

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners,

v.

APEX BEAM TECHNOLOGIES, LLC,

Patent Owner.

Patent No. 10,951,271
Filing Date: June 27, 2019
Issue Date: March 16, 2021

Inventor: Xiaobo Zhang
Title: METHOD AND DEVICE FOR
MULTI-ANTENNA TRANSMISSION IN UE AND BASE STATION

PATENT OWNER'S SUR-REPLY

Case No. IPR2023-00571

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EXHIBIT LIST

Exhibit No.	Description of Document
2001	Defendants' Patent L.R. 3-3 Invalidity Contentions and Subject Matter Ineligibility Contentions, <i>Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al.</i> , Case No. 2:22-cv-00188-JRG, served March 2, 2023
2002	Order Denying Motion to Stay Pending <i>Inter Partes</i> Review, Dkt. 55, <i>Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd., et al.</i> , Case No. 2:22-cv-00188-JRG (E.D. Tex. June 14, 2023)
2003	Redline Comparison of the Declaration of Apostolos Kakaes, Ph.D. (Ex. 1003) to the Petition
2004	Declaration of Miguel Gomez ("Gomez Decl."), dated February 6, 2024 and Exhibit A, Curriculum Vitae of Miguel Gomez
2005	Deposition of Apostolos Kakaes, taken in <i>Samsung Elecs. Co., Ltd. and Samsung Elecs. America, Inc. v. Apex Beam Techs. LLC</i> , IPR2023-00571 and IPR2023-00747, on January 18, 2024 ("Kakaes Depo.")
2006	Excerpts from Steven M. Kaplan, Wiley Electrical and Electronics Engineering Dictionary (2004)

I. INTRODUCTION

The Petitioner's Reply confirms that the authorized grounds suffer from at least two major deficiencies.

First, the Petition fails to show any disclosure in Liu that "K antenna port groups of the base station are used to transmit the first wireless signal," where K is greater than 1. Liu only discloses, and Petitioner only identifies, a single group of antenna ports involved in transmitting any given first wireless signal, (whether or not a group has a single port). On reply, Petitioner fails to rebut this argument. Petitioner instead disputes Patent Owner's proposed construction, and miscasts the argument as relying solely on the construction. It does not. While Patent Owner's construction would clarify the issue (and the errors in Petitioner's interpretation), the plain claim language requires more than one group of antenna ports used to transmit the signal, and Petitioner identifies no such disclosure.

Second, the Petition fails to show that Liu, alone or in view of Park, discloses a "proportional sequence corresponds to a ratio (ratios) among the K1 channel quality values." Petitioner's reading effectively reads any meaning out of the requirement for a "*proportional*" sequence. While Petitioner disputes the proposed construction over the exact number of values in the sequence, it fails to rebut Patent Owner's proposal giving proper meaning to the term "proportional," as recited in the claims.

The Board should issue a Final Written Decision finding the Challenged Claims not unpatentable.

II. CLAIM CONSTRUCTION

A. **“K antenna port groups of the base station are used to transmit the first wireless signal”**

Patent Owner proposes that limitation term be construed to mean “K groups of antenna ports of the base station are used to collectively transmit the first wireless signal.” POR at 11.

As “K is a positive integer greater than 1,” it is beyond dispute that this limitation requires that more than one “groups” (plural) of antenna ports “of the base station are used to transmit the first wireless signal.” ‘271 Patent, Claim 1. The core of the parties’ dispute is therefore whether the multiple groups must be involved in transmitting the first wireless signal (as Patent Owner proposes) or whether only one port group may transmit the first wireless signal (as Petitioner proposes). Petitioner’s proposal effectively reads out the plural “groups” and ignores the requirement that the K (greater than one) antenna port groups must be “used to transmit the first signal.” Given Petitioner’s unsupportable position that only one antenna port group responsible for transmitting the first wireless signal can (somehow) satisfy this limitation, Patent Owner’s construction is necessary to give meaning to the words of the claim and to clarify that the “K groups of antenna ports of the base station” must all be involved in transmitting the first wireless signal.

Petitioner first argues against any construction and critiques references to extrinsic dictionaries. Reply at 2. But it is Petitioner's attempt to read requirements out of the claim term that necessitates this construction to clarify that K (greater than one) antenna port groups must be "used to transmit the first wireless signal" – this cannot be satisfied by only one wireless port group. Petitioner's reference to extrinsic definitions is merely to show that the Petition ignores the plain meaning of those terms, effectively reducing them to a nonce. At least a portion of the parties' dispute turns on the interpretation of this claim term, and it is ripe for construction.

Petitioner next incorrectly argues that Patent Owner's construction contradicts specification embodiments in which a "port group" can include only one port. It does not. The issue is not whether a group can include only one port, but whether the term "groups" (plural) requires more than one group. The Challenged Claims expressly require multiple groups, as shown by the plural use of the term "groups" in the recited claim, and the separate claimed requirement for K groups of antenna ports, where "K is a positive integer greater than 1." Petitioner does not point to any intrinsic record to show that the plural term "groups" can be met by one singular group

Finally, Petitioner argues that the addition of the word "collectively" adds ambiguity to this claim. Petitioner is wrong. The claim clearly requires that "K antenna port groups" (plural) be used to transmit the first wireless signal. This

language requires, on its face, that the multiple (K) groups of antenna ports are used to transmit. If an antenna port group were not used to transmit, then it would neither be “used,” nor would it be one of the “K antenna port groups” recited in the claim. It is Petitioner’s attempt to read the plural “groups” out of the claim that necessitates the added word “collectively” to clarify this requirement. The parties’ dispute is clear, and there is no legitimate misunderstanding over the possible scope of the word “collectively” in the context of this construction. The issue is simply whether or not all of the K antenna port groups must be used to transmit the first wireless signal (as patent owner proposes), or whether an antenna port group that does not participate in transmitting the first wireless signal can (somehow) still be part of the K antenna port groups, as Petitioner argues.

Accordingly, the Board should adopt Patent Owner’s proposed construction and confirm the validity of the Challenged Claims.

B. “proportional sequence corresponds to a ratio (ratios) among the K1 channel quality values”

Patent Owner proposed that this term be construed as “a sequence of K1 proportions, where each of the K1 proportions is a ratio between one channel quality value to itself or to another of the K1 channel quality values.”

On reply, Petitioner primarily argues that the term should not be construed to require “a sequence of K1 proportions.” While Patent Owner disagrees, even if that

were the case, the term should still be construed to require a sequence “where each of the K1 proportions is a ratio between one channel quality value to itself or to another of the K1 channel quality values” to properly give meaning to the claimed *proportional* sequence which “corresponds to a ratio (ratios) among the K1 channel quality values.”

Petitioner’s arguments against this part of the construction rely on certain dependent claims’ recitation that the “first proportional sequence comprises quantized values corresponding to $[K1/K1-1]$ positive real numbers.” Petitioner conclusorily suggests that a “quantized value” is not a ratio, such that it contradicts the proposed construction. It is not. A quantized value merely means that something has a discrete value (such as an integer), as opposed to a continuous range set of possible values, and the ’271 Patent uses quantization consistent with its ordinary meaning. *See* ’271 Patent, 4:44-46, 14:50-53. The fact that a value may be represented as a ratio does not mean that it is not discrete. Nothing about quantization is inconsistent with Patent Owner’s proposed construction requiring that a “proportion” be “a ratio between one channel quality value to itself or to another of the K1 channel quality values.” Indeed, under Petitioner’s argument, claim 1’s recitation of “a ratio” would *already* contradict the dependent claims requirements for quantized value. Plainly, it does not.

While focusing on the manner in which the proportion is represented, Petitioner also misses the point that the claim language's requirement that a proportional sequence be "a ratio (ratios) among the K1 channel quality values" imparts a requirement that the ratio is between one channel quality value to itself or to another of the channel quality values. *See* Response at 16 (citing Ex. 2004, ¶ 34). Petitioner conspicuously fails to advance any plausible interpretation where a "*proportional sequence* corresponds to a ratio (ratios) *among the K1 channel quality values.*" As discussed below at Section III.B, this construction giving meaning to the plain language of the claim is fatal to Petitioner's arguments.

The remainder of Petitioner's Reply amounts to a boilerplate argument that the specification and file history do not require that the claims be construed, and a generalized critique of extrinsic dictionary definitions. Yet Petitioner is misreading this claim term to effectively omit the recited word "proportional" from the claim. Patent Owner's construction is necessary to give this claim term meaning, and the Board itself noted that "the parties have not addressed in detail the meaning of limitation [1d5], including the meaning of the terms 'proportional' and 'corresponds'" and "[w]e invite the parties to construe limitation [1d5] during trial." Paper 10, "Inst." at 23. The claim explicitly recites the word "proportional" and the claim itself supports a construction that gives that word meaning.

Accordingly, even if not limited to “K1 Proportions,” this term should at a minimum be construed to mean “a sequence of proportions, where each of the proportions is a ratio between one channel quality value to itself or to another of the K1 channel quality values.”

III. ARGUMENT

A. Liu Does Not Disclose or Render Obvious “wherein, K antenna port groups of the base station are used to transmit the first wireless signal; the K is a positive integer greater than 1”

Petitioner advances two arguments that Liu discloses this claim term: one based on Liu’s transmitting “signals of the M antenna ports”; and a second based on Liu’s discussion of codebook information. Pet. at 16-17. Petitioner’s arguments fail because Liu does not disclose more than 1 group of antenna ports used to transmit the first wireless signal. Liu instead contemplates a one-to-one port to signal mapping, in which each port is used to transmit its own signal. It does not disclose more than one “antenna port groups of the base station” that are “used to transmit the first wireless signal.

At the outset, Petitioner miscasts Patent Owner’s argument as relying entirely on its claim construction. This is incorrect. While Patent Owner’s construction would clarify the requirements for this claim term, even if the Board finds that this term does not require construction, the term “groupss” requires on its face more than one group, and the claim expressly requires that the number of groups (K) be greater

than one. For “antenna port groups” to be “used to transmit the first wireless signal” they must all be involved in the transmission based on the plain language of the claim – if an antenna port group were not used to transmit at least part of the signal, it would be neither “used” nor one of the “K antenna port groups” recited in the claim. The one-to-one mapping of signals to antenna ports contemplated throughout Liu cannot satisfy this requirement, even if a single antenna port is treated as a group, because there are never **more than one group** of antenna ports “used to transmit the first wireless signal.”

1. Petitioner’s First Argument Fails Because Liu Does Not “antenna port groups” (plural) Used to Transmit the First Wireless Signal

Petitioner’s first argument relies on Liu’s discussion of M antenna ports to transmit a signal to a network device. But as explained in Patent Owner’s Response, Liu discloses only a single antenna port for transmitting each singular signal – *i.e.*, a one-to-one mapping. POR at 20. Petitioner’s own expert confirmed this understanding. *Id.* Liu does not disclose, and Petitioner failed to identify, any scenario where more than one **group** of antenna ports are used to transmit the same first wireless signal.

Petitioner instead conflates antenna ports and antenna port groups in an attempt to rely on the ’271 Patent disclosure that a “group” can include a single antenna. But it does not matter whether a group is one or more antenna in this

context, because Liu does not disclose using multiple groups to transmit the same first wireless signal either way. Liu instead contemplates transmitting *M* wireless signals from *M* ports, as Petitioner's expert confirmed. *See* POR. at 21.

Petitioner also attempts to rely on the new "CSI-RS burst" argument that its expert made during his deposition, while wrongly asserting that the argument was disclosed in the Petition. The Petition's argument regarding this term is less than two pages long, much of which is devoted to its alternative "codebook information" based argument. Pet. at 16-17. The Petition plainly does not mention a "CSI-RS burst." *Id.* Nor does it advance anything resembling the argument that a reference signal could be divided across different *M* antenna ports, let alone identify any such disclosure in Liu.

Because "[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify 'with particularity' the 'evidence that supports the grounds for the challenge to each claim.'" (citing 35 U.S.C. § 312(a)(3)) and that a "reply may only respond to arguments raised in the corresponding opposition or patent owner response," these late identifications, which could have been presented in the Petition and which are not responsive to the Patent Owner's Response, should be rejected by the Board as untimely and improper. *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) ("Once the Board identifies new issues raised

for the first time in reply, neither this court nor the Board must parse the reply brief to determine which, if any, parts of that brief are responsive and which are improper. As the Board noted, ‘it will not attempt to sort proper from improper portions of the reply.’”) The Board should refuse the reply brief as untimely and improper. Patent Owner recognizes that the Board will address whether petitioner’s reply exceeds the proper scope of a reply and that a reply that raises new issues or belatedly introduces new evidence will not be considered. *See Cyanotech Corp. v. The Bd. of Trs. of the Univ. of Ill.*, IPR2013-00401, Paper 44 (P.T.A.B. June 6, 2014); US Patent Trial and Appeal Board, Consolidated Trial Practice Guide 73 (Nov. 2019) (Petitioner “may not submit new evidence or argument in reply that it could have presented earlier [in the petition], *e.g.*, to make out a *prima facie* case of unpatentability.”); *see also Rembrandt Diagnostics, LP v. Alere, Inc.*, 76 F.4th 1376, 1384 (Fed. Cir. 2023) (Petitioner’s Reply must keep “within the confines of 37 C.F.R. § 42.23(b).”).

Apparently recognizing the weakness of its position, Petitioner further looks to support this new argument in the specification of the ’271 Patent itself. Reply at 9-10. But the ’271 Patent specification is not prior art, nor is it properly combinable with Liu. Petitioner’s attempt to map what Dr. Kakaes refers to as CSI-RS burst functionality from certain portions of Liu to the ’271 Patent is not a basis for Petitioner to import other parts of the ’271 specification to fill in for missing disclosure in Liu, as it attempts to do in the Reply. *See* Reply at 9-10. This amounts

to a conclusory argument that a POSITA would already know the entire specification of the challenged patent, based on its expert's assertion that CSI-RS burst functionality (which neither the patent nor references refers to) is present in both. This argument is improper, unsupported, and in any case should be rejected because it is plainly not in the Petition. *See* Pet. at 16-17.

2. Petitioner's Second Argument Similarly Fails Because Liu's Codebook Information is Sent Separately for Each Antenna Port Group

Petitioner's second argument relies on Liu's discussion of codebook sets. This argument fails because, as with Liu's discussion of "M antenna ports" and "M signals," Liu contemplates that codebook information is mapped to antenna ports on a one-to-one basis. Even under its argument that a single antenna port constitutes a group, Petitioner's own argument admits that "a POSITA would have understood describes the base station *transmitting the wireless signal for each of the X (K) antenna port groups* because the *codebook information for each group* corresponds to the matrix that describes the beam pattern transmitted by the base station and received by the UE *for that port group.*" Pet at 17 (emphasis added). *See also* Ex. 2005, 45:19-46:3. Moreover, as explained in Patent Owner's response, Liu's "configuration" of codebook sets for antenna port groups is not even a transmission, but rather a calculation for an SNR based on the configured codebook set. POR at 23-24. Indeed, the Board has already found that Liu's teaching regarding

codebook configuration is “somewhat unclear.” Inst. At 16-17. Liu further contemplates that codebooks are used to conduct random beamforming by *user equipment*, not to transmit a wireless signal anything from the *base station* as claimed.

Petitioner fails to substantively address its own statements regarding Liu’s codebooks to the effect that codebook information is transmitted on a port-by-port basis, not by K antenna port groups. Indeed Petitioner does not appear to take the position that Liu discloses multiple antenna port groups involved in transmitting codebook information, instead arguing that the term “collectively” is too ambiguous as proposed in Patent Owner’s construction. But even without such a construction, the plain language of the claim requires multiple antenna port groups “used” to transmit a signal, which Petitioner has not (and cannot) show.

While Petitioner takes issue with the distinction between Liu’s “configuration” of codebooks and the claimed transmission, it now adopts the position that Petitioner “does not rely on the codebook being the ‘first wireless signal’” instead arguing that they “describe” some other signals. Reply at 14-15. Petitioner’s original argument plainly states that “the codebook information for each group corresponds to the matrix that describes the beam pattern transmitted by the base station,” without identifying the “X transmitted signals” which it attempts to rely on in the Reply. Pet. at 17. This argument should therefore be rejected. But in

any case, Liu does not disclose more than one group of antenna ports used to transmit any information related to a codebook – indeed the sentence of the Petition which Petitioner identifies on reply specifies a beam pattern associated with a single “port group.” Reply at 15.

Petitioner similarly fails to identify any disclosure or argument that Liu’s codebooks, which are involved in beamforming from UE to the base station, are involved in transmitting a signal *from the base station* to UE. See POR at 24. Petitioner instead points to the penumbra of the Petition for “X antenna port groups” (which are not even mentioned with respect to the “wherein, K antenna port groups of the base station are used to transmit the first wireless signal” limitation) and argues, for the first time, that some other previously unidentified signal associated with the codebooks would first be transmitted to the UE. There is not even any evidence that this signal purportedly described by the codebook is the same as the other “first signaling” on which Petitioner now attempts to rely.

Petitioner also fails to substantively address the failure of Liu’s disclosure regarding codebooks to satisfy numerous subsequent limitations, *i.e.* “the first signaling is used by the UE to determine the K antenna port groups transmitting the first wireless signal received by the UE,” and “the K antenna port groups respectively correspond to K channel quality values; the K channel quality values

are K non-negative real numbers; the K channel quality values are Reference Signal Received Powers (RSRPs) or a Signal to Interference plus Noise Ratios (SINRs).”

Accordingly, Liu does not disclose “wherein, K antenna port groups of the base station are used to transmit the first wireless signal; the K is a positive integer greater than 1” and the Challenged Claims should be found valid.

B. The Combination of Liu and Park Does Not Disclose or Render Obvious “a first proportional sequence corresponds to a ratio (ratios) among the $K1$ channel quality values,” as Required by Claim 1

As discussed above, Patent Owner proposed that this term be construed as “a sequence of $K1$ proportions, where each of the $K1$ proportions is a ratio between one channel quality value to itself or to another of the $K1$ channel quality values.” However, even if this term were not construed to require exactly $K1$ proportions in the sequence, (*i.e.* only to require “a sequence of proportions, where each of the proportions is a ratio between one channel quality value to itself or to another of the channel quality values”), Liu in view of Park still does not render it obvious.

Other elements of Claim 1 specify that “the K channel quality values are Reference Signal Received Powers (RSRPs) or a Signal to Interference plus Noise Ratios (SINRs).” As Patent Owner and its expert, Mr. Gomez, explained in the Response, the RSSI on which Petitioner relies for this limitation is neither an RSRP or SINR. POR at 27-28. Liu alone therefore fails to satisfy this claim.

Park does not remedy Liu's deficiencies because Park merely computes each of the differentials between the max(RSRP) and individual RSRPs and if a differential is greater than the threshold, then, and only then, will the UE report such antenna ports. POR at 28. This comparison is not a ratio "between one channel quality value to itself or to another of the channel quality values" as the properly construed claim requires.

Petitioner disputes Patent Owner's claim construction but focuses primarily on whether the number of proportions in a sequence must be K1. Petitioner fails to rebut that Liu's RSSI is not an RSRP or SINR, and fails to rebut that Park's computation of the difference between the max and individual RSRP is neither "a ratio between one channel quality value to itself or to another of the channel quality values" nor even a sequence of proportions.

Claim 1 should further be found valid on this basis.

C. Mr. Gomez is Qualified to Offer Expert Testimony From the Perspective of an Ordinarily Skilled Artisan

Petitioner's arguments attacking Mr. Gomez's qualifications are based on an incorrect heightened standard that "does not meet either party's definition [of a POSITA]." Reply at 23. In fact, the Board explicitly states that "[a] person may not need to be a person of ordinary skill in the art in order to testify as an expert under Rule 702, but rather must be 'qualified in the pertinent art'" and that there is "no

requirement of a perfect match between the expert’s experience and the relevant field.” Patent and Appeal Board Consolidated Trial Practice Guide (“Trial Practice Guide”) (Nov. 2019), at 34 (citing *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1363–64 (Fed. Cir. 2008) and *SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1373 (Fed. Cir. 2010)) (emphasis added).

Petitioner also incorrectly relies on the board’s adoption of its proposed level of ordinary skill in the art, which Patent Owner did not contest *solely for purposes of institution*, as a decision on the merits eliminating the work experience component normally accompanying the level of ordinary skill in the art. Reply at 23. Petitioner relies on this misapprehension to improperly critique Mr. Gomez and ignore his work experience. But as Patent Owner has proposed, and as Petitioner itself has admitted (Pet. at 9), “[a]dditional relevant work experience can compensate for less education.”

Mr. Gomez satisfies Patent Owner’s proposed definition (as well as Petitioner’s proposed definition, despite its lack of clarity). In addition to a Bachelor of Science Degree from Yale University in Electrical Engineering, Mr. Gomez has over “thirty five years of experience in the design and development of hardware and software technology used in telecommunications, data communications, wireless transmission and related protocols.” *See* Ex. 2004, Exhibit A, at 1, 3. Mr. Gomez has considerable experience designing products that utilize the underlying technologies

of Spread Spectrum (802.11a,b,g,n), LTE, OFDM, RF Transmission and reception, which are in turn utilized by LTE and by 5G NR. *Id.* at 2. Specifically, the following work experiences listed in Mr. Gomez's CV are highly pertinent to the field of "telecommunications systems," which Petitioner agrees is the relevant field. Pet. at 13.

Mr. Gomez's work experience began in 1983 at ROLM Corporation where he designed transmission protocols for business telephone equipment. Ex. 2004, Exhibit A, at 6. Later, in 1985, Mr. Gomez was a founding member of Stratacom, Inc. where he designed long haul voice and data routing equipment, and developed compression algorithms for voice communications. *Id.* Mr. Gomez's work at Stratacom also included designing methods to include data on the voice transmission paths that later became known as Frame Relay. *Id.* In 1990, as a consultant, Mr. Gomez worked on circuit design in "computing, telephony and data systems." *Id.* at 5 (emphasis added). At ActSolar, from August 2006 to March 2009, Mr. Gomez was Vice President and tasked with implementing both power conversion circuitry, as well as a radio system, to convey the health status of the solar array to a web server. *Id.* at 3. Petitioner's allegations that Mr. Gomez is not a POSITA in the field of wireless communications are therefore meritless and should be rejected.

As described above, Mr. Gomez not only provides sufficient qualifications in the field of wireless networking but also meets the parties' agreed upon definition of a POSITA. And, Mr. Gomez has previously been recognized as having sufficient qualifications in the field of wireless networking. For example, as an expert, Mr. Gomez has been engaged in several cases relating to OFDM. Between September 2012 and August 2013, in the case of *WiLAN Inc. v. HTC Corp.* (2:11-CV-68-JRG), Mr. Gomez supported WiLAN investigating VHDL, Verilog, C, and C++ source code that implemented OFDM and SC-OFDMA. Ex. 2004, Ex. A at 13-14 (emphasis added). Between May 2009 and March 2011, Mr. Gomez also investigated OFDM implementations used in 802.11a,b,g,n in the case of *WiLAN v. Acer* (2:07-CV-473). *Id.* at 18-19. In this case, Mr. Gomez also supported WiLAN investigating Verilog, C, and C++ source code that implemented OFDM. *Id.* (emphasis added).

Therefore Mr. Gomez easily meets the level of requisite experience for a POSITA. Mr. Gomez also responded to every question posed by Petitioner's counsel at his depositions, and Petitioner cannot point to an instance where Mr. Gomez could not respond for lack of relevant technical experience. *See generally* Ex. 1024.

The Board has broad discretion to assign weight to be accorded expert testimony. Trial Practice Guide at 35 (citing *Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010)). Such broad discretion certainly extends here, where an expert, like

Mr. Gomez, provides “testimony that is helpful to the Board” and is qualified in the pertinent art of wireless networking. *Id.* at 34 (“[T]he absence of an advanced degree in a particular field may not preclude an expert from providing testimony that is helpful to the Board, so long as the expert’s experience provides sufficient qualification in the pertinent art.”).

IV. CONCLUSION

The Board should issue a Final Written Decision finding the Challenged Claims not unpatentable.

Respectfully submitted,

Dated: June 11, 2024

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned APEX BEAM TECHNOLOGIES, LLC'S PATENT OWNER SUR-REPLY specified in 37 C.F.R. § 42.24 has 4,424 words in compliance with the 5,600 word limit set forth in 37 C.F.R. § 42.24. This word count was prepared using Microsoft Word for Office 365.

Respectfully submitted,

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CERTIFICATE OF SERVICE

A copy of the foregoing Patent Owner's Sur-Reply has been served on

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