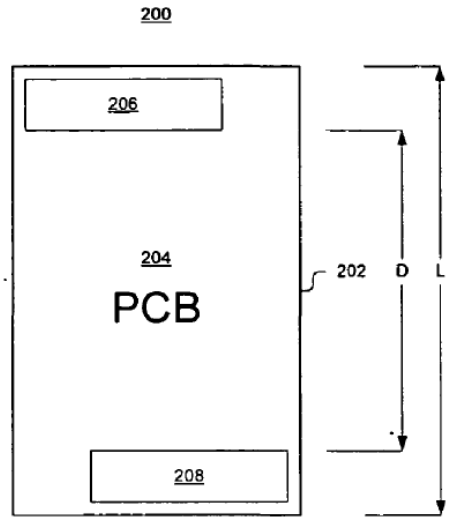


FIG. 2A

In fact, Dou emphasizes the importance of the quarter-wavelength spacing between the two antennas by reciting this limitation in the claims themselves:

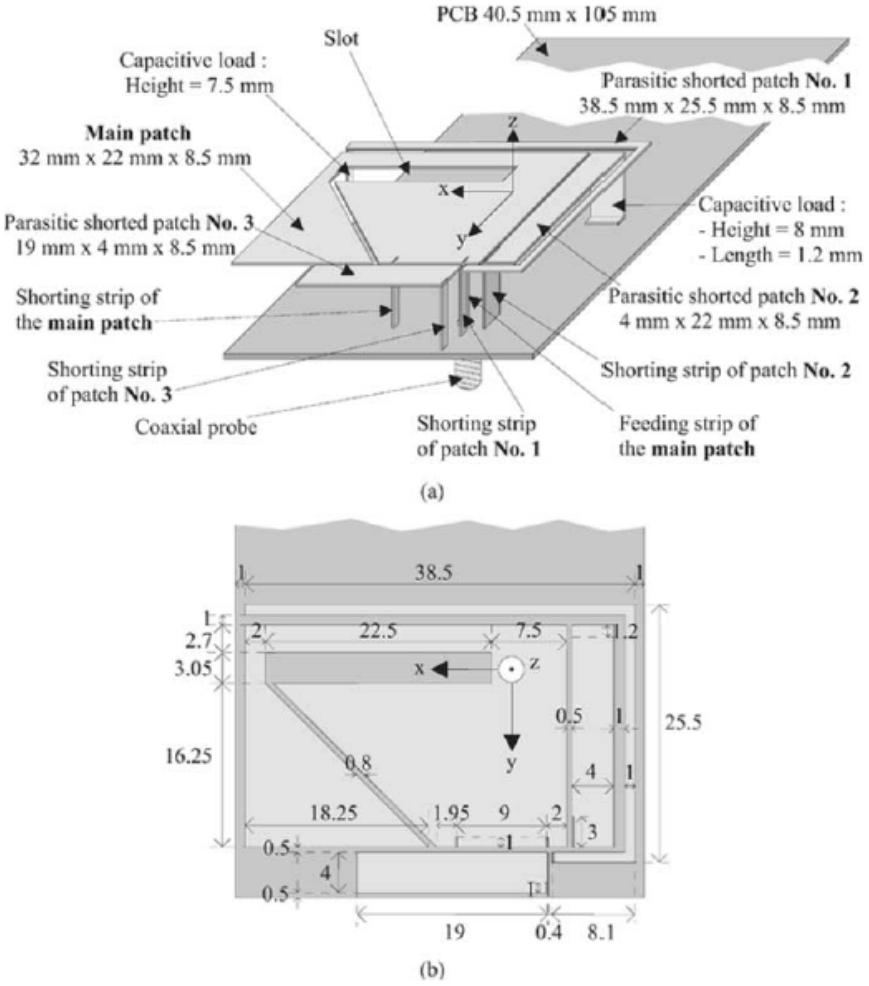
> 8. The wireless device of claim 2, ***said first diversity antenna and said second diversity antenna separated by a distance greater than or equal to a quarter wavelength of a lowest operating frequency of said wireless device***.

Id. at Claim 8 (emphasis added). *See also* EX2010 at ¶ 38.

Applying Dou's antenna spacing specification to a frequency of, for example, 870 MHz results in a minimum spacing between the antennas of 86.2 mm. EX2010 at ¶ 39. Specifically, the wavelength λ corresponding to a frequency of 870 MHz is 344.8 mm. At this wavelength, the spacing *D* between Dou's first and second antennas 206, 208, which is specified to be ≥λ/4, must be at least 86.2 mm. *Id.*

ii. Ciais-Quadband

Pascal Ciais et al., "Design of an Internal Quad-Band Antenna for Mobile Phones," *IEEE Microwave and Wireless Components Letters,* vol. 14, no. 4, pp.148-150, April 2004 ("Ciais-Quadband" or EX1009) discloses a planar inverted-F antenna (PIFA) suitable for cellular telephone applications. In the sole embodiment described by Ciais-Quadband and shown in Figs. 1A and 1B, a single antenna is located at a short end of a PCB ground plane and consists of a main patch with a slot, three quarter-wavelength parasitic elements, and capacitive loads that create additional resonances at four different frequencies. EX1009 at 148; EX2010 at ¶¶ 40-42.

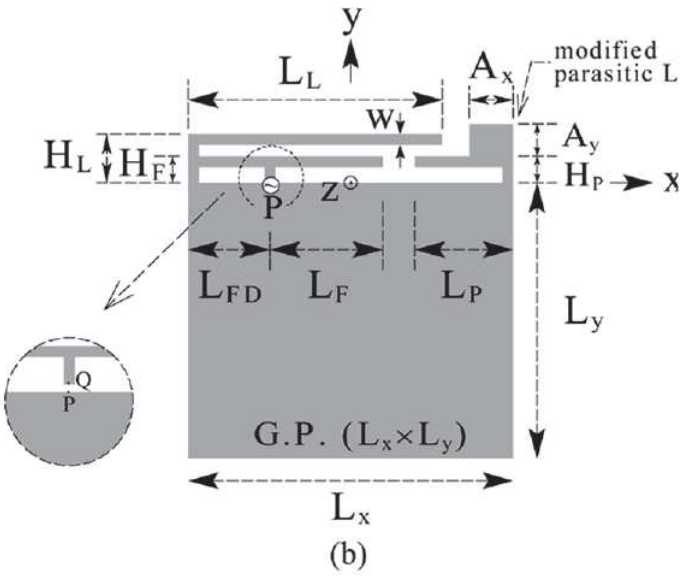


As shown in Figs. 1A and 1B, the overall dimensions of Ciais-Quadband's antenna are 38.5 mm x 28.5 mm with a height (spacing from the PCB) of 8.5 mm. The antenna has clearances of 0.5 mm from the end (short) edge of the PCB and 1.0 mm from each of the side (long) edges of the PCB. The PCB dimensions are 40.5 mm x 105.0 mm. *Id*. at 148-149. Ciais-Quadband identifies the lowest band of the antenna as 870-960 MHz, i.e., 870 MHz is the lowest frequency of the Ciais-Quadband antenna. *Id*. at 149.

Because Ciais-Quadband does not attempt to provide antenna diversity, Ciais-Quadband includes only a single quad-band antenna located at one of the short ends of the PCB. Ciais-Quadband, consequently, does not contend with the issue of a suitable spacing between two such antennas to provide spatial diversity or whether the size and shape of such an antenna is practical to enable spatial diversity in a wireless device. EX2010 at ¶ 42

iii. Nakano

H. Nakano *et al*. "An Inverted FL Antenna for Dual-Frequency Operation," *IEEE Transactions on Antennas and Propagation*, vol. 53, no. 8, pp. 2417-2421, Aug. 2005 ("Nakano" or EX1012) describes an inverted FL antenna (InvFLA) designed to obtain dual-frequency operation for the wireless LAN frequencies of 2.45 GHz and 5.2 GHz. EX1012 at 2417. Nakano's antenna is made of a thin, flat conducting film implemented in a card-type structure in which the antenna is co-planar with a ground plane and extends from a long side of the ground plane. *Id*. at 2417-2418. The ground plane dimensions are 30 mm (L_x) x 25.5 mm (L_y), and the antenna dimensions are 30 mm x 5.5 mm. *Id*. at 2418-2420. As shown in Fig. 1(b) of Nakano, the antenna includes three sub-elements: an inverted L element, an inverted F element, and a parasitic inverted L element. *Id*. at 2418.



(b)

iv. Baliarda

Baliarda is the pre-grant publication of U.S. Application No. 11/614,429 (the "'429 Application"). The '429 Application is contained within the '677 Patent's priority chain:

> This application is a continuation of U.S. patent application Ser. No. 15/856,626 filed Dec. 28, 2017, which is a continuation of U.S. patent application Ser. No. 14/738,090 filed Jun. 12, 2015, which is now U.S. Pat. No. 9,899,727, issued on Feb. 20, 2018, which is a continuation of U.S. patent application Ser. No. 14/246,491 filed Apr. 7, 2014, which is now U.S. Pat. No. 9,099,773, issued on Aug. 4, 2015, which is a continuation of U.S. patent application Ser. No. 11/614,429 filed Dec. 21, 2006, which is now U.S. Pat. No. 8,738,103, issued on May 27, 2014, which claims the benefit of U.S. Provisional Application No. 60/831,544, filed on Jul. 18, 2006, and claims the benefit of U.S. Provisional Application No. 60/856,410, filed on Nov. 3, 2006, the entire contents of which are hereby incorporated by reference. This patent application further claims priority from, and incorporates by reference the entire disclosure of European Patent Application No. EP 06117352.2, filed Jul. 18, 2006.

EX1001 at 1.

The Parties agree that the specifications of the '429 Application and Baliarda are materially identical to that of the '677 Patent. Petition at 97.

III. CLAIM CONSTRUCTION

Claims in this IPR are construed "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art." 37 C.F.R. § 42.100. Patent Owner does not necessarily agree with Petitioners' claim construction as presented in the Petition (Petition at 13-31), or in any other proceeding, but any differences are not directly pertinent to any of the arguments Patent Owner is making in this proceeding and, accordingly, are not addressed.

Patent Owner provides the following discussion of how a POSITA would have understood "4G communication standard" at the time of the earliest priority date for the '677 Patent.

Claim 1 recites "a first antenna within the wireless device and configured to support at least three frequency bands … at least one of the three frequency bands being associated with a ***4G communication standard***." Claim 12 includes a similar recitation of "a first antenna within the wireless device … configured to transmit and receive signals from a ***4G communication standard***." Patent Owner's position has consistently been that "4G communication standard" should be given its ordinary

and customary meaning under the *Phillips* claim construction standard, which evaluates how the expression "4G communication standard" would have been understood by a POSITA as of the priority date of the application in light of the specification, claims, and prosecution history of the '677 Patent and appropriate extrinsic evidence. *Phillips v. AWH Corp.,* 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

To the extent, however, that a construction of the term is necessary for the Board's resolution of the issues in this proceeding, Patent Owner submits that a POSITA would have understood that "4G communication standard" refers to a technical specification related to the Fourth Generation (4G) of broadband cellular network technology, a position consistent with Patent Owner's position in the ADT litigation. *See* EX1017 at n. 9. A "first antenna … configured to support at least three frequency bands … at least one of the three frequency bands being associated with a 4G communication standard" would be an antenna configured to support a frequency band associated with a technical specification related to the Fourth Generation (4G) of broadband cellular network technology.

The Specification of the '677 Patent explains that “4G standards” (which it sometimes calls “4G services”) include “HSDPA, WiBro, WiFi, WiMax, UWB, or other high-speed wireless standards.” EX1001 at 25:1-12. Thus, a non-exhaustive list of examples of the claimed “frequency bands being associated with a 4G

communication standard" may include 1900-2170 MHz, 810-960 MHz, 1710-1990 MHz, or 2-11 GHz (including some of its subregions such as 3-10 GHz, 2.4-2.5 GHz, and 5-6 GHz), as well as "additional frequency bands corresponding to said 4G standards." *Id*. at 25:1-12. Further, as discussed in more detail below, the POSITA would have understood from the disclosures in the '677 Patent that "frequency bands being associated with a 4G communication standard" also include other frequency bands, particularly the Upper and Lower 700 MHz Bands, as these bands had been allocated by the FCC to cellular communications prior to the earliest priority date for the '677 Patent.

IV. THE PERSON OF ORDINARY SKILL IN THE ART

Patent Owner assumes the POSITA definition asserted in the Petition.

V. ARGUMENT

A. Ground 3 – Claims 1-5 and 12-20 are patentable over Baliarda

The Institution Decision determined that Baliarda was prior art to the '677 Patent because, allegedly, the POSITA would not have understood that frequencies associated with the "4G communication standard" included frequencies within the 698-806 MHz spectrum as of the earliest priority date in the '677 Patent's priority

claim, and, therefore, the '677 Patent was not entitled to its priority date.[1] Institution Decision at 65 ("[B]ased on the current record, Petitioner demonstrates a reasonable likelihood that as of the '429 application's December 21, 2006, filing date, the '429 application did not 'reasonably convey[] to those skilled in the art that the inventor had possession' of 'an antenna configured to send or receive signals in the 698-806 MHz spectrum.'"). The Institution Decision is simply mistaken.

The POSITA would have understood from the disclosures of the '677 Patent that frequency bands associated with "4G communication standards" included the Upper and Lower 700 MHz Frequency Bands. In fact, frequencies within this spectrum range were specifically identified by the FCC as being allocated for "uses ranging from the implementation of next generation applications and extensions of existing mobile and fixed networks to the implementation of various innovative

[1] It will be understood, of course, that this conclusion necessarily requires a claim construction of "4G communication standard" as encompassing the 698-806 MHz frequencies. A finding that "4G communication standard" did not encompass the frequencies in question would necessarily eviscerate any requirement to demonstrate that the inventor had possession of an antenna configured to send or receive signals in the 698-806 MHz spectrum. In short, if the claims are found not to cover these frequencies, no requirement exists to show support for these frequencies.

stand-alone technologies." EX2018 at ¶ 70; *see also* 67 Fed. Reg. 5491, 5496. The FCC specifically noted "that the propagation characteristics of the Lower 700 MHz Band [were] ideal for two-way mobile communications." EX2018 at ¶ 8; *see also* 67 Fed. Reg. 5491, 5492.

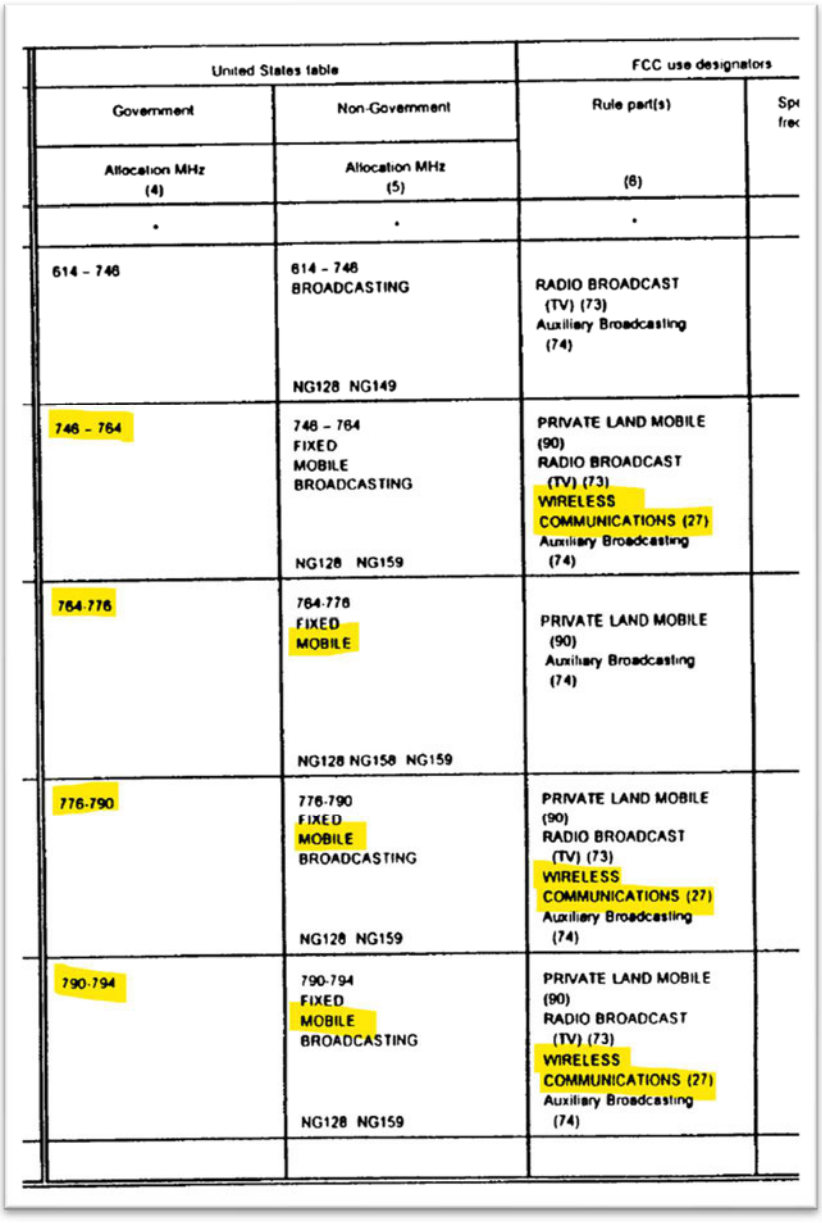
As will be shown in detail in the discussion below, the Lower 700 MHz Band and the Upper 700 MHz Band were identified by the FCC as being allocated for cellular and other broadband services prior to the earliest priority date for the '677 Patent, and in some instances, licenses within these frequency bands had been granted to wireless communications companies prior to the earliest priority date in the '677 Patent's priority claim. This background information would have informed the POSITA's understanding that frequencies associated with "4G communication standards" included the Upper and Lower 700 MHz Bands due to the fact that the FCC had allocated these bands to provide for expanding cellular coverage and to provide for new and emerging cellular technologies. The fact these bands were still being used for television broadcasting as of July of 2006 was understood and planned as part of the analog to digital television ("DTV Transition"), not due to any uncertainty that these bands would ultimately be allocated to cellular services. *See* EX2023 at 4 ("The statute further requires incumbent broadcasters to cease operation in the recovered spectrum by the end of 2006 unless the end of the transition is extended. As provided in the statute, the FCC is required to extend the

end of the transition at the request of individual broadcast licensees on a market-by-market basis if one or more of the four largest network stations or affiliates are not broadcasting in digital, digital-to-analog converter technology is not generally available, or 15 percent or more television households are not receiving a digital signal."). And, in fact, it was expected that licensees would be able to operate within these bands at the same time they were being used for television broadcast. EX2023 at 4 ("New licensees may operate in the band prior to the end of the transition, provided they do not interfere with these existing broadcasters on Channels 52 to 59. Depending on the license, there may be significant interference protection issues for new licensees seeking to initiate service in the Lower 700 MHz Band.").

i. Prior to 2006, the POSITA would have understood that the Upper 700 MHz Band (746-806 MHz) were associated with wireless communication services

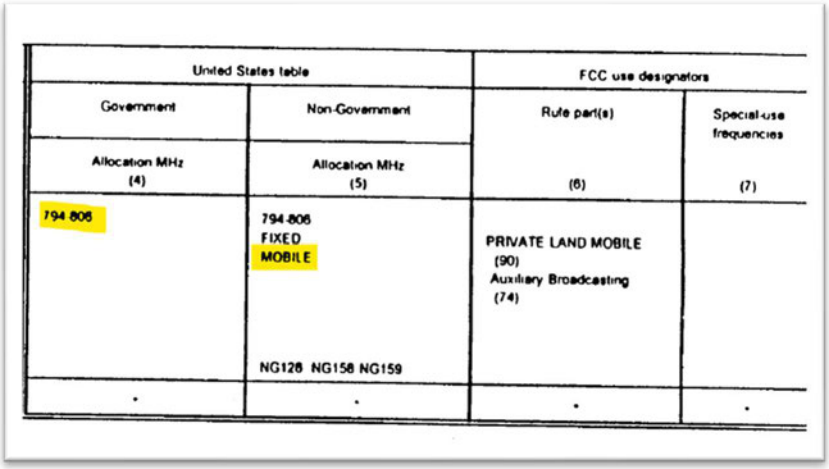
In July of 1997, the FCC issued a Notice of Proposed Rulemaking for the reallocation of TV channels 60-69, corresponding to the Upper 700 MHz Band. This reallocation was intended to expand the capacity of cellular services. Reallocation of TV Channels 60–69, the 746–806 MHz Band, 62 Fed. Reg. 41012-41015 (July 31, 1997).In January of 1998, the FCC ordered that the Upper 700 MHz Band was going to be allocated to commercial services via competitive bidding. EX2017 at 22960-61; *see also* 63 Fed. Reg. 6669. As indicated in the order, "[t]his spectrum is located near spectrum now used for cellular telephone and other land mobile

services, and it could be used to expand the capacities of these services." EX2017 at 22960-61. Reproduced below are details of a chart from the FCC order illustrating the allocation of the Upper 700 MHz Band.



United States table		FCC use designators	
Government	Non-Government	Rule part(s)	Spe freq
Allocation MHz (4)	Allocation MHz (5)	(6)	
•	•	•	
614 - 746	614 - 746 BROADCASTING NG128 NG149	RADIO BROADCAST (TV) (73) Auxiliary Broadcasting (74)	
746 - 764	746 - 764 FIXED MOBILE BROADCASTING NG128 NG159	PRIVATE LAND MOBILE (90) RADIO BROADCAST (TV) (73) WIRELESS COMMUNICATIONS (27) Auxiliary Broadcasting (74)	
764-776	764-776 FIXED MOBILE NG128 NG158 NG159	PRIVATE LAND MOBILE (90) Auxiliary Broadcasting (74)	
776-790	776-790 FIXED MOBILE BROADCASTING NG128 NG159	PRIVATE LAND MOBILE (90) RADIO BROADCAST (TV) (73) WIRELESS COMMUNICATIONS (27) Auxiliary Broadcasting (74)	
790-794	790-794 FIXED MOBILE BROADCASTING NG128 NG159	PRIVATE LAND MOBILE (90) RADIO BROADCAST (TV) (73) WIRELESS COMMUNICATIONS (27) Auxiliary Broadcasting (74)	

EX2017 at 22977 (annotated) *see also* 63 Fed. Reg. 6674.



United States table		FCC use designators	
Government	Non-Government	Rule part(s)	Special-use frequencies
Allocation MHz (4)	Allocation MHz (5)	(6)	(7)
794-806	794-806 FIXED MOBILE NG126 NG158 NG159	PRIVATE LAND MOBILE (90) Auxiliary Broadcasting (74)	
.	.	.	.

EX2017 at 22978 (annotated) *see also* 63 Fed. Reg. 6675.

As indicated by "Wireless Communications (27)" included in the "FCC use designators" column of the charts, bands within the Upper 700 MHz Band were being allocated to services subject to FCC rule 27, which covers wireless communications services. *See* 47 C.F.R. § 27.2. Accordingly, the POSITA would have understood that the Upper 700 MHz Band was going to be used for expanded cellular services as of 1998, ***almost a decade prior to the earliest priority date in the '677 Patent's priority claim.***[2]

[2] Licenses for operation within the Upper 700 MHz Band were scheduled to be auctioned on August 1, 2000. This auction was, however, postponed at the request of the telecommunications industry, including the Vice President and Deputy Counsel of Verizon Wireless, an identified real-party-in-interest in IPR2026-00196, a proceeding in which this same ground has been presented. EX2028.

ii. Prior to 2006, the POSITA would have understood that the Lower 700 MHz Band (746-806 MHz) was going to be associated with wireless communication services

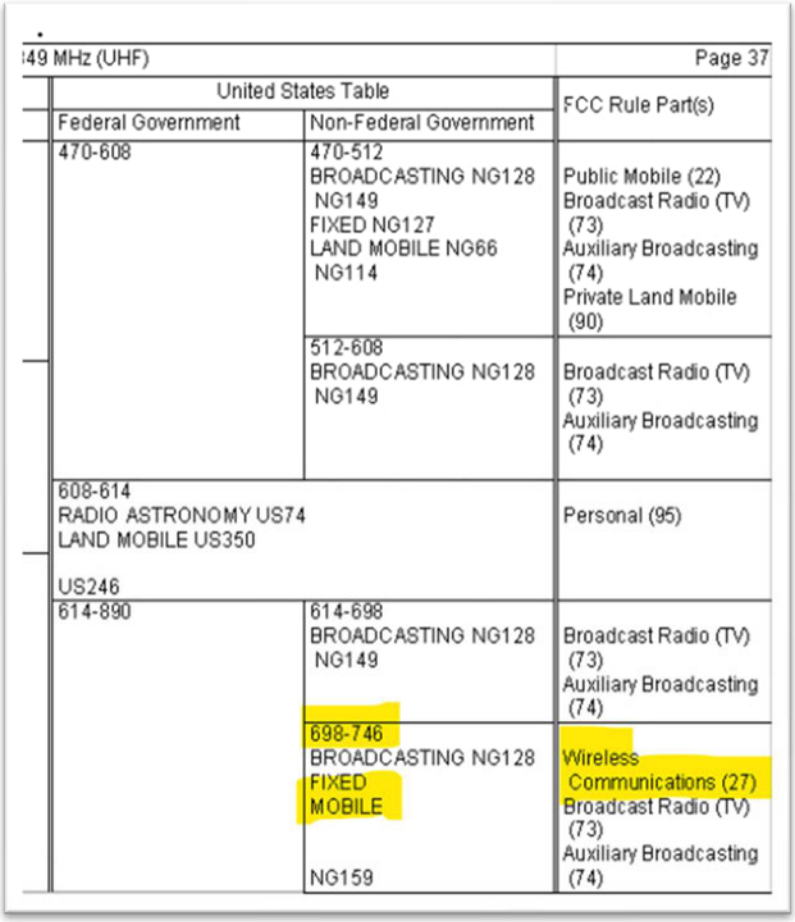
In January of 2002, in response to "tremendous growth in the new wireless services and demand for spectrum," the FCC ordered that the Lower 700 MHz Band would also be reallocated for wireless communications after the DTV transition. EX2018 at ¶ 8; *see also* 67 Fed. Reg. 5491-5513. The reallocated spectrum would:

> [A]llow the provision of services to the public that could include mobile and other digital new broadcast operations, fixed and ***mobile wireless commercial services (including FDD- and TDD-based services),*** as well as fixed and mobile wireless uses for private, internal radio needs.198 The record in this proceeding demonstrates demand for expanded wireless services in the Lower 700 MHz Band, particularly in non-urban areas, for uses ranging from ***the implementation of next generation applications and extensions of existing mobile and fixed networks to the implementation of various innovative stand-alone technologies***.

EX2018 at ¶ 70 (emphasis added); *see also* 67 Fed. Reg. 5596 (February 6, 2002).

As understood by the POSITA, 4G, LTE and 3G cellular networks utilize Time Division Duplex and Frequency Division Duplexing technologies, *i.e.,* they are FDD- and TDD-based services. *See, e.g.,* EX2024 at 7 ("The present document establishes the User Equipment (UE) minimum RF characteristics of E-UTRA for

both FDD and TDD modes"). Accordingly, the intent of this allocation was to provide spectrum allocation for advanced cellular communication services, such as 4G, LTE and 3G cellular services. Reproduced below is a detail of a chart from the FCC order illustrating the allocation of the Lower 700 MHz Band.



49 MHz (UHF)		Page 37
United States Table		FCC Rule Part(s)
Federal Government	Non-Federal Government	
470-608	470-512 BROADCASTING NG128 NG149 FIXED NG127 LAND MOBILE NG66 NG114	Public Mobile (22) Broadcast Radio (TV) (73) Auxiliary Broadcasting (74) Private Land Mobile (90)
	512-608 BROADCASTING NG128 NG149	Broadcast Radio (TV) (73) Auxiliary Broadcasting (74)
608-614 RADIO ASTRONOMY US74 LAND MOBILE US350 US246		Personal (95)
614-890	614-698 BROADCASTING NG128 NG149	Broadcast Radio (TV) (73) Auxiliary Broadcasting (74)
	698-746 BROADCASTING NG128 FIXED MOBILE NG159	Wireless Communications (27) Broadcast Radio (TV) (73) Auxiliary Broadcasting (74)

EX2018 at Appendix B (annotated); *see also* 67 Fed. Reg. 5509.

As indicated by "Wireless Communications (27)" included in the "FCC use designators" column of the charts, bands within the Lower 700 MHz Band were being allocated to services subject to FCC rule 27, which covers wireless

communications services. *See* 47 C.F.R. § 27.2. Further, portions of the Lower 700 MHz Band were auctioned off in the Fall of 2002 with winning bids going to wireless communications companies. EX2019. Accordingly, as of the Fall of 2002, it would have been well understood by the POSITA that the Lower 700 MHz Band was going to be used for wireless communications, and communications using technologies associated with 4G, LTE and 3G cellular networks.

While the FCC continued to tweak the rules surrounding the Lower 700 MHz Band and the Upper 700 MHz Band (*see, e.g.,* EX2025), the plan to allocate the Lower 700 MHz Band and the Upper 700 MHz Band for mobile communication services did not change. Ultimately, the majority of the Upper and Lower 700 MHz Bands were auctioned off in early 2008, with many of the licenses being acquired by a party now challenging this patent under this very ground, Petitioner Cellco Partnership in IPR IPR2026-00196. EX2026; EX2027.

iii. The Institution Decision erred in its legal analysis

The Institution Decision finds that "the '429 application did not 'reasonably convey[] to those skilled in the art that the inventor had possession' of '***an antenna configured to send or receive signals in the 698-806 MHz spectrum,' including LTE band 12***." Institution Decision at 65. "'[A]n antenna configured to send or receive signals in the 698-806 MHz spectrum,' including LTE band 12," however, is not recited in the claims of the '677 Patent. The correct written description analysis

determines whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession ***of the claimed subject matter*** as of the filing date. *Mentor Graphics Corp. v. EVE-USA, Inc.*, 851 F.3d 1275, 1296 (Fed. Cir. 2017). The panel should have analyzed whether the '429 application reasonably conveyed to those skilled in the art that the inventors had possession of what is recited in the claims: an antenna "configured to support … [a frequency band] being associated with a 4G communication standard." The '429 Application clearly conveyed to the skilled artisan that the inventors were in possession of such an antenna.

A genus can be sufficiently disclosed by "either a representative number of species falling within the scope of the genus or structural features common to the members of the genus so that one of skill in the art can visualize or recognize the members of the genus." *Brita LP v. Int'l Trade Comm'n*, 156 F.4th 1326, 1335 (Fed. Cir. 2025). In fact, in many instances, disclosure of just a ***single*** species is sufficient to provide written description support for a claim directed to a genus where the field is predictable and the person skilled in the art would readily discern that other members of the genus would perform similarly. *Bilstad v. Wakalopulos*, 386 F.3d 1116, 1125 (Fed. Cir. 2004). Petitioners neither allege that the field of antennas is unpredictable, nor have they alleged that the operation of an antenna at one particular frequency would perform substantially differently than others. Petitioners instead

take the opposite position, relying on predictability of the antenna arts in alleging obviousness of the claimed inventions. *E.g.,* Petition at 35-36; EX1007 at ¶¶ 124-127.

The Institution Decision erred because, instead of looking for support for "4G communication standard" in the '429 Application, of which there is plenty, the Panel looked for explicit support for a specific species or embodiment of the claimed invention. *E.g.,* Institution Decision at 67 ("[T]hose disclosures do not show possession of LTE band 12 with 698-716 MHz for uplink and 728-746 MHz for downlink."). This is not the correct analysis:

> [T]he specification need not feature a written description of every specific variant within the scope of the claim. Indeed, it would make little sense for a written description requirement explicitly to include every possible iteration of the broader invention. To do so would encourage patentholders to write out potentially infinite possibilities.

ABS Glob., Inc. v. Inguran, LLC, 914 F.3d 1054, 1075 (7th Cir. 2019).

Because the Panel incorrectly sought disclosure of a specific embodiment of the claimed invention, instead of looking to the clear support for the invention as claimed, the Panel incorrectly determined that the '429 Application failed to provide written description support for independent claims 1 and 12.

iv. The Correct Legal Analysis Shows the '677 Patent is Entitled to its Priority Claim

Under the correct analysis, the claims of the '677 Patent are fully supported by the '429 Application, entitling the '677 Patent to the '429 Application's priority date, and eliminating Baliarda as prior art.

As discussed in Section V.A.iv, *supra,* a genus (*e.g.,* "4G communication standards") can be sufficiently disclosed by a representative number of species falling within the scope of the genus (*e.g.,* a representative number of such standards) or structural features common to the members of the genus so that one of skill in the art can visualize or recognize the members of the genus (*e.g.,* a representative number of frequencies associated with 4G communication standards). *See Brita LP v*, 156 F.4th at 1335. In fact, in many instances, disclosure of just a <u>*single*</u> species is sufficient to provide written description support for a claim directed to a genus where the field is predictable and the person skilled in the art would readily discern that other members of the genus would perform similarly. *Bilstad*, 386 F.3d at 1125. The '429 Application clearly provides such disclosure through multiple representative species ("HSDPA, WiBro, WiFi, WiMax, UWB, or other high-speed wireless standards" and their associated frequencies) and by describing structural features of the genus in the form of multiple example frequencies at which the antennas operate,

as well as their highspeed operation. *See, e.g.,* POPR at 15 *citing* EX1001 at 25:1-12.

The Parties agree that multiple examples of "4G Communication standards" and their associated frequencies were disclosed in the '429 Application. In fact, Petitioners described these examples in the Petition:

> Thus, "4G communication standard" is met by a "wireless standard" for "4G services" and "antenna… configured to… receive signals from a 4G communication standard" (or "receive signals employing a 4G communication standard") is met by an antenna that is operable in a frequency range used by a "4G service," where the "i.e." signal means that the patent defines a "4G service" as "comprising 3G and other advanced services such as for instance HSDPA, WiBro, WiFi, WiMAX, UWB or other high-speed wireless standards[.]

Petition at 29-30.

Patent Owner similarly described these examples in the POPR:

> A "first antenna … configured to support at least three frequency bands … at least one of the three frequency bands being associated with a 4G communication standard" would be an antenna configured to support a frequency band associated with a technical specification related to the Fourth Generation (4G) of broadband cellular network technology.
>
> The Specification of the '677 Patent explains that "4G standards" (which it sometimes calls "4G services") include "HSDPA, WiBro, WiFi, WiMax, UWB, or other high-speed wireless standards." EX1001

> at 25:1-12. Thus, examples of the claimed "frequency bands being associated with a 4G communication standard" may include 1900-2170 MHz, 810-960 MHz, 1710-1990 MHz, or 2-11 GHz (including some of its subregions such as 3-10 GHz, 2.4-2.5 GHz, and 5-6 GHz), as well as "additional frequency bands corresponding to said 4G standards."

POPR at 14-15.

In other words, the Parties agree that the '429 Application disclosed multiple species of the genus "4G communication standard." As indicated in the above-quoted language, the '677 Patent explicitly supports the 1900-2170 MHz, 810-960 MHz, 1710-1990 MHz, and 2-11 GHz (including some of its subregions such as 3-10 GHz, 2.4-2.5 GHz, and 5-6 GHz) frequency bands.

Further, the knowledge of the POSITA shows that these disclosed examples would indicate to the POSITA that the inventors were in possession of the 698-806 MHz spectrum. *See Rivera,* 857 F.3d at 1322 ("The knowledge of ordinary artisans may be used to inform what is actually in the specification."). As discussed above, the Upper and Lower 700 MHz Bands were well understood by the POSITA as being associated with advanced cellular services no later than the Fall of 2002, at which point licenses were granted to wireless communications providers in these frequency bands. EX2016, EX2020, EX2021, EX2022. In fact, the FCC specifically identified these bands as being appropriate to expand the capacity of cellular services and for the implementation of next generation applications and extensions of existing mobile

technologies, including technologies associated with 4G, LTE and 3G cellular networks. 62 Fed. Reg. 41012-41015 (July 31, 1997); EX2018 at ¶ 70; *see also* 67 Fed. Reg. 5596. Accordingly, where the '677 Patent refers to "additional frequency bands corresponding to said 4G standards," it is clear that this passage would have been understood by the POSITA as including the 698-806 MHz spectrum as these are the frequency bands that the FCC allocated for the purpose of implementing future cellular networks and technologies.

Accordingly, the '677 Patent would have reasonably conveyed to the POSITA that the inventors were in possession of "a first antenna within the wireless device and configured to support at least three frequency bands … at least one of the three frequency bands being associated with a 4G communication standard," in which the "at least one of the three frequency bands being associated with a 4G communication standard" operates in *at least* the 1900-2170 MHz, 810-960 MHz, 1710-1990 MHz, 2-11 GHz, ***and 698-806 MHz*** frequency bands. In other words, the disclosure of the '429 Application reasonably conveyed to the POSITA that the inventors were in possession of the ***entire scope*** of the claims of the '677 Patent. The '677 Patent is thus entitled to its earliest priority date.

Because the '677 Patent is entitled to its priority date, Baliarda is ***not*** prior art to the '677 Patent, and, therefore, cannot show that any claim of the '677 Patent is unpatentable under any standard, much less the preponderance of the evidence

standard of 35 U.S.C. § 316. Therefore, Patent Owner requests that the Board confirm that patentability of claims 1-5 and 12-20.

Finally, for completeness, Patent Owner maintains its position from the POPR, mainly that the errors in Petitioners' position are readily apparent from the differences in the present case and the cases the Petition cites purportedly in support of its position. Consider, for example, *Arthrex, Inc. v. Smith & Nephew, Inc.,* 35 F.4th 1328, 1343–44 (Fed. Cir. 2022). In *Arthrex*, the subject patent's priority chain included *continuations-in-part.* Accordingly, the subject patent specification described embodiments that included both "flexible" and "rigid" eyelets, and generically claimed "an eyelet," encompassing both embodiments. *Id.* at 1340–42. The subject patent's priority chain, however, included a reference with a different disclosure that failed to provide written description support for the "flexible eyelet" embodiment, and instead discouraged the use of such flexible eyelets. *Id.* at 1342. Accordingly, the priority chain in *Arthrex* included applications having differing disclosures, some of which failed to provide written description for all the disclosed embodiments in the subject patent. In the current case, however, the '677 Patent, Baliarda, and their shared priority applications have ***identical*** disclosures, and, therefore, present a completely different posture.

Or consider *ICU Medical v. Alaris Med. Sys.*, 558 F.3d 1368, 1377-78 (Fed. Cir. 2009), in which every embodiment of the disclosed medical valve contained a

"spike," and therefore, "a person of skill in the art would not understand the inventor of the … patents to have invented a spikeless medical valve." *ICU Med.,* 558 F.3d at 1378-79. As some claims of the patent in that case did not include a "spike," the court held that the subject patent failed to provide written description support for the full breadth of the "spikeless" claims. In contrast, in the present case, a POSITA would have understood the inventors of the '677 Patent to have invented "a first antenna … configured to support … [a frequency band] being associated with a 4G communication standard." Here, the disagreement between the Parties is not whether a POSITA would have understood the inventors as being in possession of "a first antenna … configured to support … [a frequency band] being associated with a 4G communication standard." It is clear from the specification of the '677 Patent that the inventors were in possession of such antennas due to the disclosure of multiple examples of 4G standards and their associated frequencies, as well as "other high-speed wireless standards" and "additional frequency bands corresponding to said 4G standards." *E.g.,* EX1001 at 25:1-12; *see also e.g.,* Petition at 29-30. Rather, the disagreement here is one of claim construction: how would a POSITA have understood a "4G communication standard" as of the priority date for the '677 Patent, not whether the inventors were in possession of such an antenna at the relevant priority date.

Or consider *Google LLC v. Valtrus Innovations Ltd.*, IPR2022-01406, Paper 40 (Apr. 3, 2024), in which the claims explicitly recite "virtual machines," but the priority application "does not mention virtual machines and does not include Figure 7 or any of the other portions of the '005 patent pertaining to the virtual machine embodiment." *Id.* at 18. In contrast, in the present case, the '677 Patent and Baliarda have identical disclosures that discuss "4G standards" and provide ample examples of 4G services and their associated frequencies. *E.g.,* EX1001 at 25:1-12; *see also e.g.,* Petition at 29-30. In the present case, reference to a "4G communication standard" is not new matter added in a later application.

There is a clear pattern to the cases cited by Petitioners – the claims of the patents deemed to lack written description all recite subject matter that is unambiguously broader than the disclosures of the priority applications. That is not the case in the present proceeding. The claims of the '677 Patent recite a "4G communication standard" and the priority applications for the '677 Patent provide sufficient disclosure of 4G standards and services such that a POSITA would have understood the inventors as being in possession of the claimed invention no later than July 18, 2006, the filing date of U.S. Provisional Application No. 60/831,544 and EP App. No. 06117352. Thus, the disagreement between the Parties lies in what those terms meant as of the priority date for the '677 Patent, not whether the '677 Patent provides written description support for the term.

Despite Petitioners' protests to the contrary, these cases illustrate Patent Owner's initial characterization of the disagreement between the parties as one of claim construction – Petitioners' believe that the 698-806 MHz frequency band is "expressly excluded" from the construction of "4G communication standard (Petition at 97), while Patent Owner believes that the 698-806 MHz frequency band was understood by the POSITA as being included in the correct construction of "4G communication standard" as of the '677 Patent's earliest priority date (POPR at 29-39). Petitioners, however, realize that a claim construction disagreement does not help them invalidate the '677 Patent – if Petitioners are correct that the 698-806 MHz frequency band was "expressly excluded" from the scope of the claims, there is no need for the '429 Application to provide written description for it. But if Patent Owner is correct that the skilled artisan would have understood "4G communication standard" as encompassing these frequencies, then this scope was supported by the '429 Application's multiple examples of "4G features," "4G services," and "4G standards" and their accompanying frequencies. In other words, regardless of who is correct about the scope of "4G communication standard," the alleged written description problem falls away. This is, apparently, why Petitioners have adopted Patent Owner's construction and attempt to recast this disagreement as one of written description and priority despite believing that the 698-806 MHz frequency band was "expressly excluded" from the scope of the claims. The cases cited above illustrate

that this is not a written description/priority issue – unlike the cases cited by Petitioners, the claim terms in the ‘677 Patent were described with reference to numerous illustrative examples in the ‘429 Application. In short, concluding that the claims are not supported by the '429 Application requires, on the one hand, interpreting the claims as covering the 698-806 MHz frequency band based on the evidence presented but, on the other hand, finding that evidence insufficient to show possession of the claims as so interpreted.

B. Ground 1 – Claims 1-9 are patentable over Dou in view of Ciais-Quadband

The Institution Decision correctly determined that Ground 1 failed to meet the “reasonable likelihood” institution standard. Institution Decision at 50. For completeness of the record, Patent Owner provides the following arguments in support of the Institution Decision’s determination regarding Ground 1.

The Petition alleges that claims 1-9 would have been obvious to a POSITA at the time of invention based on the combined teachings Dou and Ciais-Quadband. Petition at 32-69. Because the proposed combination of Dou with Ciais-Quadband provided in the Petition directly contradicts the teachings of Dou, the combination would not have been obvious and a POSITA would not have had a reasonable expectation of success in implementing the combination. Therefore, Ground 1

cannot show, by a preponderance of the evidence, the invalidity of any claim of the '677 Patent.

An objective of Dou's antenna design is to achieve spatial diversity between two antennas. EX1013 at ¶¶ [0017], [0022], [0023]; EX2010 at ¶ 46. The combination of Dou and Ciais-Quadband proposed in the Petition would construct an antenna that violates the explicit design constraints specified by Dou – design constraints that are well known in the art as being necessary to achieve the spatial diversity Dou's antenna design seeks. EX2010 at ¶ 46. Because the Petition modifies Dou's antenna in a way that is contrary to Dou's design constraints, the proposed combination would not have been obvious. *Id.*

Dou's diversity antenna includes two antennas 206 and 208 located at opposite ends of a PCB 204 for the purpose of achieving spatial diversity. *See* Section II.D.i, *supra*; EX1013 at ¶ [0017]; EX2010 at ¶ 47. The Petition proposes to implement Patent Owner's claimed antenna system by replacing Dou's first antenna 206 with a first copy of Ciais-Quadband's quad-band antenna and by replacing Dou's second antenna 208 with a second copy of Ciais-Quadband's quad-band antenna. Petition at 35. Despite the Petition showing many annotated diagrams throughout and carefully identifying the dimensions of the proposed combination, the Petition tellingly provides no diagram showing the structure resulting from the proposed combination of Dou and Ciais-Quadband. Nor does the Petition include any discussion of whether

Dou's antenna arrangement – modified by substituting two copies of Ciais-Quadband's single antenna – satisfies Dou's specification of having at least a quarter-wavelength spacing between the two antennas to provide spatial diversity, the primary objective of Dou's antenna design.

The Petition relies on the embodiment shown in Figs. 2A and 2B of Dou, replacing each of antennas 206 and 208 with a copy of Ciais-Quadband's antenna. Petition at 45. As explained in Section II.D.i, *supra*, Dou specifies that the first and second antennas 206 and 208 be "separated by a distance (D) that is no less than the quarter wavelength (>=λ/4) of the lowest frequency." EX1013 at ¶ [0024]. The lowest frequency of Ciais-Quadband's antenna is 870 MHz. EX1009 at 149. The wavelength λ corresponding to a frequency of 870 MHz is 344.8 mm, and a quarter of this wavelength – the minimum spacing specified by Dou to achieve spatial diversity at this wavelength – is 86.2 mm. See Section II.D.i, *supra*. EX2010 at ¶ 48.

In the proposed combination of Dou and Ciais-Quadband, the Petition "uses Dou's ground plane 210" (Petition at 37) but implements it using the 40.5 mm x 105 mm dimensions from Ciais-Quadband because it is "representative of the Printed Circuit Board (PCB) of a typical mobile phone." EX1009 at 148; Petition at 45-46. The Petition further asserts that the antenna rectangle of the Ciais-Quadband antenna is 38.5 x 28.5 mm. EX1009 at 149; Petition at 49. Factoring in the Ciais-Quadband antenna's clearances of 0.5 mm from the end edge of the PCB (EX1009 at 148), the

recipe for combining Dou and Ciais-Quadband prescribed by the Petition yields the following structure:

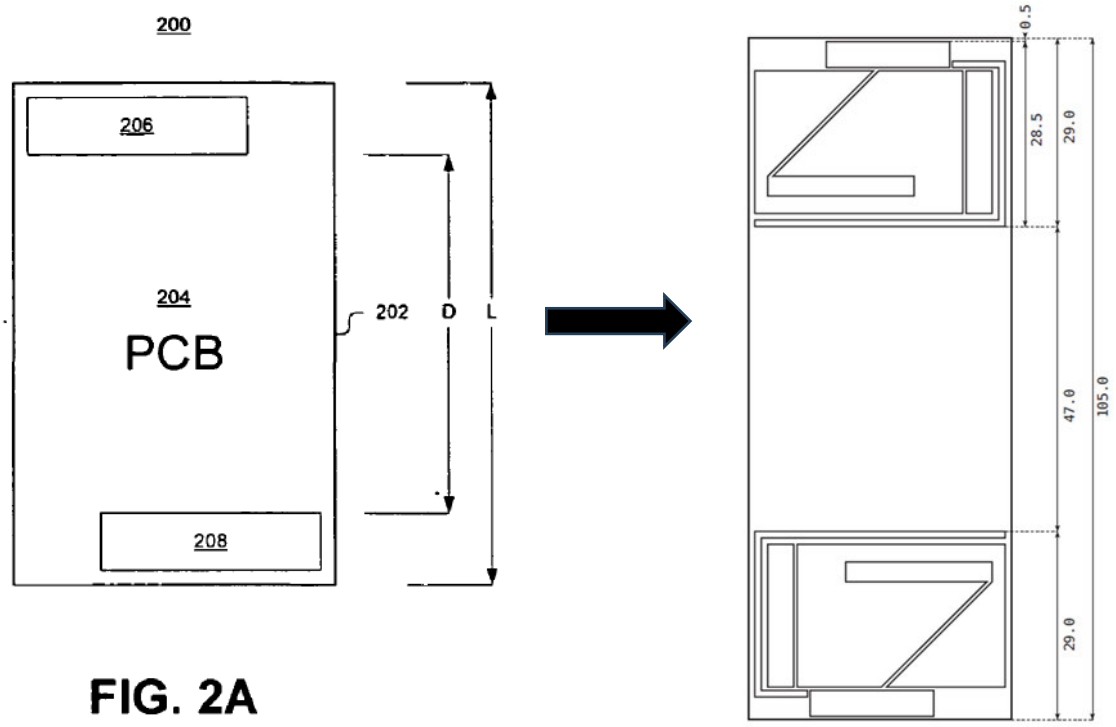


FIG. 2A

EX2010 at ¶ 49.

Subtracting the 29 mm required for the antennas at each end of the PCB from the 105 mm overall length of the PCB results in a spacing between the two antennas of 47.0 mm. This distance is ***barely more than half*** of the quarter-wavelength lower bound (86.2 mm) of the spacing specified by Dou to achieve spatial diversity at the antennas' lowest frequency (870 MHz). EX2010 at ¶ 50. Such a spacing between antennas is contrary to the express teachings of Dou and would have eliminated effective spatial diversity, the core feature Dou's antenna architecture seeks to

provide. The proposed modification, therefore, would not have been obvious to a POSITA at the time of invention of the '677 Patent. *See In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984) (finding that a modification that renders the invention inoperable for its intended purpose is not obvious because it teaches away from the invention); *see also Ex Parte Bjarne Harbo & Lucas Willemoes Hesselhof,* No. APPEAL 2024-002314, 2025 WL 2159181, at *3 (P.T.A.B. July 25, 2025).

A POSITA, understanding that at least a quarter-wavelength spacing between antennas is necessary to achieve spatial diversity, and following Dou's express specification of this spacing would not have expected the combination proposed in Ground 1 of the Petition to successfully provide the spatial diversity Dou's antenna arrangement is intended to provide. EX2010 at ¶ 50. Thus, the Petition fails to meet its burden of establishing that a POSITA would have been motivated to make such a combination, let alone yield predictable results doing so. *See KSR Int'l Co. v. Teleflex Inc.,* 550 U.S. 398, 421 (2007) (noting that if an ordinarily skilled artisan would not believe that a particular combination would have a reasonable expectation of "anticipated success," the combination may not be obvious). The combination of Dou and Ciais-Quadband proposed in Ground 1 of the Petition, consequently, would not have been obvious to a POSITA at the time of invention.

Petitioners claim that Patent Owner mischaracterizes Dou because “Dou describes spatial diversity as just one of several ‘diversity techniques’ for creating

diversity." Reply at 1. Petitioners miss the point. Petitioners' Dou+Ciais-Quadband and Dou+Ciais-Quadband+Nakano combinations (collectively "Dou+Ciais combinations") would only be understood by the POSA as implementing spatial diversity as the combinations are not consistent with pattern or polarization diversity.

Indeed, as noted by ***Petitioners'*** expert, "[a] diversity architecture such as that described in Dou can be implemented in various forms: spatial diversity (using physically separated antennas), pattern diversity (using antennas with different radiation patterns), and/or polarization diversity (using orthogonally polarized elements)." EX1007, ¶113. The Dou+Ciais combinations proposed in the Petition provide two identical Ciais-Quadband antennas physically separated from each other on opposite ends of the ground plane. Petition at 45. In other words, the Dou+Ciais combinations allegedly provide diversity "using physically separated antennas," ***which is spatial diversity***. EX1007, ¶113. In contrast, the Petition nowhere proposes using "antennas with different radiation patterns," nor does it propose using "orthogonally polarized elements." *See id.* Rather, the Petition proposes using identical Ciais-Quadband antennas, which would exhibit substantially identical omnidirectional radiation patterns, in a parallel arrangement on the ground plane. *See* EX1009 at 150. Therefore, the only diversity possibly implemented in the Dou+Ciais combinations is spatial diversity.

Petitioners also argue that the Dou+Ciais combinations, while not relying on spatial diversity, nevertheless do provide spatial diversity. Reply at 3. Petitioners further allege that Patent Owner falsely asserts that the Dou+Ciais combinations depend on use of Ciais-Quadband's 40.5 mm x 105 mm PCB. *Id*. Petitioners, however, are attempting to recharacterize the Dou+Ciais combinations presented in the Petition in an effort to salvage this ground after the Board determined it was insufficient.

Petitioners do not contest that a quarter wavelength spacing is required for spatial diversity. *See* Reply at 2-3. Instead, Petitioners argue that the Petition does not rely on Ciais-Quadband's 40.5 mm x 105 mm ground plane, and that a POSA could craft a ground plane to meet spatial diversity requirements. Reply at 3. This, however, is not what the Petition says. The Petition explicitly states that it is utilizing the ground plane teachings of Ciais-Quadband, including a 40.5 x 105 mm ground plane, within the Dou architecture: "Dou+Ciais-Quadband meets [1.b] because it uses Dou's ground plane 210 ***to implement Ciais's ground plane teaching***. … ***Ciais teaches a rectangular (40.5 mm x 105 mm) PCB, also backed by a ground plane***, that Ciais explains is representative of PCBs for typical mobile phones." Petition at 37, 45 (emphasis added).

Further, the Petition alleges that the Dou+Ciais combinations are obvious because "Ciais's quadband antenna provided operation at 870-960 MHz and 1710-

2170 MHz, each of which used well-known communication standards (GSM, DCS, PCS, UMTS), making the antenna 'suitable for mobile phone applications' like Dou's wireless device." Petition at 34, *citing* Ciais-Quadband at 148. Ciais-Quadband, however, explains on page 148 that "The PCB size, especially its length, has a strong influence on the performances of mobile phone antennas," and that the 40.5 mm x 105 mm PCB was chosen because it "equally helps in these both [*sic*] bands for an efficient antenna-chassis combination." EX1009 at 148. It is disingenuous for Petitioners to argue that they are not relying on Ciais-Quadband's ground plane size, which makes the antenna suitable for operation at the GSM and PCS bands, as well as suitable for mobile phone antennas, when these are the precise reasons that the Petition contends the Dou+Ciais combinations render the claims obvious.

Finally, Petitioners argue the Dou+Ciais combinations are not implementing spatial diversity because Patent Owner has shown that the combinations fail to meet the requirements for spatial diversity (*See* POPR at 18-23; *see also* section D, *supra*). The Petition, however, does not allege that the Dou+Ciais combinations implement pattern or polarization diversity, nor do they provide such diversity. The combinations utilize two Ciais-Quadband antennas which have the same radiation patterns, and therefore, cannot provide pattern diversity. *See* EX2029 at ¶¶ 6-7. The Ciais-Quadband antennas exhibit the same polarization as they are arranged in

parallel in the combination. Therefore, the antennas are not orthogonally polarized elements and do not provide polarization diversity. *See id.* at ¶ 5. Accordingly, regardless of how Petitioners characterize their reliance on Dou's ***diversity*** techniques, the Dou+Ciais combinations do not implement ***any*** antenna diversity – the Ciais-Quadband antennas are not sufficiently separated for spatial diversity, the antennas do not have the different radiation patterns needed for pattern diversity, and they are not orthogonally polarized as needed for polarization diversity. *See id., passim.* Therefore, a POSITA would have had no motivation for the Dou+Ciais combinations.

In light of the above, Patent Owner submits that the Institution Decision correctly determined that Ground 1 failed to meet "reasonable likelihood" standard for institution, and therefore, also fails to meet the "preponderance of the evidence" standard applied at this stage of the proceeding. Therefore, Patent Owner requests that Board issue a final written decision confirming the patentability of claims 1-9 over Dou in view of Ciais-Quadband.

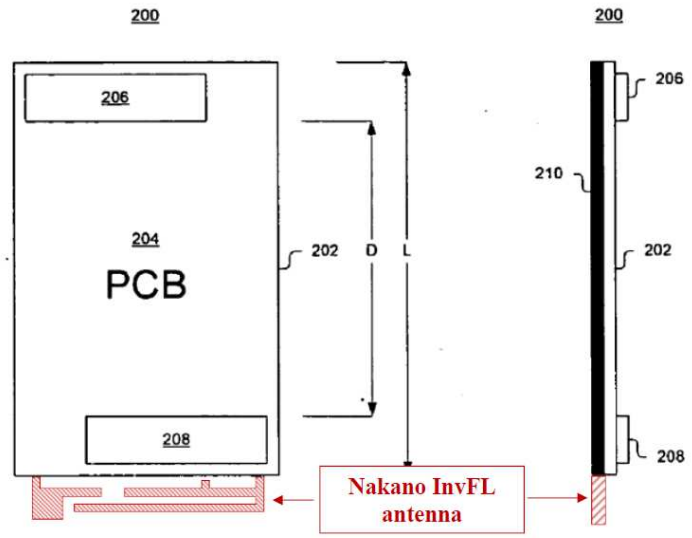
C. Ground 2 – Claims 1-20 are patentable over Dou in view of Ciais-Quadband and Nakano

The Institution Decision correctly determined that Ground 2 failed to meet the "reasonable likelihood" institution standard. Institution Decision at 52. For

completeness of the record, Patent Owner provides the following arguments in support of the Institution Decision's determination regarding Ground 2.

The Petition alleges in Ground 2 that claims 1-20 would have been obvious to a POSITA at the time of invention based on the combined teachings of Dou, Ciais-Quadband, and Nakano. Because Nakano does nothing to remedy the deficiencies of the combination of Dou and Ciais-Quadband proposed in Ground 1 of the Petition, a POSITA would not have combined Dou, Ciais-Quadband, and Nakano for substantially the same reasons explained in Section V.A., *supra*.

In Ground 2, the Petition proposes adding Nakano's inverted FL (InvFL) antenna "alongside" the Dou+Ciais-Quadband combination of Ground 1 to cover wireless LAN frequencies. Petition at 69-70. In the proposed arrangement, Nakano's antenna extends off the bottom end of the Dou+Ciais-Quadband PCB.



Id. at 71.

Regarding independent claims 1 and 6, the Petition does not further rely on Nakano in Ground 2, merely referring back to the arguments from Ground 1 and noting that Nakano's InvFL antenna replaces Dou's WiFi/Bluetooth antenna. That is, Ground 2 still proposed to replace Dou's two antennas 206 and 208 with duplicate copies of the Ciais-Quadband antenna. Petition at 72. Likewise, for independent claim 12, Ground 2 relies on this same proposed combination. Petition at 79-83. Consequently, the proposed addition of Nakano's antenna does nothing to address the non-obviousness of replacing Dou's antennas with two copies of Ciais-Quadband's antenna, as explained in Section V.A., *supra*. The proposed combination of Dou+Ciais-Quadband+Nakano still destroys the spatial diversity Dou sought to achieve between antennas 206 and 208, because the spacing between the swapped-in Ciais-Quadband antennas is barely half that specified by Dou.[3] EX2010 at ¶¶ 53.

[3] Patent Owner notes for completeness that the Petition incorrectly states that "Nakano's InvFL extends from a 'co-planar ground plate' on the **short side** of a rectangular 'card-type structure.'" Petition at 70. The opposite is true. As shown in Fig. 1 of Nakano and explained in Section II.D.iii, *supra*, Nakano's antenna extends from the **long side** of the structure (L_X = 30 mm, L_Y = 25.5 mm). Ground 2, which requires extending Nakano's antenna from the **short side** of the ground plane, is premised on this false characterization of Nakano's disclosure.

In light of the above, Patent Owner submits that the Institution Decision correctly determined that Ground 2 failed to meet "reasonable likelihood" standard for institution, and therefore, also fails to meet the "preponderance of the evidence" standard applied at this stage of the proceeding. Therefore, Patent Owner requests that Board issue a final written decision confirming the patentability of claims 1-20 over Dou in view of Ciais-Quadband and Nakano.

VI. CONCLUSION

In light of the foregoing, Patent Owner submits that the Petition has failed to show, by a preponderance of the evidence, the unpatentability of any claim of the '677 Patent. Therefore, Patent Owner respectfully requests that the Board issue a final written decision confirming the patentability of claims 1-20 of the '677 Patent.

Dated: February 25, 2026

Respectfully submitted,
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Fractus S.A.

CERTIFICATE OF SERVICE

The undersigned certifies that pursuant to 37 C.F.R. § 42.6(e), a copy of the foregoing **PATENT OWNER'S RESPONSE** and accompanying **EXHIBITS** were served via email (as previously consented to by counsel) on February 25, 2026 to lead and backup counsel of record for Petitioners as follows:

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Dated: February 25, 2026

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that this brief complies with the type-volume limitation of 37 C.F.R. § 42.24 because this brief contains 11,749 total words.

Dated: February 25, 2026

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