

EXHIBIT 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.
Petitioner,

v.

UMBRA TECHNOLOGIES LTD
Patent Owner.

Inter Partes Review No.: IPR2024-00497
U.S. Patent No. 10,630,505

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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Patent Trial and Appeal Board
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P.O. Box 1450
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Petitioner's Updated Exhibit List

<i>Exhibit #</i>	<i>Description</i>
1001	U.S. Patent No. 10,630,505 (the “’505 Patent”)
1002	Select portions of prosecution history of the ’505 Patent (“File History”)
1003	Declaration of Petitioner’s Expert Dr. A.L. Narasimha Reddy (“Reddy”)
1004	U.S. Patent No. 10,177,957 (“Hankins”)
1005	U.S. Patent No. 6,502,135 (“Munger”)
1006	U.S. Pat. App. Publ. No. 2014/0359704 to Chen (“Chen”)
1007	U.S. Pat. App. Publ. No. 2010/0275017 to Iyer (“Iyer”)
1008	RFC 1034 (November 1987) (“Mockapetris”)
1009	U.S. Pat. App. Publ. No. 2013/0275570 to Treuhaft et. al. (“Treuhaft”)
1010	Related Patents
1011	Computer Networks
1012	Supplemental Declaration of Dr. A.L. Narasimha Reddy

I. INTRODUCTION

The Patent Owner Response (POR) is directed to a single issue—the construction of the *end-to-end-tunnels* recited in Claim 1. Although it concedes that the parties agree that the term does not need to be construed and should given its plain and ordinary meaning (POR 7), the majority of the POR is spent arguing that an *end-to-end tunnel* must include certain features:

- A single end-to-end tunnel cannot include multiple tunnels joined together at intermediate points. POR 8, 9, 13, 14, 15, 16.
- An end-to-end tunnel is a connection between two devices with encapsulated communications therebetween. POR 7, 9, 12, 13, 14, 16, 17 18.
- An end-to-end tunnel spans in an “uninterrupted fashion” between endpoints. POR 10, 13.

In support of these arguments, the POR mischaracterizes the ’505 Patent, the file history, the Hawkins reference, the Petition, and this very proceeding itself. The Board should reject the unsupported arguments in the POR and find that the Challenged Claims are unpatentable over the cited art of Grounds 1 and 2.

II. THE POR MISCHARACTERIZES THE INTRINSIC EVIDENCE

A. The POR Mischaracterizes This Proceeding

As an initial matter, the POR faults the Board for a “*sua sponte*” claim construction of the term *end-to-end tunnels* even though the parties agreed that no construction was necessary. POR 7. This is not accurate, as the Board only construed the term in response to Patent Owner’s proposed construction.

The Petition asserted that “each claim term in the Challenged Claims be given its plain and ordinary meaning and that no specific construction of any claim term is required because the prior art relied on meets each of the claim terms under any reasonable construction.” Pet. 15. In the POR “[t]he Patent Owner does not dispute this proposal.” POR 7.

However, in its previously filed POPR, the Patent Owner asserted that the term *end-to-end tunnel* “refers to a tunnel that spans, in an uninterrupted fashion, the entire overlay network path between the endpoints.” POPR 3. Thus, the Patent Owner proposed a specific construction in the POPR that the Petitioner never had an opportunity to respond to. The Petitioner disagrees with Patent Owner’s proposed construction in the POPR because it is ambiguous and inconsistent with the intrinsic record of the ’505 Patent. The Patent Owner asserted its specific construction of the term in support of its argument that Hawkins, the primary reference of Ground 1, was substantially similar to Chen which was cited by the

examiner during prosecution, in order to assert its 325(d) challenge that Hawkins did not disclose the recited “*end-to-end tunnels*.” Thus, the Board necessarily construed the term in response to the argument put forward by the POPR, rejected the POPR’s proposed construction, and further denied the POPR’s challenge finding that “Hankins is not ‘the same or substantially the same as Chen.’” DI 17, 20-21. Specifically, in response to the POPR proposed construction, the Board held:

We preliminarily determine that the term “end-to-end tunnels” means communication paths connecting endpoint devices to one or more intermediate access point servers and one or more control servers. Ex. 1001, 4:5–8. Stated differently, the “end-to-end tunnels” connecting endpoint devices may include intermediate access point servers or control servers.

DI. 21.

This construction is consistent with the intrinsic record. Thus, it was the Patent Owner who proposed a construction of the limitation and not the Board that “*sua sponte*” construed a claim term when the parties agreed that no construction was necessary. POR 7

B. The '505 Patent

1. The '505 Patent Identified That the Problem with Point-to Point Tunnels was the Lack of Centralized Control

The '505 Patent describes that it was centralized control over the communication paths that distinguished its invention from the prior art. For example, the '505 Patent describes that a big disadvantage in the prior art for sending communications between two points using point-to-point tunnels over the Internet is that there is “little to no control over the routes between the two points as they rely on the policy of various middle players on the internet who carry their traffic over their network(s) and peer to other carriers and or network operators.” EX-1001 2:48-57.

FIG. 9 of the '505 Patent illustrates one such prior art system using a point-to-point tunnel, explaining that it was common for a third-party internet server provider (ISP) to carry traffic of other ISPs. EX-1001 13:3-7.

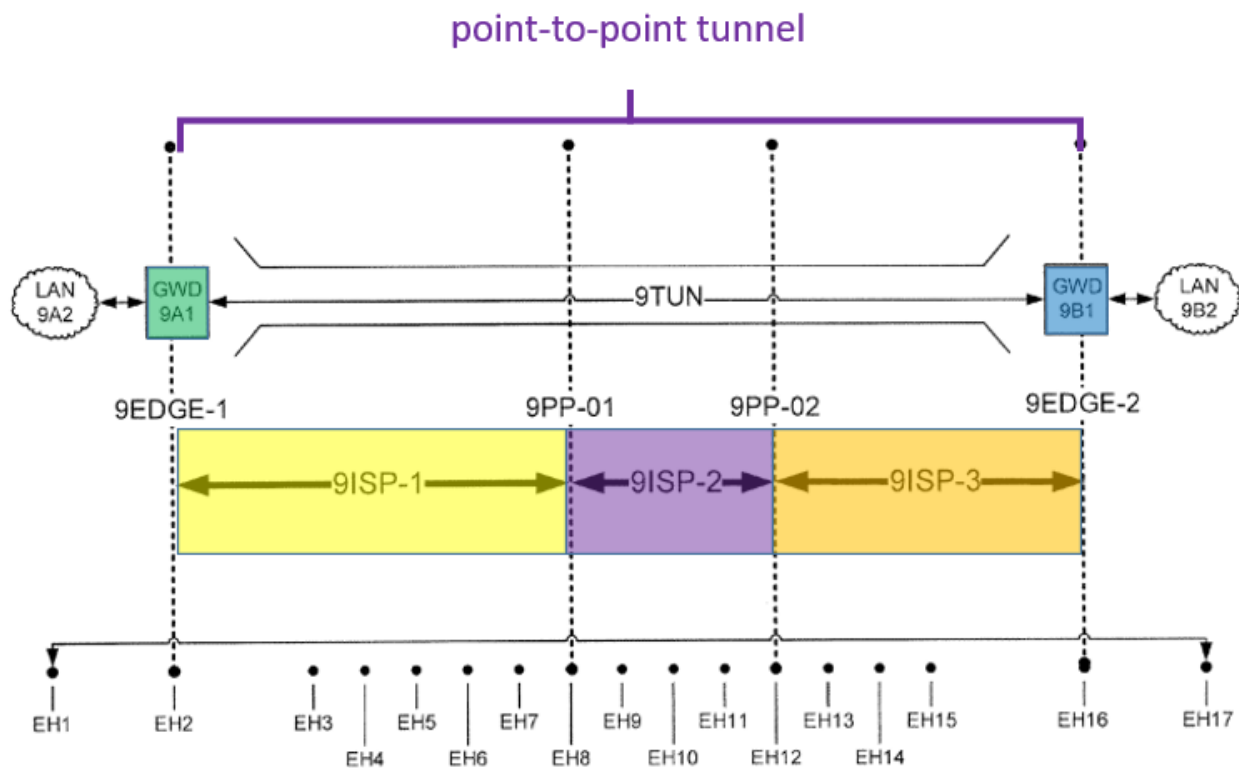


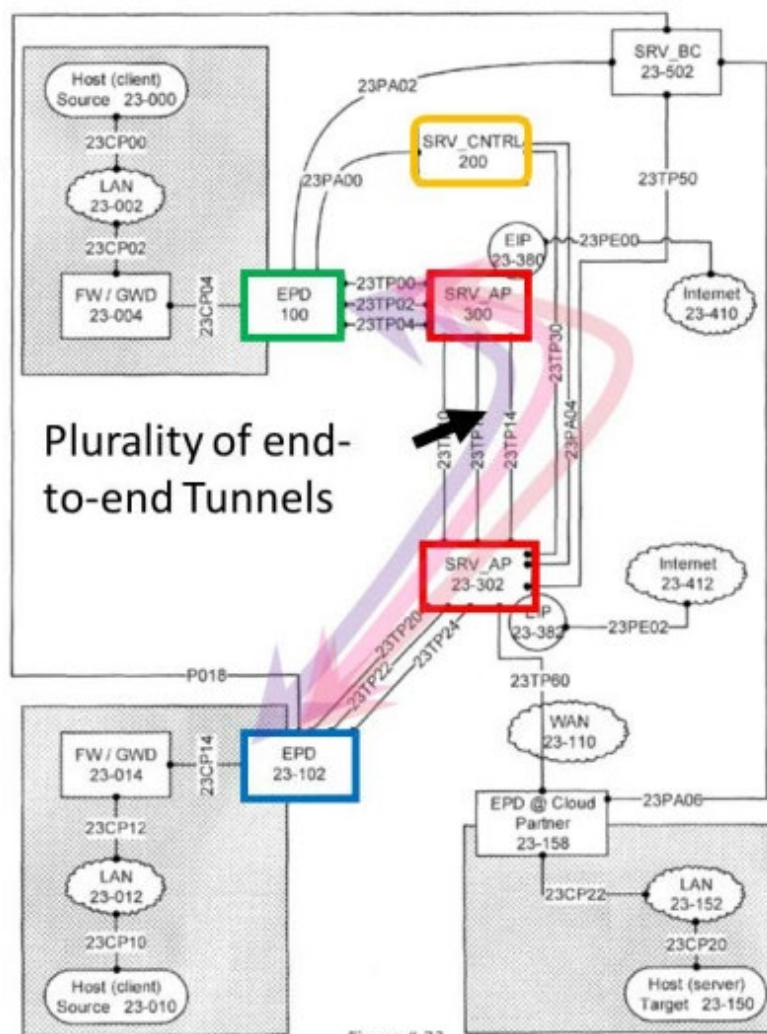
Figure # 9

EX-1001 FIG. 9 (annotated).

FIG. 9 illustrates a point-to-point tunnel (9TUN) built between two gateway devices 9A1 (green) and 9B1 (blue). EX-1001 12:47-48. LAN 9A2 connects through its gateway 9A1 to the network of one internet service provider 9ISP-1 (yellow), and LAN 9B2 connects through gateway 9B1 to internet service provider 9ISP-3 (orange). Both 9ISP-1 and 9ISP-3 have a requirement that their network traffic in both directions must transit through the network of another internet service provider 9ISP-2 (purple), but there was no control by 9ISP-1 or 9ISP-3

over how 9ISP-2 will carry their traffic. While customers of 9A2 of 9ISP-1 are able to directly complain about service issues to their 9ISP-1, and 9B2 can complain directly to 9ISP-3, if the issue is with 9ISP-2, then there is very little that 9A2 or 9B2 can do to directly influence 9ISP-2. EX-1001 12:59-13:14. Thus, the '505 Patent describes that the problem with point-to-point tunnels is that there is "limited control over routing and quality of service of the total connection. Consequently, it was difficult for point-to-point tunnels to maintain a high quality, stable connection over distance, especially when there are portions of traffic transiting third party networks." EX-1001 13:14-21. Note that the point-to-point tunnel of FIG. 9 spans from one endpoint device to another endpoint.

The '505 Patent's proposed solution was a global virtual network (GVN) of endpoint devices and access point servers with a centralized control server for automatically monitoring and controlling the routing of communications between endpoint devices using tunnels. EX-1001 3:11-62. One such GVN is illustrated in FIG. 23 which illustrates a communication path between endpoints comprising one or more intermediate tunnels connecting each endpoint device (green/blue) to one or more intermediate access point servers (red) and one or more control servers (yellow). EX-1004 4:4-8.



Each endpoint device is connected to its corresponding access point server by three intermediate tunnels and each access point server is connected to each other by three intermediate tunnels. Thus, there are multiple intermediate tunnels that can be selected to form an end-to-end tunnel between the endpoints. Thus, FIG. 23 illustrates “multiple tunnel connectivity between End Point Devices (EPD) and Access Point servers (SRV_AP)” and is color coded to show how each element of Claim 1 reads on the figure. EX-1001 5:32-34; FIG 23.

*1. A network system comprising:
a first device;
a second device; and
a plurality of intermediate access point servers that form a plurality
of end-to-end tunnels connecting the first device and the second
device; and
a control server, wherein the control server receives information
from at least one of the plurality of intermediate access point
servers, and wherein the control server selects one of the plurality of
end-to-end tunnels for communication between the first and second
devices based on the information.*

EX-1001 Claim 1

Thus, as illustrated in FIG. 23 and recited in Claim 1, what distinguishes the claimed invention from the prior art is not an end-to-end tunnel, but a *control server* that selects the intermediate tunnels that are joined at intermediate access point servers to form multiple end-to-end tunnels. Claim 1 requires that the control server receives information from at least one intermediate access point server and selects one of the end-to-end tunnels based on the received information. The '505 Patent describes that the received information can be tunnel information, peer information, traffic information, cache information and other information. EX-1001 52:30-35.

FIGs. 33 and 34 of the '505 Patent further illustrate a GVN end-to-end tunnel. Fig 33. illustrates GVN end-to-end tunnel(s) from LAN to EPD (green) to SRV_AP (red) to EPD (blue) to LAN:

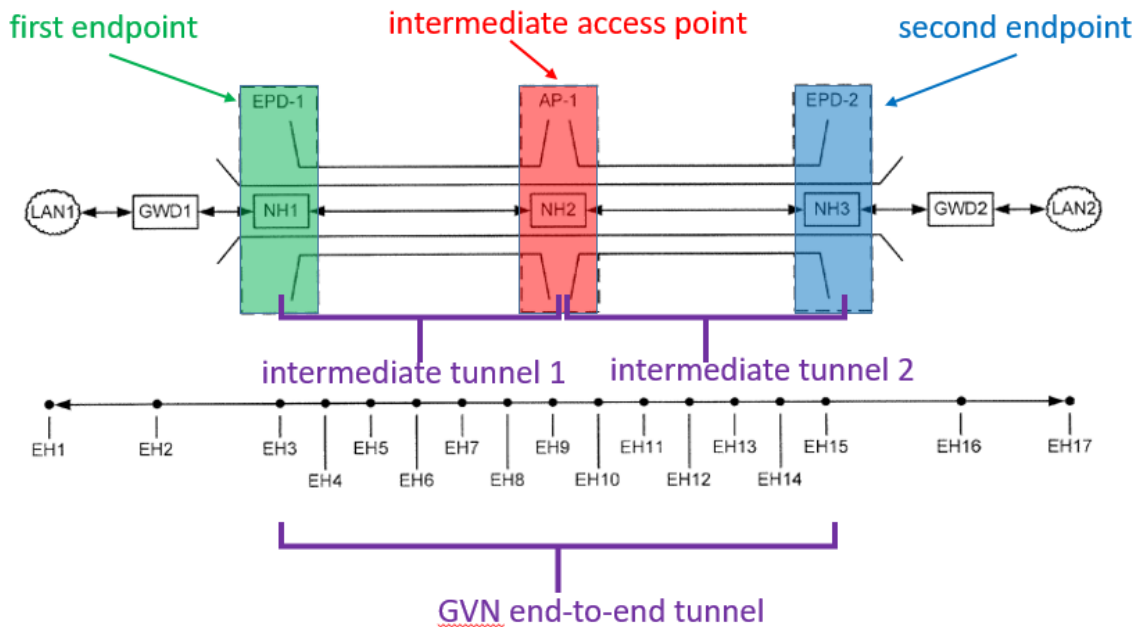


Figure # 33

EX-1004 FIG 33; EX-1012 ¶5.

There is “one tunnel between EPD-1 and AP-1” (intermediate tunnel 1), “joined to a second tunnel between AP-1 and EPD-2” (intermediate tunnel 2) which together form the GVN “tunnel that extends over the entirety of the transit” from one endpoint to the other. EX-1001 33:7-19. The '505 patent expressly states that FIG 33 “illustrates an end-to-end GVN tunnel(s) between edges of two LANs via one SRV_AP” which is consistent with FIG. 23’s disclosure that multiple intermediate tunnels exist between an endpoint and an intermediate access point

server that can be selected to form **multiple** end-to-end tunnels. EX-1001 33:9-11; EX-1012 ¶6.

Likewise, FIG. 34 shows a GVN tunnel, but this time includes two access point servers AP-1 and AP-2 (both red). This GVN tunnel differs from GVN tunnel of FIG 33 in that FIG. 34 also includes an additional tunnel from AP-1 to AP-2 (intermediate tunnel 3). EX-1004 33:25-31; EX-1012 ¶7.

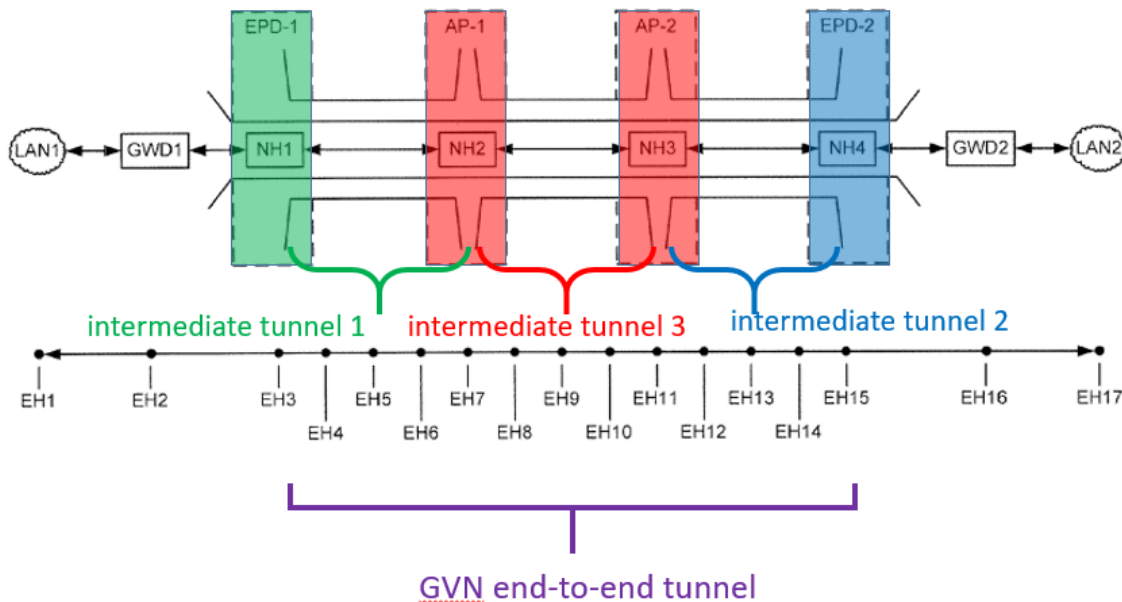


Figure # 34

EX-1004 FIG. 34; EX-1012 ¶7.

The '505 Patent expressly states that FIG. 34 “illustrates an end-to-end GVN tunnel(s) between edges of two LANs via two (or possibly more) SRV_APs” which is consistent with FIG. 23’s disclosure that multiple intermediate tunnels

exist between an endpoint and an intermediate access point server that can be selected to form multiple end-to-end tunnels. EX-1001 33:24-26; EX-1012 ¶8.

FIGs. 23, 33 and 34, in which the control server selects the intermediate tunnels to form end-to-end tunnels, are consistent with the '505 Patent description of its improvement over the prior art:

Systems and methods for connecting devices via a virtual global network are disclosed. In one embodiment the network system may comprise a first device in communication with a first endpoint device and a second device in communication with a second endpoint device. The first and second devices may be connected with a communication path. The communication path may comprise one or more intermediate tunnels connecting each endpoint device to one or more intermediate access point servers and one or more control servers.

EX-1001 Abstract; EX-1012 ¶9.

Thus, the specification of the '505 Patent demonstrates that the Board's construction is correct:

We preliminarily determine that the term “end-to-end tunnels” means communication paths connecting endpoint devices to one or more intermediate access point servers and one or more control servers. Ex. 1001, 4:5–8. Stated differently, the “end-to-end tunnels” connecting endpoint devices may include intermediate access point servers or control servers.

DI. 21.

2. The POR Mischaracterizes the 505 Patent

The POR argues that the '505 Patent distinguishes its claimed “end-to-end tunnels” from prior art “point-to-point tunnels.” POR 3, 10, 13. The 505 Patent does no such thing. For example, the POR asserts that FIG. 33 of the '505 Patent discloses “point-to-point tunnels” and argues that FIG. 33 “contrasts ‘*end-to-end tunnel*’ with the alternative, shorter ‘*point-to-point tunnels*’ (as annotated in blue).” POR 10, 13. This is not correct. As discussed above, FIG. 9 of the 505 Patent discloses prior art point-to-point tunnels and describes that the problem with point-to-point tunnels is that there is limited control over routing and quality of service of the total connection. As a consequence, it was difficult for point-to-point tunnels to maintain a high quality, stable connection over distance, especially when there are portions of traffic transiting third party networks. EX-1001 13:14-21.

On the other hand, FIG. 33 is directed to the claimed invention of a GVN tunnel which is created by joining intermediate tunnels under the control of a central server and is the improvement of the prior art point-to-point tunnels of the prior art illustrated in FIG. 9. There is no description in the '505 Patent that FIG. 33 is illustrating point-to-point tunnels. Thus, the POR's assertion that that FIG. 33 illustrates point-to-point tunnels is wrong.

- a. **There is no factual support for the POR's argument that a single end-to-end tunnel cannot include multiple tunnels joined together at intermediate points.**

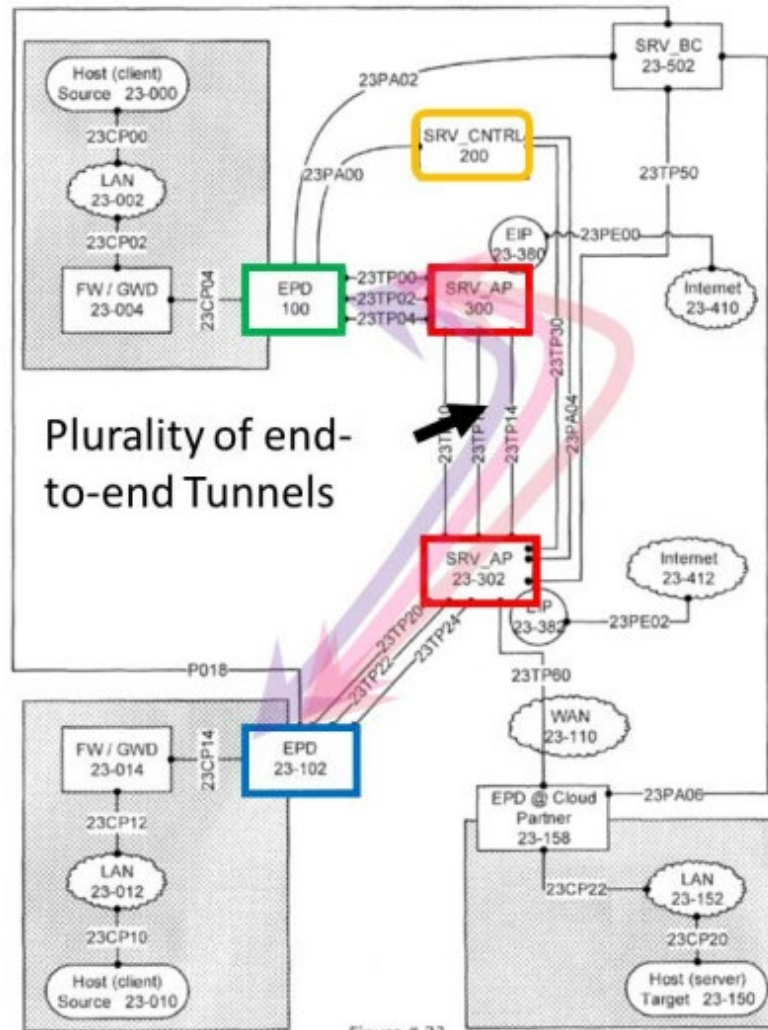
The POR's assertion that a single end-to-end tunnel cannot include multiple tunnels joined together at intermediate points ignores the express disclosure of the '505 Patent. POR 8, 9, 13, 14, 15, 16. For example, each of FIGs. 23, 33 and 34 illustrate that a single end-to-end tunnel may be formed by joining multiple intermediate tunnels. The '505 Patent expressly states that joined tunnels appear as a single tunnel:

While FIGS. 33, 34 and 35 all illustrate the **joining of tunnels** at AP hops, **this is viewed as a single tunnel** by client devices within LAN1 and LAN2. This singular tunnel represents the neutral Third Layer of the GVN within which it is possible to run all traffic that would normally transit Internet over the internet, including TCP, UDP, and other protocols, plus other tunnels such as IPSec, OpenVPN, PPTP, or other.

EX-1001 34:1-7; EX-1012 ¶10.

The "**GVN tunnel**" of FIG. 33 is expressly described as "[t]here is **one tunnel** between EPD-1 and AP-1 **joined to a second tunnel** between AP-1 and EPD-2." Likewise, in describing the "**GVN tunnel**" of FIG. 34, the '505 Patent states that the "[t]he difference between this variation and FIG. 33 is that there is a second AP-2 inserted into the path to represent another **joining of tunnels** AP-1 to AP-2 and AP-2 to EPD-2. EX-1001 33:28-31; EX-1012 ¶11.

Further, as demonstrated in FIG. 23, the whole purpose of the invention as claimed is that the control server (yellow) “selects one of the plurality of end-to-end tunnels (purple/pink/mauve) for communication between the first (green) and second (blue) devices:



EX-1001 Fig. 23; EX-1012 ¶12.

FIG. 23 illustrates that multiple intermediate tunnels between two devices such as 23TP00, 23TP02, 23TP04 or 23TP10, 23TP12, 23TP14 or 23TP20,

23TP22, 23TP24 can either offer a single communication path by sending traffic down one tunnel, or two or more tunnels can be aggregated together where two or more tunnels can carry traffic as if they are one tunnel. EX-1001 24:33-39. FIG. 23 is consistent with the invention described in the Abstract of the '505 Patent that the endpoint devices are "connected" by intermediate tunnels to intermediate access point servers:

The communication path may comprise one or more intermediate tunnels connecting each endpoint device to one or more intermediate access point servers and one or more control servers.

EX-1001 Abstract; EX-1012 ¶13.

Other embodiments of the '505 Patent are consistent with FIGs. 23, 33 and 34 illustrating multiple intermediate tunnels connecting to form end-to-end tunnels. For example, FIG. 17 shows endpoint devices connected through multiple concurrent tunnels:

End point devices (EPD) 17-100 through 17-110 will connect with one or more multiple SRV_AP servers through one or more multiple concurrent tunnels.

EX-1001 20:17-20; EX-1012 ¶14.

FIG. 19 shows multiple tunnels connecting endpoint devices with multiple intermediate access points:

End point devices (EPD) such as 19-100 through 19-128 gateway will connect with the most appropriate SRV_AP server relative to their location, their network connectivity, its peering and other relevant factors. These factors are constantly changing and therefore multiple tunnels to multiple SRV_AP servers are maintained by an EPD at all times. Each EPD connects with various (one or more) SRV_AP servers simultaneously.

EX-1001 21:18-25; EX-1012 ¶15.

Even the embodiment that the POR relies on to assert a single tunnel cannot be a plurality of tunnels does not support the POR's argument. FIG. 39 clearly states that internal tunnel 39-P20 is simply the aggregation of both other tunnels "joined at SRV_AP 39-200." EX-1001 36:41-48; EX-1012 ¶16.

b. There is no factual support for the POR's argument that an end-to end tunnel is a connection between two devices with encapsulated traffic therebetween

The '505 Patent only uses the word encapsulation once when describing that IPv4 traffic can be encapsulated for an IPv6 tunnel. EX-1001 39:27-31. None of the figures illustrating end-to-end tunnels discussed above include any discussion of encapsulation. That a tunnel can carry encapsulated traffic is no justification for construing an end-to-end tunnel to *require* encapsulated traffic. The POR's argument is simply an improper attempt to import a limitation from an embodiment into a claim term.

c. There is no factual support that an end-to-end tunnel spans in an “uninterrupted fashion” between endpoints.

The '505 Patent does not use the word “uninterrupted”, and the POR does not explain what “uninterrupted fashion” means. POR 10, 13. For example, in describing FIG. 33, the GVN tunnel is not described as uninterrupted, but instead is described as having seven hops from LAN1 to LAN2. EX-1001 33:15-24. The POR does not address whether a “hop” is an interruption in the tunnel. Moreover, the '505 Patent describes that intermediate access points in a GVN can perform processing of traffic which is inconsistent with the POR’s argument that a tunnel spans an intermediate access point “uninterrupted.” For example, an intermediate access point can perform domain name system (DNS) lookup, caching of content, smart routing, or firewall services. EX-1001 4:9-40. Thus, the POR’s argument for requiring that an end-to-end tunnel spans in an “uninterrupted fashion” between endpoints is without factual support and is also ambiguous as to what “uninterrupted” means.

3. The POR Mischaracterizes the Prosecution History

The POR asserts that the prosecution history describes that an “*end-to-end-tunnel*” is described as an ‘*encapsulation of communications*’ between ‘*endpoints.*’” POR 17 (emphasis in original). This is not accurate.

During prosecution, the examiner rejected Claim 1 as anticipated by Chen. Chen doesn’t use the word tunnel. Instead, the examiner asserted that Chen’s

disclosure of encapsulated communications over a VPN constituted the recited “intermediate tunnel.” EX-1002 165.

In response, the Patent Owner amended Claim 1 as follows:

1. (Currently amended) A network system ~~for connecting devices via a global virtual network,~~ comprising:
 - a first device ~~in communication with a first endpoint device;~~
 - a second device ~~in communication with a second endpoint device;~~ and
 - a ~~communication path~~ plurality of intermediate access point servers that form a plurality of end-to-end tunnels connecting the first device and the second ~~end-point~~ device; and
 - a control server, wherein the control server receives information from at least one of the plurality of intermediate access point servers, and wherein the control server selects one of the plurality of end-to-end tunnels for communication between the first and second devices based on the information~~further comprising one or more intermediate tunnels connecting each endpoint device to one or more intermediate access pointer servers and one or more control servers.~~

EX-1002 145.

The Applicant argued that the Chen’s encapsulation of communication under the VPN did not correspond to an intermediate tunnel, but even if it did, Chen **failed** to disclose:

- (1) the use of the VPN protocol to encapsulate communications between
pairs of Smart Devices, and

(2) that the Private Cloud Server joins multiple VPN links to provide end-to-end encapsulation and consequently the VPN links would not form a plurality of “end-to-end” tunnels.

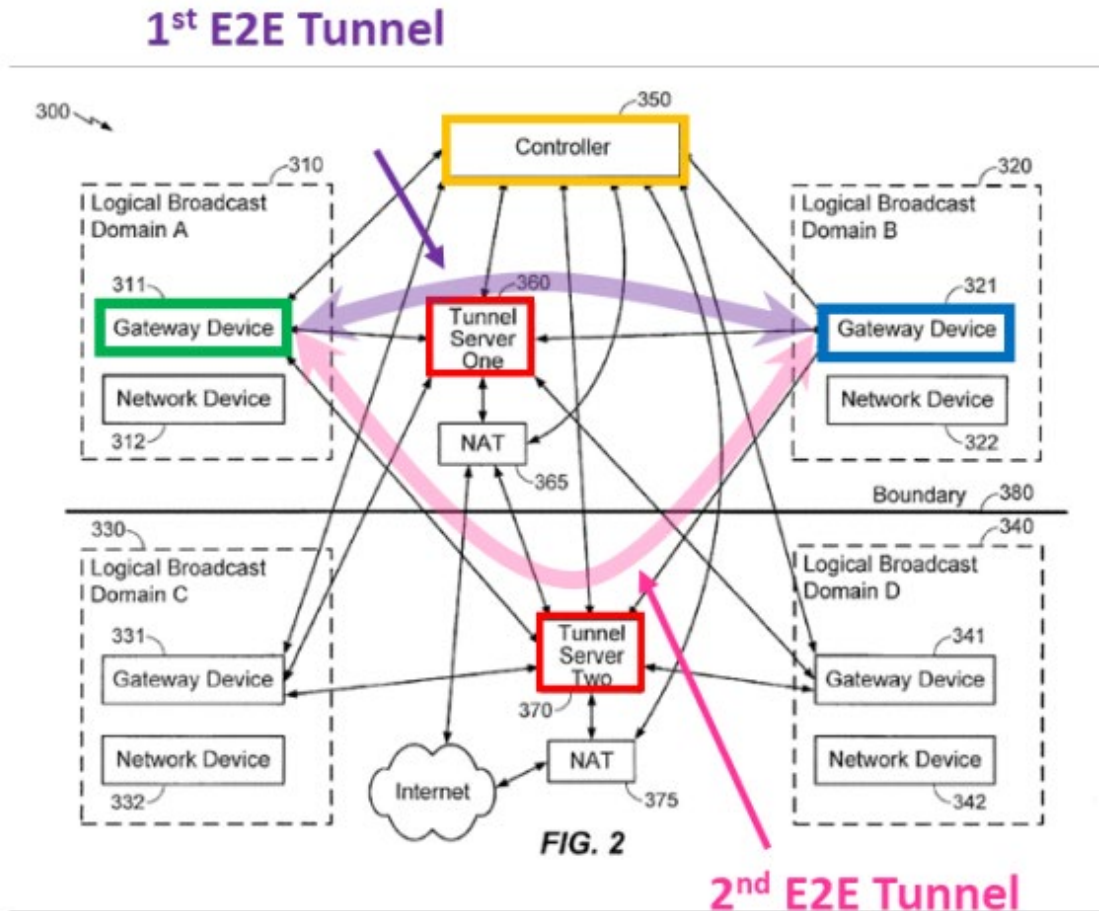
EX-1002 0150-151.

Thus, Applicant did not assert that an “*end-to-end-tunnel*” is an ‘*encapsulation of communications*’ between ‘*endpoints*’.” Instead, it expressly stated that it disagreed that encapsulation of communications is a tunnel. Its central argument was that Chen did not have a control server that joins tunnels between endpoints to form a plurality of end-to-end tunnels. EX-1002 151. In other words, Applicant argued that even if Chen’s encapsulation of communications could be deemed to be a tunnel, the tunnels formed were not under the control of a centralized control server.

Thus, the prosecution history does not support the POR’s argument that an “end-to-end tunnel” requires encapsulation. Encapsulation was only discussed because Chen did not disclose the use of tunnels.

III. HANKINS DISCLOSES A PLURALITY OF END-TO-END TUNNELS

The Petition described how Hawkins was a parallel disclosure to the disclosure of the '505 Patent disclosing a nearly identical architecture. Pet. 4-5.



EX-1004 FIG. 2.

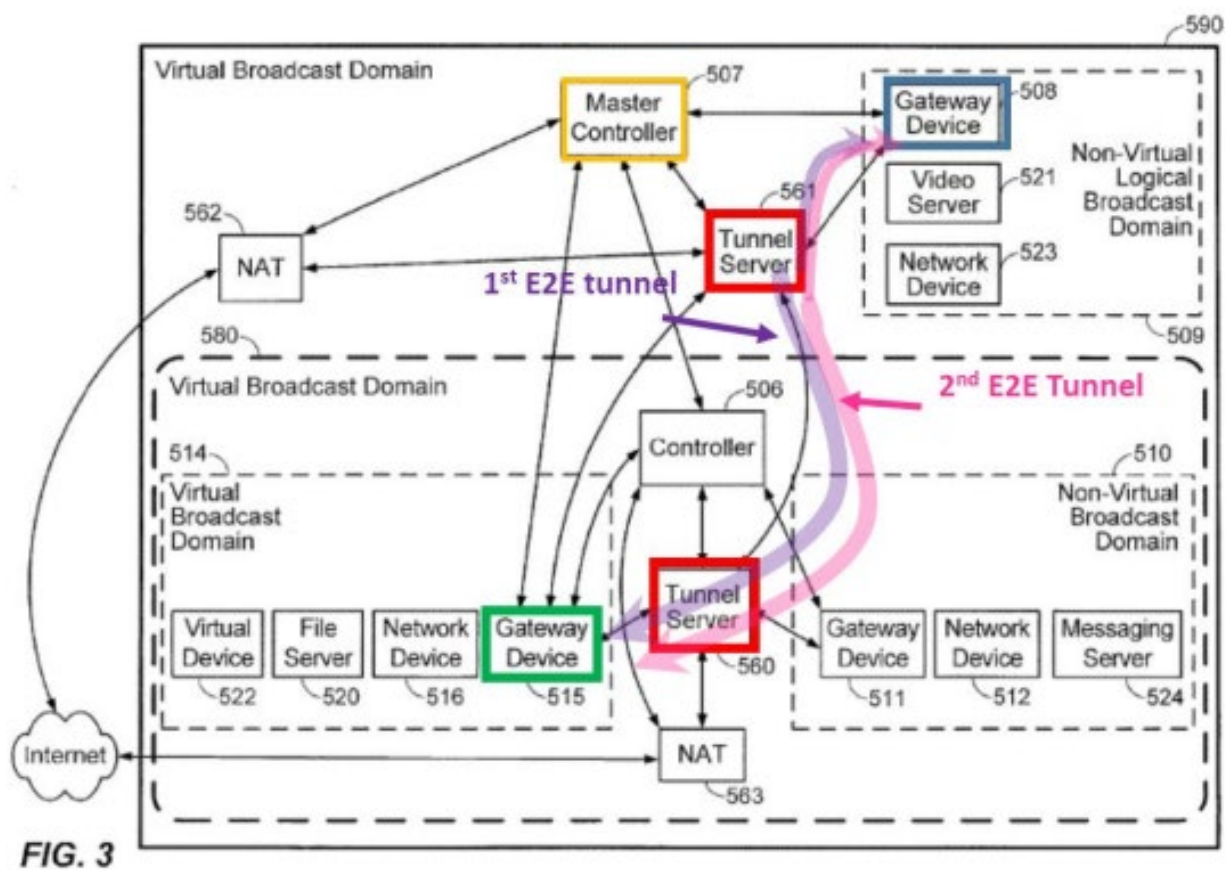
Hankins discloses the system illustrated in FIG. 2 includes a first gateway device 311 (green) and a second gateway device 321 (blue), a plurality of access point servers including tunnel server one (red) and tunnel server two (red) that each

form an end-to-end tunnel (purple and pink) between the devices, and a central server controller 350 (gold) that selects one of the end-to-end tunnels for communication between the devices based upon information the controller 350 receives from at least one of the tunnel servers. Pet. 5 (citing EX-1004 Fig. 2; EX-1003 ¶33).

The Petition provides three examples of how Hawkins discloses the plurality of end-to-end tunnels recited in limitation [1.3]. *First*, with respect to Annotated FIG. 2 above, Hankins shows a first end-to-end tunnel (purple) between gateway 311 and gateway 321 through tunnel server 360, and a second end-to-end tunnel (pink) between gateway 311 and gateway 321 through tunnel server 370. Thus, FIG. 2 discloses tunnel servers 360 and 370 (*a plurality of intermediate access point servers*) that form a first end-to-end tunnel from gateway 311 to gateway 321 through tunnel server 360, and form a second end-to-end tunnel from gateway 311 to gateway 321 through tunnel server 370 (*a plurality of end-to-end tunnels connecting the first and the second devices*). Pet. 32 (citing EX-1004 25:14-33, FIG. 2; EX-1003 ¶86).

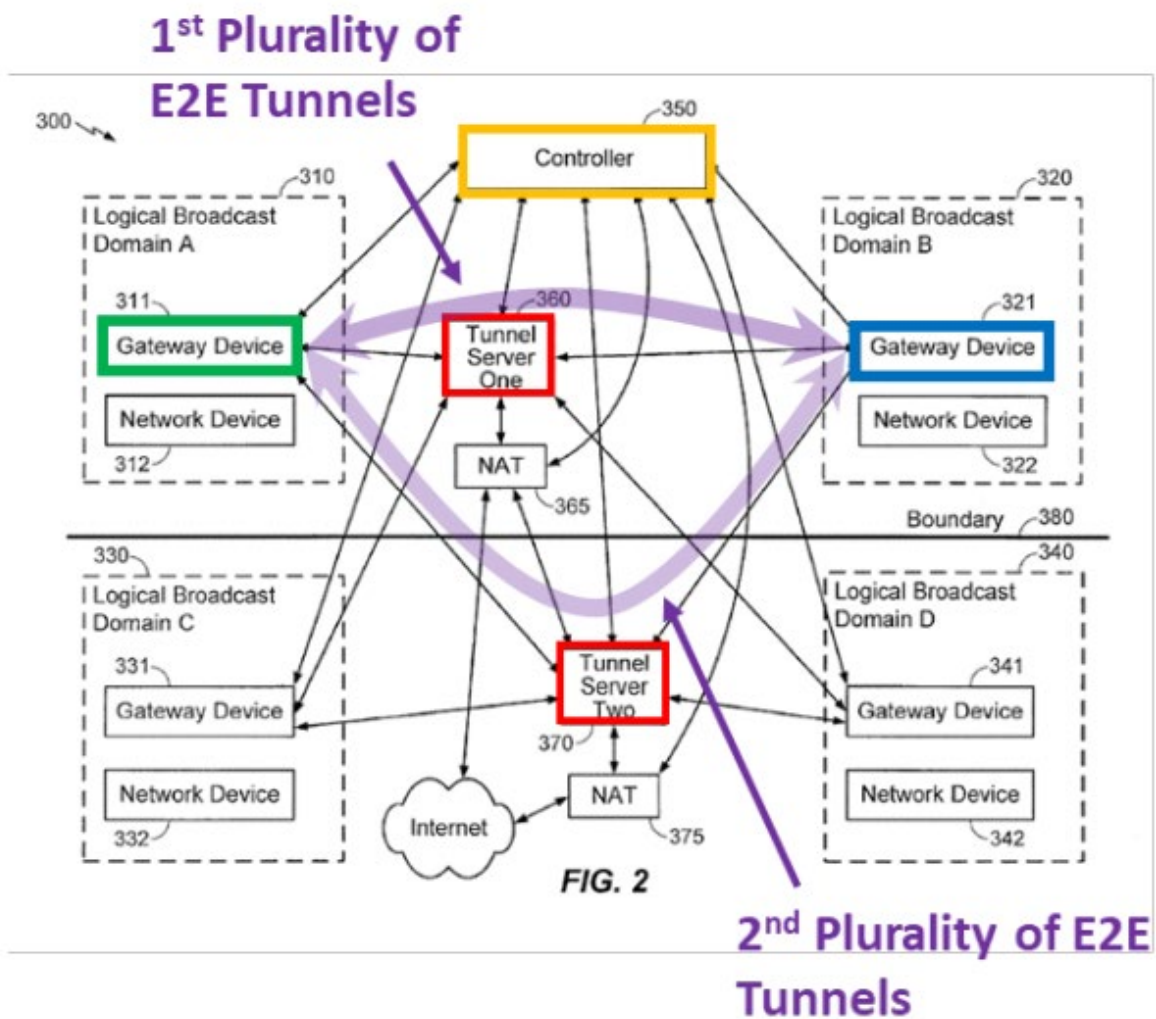
Second, Hankins provides another embodiment in FIG. 3 that discloses a plurality of end-to-end tunnels passing through tunnel servers 560 and 561. In FIG. 3, Hankins illustrates tunnel servers 560, 561 [*a plurality of intermediate access point servers*] that form a plurality of end-to-end tunnels. For example, a first end-

to-end tunnel (purple) connects gateway device 515 (green) [first device] with gateway device 508 (blue) [second device] via tunnel server 561 and 560, and a second end-to-end tunnel (pink) connects gateway device 515 (green) [first device] with gateway device 508 (blue) [second device] via tunnel server 561 and tunnel server 560. Pet. 33 (citing EX-1004 32:47-60, FIG. 3; EX-1003 ¶87.)



Third, Hankins discloses tunnel servers 360 and 370 (red) [a plurality of intermediate access point servers] that form a plurality of paths or channels (purple/pink)[end-to-end tunnels] connecting the gateway device 311 (green) [first device] with the gateway device 321 (blue) [second device] as shown in FIG. 2

below. EX-1003 ¶88. Although FIG. 2 of Hankins shows a single line between the gateway devices and tunnel servers, Hankins describes these devices are logically joined which a POSITA understood would represent multiple tunnel paths between the gateway devices and tunnel servers. EX-1005 7:56-65; 36:18- 27 (“a tunneling protocol may be substantially compliant with ... Multipath Virtual Private Network”). Thus, a POSITA understood that the single line between gateway 311 and gateway 321 through tunnel server 360 represents a first plurality of end-to-end tunnels and likewise, the single line between gateway 311 and gateway 321 through tunnel server 370 represents a second plurality of end-to-end tunnels. Pet. 34-35 (citing EX-1003 ¶90).



EX-1004 FIG. 2.

Just like the '505 Patent, Hankins discloses that the tunnel servers join intermediate tunnels to form a plurality of end-to-end tunnels. Specifically, Hankins discloses that transmitting signal packets via the tunnel server permits signal packet communications between the network devices of the two separate logical broadcast domains to “allow gateway device 515 and gateway device 511

to communicate”, while bypassing use of a routing table and while bypassing network address translation. Ex-1004 31:8-12; Claim 1.

Just like the '505 Patent, Hankins discloses that the tunnel servers [*intermediate access point servers*] may process packets, including a private network policy and an inspection process, which may include virus scanning, filtering, deep packet inspection, and a firewall,

Thus, Hankins discloses a *plurality of end-to-end tunnels* as recited in limitation [1.3].

February 21, 2025

/Patrick D. McPherson/
Patrick D. McPherson, Reg. No. 46,255
505 9th Street, N.W., Suite 1000
Washington, D.C. 20004
P: (202) 776-7800
F: (202) 776-7801
PDMcPherson@duanemorris.com

ATTORNEY FOR PETITIONER

CERTIFICATION OF SERVICE ON PATENT OWNER

Pursuant to 37 C.F.R. §§ 42.6(e), the undersigned certifies that on February 21, a complete and entire copy of Petitioner's Reply to Patent Owner's Response, was served by filing with P-TACTS along with a copy via electronic mail to the Patent Owner's counsel at the following addresses:

jshapiro@devlinlawfirm.com,
jharris@gardellagraces.com,
mdorfman@gardellagraces.com,
ggardella@gardellagraces.com,
tdevlin@devlinlawfirm.com,
jlennon@devlinlawfirm.com

February 21, 2025

By: /Patrick C. Muldoon/
Patrick C. Muldoon
Reg. No. 47,343
Duane Morris LLP
901 New York Ave. NW, Suite 700 E
Washington D.C., 20001
P: (202) 776-7800
F: (202) 776-7801

PCMuldoon@duanemorris.com

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24 et seq., the undersigned certifies that this document complies with the type-volume limitations. This document contains 3656 words as calculated by the “Word Count” feature of Microsoft Word 2010, the word processing program used to create it.

Dated: February 21, 2024

/Patrick C. Muldoon/
Patrick C. Muldoon Reg. No. 47,343
Duane Morris LLP
901 New York Ave. NW Suite 700 E
Washington D.C., 20001
P: (202) 776-7800
F: (202) 776-7801

PCMuldoon@duanemorris.com