UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

CM HK, LIMITED,
Patent Owner

IPR2025-01071
Patent 11,698,687

PATENT OWNER'S
PRELIMINARY RESPONSE TO PETITION FOR *INTER PARTES*
REVIEW OF U.S. PATENT 11,698,687

EXHIBIT LIST

Ex. No.	Description
2002	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd. et al.*, Case No. 4:24-cv-06567 at Docket 1 (N.D. Cal. Sep. 18, 2024), Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc.'s Complaint for Declaratory Judgment
2003	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880 at Docket 46 (E.D. Tex. June 26, 2025), Defendants Samsung Electronics Co, Ltd. And Samsung Electronics America, Inc.'s Renewed Motion to Stay Pending Resolution of Any Motion to Dismiss the NDCA Action
2004	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880 at Docket 47 (E.D. Tex. July 9, 2025), Plaintiff CM HK Ltd.'s Opposition to Defendants' Motion to Dismiss, Transfer, or Stay
2005	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 73 (N.D. Cal. May 15, 2025), Order Granting Defendant CM HK, Ltd.'s Motion to Dismiss
2006	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 80 (N.D. Cal. June 10, 2025), Joint Stipulation and Order to Stay All Deadlines in the Scheduling Order
2007	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 72 (N.D. Cal. May 13, 2025), Joint Claim Construction and Prehearing Statement
2008	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880 at Docket 2 (E.D. Tex. November 1, 2024), Plaintiff's Original Complaint for Patent Infringement
2009	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880 at Docket 17 (E.D. Tex. Jan 28, 2025), Plaintiff's Amended Complaint for Patent infringement
2010	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880 at Docket 36 (E.D. Tex. Mar. 3, 2025), Docket Control Order

2011	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880, (E.D. Tex. Jan. 7, 2025), Plaintiff's P.R. 3-1 & 3-2 Disclosures
2012	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.,* Case No. 2:24-cv-00880, (E.D. Tex. Mar. 4, 2025), Defendants Samsung Electronics Co., Ltd and Samsung Electronics America, Inc's Local Patent Rule 3-3 Disclosures
2013	Docket Navigator, "Time to Trial for Judge Rodney Gilstrap" (August 7, 2025)
2014	Docket Navigator, "Time to Trial for Eastern District of Texas," (August 7, 2025)
2015	U.S. Patent Publication No. 2011/0199298, Bassompiere et al.
2016	Email from Bratton, Ariell, RE: *Samsung v. CM HK, Ltd.,* Case No. 4:24-cv-06567 (N.D. Cal.), IPR Threats to Evans, Christopher (May 2, 2025)
2017	March 24, 2025, Director's Memo, *Guidance on USPTO's recission of* "*Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation*", Boalick, Scott R. (August 7, 2025)
2018	Patent Trial and Appeal Board, FAQs for Interim Processes for PTAB Workload Management (accessed August 15, 2025)
2019	*CM HK, Limited, v. Samsung Electronics Co., Ltd., et al.*, Case No. 2:24-cv-00880 at Docket 55 (E.D. Tex. Aug 20, 2025), Order staying the case
2020	U.S. Patent Publication No. 2011/0163950, Ye et al
2021	U.S. Patent Publication No. 2011/0175806, Ye et al
2022	Declaration of Christopher L. Evans
2023	*CyWee Group Ltd. v. Samsung Electronics Co., Ltd., et al.*, Case No. 2:17-cv-00140-RWS-RSP (E.D. Tex. Mar. 21, 2018), Declaration of Dr. Joseph J. LaViola, Jr. Ph.D. in support of CyWee Group Ltd.'s Reply Claim Construction Brief

2024	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 110 (N.D. Cal. Aug. 27, 2025), Samsung's Opposition to CM HK's Rule 11 Motion for Sanctions
2025	*CyWee Group Ltd. v. Samsung Electronics Co., Ltd., et al.*, Case No. 2:17-cv-00140-RWS-RSP at Docket 67 (E.D. Tex. Mar. 9, 2018), Samsung's Responsive Claim Construction Brief
2026	*CyWee Group Ltd. v. Samsung Electronics Co., Ltd., et al.*, Case No. 2:17-cv-00140-RWS-RSP at Docket 67-1 (E.D. Tex. Mar. 9, 2018), Responsive Declaration of M. Ray Mercer, Ph.D.
2027	Andre Cornman & Darren Mei, *Extended Kalman Filtering* (Stanford EE 267, Virtual Reality Course Report, Gordon Wetzstein & Robert Konrad instructors, 2019)
2028	U.S. Patent & Trademark Office, Memorandum from Coke Morgan Stewart, Acting Under Sec'y of Commerce for Intellectual Prop. & Acting Dir. of the U.S. Patent & Trademark Office, to Members of the Patent Trial & Appeal Bd. (July 31, 2025), Enforcement and Non-Waiver of 37 C.F.R. § 42.104(b)(4) and Permissible Uses of General Knowledge in Inter Partes Reviews
2029	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 110 (N.D. Cal. Aug. 27, 2025), Samsung's Opposition to CM HK's Rule 11 Motion for Sanctions
2030	*Samsung Electronics Co., Ltd., et al., v. CM HK, Ltd.,* Case No. 4:24-cv-06567 at Docket 110 (N.D. Cal. Aug. 27, 2025), Samsung's Opposition to CM HK's Rule 11 Motion for Sanctions
2031	*Google LLC v. CyWee Group Ltd.*, IPR2018-01257 (P.T.A.B. Jun. 14, 2018), Declaration of Prof. Majid Sarrafzadeh.

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I. INTRODUCTION

This Petition should be denied. It fails both substantively and procedurally.

First, the Petition never shows that the prior art discloses the claimed progression of quaternion calculations, which includes providing an updated quaternion based on predicted axial accelerations. Although its sole reference—Bassompiere (Ex. 1006)—includes an embodiment that uses a quaternion model, the Petition attempts to shoe-horn another embodiment based on a simplified Euler angle model (yaw is assumed to be zero) and then asserts that it would have been obvious to modify this simplified Euler angle model to use quaternions as claimed. Calling a Euler-based prediction "the same thing" is not disclosure; it is relabeling. In fact, Bassompiere does not describe determining predicted axial accelerations or performing the claimed progression of quaternion calculations in its quaternion embodiment. The Petition fails to present a coherent argument to cure Bassompiere's deficiency.

Second, the Petition attempts to fill those gaps with expert testimony and generic appeals to "motivation to modify." That is not permitted in IPR. Expert say-so cannot supply a missing claim limitation. The Petition points to portions of the expert declaration in which their expert arrives at quaternion equations that yield some of "the exact same formulas" as in the '687 Patent. However, this is not evidence of invalidity of the '687 Patent but rather evidence of impermissible hindsight of the Petitioner. And converting a Euler-angle EKF into a quaternion-based EKF is not a

routine swap—it requires reengineering the filter's state space, propagation equations, and error model.

Third, the Petition dodges claim construction on the very term at the center of the case: "predicted axial accelerations." The specification defines those accelerations as gravitational components along the device's axes derived from the current quaternion. Petitioner relies instead on a Euler-based prediction but never offers a construction of the claim term. That omission precludes a meaningful prior art analysis.

In short, Bassompiere's Euler-angle framework is not the quaternion-based system claimed in the '687 Patent, and expert testimony cannot rewrite it into one. Because the Petition sidesteps claim construction, relies on missing disclosures, and asks the Board to credit expert reconstruction in place of prior art, it does not meet the statutory standard. Institution should be denied.

II. RELEVANT PROCEDURAL BACKGROUND

A. PRIOR CYWEE LITIGATION AND IPRS CONCERNING RELATED PATENTS.

CyWee Group Limited previously accused Samsung of infringing the U.S. Patents 8,441,438 (the "'438 Patent") and 8,552,978 (the "'978 Patent") in a suit filed in February 2017 styled *CyWee Group Ltd. v. Samsung Electronics Co. Ltd., et al*, No. 2:17-cv-00140-WCB-RSP (E.D. Tex.) (the "CyWee Litigation"). The '438

and ’978 Patents are related to U.S. Patent No. 11,698,687 (the “’687 Patent”) at issue here.

CyWee Group, Ltd.[1] also asserted the ’438 and ’978 Patents against Apple, LG, Huawei, HTC, Motorola, Google, and ZTE in the following cases:

> *CyWee Group Ltd. v. Apple Inc., No. 4:14-cv-01853* (N.D. Cal. 4/22/2014)
>
> *CyWee Group Ltd. v. Huawei Technologies Co., Inc. et al, No. 2:17-cv-00495* (E.D. Tex. 6/9/17)
>
> *CyWee Group Ltd. v. LG Electronics, Inc. et al, No. 3:17-cv-01102* (S.D. Cal. 5/31/17)
>
> *CyWee Group Ltd. v. HTC Corporation et al, No. 2:17-cv-00932* (W.D. Wa. 6/16/17)
>
> *CyWee Group Ltd. v. Motorola Mobility LLC, No. 1:17-cv-00780* (D. Del. 6/16/2017)
>
> *CyWee Group Ltd. v. ZTE Corp. et al, No. 3:17-cv-02130* (S.D. Cal. 10/17/17)
>
> *CyWee Group Ltd. v. Google, Inc., No. 1:18-cv-00571* (D. Del. 4/16/2018)

Petitions for *inter partes* review (“IPR”) were filed by nearly all these defendants and were consolidated into three IPRs: IPR2018-01257, IPR2018-01258, and IPR2019-00143. Samsung was granted permission to join IPR2018-01258 and IPR2018-01258. *See* IPR2019-00535, Paper 10; *and* IPR2019-00534, Paper 10.

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[1] CyWee Group, Ltd. is a prior assignee of the portfolio of patents related to the ’687 Patent.

There is also a co-pending IPR2025-01023 for related patent, U.S. Patent No. 10,852,846 (the "'846 Patent").

In the IPRs, all asserted claims of the '438 Patent were found unpatentable:

IPR#	**Patent**	**Unpatentable Claims**	**Reason**
IPR2019-00143	8,441,438	1, 4, 5, 14-17, 19	§103: Yamashita & Bachmann
IPR2018-01258	8,441,438	1, 3-5	§103: Zhang & Bachmann
IPR2018-01257	8,552,978	10, 12	§103: Zhang & Bachmann

The '687 Patent explicitly overcame multiple rejections based on the same art, Bachmann and Yamashita, that was asserted in those IPRs:

Date	**Title of Action**	**Rejections**
12/8/21	Final Rejection	35 USC § 103: Claims 1-28 are unpatentable over **Yamashita** (8,267,785) in view of **Bachmann** (7,089,148)
3/21/22	Final Rejection	35 USC § 103: Claims 1-5, 7-19, 21-28 are unpatentable over **Yamashita** (8,267,785) in view of **Bachmann** (7,089,148)
8/18/22	Final Rejection	35 USC § 103: Claims 1-5, 7-19, 21-28 are unpatentable over **Yamashita** (8,267,785) in view of **Bachmann** (7,089,148) and Zhao (US 2011/0307213).

In addition, U.S. Patent Publication No. 2011/0199298—the "U.S. equivalent of Bassompiere," which is the primary reference at issue here—was listed on an Information Disclosure Statement Submitted by Applicant and considered by the examiner during prosecution. Ex. 1004 at 110, 138; Pet. at 4.

B. THE CALIFORNIA LITIGATION FILED BY PETITIONER.

On September 18, 2024, Samsung filed a complaint for declaratory judgment in the Northern District of California seeking only a declaration that it *does not infringe* claims 1, 14, and 27 of the ’687 Patent, claims 1 and 7 of the ’846 Patent, claims 1 and 13 of U.S. Patent 10,275, 038 (the “’038 Patent”), and claims 1 and 10 of U.S. Patent 10.817,072 (the “’072 Patent”) (the “California Litigation”). Ex. 2002 at ¶¶ 1, 72, 78, 84, 90.

Petitioner deliberately limited its complaint to non-infringement claims to preserve its ability to file this IPR Petition—sidestepping the statutory bar against doing so after challenging validity in court. See 35 U.S.C. § 315(a)(1). This maneuver reflects a calculated effort to manipulate procedure to skirt congressional intent. IPRs were meant to be “quick and cost effective alternatives to litigation,” not tools for procedural gamesmanship. H.R. Rep. No. 112-98, at 48 (2011); S. Rep. No. 110–259, at 20 (2008).

On May 13, 2025, the parties filed their Joint Claim Construction and Prehearing Statement. Ex. 2007.

III. TECHNOLOGY BACKGROUND

A. ORIENTATION TRACKING AND SENSOR FUSION

Modern motion-sensing devices estimate orientation by combining signals from multiple sensors, a process known as sensor fusion. The two primary sensors are accelerometers and gyroscopes.

Accelerometers measure linear acceleration. They are "particularly useful in determining the direction of gravity." Ex. 1002 at ¶ 20. However, "the reading of an accelerometer may be accurate only when the pointing device is static … due to the limitation on known accelerometers that these sensors may not distinguish the gravitational accelerations from the acceleration of the forces including centrifugal forces or other types of additional accelerations imposed or exerted by the user." Ex. 1001 at 3:29-35. Accelerometers are accurate over long periods of time because they do not drift. Ex. 2027 at 1. But their data is noisy and affected by motion. *Id.*

Gyroscopes measure angular velocity. Ex. 1001 at 2:31-33. The '687 Patent shows that by integrating these measurements over time, one can estimate changes in orientation. Ex. 1001 at 17:60-68. In the short term, gyroscopes provide smooth and accurate data. Over time, however, gyroscope integration suffers from drift, causing the orientation estimate to wander. Ex. 2027 at 1.

Because accelerometers are noisy during motion and gyroscopes drift over time, orientation tracking systems combine them using filtering methods (such as Kalman

filters), a teaching of the ’687 Patent that has since been adopted by others. Ex. 2027 at 1. Kalman filters, or extended Kalman filters (EKF) are a framework that can be implemented in many ways. Ex. 2023 at ¶ 26.

B. Euler Angles vs. Quaternions

Orientation can be represented mathematically in several ways. Two of the most common are Euler angles and quaternions.

Euler angles represent orientation as three sequential angles (yaw, pitch, and roll) about three orthogonal axes. Ex. 2027 at 1; Ex. 2031 at ¶ 29. While intuitive, Euler angles are not globally valid. They are subject to *gimbal lock*, where two axes align and a degree of freedom is lost. Ex. 1015 at 47:17-23 (“So Euler angles, for example, go from zero to 360. Zero and 360 are the same value, orientation. So, you know, there’s ambiguity there.”). Moreover, Euler angles do not directly encode how to rotate a vector from one reference frame into another. To perform such a rotation, Euler angles must be converted into a rotation matrix or quaternion.

Quaternions, by contrast, represent orientation as a four-dimensional unit vector. Ex. 1001 at 16:56, Ex. 1002 at 18 n2. Quaternions are comprised of a three-dimensional vector and a scale of value to represent an axis and angle. Ex. 1015 at 45:21-46:3. Quaternions avoid gimbal lock and can be updated efficiently through quaternion multiplication. Ex. 1015 at 45:23-48:23. Most importantly, a quaternion directly encodes a rotation operator: any vector can be rotated into another frame by

applying the quaternion algebraically. Ex. 1002 at 18 n.2 ("quaternions … have the unique property of maintaining rotational relationships with relatively limited computational complexity"); Ex. 1015 at 49:3-7; Ex. 2031 at ¶¶ 30-31. This makes quaternions the preferred representation for real-time recursive filters and for computing derived values, such as predicted gravitational accelerations.

The difference between Euler angles and quaternions is material, not trivial. Euler angles represent orientation as a sequence of three rotations, but this mathematical formulation suffers from singularities—points where the mapping from orientation to roll, pitch, and yaw breaks down. At a singularity, two axes align, and the system loses a degree of freedom, meaning multiple different sets of Euler angles correspond to the same physical orientation. Ex. 1015 at 45:23-48:23. The practical manifestation of this problem is known as gimbal lock: when the rotational axes collapse, the system can no longer distinguish rotations around them, producing instability or ambiguity in orientation tracking. By contrast, quaternions represent orientation in four dimensions and never suffer from singularities or gimbal lock, which makes them both numerically stable and computationally efficient for continuous, real-time sensor fusion. *Id.* But, "[w]hile implementing orientation tracking using quaternions provides advantages like avoiding gimbal lock, it is significantly more complex than the Kalman filter Euler angles." Ex. 2027 at 1.

In sum, Euler angles and quaternions are not two labels for the same thing — they are different mathematical building blocks for describing orientation. Euler angles rely on sequential trigonometric rotations, which can become unstable at certain positions. Quaternions use four-component algebra that avoids those breakdowns. As a result, converting from Euler-angles to quaternions is not like swapping out the tires on a car; it's like switching from driving a car to piloting an airplane. Both are vehicles, and both get you from one place to another, but the controls, the instruments, and even the physics you rely on are completely different. You don't "convert" a car into a plane — you design a plane from the ground up to handle a different environment. In the same way, an extended Kalman filter built on Euler angles cannot simply be adapted to use quaternions. The state variables, the prediction equations, and the error models all change, so the filter must be entirely re-engineered — from how it propagates motion, to how it compares measurements, to how it models errors.

This complexity is demonstrated by the 18 pages Dr. Sarrafzadeh spends explaining how a POSITA "would move between Euler angle quaternions representations of variables in the EKF and related equations using known relationships between Euler angles and quaternions." *See* Ex. 1002 at ¶¶ 48, 55-85.

Finally, Petitioner acknowledges that EKFs using Euler angles and quaternions would be separate inventions when they argued that the '687 Patent cannot claim

priority to its provisional because the "provisional '558 application makes no mention of, and presents no equations using, quaternions." Pet. at 68. Patent owner does not disagree on this point and is not alleging that it is entitled to a filing date of the provisional '558 application; rather, the Patent Owner is entitled to a filing date for the earliest disclosure in the family that discloses quaternions.

C. BASSOMPIERE (EX. 1006).

Bassompiere (Ex. 1006) describes a handheld pointer whose movement is rendered on a display. Bassompiere uses an accelerometer and gyroscope to estimate the pointers orientation. Pet. at 16. Bassompiere describes different embodiments which utilize different approaches. In the primary embodiment described in Bassompiere, which is also the primary embodiment relied upon in the Petition, the state vector (x) is represented as a vector including pitch and roll angles: "$x=[\theta\ \psi]$" with the yaw angle φ set to zero. Ex. 1006 at 19:5-12.

Although Bassompiere briefly mentions that quaternions could be used "to avoid computations of sines and cosines" it does not explain how an extended Kalman filter would implement quaternions. Ex. 1006 at 20:10-21:7. Equations 25-27 of Bassompiere represent the quaternion embodiment. Ex. 1006 at 22:10-23:7. Bassompiere's detailed equations, including its definition of the state vector, the prediction step, and the measurement model, are expressed in terms of Euler angles. *See generally* Ex. 1006; Pet. at 33 ("As shown in equation 21 above, the state vectors

… include the pitch and roll angles in Euler angle form."); Ex. 1002 at ¶ 48. The reference provides no quaternion update formula, and no quaternion error model. *See generally* Ex. 1006. In other words, Bassompiere identifies quaternions as a theoretical alternative but never teaches how to use them in its EKF framework.

D. THE '687 PATENT.

The '687 Patent takes a different approach from Bassompiere. It describes an electronic device (claims 1-13, 27) and a method (claims 14-26, 28) which perform a progression of calculations using quaternions:

> 1. An electronic device subject to movements and rotations in a spatial reference frame, comprising:
>
> a motion sensor module having sensor circuitry configured to generate measured angular velocities and measured axial accelerations; and
>
> a computing processor having processor circuitry configured to calculate a resulting deviation associated with the movements and the rotations of the electronic device in the spatial reference frame by performing the following in sequence:
>
> providing a **previous quaternion** corresponding to time T−1 based on the measured axial accelerations corresponding to time T−1 and the measured angular velocities corresponding to time T−1, without using the measured angular velocities corresponding to time T;
>
> converting measured angular velocities corresponding to time T, based on the previous quaternion, into a **current quaternion** corresponding to time T, without using measured axial accelerations corresponding to time T;

converting variables of the current quaternion into **predicted axial accelerations** corresponding to time T, which is associated with the pitch and roll angles of the electronic device and without being associated with the yaw angle of the electronic device;

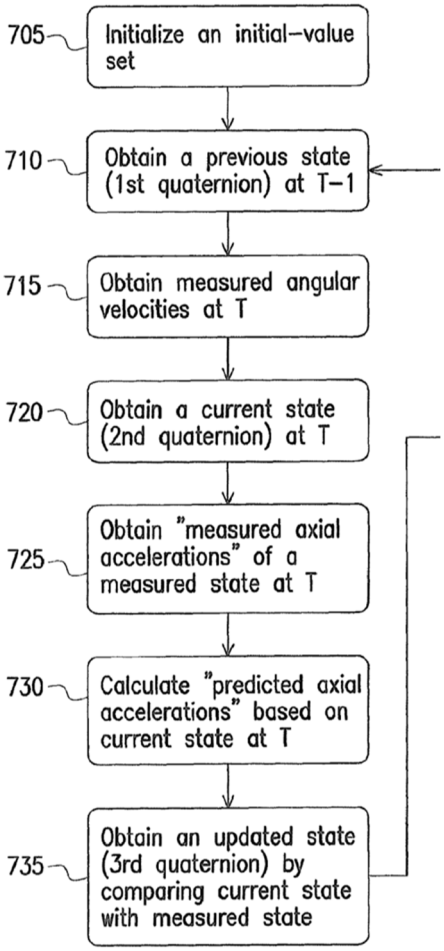
comparing the **predicted axial accelerations** with the measured axial accelerations corresponding to time T to obtain a first comparison result;

obtaining an **updated quaternion** associated with time T based on the current quaternion and the first comparison result;

using the updated quaternion as a next occurrence of the previous quaternion; and

providing the resulting deviation based on the updated quaternion;

wherein the processor circuitry is further configured to provide content based on the resulting deviation in the spatial reference frame.



The sensor fusion method described in claim 1 is shown in Figures 7, 8, 10, 11, 12. It starts with the previous quaternion from t-1 (**710** - first quaternion) and used in conjunction with measured angular velocities (**715**) and the differential equation described in Equation 1 to compute a current quaternion at time t (**720** - second quaternion). Ex. 1001 at 16:20-56. The current quaternion is used to compute the predicted axial accelerations (**730**) with Equations 2-4. *Id.* at 17:12-18. Then the current quaternion (second quaternion), the predicted axial accelerations, and the measured axial accelerations are used to compute an updated quaternion (**735** - third quaternion) using Equations 5-11. *Id.* at 17:38-18:4.

By comparing the predicted axial accelerations (gravitational accelerations along devices axis) from the current quaternion to the measured axial accelerations, the ’687 Patent can distinguish gravity from non-gravity (i.e. motion) axial accelerations.

This ability is inherent to quaternions. Because a quaternion directly encodes a rotation operator, it can be applied to the known gravity vector to predict what gravity should look like in the device's frame.

IV. FILING DATE

Petitioner alleges that the '687 Patent is not entitled to the January 6, 2010 filing date of the '558 provisional application at least because the "provisional '558 application makes no mention of, and presents no equations using quaternions." Pet. at 71. Patent Owner does not claim priority to the '558 provisional application but rather claims priority to the earliest priority application that expressly presents equations using quaternions, U.S. App. No. 12/943,934 filed Nov. 11, 2010.

V. CLAIM CONSTRUCTIONS

Petitioner only construes one term, spatial reference frame, in the Petition, even though the parties have identified seven disputed terms in the Joint Claim Construction and Prehearing Statement filed in the California Litigation that was filed before this Petition. Ex. 2007. Worse, Samsung identified "predicted axial accelerations" to be dispositive of infringement in its complaint in the California Litigation but did not construe that term here.

A. "SPATIAL REFERENCE FRAME"

Petitioner's Proposed Construction	Patent Owner's Proposed Construction
reference frame associated with **a 3D pointing device**, which always has its origin at the same point in the device and in which the axes are always fixed with respect to the device	frame of reference associated with **the electronic device**, which always has its origin at the same point in the device and in which the axes are always fixed with respect to the device

The parties largely agree on the construction of this term, with the only dispute being whether it should be "a 3D pointing device," as Samsung contends, or "the electronic device" as stated in the claim.

Samsung's proposed construction is incorrect because it reads in new, unsupported limitations. Samsung argues that the Board construed the term "spatial reference frame" in a prior IPR concerning the related '978 Patent to mean "reference frame associated with **the 3D pointing device**, which always has its origin at the same point in the device and in which the axes are always fixed with respect to the device." Pet. at 23. But Samsung acknowledges that claims 1, 7, and 14 of the '687 Patent "do not recite the term '3D pointing device,'" so the construction "should be modified to recite 'a' 3D pointing devices as opposed to 'the' 3D pointing device." Pet. at 23. It would be improper to import a "3D pointing device" limitation into the claims since they do not otherwise require one. *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1326 (Fed. Cir. 2012); *See, e.g., Hoganas AB v. Dresser Indus., Inc.,* 9 F.3d 948, 950 (Fed. Cir.

1993) ("It is improper for a court to add extraneous limitations to a claim, that is limitations added wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claim.").

The reason the Board and the parties previously construed this term to require a 3D pointing device is because that is what the claims of the '978 Patent required:

> 1. **A 3D pointing device**, comprising:
>
> an orientation sensor, generating an orientation output associated with an orientation of the 3D pointing device associated with three coordinate axes of a global reference frame associated with Earth;
>
> a rotation sensor, generating a rotation output associated with a rotation of **the 3D pointing device associated with three coordinate axes of a spatial reference frame associated with the 3D pointing device**; and
>
> a first computing processor, using the orientation output and the rotation output to generate a transformed output associated with a fixed reference frame associated with a display device,
>
> wherein the orientation sensor comprises:
>
> an accelerometer, generating a first signal set comprising axial accelerations associated with movements and rotations of **the 3D pointing device in the spatial reference frame**;
>
> …

Ex. 1010 at 35:40-58. The '978 Patent requires "a spatial reference frame associated with the 3D pointing device." *Id.* That is why the Board construed "spatial reference frame" to be associated with a "3D pointing device" in the '978 Patent.

By contrast, the claims of the ’687 Patent are tracking the “movements and the rotations of **the electronic device** in the spatial reference frame,” not a 3D pointing device:

> 1. **<u>An electronic device</u>** subject to movements and rotations in a spatial reference frame, comprising:
>
> a motion sensor module having sensor circuitry configured to generate measured angular velocities and measured axial accelerations; and
>
> a computing processor having processor circuitry configured to calculate a resulting deviation associated with the movements and the rotations of **<u>the electronic device</u> in the spatial reference frame** by performing the following in sequence:
>
> …

Ex. 1001 at 31:15-26, 32:59-68. The claims do not mention a 3D pointing device, so it would be improper to import this limitation. *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1326 (Fed. Cir. 2012).

Accordingly, the Board should construe “spatial reference frame” to mean “frame of reference associated with **<u>the electronic device</u>**, which always has its origin at the same point in the device and in which the axes are always fixed with respect to the device.”

B. "PREDICTED AXIAL ACCELERATIONS"

Petitioner's Proposed Construction	Patent Owner's Proposed Construction
No construction provided in Petition. "Plain and ordinary meaning" in California Litigation.	"Gravitational acceleration along the electronic device's axes derived from the current quaternion"

The claims and specification consistently define "predicted axial accelerations" as gravitational accelerations along the device's axes at time T, derived from the current quaternion:

> converting variables of the current quaternion into **predicted axial accelerations** corresponding to time T, which is associated with the pitch and roll angles of the electronic device and without being associated with the yaw angle of the electronic device;
>
> comparing the **predicted axial accelerations** with the measured axial accelerations corresponding to time T to obtain a first comparison result;

Ex. 1001, Claim 1 (emphasis added).

> In other words, two sets of axial accelerations may be obtained for the measured state of the nine-axis motion sensor module; one may be the measured axial accelerations Ax, Ay, Az in step **725** and the other may be the **predicted axial accelerations Ax′, Ay′, Az′ in step 730 calculated based on the abovementioned current state or second quaternion in relation to the measured angular velocities thereof**. Furthermore, in one embodiment, the computing processor may **use a data conversion utility to convert quaternion into the predicted axial accelerations Ax′, Ay′ and Az′.** This data conversion utility may be a software program represented by the following equations (2), (3) and (4). Id. at 17:18-30.
>
> In other words, in one embodiment as shown in step 735, it is preferable to compare the second quaternion in relation to the

> measured angular velocities of the current state at present time T with the measured axial accelerations Ax, Ay, Az as well as the **predicted axial accelerations Ax', Ay', Az' also at present time T.** Id. at 17:45-52 (emphasis added).

And because "predicted axial accelerations" are computed from the current quaternion they *only contain* gravitational accelerations along the device's axes:

> Since the predicted axial acceleration is derived from the second quaternion, and a person of ordinary skill in the art would understand that the second quaternion is normalized so that it represents orientation, then the predicted axial accelerations would represent and **only represent axial accelerations that would stem from gravity** (since gravitational acceleration is used to determine orientation). There would be no linear or centrifugal acceleration components as part of the predicted axial acceleration.

Ex. 2023: Declaration of Dr. LaViola at ¶ 23 (emphasis added). This is what enables the system to decouple non-gravitational accelerations (i.e., "undesirable axial accelerations") from gravity in the accelerometer data:

> In a preferred embodiment of the present invention, said undesirable external interferences may further comprise or refer to **undesirable axial accelerations caused by undesirable external forces other than a force of gravity**; in another preferred embodiment, said undesirable external interferences may further comprise or refer to undesirable magnetism caused by undesirable electromagnetic fields. In other words, the method and algorithm provided by the present invention may preferably generate or provide an output of the resultant deviation of the nine-axis motion sensor module **excluding the abovementioned undesirable interferences**. In one example, external forces exerted to cause axial accelerations of a nine-axis motion sensor of an electronic device of the present invention **may be decoupled or separated from a force of gravity**… '687 Patent, 18:48-62.

In the California Case, Samsung proposed to construe this term to have its "plain and ordinary meaning." Ex. 2007 at 3. But the "plain and ordinary meaning" is inadequate "when reliance on a term's 'ordinary' meaning does not resolve the parties' dispute." *Hybrid Audio, LLC v. Asus Computer Int'l Inc.*, No. 3:17-CV-05947-JD, 2022 WL 3348594, at *3 (N.D. Cal. Aug. 12, 2022) (citing *O2 Micro Int'l, Ltd. v. Beyond Innovation Tech. Co., Ltd.*, 521 F.3d 1351, 1361 (Fed. Cir. 2008)).

Accordingly, the Board should construe "predicted axial accelerations" to mean "gravitational acceleration along the electronic device's axes derived from the current quaternion."

VI. PETITION FAILS TO CONSTRUE KEY CLAIM TERMS.

The Petition is procedurally deficient because it fails to construe the challenged claims as required by PTAB rules. Failure to construe claim terms violates 37 C.F.R. § 42.104(b)(3), which requires that a petition must include "a statement of how the challenged claim is to be construed." This is not optional. A petitioner must explain how each challenged claim should be interpreted so that the Board can evaluate whether the prior art teaches the claimed features. The Board has denied institution when the petitioner fails to provide its own claim constructions. *Carefusion Corp. v. Baxter Int'l, Inc.*, No. 5,782,805, 2017 WL 506561, at *2 (P.T.A.B. Feb. 6, 2017) (denying institution because "Petitioner has failed to provide a sufficient statement

of how the challenged claims are to be construed as required by 37 C.F.R. § 42.104(b)(3)"). And the Federal Circuit has been clear that "plain and ordinary meaning" is not an adequate construction "when a term has more than one 'ordinary' meaning or when reliance on a term's 'ordinary' meaning does not resolve the parties' dispute." *NobelBiz, Inc. v. Glob. Connect, L.L.C.*, 701 F. App'x 994, 997 (Fed. Cir. 2017) (citing *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1361 (Fed. Cir. 2008)).

Here, Samsung construes only one term — spatial reference frame"— and offers no construction for any other limitation, including the term "predicted axial accelerations." Pet. at 22-25. That omission is not a minor oversight. Petitioner put the scope of "predicted axial accelerations" at the heart of the case when it alleged its devices do not infringe claims 1, 14, and 27 of the '687 Patent because they are not "obtaining a quaternion by *predicting axial accelerations*; comparing *predicted axial accelerations* with measured axial accelerations; and using *predicted axial accelerations* converted form measured angular velocities." Ex. 2002 at ¶ 88.

Additionally, Petitioner has taken inconsistent and shifting positions on the meaning of the term "predicted axial accelerations." Originally, Samsung argued that the term "predicted axial accelerations" was indefinite in claim construction briefs filed in the CyWee Case:

As discussed above, it is undisputed that a POSA would understand that the term "axial accelerations" could have multiple different interpretations. LaViola Decl. ¶ 29; Mercer Decl. ¶¶ 70–74. This ambiguity is compounded in Claims 14 and 19, which in addition recite "**predicted** axial accelerations." As with measured axial accelerations, a POSA would not have known whether the predicted axial accelerations are: (i) linear accelerations; (ii) centrifugal accelerations; (iii) gravitational accelerations; or (iv) a combination from among the three. Mercer Decl. ¶¶ 164–65.

"Predicted Axial Acceleration" Ambiguities

164. A POSA would have understood that the term "predicted axial accelerations" could have multiple possible interpretations for the same reasons that "axial accelerations" can have multiple possible interpretations. (Described above in ¶¶ 70–74.)

165. Specifically, a POSA would not have known whether "predicted axial accelerations" were a prediction of: (i) linear accelerations; (ii) centrifugal accelerations; (iii) gravitational accelerations; or (iv) some combination of the three.

Ex. 2025 at 13; Ex. 2026 at ¶¶ 164-165. Just before filing this Petition, Petitioner construed "predicted axial acceleration" to have its "plain and ordinary meaning," while also refusing to articulate it. Ex. 2007 at 3; Ex. 2024 at 4-7 (refusing to elaborate on plain meaning). This refusal to disclose its understanding of the meaning of this term is the subject of a pending Rule 11 Motion for Sanctions filed by Patent Owner in the California Case. Ex. 2029, 2024, 2030. Continuing this pattern of obfuscation, the Petition offers no construction for "predicted axial accelerations." Pet. at 22-25.

This pattern of evasive claim construction underscores the defect. As the Federal Circuit has held, "plain and ordinary meaning" is not a construction when it leaves the parties' dispute unresolved. *NobelBiz, Inc. v. Glob. Connect, L.L.C.*, 701 F. App'x 994, 997 (Fed. Cir. 2017). When the scope of a central claim limitation is actively disputed, the Petition cannot sidestep the issue.

By failing to construe any term other than "spatial reference frame," Samsung has deprived the Board of the framework it needs to evaluate the prior art. This failure is deliberate. In the California Case, CM HK has already sought Rule 11 sanctions because Samsung's refusal to articulate a construction for "predicted axial accelerations" is objectively unreasonable. The same refusal infects this IPR. Because the Petition does not construe *"predicted axial accelerations"*—a limitation central to every challenged claim.

Samsung avoids construing "predicted axial accelerations" so it can point to Bassompiere's "a priori estimate of pitch and roll" as meeting that limitation. Pet. at 17–18, 32–34; Ex. 1002 ¶¶ 50–56. But that argument only works if "predicted axial accelerations" is improperly construed to include Euler orientation angles because as, the Petition acknowledges, Bassompiere's estimate is computed using Euler angles. Pet. at 36–38. But when properly construed, "predicted axial accelerations" is derived from "the current quaternion"—not pitch and roll. *Supra* § V(B). If "predicted axial accelerations" is given its proper meaning, consistent with the

specification, Bassompiere's pitch/roll estimates cannot satisfy the limitations requiring quaternions. Samsung's conflation of Euler angles with quaternions is exactly why the Board cannot accept silence on claim construction.

Therefore, the Petition must be denied under § 42.104(b)(3) and the Board's precedent.

VII. PETITIONER PROVIDES INCONSISTENT POSITIONS ON POSA.

Samsung's expert, Dr. Sarrafzadeh, has taken inconsistent positions on the definition of a person of ordinary skill in the art ("POSA"), and his revised definition in this case appears crafted to suit Petitioner's obviousness theory rather than to reflect the actual state of the art. Inconsistent positions on POSA undermine the Petition.

In prior proceedings involving the related '438 and '978 Patents, Dr. Sarrafzadeh testified that a POSA "had at least a Bachelor's Degree in Computer Science, Electrical Engineering, Mechanical Engineering, or Physics, or equivalent work experience, along with knowledge of sensors (such as accelerometers, gyroscopes and magnetometers), and mobile computing technologies." Ex. 2031 ¶ 24. Notably, his definition did not require two years of work experience or any specialized knowledge of "Kalman filters, quaternion mathematics, or sensor fusion algorithms."

In this proceeding, however, Dr. Sarrafzadeh now asserts that a POSA would have "an undergraduate degree in electrical engineering, computer engineering, computer science, physics or a related field along with two years of work experience in the field of sensors (such as accelerometers, gyroscopes and magnetometers), sensor fusion algorithms, including Kalman Filters, quaternion mathematics, and mobile computing technologies." Ex. 1002 ¶ 17. This sudden expansion of the skill set—particularly the insertion of quaternion mathematics—aligns neatly with Petitioner's obviousness theory, which depends on treating Euler angles and quaternion-based accelerations as easily interchangeable. *See* Pet. at 34 ("Thus, a POSA would have been motivated to modify equation 21 to include quaternions instead of Euler angles."); Ex. 1002 at ¶¶ 48, 55-85 (explaining "how a person or skill in the art would move between Euler angle and quaternions representations of variables in the EKF and related equations using known relationships between Euler angles and quaternions").

Petitioner offers no evidence to support this heightened definition beyond Dr. Sarrafzadeh's own conclusory say-so. Ex. 1002 at ¶ 17. And the Federal Circuit has repeatedly held that "conclusory expert testimony is inadequate to support an obviousness determination." *See TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1358-59 (Fed. Cir. 2019) ("[C]onclusory expert testimony is inadequate to support

an obviousness determination."). Dr. Sarrafzadeh's testimony here contradicts his prior sworn opinions, undermining his credibility.

The Federal Circuit has emphasized that the level of ordinary skill is a fact question guided by objective factors, not an expert's litigation-driven preference. *See Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007); *Best Med. Int'l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022). Petitioner has provided no factual support that, in late 2009–2010, an average practitioner had quaternion mathematics and sensor-fusion EKF design as baseline skills.

Thus, the Board should reject Petitioner's attempt to inflate the level of ordinary skill.

VIII. GROUND 1 FAILS BECAUSE PETITIONER DOES NOT SHOW CLAIMED CALCULATIONS BASED ON AXIAL ACCELERATIONS AND QUATERNIONS

Petitioner's Ground 1 alleges claims 1-7, 12, 14, and 25 are obvious under pre-AIA U.S.C. § 103(a) based on Exhibit 1006, an English language translation of WO2009/0156499 to Bassompiere ("Bassompiere"). Pet. at 3. The U.S. National Stage entry of Bassompiere was considered during prosecution of the '687 Patent. Pet. at 4; Ex. 1004 at 138 (US2011/0199298).

Claims 1-7, 12, 14, and 25 each include calculation steps involving progressive calculations of quaternions starting with a "previous quaternion," then determining a "current quaternion," and finally an "updated quaternion." "[P]redicted axial

accelerations" are also calculated, and the "updated quaternion" is based on a the "current quaternion" and a "comparison result" between the "predicted axial acceleration" and "measured axial accelerations." Ground 1 relies on Bassompiere (Ex. 1006) to meet the claim elements concerning **quaternions** and **predicted axial accelerations**. Pet. at 25–68.

Bassompiere describes different embodiments which utilize different approaches. In the primary embodiment described in Bassompiere, which is also the primary embodiment relied upon in the Petition, the state vector (x) is represented as a vector including pitch and roll angles: "x=[θ ψ]" with the yaw angle φ set to zero. Ex. 1006 at 19:5-12. The Petition admits that Bassompiere includes an embodiment which utilizes quaternions (e.g., reference to Bassompiere eq. 26). Pet. at 35, 37, and 47.

Rather than referring to the embodiment of Bassompiere which describes quaternion, the Petition extensively relies on the simplified Euler angle embodiment. Pet. pgs. 32-68.

To meet the "previous quaternion" requirement, Petitioner points to Bassompiere's state vector at time k–1. Pet. at 32-33. But Petitioner concedes that Bassompiere's state vectors "include the pitch and roll angles in Euler angle form." Pet. at 33. Euler angles are not quaternions. Petitioner then argues that "a POSA would have been motivated to modify equation 21 to include quaternions instead of

Euler angles." *Id.* (citing Ex. 1002 ¶¶ 55–56). That argument highlights the deficiency: expert testimony cannot supply a missing limitation. See 35 U.S.C. § 311(b); Ex. 2028. And switching from Euler angles to quaternions is not a routine substitution but requires the reengineering of the EKF.

The Petition also repeatedly conflates aspects of the simplified Euler angle and quaternion embodiments of Bassompiere. For instance, when attempting to allege that Bassompiere discloses a "current quaternion" as recited in the claims, the Petition incorrectly states, "A POSA would have understood that equation 26 is a quaternion form representation of equation 21." Pet. at 35 (citing Ex. 1002 at ¶ 68). Equations 21 and 26 of Bassompiere are reproduced below. Ex. 1006 19:3, 22:21.

$$\hat{x}_k^- = \begin{pmatrix} \hat{\theta}_k^- \\ \hat{\psi}_k^- \end{pmatrix} = \begin{pmatrix} \hat{\theta}_{k-1} \\ \hat{\psi}_{k-1} \end{pmatrix} + T_e \cdot \begin{pmatrix} \alpha \cdot \sqrt{\omega_Y^2 + \omega_Z^2} \\ \omega_x \end{pmatrix} \qquad \text{Eq. 21}$$

$$\dot{q} = \frac{1}{2} \cdot \begin{vmatrix} q_0 \\ q_1 \\ q_2 \\ q_3 \end{vmatrix} \otimes \begin{vmatrix} 0 \\ \omega_X \\ \omega_Y \\ \omega_Z \end{vmatrix} \qquad \text{Eq. 26}$$

However, equations 21 and 26 are clearly not equivalent. As discussed in their own expert declaration, $\dot{q}$ "is the time derivative of the quaternion." Ex. 1002 at ¶ 66. Whereas, $\hat{x}_{\bar{k}}$ is "a priori estimation of the state vector by numerical integration of the chosen dynamic model." Ex. 1006 at 19:1-2. Neither the Petition nor the expert declaration explain how a "time derivative" is equivalent to an "estimation" of a

"state vector." The Petition therefore does not provide a coherent argument that Bassompiere discloses a "current quaternion" as recited in the claims. Seeing equivalency where there is none is a hallmark of hindsight bias. *See InTouch Technologies, Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014) ("It appears that [the expert] relied on the ... patent itself as her roadmap for putting what she referred to as pieces of a jigsaw puzzle' together.").

With respect to "predicted axial acceleration" as recited in the claims, the Petition relies exclusively on the simplified Euler angle embodiment of Bassompiere without pointing to a corresponding counterpart in the quaternion embodiment of Bassompiere. Pet. at 38-44. Instead, the Petition relies on their expert, Dr. Sarrafzadeh to arrive at an equation that they allege is the "would yield the exact same formulas as Equations 2 through 4 in the challenged '687 Patent." Pet. at 41. Reshaping the prior art reference to fit the solution provided in the challenged patent is another hallmark of hindsight bias. *See Insite Vision Inc. v. Sandoz, Inc.*, 783 F.3d 853, 859 (Fed. Cir. 2015) ("Defining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness.").

With respect to the "updated quaternion" as recited in the claims, the Petition relies exclusively on the simplified Euler angle embodiment of Bassompiere without pointing to a corresponding counterpart in the quaternion embodiment. Pet. at 44-51. Instead, the Petition relies on an equation created by their expert, Dr.

Sarrafzadeh, which appears nowhere in Bassompiere and includes several variables ($\hat{q}_k$, $h(\hat{q}_{\bar{k}})$, and z_k) which are not mentioned in Bassompiere. Pet. at 46. Dr. Sarrafzadeh's equation is copied below for reference.

$$\hat{q}_k = \hat{q}_{\bar{k}} \otimes (K_k(z_k - h(\hat{q}_{\bar{k}})))$$

To make this equation work, the Petition describes further assumptions that were made by Dr. Sarrafzadeh: "for the dimensions of $\hat{q}_k$, z_k, and $h(\hat{q}_{\bar{k}})$ to match, the Kalman gain K_k must be a 4×3 matrix." Pet. at 46.

Bassompiere's Euler-based EKF is fundamentally different from the '687 Patent's quaternion-based framework. Petitioner's own expert underscores the point: he devotes nearly twenty pages of his declaration to show how a POSITA might attempt to rewrite Bassompiere's Euler-angle EKF in quaternion form. Ex. 1002 at pgs. 31–51. That effort only confirms that it is not a simple conversion. Regardless, a missing disclosure cannot be supplied by expert testimony or general knowledge. See 35 U.S.C. § 311(b); Ex. 2028.

In summary, both Bassompiere and the '687 Patent employ the idea of predicting what the accelerometer should read, but they implement this prediction in fundamentally different ways. Bassompiere derives its predicted values from Euler angles (pitch and roll), a framework that becomes unstable at singularities and is valid only within a limited range of torsions. The '687 Patent, by contrast, derives

predicted accelerations from a quaternion-based state updated with gyroscope data—a mathematically robust formulation that is globally valid, resistant to drift, and well-suited for real-time sensor fusion. Moving from Euler-angle prediction to quaternion-based prediction is not a trivial substitution—it requires redesigning the Kalman filter's state space (what the filter tracks), its propagation step (how it predicts the next state), and its error model (how it measures and corrects differences with sensor data).

For these reasons, Ground 1fails.

IX. THE PETITION IS DEFECTIVE FOR IMPROPER RELIANCE ON EXPERTS.

The statute is clear: an IPR "may be instituted only on a ground that could be raised under section 102 or 103 and only on the basis of prior art consisting of patents or printed publications." 35 U.S.C. § 311(b) (emphasis added). The Board's Trial Practice Guide reinforces this boundary: "expert testimony cannot take the place of disclosure from patents or printed publications." Trial Practice Guide (2019) at 36.

The USPTO's recent memorandum to the PTAB removes any doubt. "[A]pplicant admitted prior art (AAPA), expert testimony, common sense, and other evidence that is not 'prior art consisting of patents or printed publications' (collectively 'general knowledge') may not be used to supply a missing claim limitation." Ex. 2028 (July 31, 2025 Memo) at 1. The memo further instructs that

"[p]er 35 U.S.C. § 312(a)(4), the Board shall deny an IPR Petition that fails to comply with Rule 104(b)(4)." Id.

Samsung's Petition violates these principles. It relies on a single reference to meet the key claim features and attempts to cure the deficiencies of that reference with expert testimony to make an obviousness allegation. For example, its expert to assert that "a POSA would have been motivated to modify equation 21 [in Bassompiere] to include quaternions instead of Euler angles" because the claims of the '687 Patent expressly require quaternions. Pet. at 34 (citing Ex. 1002 ¶¶ 55–56). To fill the gap, Dr. Sarrafzadeh devotes nearly twenty pages of his declaration to rewriting Bassompiere's Euler-based equations "in quaternion form," and explaining how to convert them back into Euler angles. Ex. 1002 at pgs. 31-51.

That effort underscores the problem rather than solving it. As other researchers in the field have confirmed, "[w]hile implementing orientation tracking using quaternions provides advantages like avoiding gimbal lock, it is significantly more complex than the Kalman filter using Euler angles." Ex. 2027 at 1. In other words, this is not a "trivial" substitution. It required Dr. Sarrafzadeh to attempt to create the missing limitation from scratch—something Bassompiere never teaches.

But expert testimony cannot supply what the prior art lacks. *See* 35 U.S.C. § 311(b); Ex. 2028. By relying on Dr. Sarrafzadeh's say so to fill in missing claim limitations, the Petition fails as a matter of law.

X. CONCLUSION

Samsung's Petition falls short on both law and fact. The Petition never identifies a prior-art disclosure of claimed quaternion-based calculations or quaternion-derived predicted axial accelerations—features at the core of every challenged claim. The embodiment of Bassompiere relied upon by the Petitioner is a Euler-angle filter. It outputs Euler angles, and it models expected accelerometer readings from those angles. This embodiment does not disclose quaternions, quaternion propagation, or quaternion error correction. Bassompiere also includes a quaternion embodiment, and rather than addressing the deficiencies of this embodiment, the Petitioner makes false equivalencies between the two embodiments and relies on expert testimony to hand-wave away the differences.

But expert reconstruction cannot substitute for disclosure in a patent or printed publication. And as even Petitioner's own expert shows, moving from Euler angles to quaternions is not a trivial substitution but a wholesale redesign of the Kalman filter's state space, propagation, and error model.

The Petition also sidesteps claim construction for "predicted axial accelerations," the very limitation it relies on to distinguish infringement in district court. That omission violates PTAB rules and prevents any meaningful anticipation or obviousness analysis.

In short, the Petition relies on missing disclosures, improper expert substitution, and undisclosed claim-scope positions. It does not demonstrate a reasonable likelihood of prevailing on any challenged claim. Institution should be denied.

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CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Preliminary Patent Owner Response totals 6,897 words, which is less than the 14,000 allowed under 37 C.F.R. § 42.24(b)(1), excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

This brief complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft Word in 14-point Times New Roman font.

Respectfully submitted,

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CERTIFICATE OF SERVICE 37 C.F.R. § 42.6(e))

The undersigned hereby certifies that the above document was served September 19, 2025 by filing this document through the Patent Trial and Appeal Case Tracking System (P-TACTS) as well as delivering a copy via electronic mail to the following practitioners of record for Petitioners:

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