

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SOLAREEDGE TECHNOLOGIES LTD.,
Petitioner,

v.

KOOLBRIDGE SOLAR, INC.,
Patent Owner.

IPR2022-00009
Patent 8,937,822 B2

Before THU A. DANG, BRIAN J. McNAMARA,
and PATRICK M. BOUCHER, *Administrative Patent Judges*.

McNAMARA, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

SolarEdge Technologies Ltd. (“Petitioner”) filed a petition, Paper 2 (“Petition” or “Pet.”), to institute an *inter partes* review of claims 1–13 and 20 (the “challenged claims”) of U.S. Patent No. 8,937,822 B2 (Ex. 1101, “the ’822 patent”). 35 U.S.C. § 311. Having filed multiple petitions, Petitioner also filed a paper styled “Petitioner’s Petition Ranking And Explanation Of Material Differences Between Petitions.” Paper 3 (“Ranking”). Koolbridge Solar, Inc. (“Patent Owner”) filed a Preliminary Response, Paper 7 (“Prelim. Resp.”), contending that the Petition and all of Petitioner’s other petitions concerning the ’822 patent should be denied as to all challenged claims. We have jurisdiction under 35 U.S.C. § 314, which provides that an *inter partes* review may not be instituted unless the information presented in the Petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

A decision to institute under § 314 may not institute on fewer than all claims challenged in the petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018). In addition, per Board practice, if the Board institutes trial, it will “institute on all grounds in the petition.” PTAB Consolidated Trial Practice Guide, 5–6 (Nov. 2019); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

Having considered the arguments and the associated evidence presented in the Petition and the Preliminary Response, for the reasons described below, we decline to institute *inter partes* review.

II. REAL PARTIES IN INTEREST

Petitioner identifies itself (SolarEdge Technologies, Inc.) as the sole real party-in-interest. Pet. vii. Patent Owner identifies itself (Koolbridge Solar, Inc.) as the sole real party-in-interest. Paper 5, 2.

III. RELATED MATTERS

The Petition states that the '822 patent is asserted in the following litigation: *Koolbridge Solar, Inc. v. SolarEdge Technologies, Inc.*, No. 1:20-cv-01374-MN (D. Del.). Pet. i.¹ Petitioner notes that after being notified of Petitioner's intent to file petitions for *inter partes* review of the '822 patent, Patent Owner voluntarily dismissed its lawsuit without prejudice. *Id.*; see also Paper 5, 2.

IV. THE '822 PATENT

The '822 patent relates to DC to AC converters for electric power systems that may be of particular interest in solar energy systems. Ex. 1101, 1:5–9. The '822 patent describes a first implementation in which a waveform generator is based on expressing the desired output voltage waveform as a series of numerical samples in a number base. *Id.* at 3:17–20. Each sample is expressed as a plurality of digits in the number base. *Id.* at 3:20–22. One or more high frequency, bi-directional, isolating DC to DC converters convert input DC power at a first voltage to a series of relatively floating DC output voltages. *Id.* at 3:22–24. The floating DC output voltages are in the same ratio to one another as powers of the number base. *Id.* at 3:24–26. Switches connected to each of the floating DC supplies are controlled according to a corresponding digit of the numerical sample to generate a corresponding floating output voltage waveform. *Id.* at 3:26–29.

¹ Second set of pages numbered with Roman numerals (Mandatory Notices)

The floating output waveforms are then directly connected in series to form the desired power output waveform having the desired repetition frequency, thereby eliminating the need for low-frequency transformers or other weighting means. *Id.* at 3:26–33.

Figure 1 of the '822 patent is reproduced below.

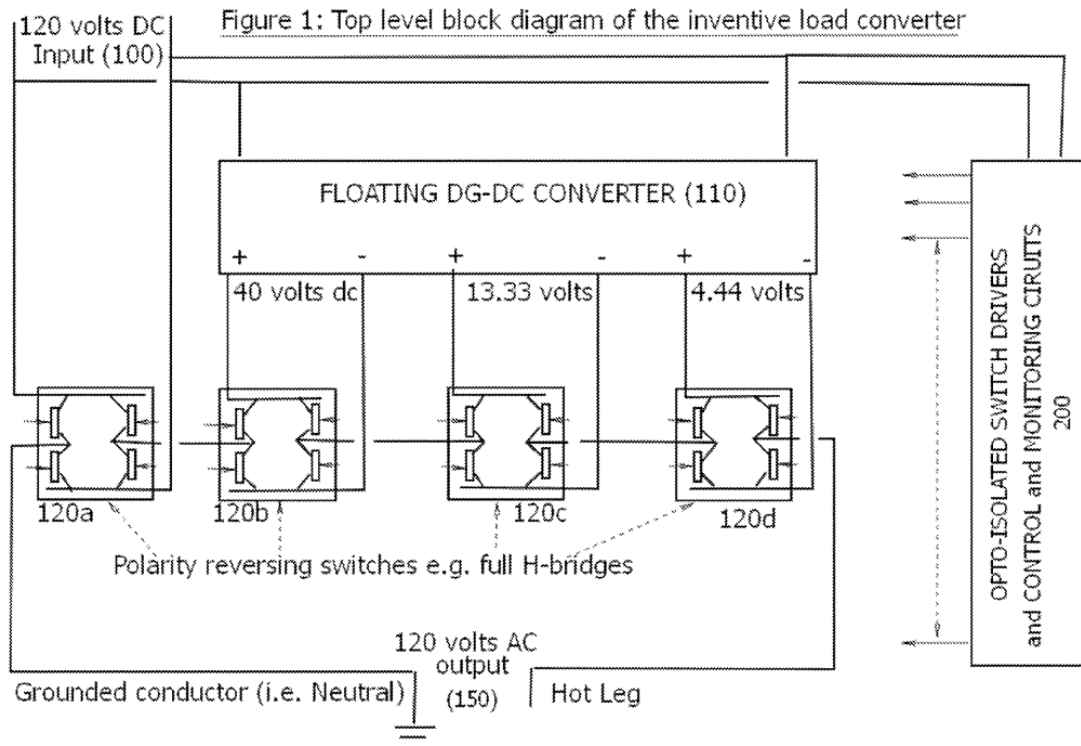


Figure 1 of above is a block diagram of one implementation the DC-AC load converter of the '822 patent. Ex. *Id.* at 5:33–34, 6:17–18. As an example, ten (10), 12 volt rechargeable batteries connected in series can be used to form 120 V DC input 100. *Id.* at 6:18–20. The apparatus of Figure 1 generates a 120 V AC output at terminals 150; one of these terminals may be connected to a grounded conductor or neutral of the AC load. *Id.* at 6:20–23.

As shown in Figure 1, bi-directional DC-DC converter 110 converts DC input 100 to a number of floating DC output voltages. *Id.* at 6:23–24.

The inverter AC output waveform to be generated is represented as a sequence of numerical samples. *Id.* at 6:41–43. Each numerical sample value is expressed with four digits in the ternary number system, T1–T4, where T_i (i=1 . . . 4) can take on only one of three values (-1, 0, or +1). Therefore, in addition to the DC input, floating DC-DC converter 110 generates 3 corresponding DC floating supplies with ratios of 1:1/3:1/9:1/27, resulting in floating DC voltages of 40 volts, 13.33 volts and 4.44 volts, when the source is 120 Volts DC. *Id.* at 6:41–52. As the sum of the DC input and all the outputs of the DC-DC converter is 177.77, the peak AC output is 177.77 volts, which corresponds to a useful sine wave output of 125.7 volts rms. *Id.* at 6:54–57. Other scaling is possible. *See id.* at 6:60–7:6.

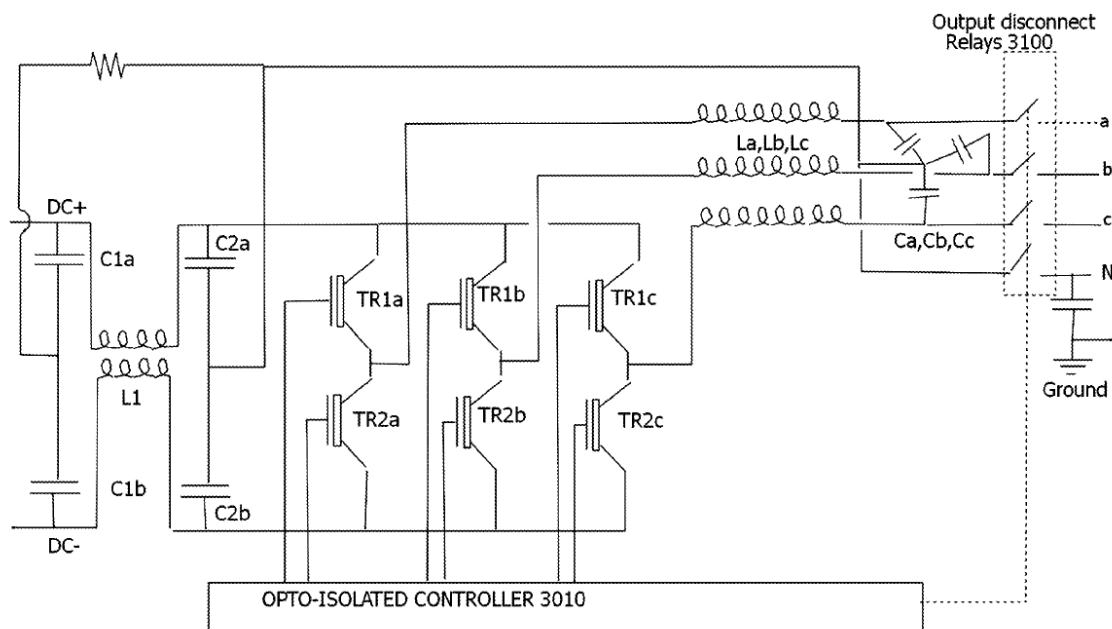
The floating DC input and the floating DC outputs from converter 110 each feed respective polarity reversing switches 120a-120d that are connected in series to AC output 150 and controlled by opto-isolator driver 200, so that “by either inverting the selected polarity of each DC Supply or not, or not selecting it, in accordance with a respective one of the ternary digits T4, T3, T2, T1, the series-connected output can be any of the 81 values (120T4+40T3+13.33T2+4.44T1) volts.” *See id.* at 6:25–30, 7:7–16. “In order to generate a 60 Hz step-approximation to a 125.7 volt rms sinewave, the switches are controlled to select sequentially among the 3⁴=81 possible voltage levels from -177.77 to +177.77 volts and back again repetitively . . . and at the proper times,” i.e. 2x81x60=9720 level changes per second. *Id.* at 7:39–45; 8:38–41.

A common characteristic among the embodiments of the invention is that “a common mode signal is created in-phase on both the positive and negative DC input terminals on all DC conductors.” *Ex. Id.* at 4:46–49. In a

single-phase application, the common-mode AC signal is at the same frequency as the output frequency; in a three-phase application, the common mode frequency is three times the output frequency; in a quadrature case, the common mode frequency is twice the AC output frequency. *Id.* at 4:49–53. Detecting AC leakage current at the common mode frequency is easier than detecting a DC leakage current, making detection such DC leakage current easier. *Id.* at 4:53–56.

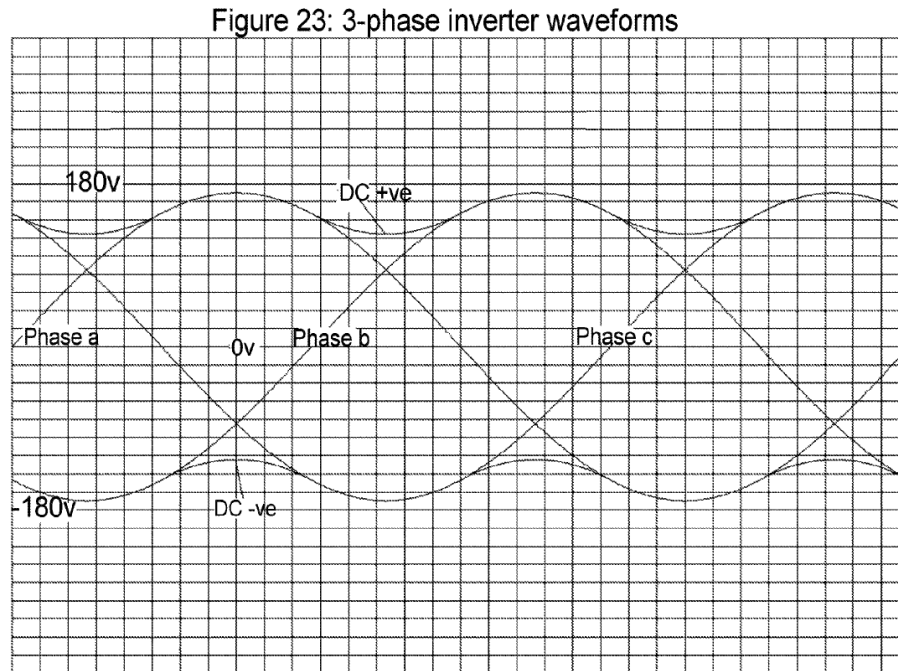
Figure 16 of the '822 Patent reproduced below shows a 3-phase grid inverter. Ex. 1101, 5:60–61, 26:35–36.

FIGURE 16: INVENTIVE 3-PHASE GRID INTERTIE INVERTER



In Figure 16, the DC input is applied to three half-bridges that connect either DC+ or DC- through an LC smoothing filter to each of three-phase outputs a, b, and c, e.g., a 120/208 utility connection with a neutral, preferably a utility transformer with a Y-configured secondary to accommodate RFI filter capacitors to decouple RF interference to neutral rather than to ground. *See id.* at 26:36–46.

Figure 23 reproduced below shows the inverter voltage waveforms at the output to the utility and on the input DC+ and DC- lines. *Id.* at 26:57–58.



Operating the switches according to specific logic “causes a common-mode AC signal to appear in-phase on DC terminals with a frequency of three times the AC output frequency of the inverter, that is 180 Hz for an output frequency of 60 Hz.” *See id.* at 26:57–27:8 (describing the specific switching logic for operating the half-H bridges). The 180 Hz common mode signal is almost a sine wave. *Id.* at 27:58–60; *see also id.* at 27:20–28:21 (discussing details of grid tie operation). The presence of an AC component on the DC terminals “facilitates detection of ground leakage faults on the DC side,” e.g., “if the inverter is connected to the utility via a regular two-pole AC GFI breaker, any leakage path on the DC side will result in a 60 Hz imbalance current between neutral and hot on the AC side, tripping the breaker.” *See id.* at 25:42–48.

V. ILLUSTRATIVE CLAIM

Claim 1, reproduced below with the paragraph designations used in the Petition, is representative of the subject matter of the challenged claims of the '822 patent:

1[A]. DC to AC conversion apparatus for converting power from a DC Source to produce an power output waveform at a first repetition frequency, comprising

[1B-1C] a set of at least one live AC output terminals, at least one output terminal designated as a ground, neutral or reference potential terminal;

[1D] a floating DC power source having a positive and a negative terminal connected respectively to the positive and negative DC input terminals of a DC to AC converter,

[1E] wherein the DC to AC converter causes (1) an AC output waveform at said first repetition frequency and having a voltage relative to one of said at least one ground, neutral or reference potential terminals to appear with a unique phase at each of a number N at least equal to one of said set of live AC output terminals, and

[1F] [wherein the DC to AC converter causes:] a common-mode voltage waveform at a second repetition frequency to appear relative to one of said at least one ground, neutral or reference potential terminals and in the same phase on both of said positive and negative terminals of said DC power source, wherein the second repetition frequency is a multiple equal to the same said number N of said first repetition frequency.

Ex. 1101, 41:2–24.

VI. ASSERTED GROUNDS

Petitioner asserts that claims 1–13 and 20 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 8–10	102	Schmidt ²
1–3, 8–10	103	Schmidt
4, 11	103	Schmidt, Suzuki ³
5, 12, 13	103	Schmidt, Iwata ⁴ , Nishimura ⁵
6, 20	103	Schmidt, Koyama ⁶ , Ahmed ⁷
7	103	Schmidt, Becker ⁸ , Russell ⁹
2	103	Schmidt, Mohan ¹⁰

VII. MULTIPLE PETITIONS

A. Introduction

Petitioner filed three petitions citing different references against the challenged claims. Petitioner’s chart showing its ranking of Petitions is reproduced below. Ranking 1.

² U.S. Patent No. 7,046,534 (Ex. 1103).

³ Japanese Pat. App. Pub. No. P2004-7941A (Ex. 1130; English Translation, Ex. 1131).

⁴ U.S. Patent Application Pub. No. 2008/0192519 (Ex. 1107).

⁵ U.S. Patent Application Pub. No. 2009/0086520 (Ex. 1108).

⁶ Certified Translation of Ex. 1127, PCT Pub. No. WO 2010/055713 (Ex. 1109).

⁷ K. H. Ahmed, S. J. Finney and B. W. Williams, Passive Filter Design for Three-Phase Inverter Interfacing in Distributed Generation, Compatibility in Power Electronics, CPE 2007, IEEE, pp. 1–9, 2007 (Ex. 1110).

⁸ U.S. Patent No. 7,576,449 (Ex. 1125).

⁹ U.S. Patent Application Publication No. 2002/0171436 (Ex. 1126).

¹⁰ Mohan, N., Power Electronics: Converters Applications and Design (2nd Ed. John Wiley & Sons. Inc.) (Ex. 1112).

Rank	Petition	Primary Reference(s)	Claims
A-1	IPR2022-00007 (Petition 1)	Tracy	1-13, 20
A-2	IPR2022-00010 (Petition 4)	Suzui	14-19
B-1	IPR2022-00008 (Petition 2)	Mori	1-13, 20
B-2	IPR2022-00011 (Petition 5)	Fujimoto	14-19
C-1	IPR2022-00009 (Petition 3)	Schmidt	1-13, 20
C-2	IPR2022-00012 (Petition 6)	Mirafzal	14-19

This Decision addresses Petitioner’s ranking of Petitions 1, 2, and 3. Petitioner identifies the challenged claims as the Group 1 claims. Ranking 1. For IPR2022-00009 (the instant Petition, referred to by Petitioner as Petition 3), Petitioner identifies Schmidt as the primary reference; for IPR2022-00007 (referred by Petitioner as Petition 1), Petitioner identifies Tracy¹¹ as the primary reference; for IPR2022-00008 (referred to by Petitioner as Petition 2), Petitioner identifies Mori¹² as the primary reference. *Id.* at 1. Petitioner ranks Petitions 1, 2 and 3 as A-1, B-1, and C-1, respectively. *Id.*

Arguing that the ’822 patent claims concern two separate inventions, Petitioner also filed three petitions against claims 14–19 (designated by Petitioner as the Group 2 claims) of the ’822 patent. *Id.* For IPR2022-00010 (referred to by Petitioner as Petition 4), Petitioner identifies Suzui as the primary reference; for IPR2022-00011 (referred to by Petitioner as Petition 5), Petitioner identifies Fujimoto¹³ as the primary reference; and for IPR2022-00012 (referred to by Petitioner as Petition 6), Petitioner identifies

¹¹ U.S. Patent No. 7,088,601.

¹² Certified translation of Japanese Patent Application Publication No. 2006-238630.

¹³ Certified Translation of Ex. 1233 (IPR2022-00008), Japanese Patent Application Publication No. JP 11-122819.

Mirafzal¹⁴ as the primary reference. Petitioner ranks Petitions 4, 5, and 6 as A-2, B-2, and C-2, respectively. *Id.*

B. The Challenged Claims of the Instant Petition (Group 1 Claims)

Petitioner characterizes claim 1 as “recit[ing] a common-mode waveform that is intrinsic to any transformer,” and “broadly cover[ing] the single-phase, cascaded H-bridge inverter in Fig. 1; the single-phase, H-bridge inverter in Fig. 15; and the three-phase, half-bridge inverter in Fig. 16.” Ranking 2. Petitioner argues it would be prejudiced if not permitted to challenge the claims with a primary reference directed to each of these implementations. *Id.*

According to Petitioner, there are material differences between Petitions 1, 2, and 3 because the dependent claims diverge in a way that requires different analysis. *Id.* at 1–2. Petitioner argues that Mori, the primary reference in Petition 2, is “strongest on claims 5, 12, and 13,” which Petitioner asserts “are directed to the single-phase cascaded H-bridge inverter and ternary control in Fig. 1,” but Mori “requires structural changes to meet claim 7.” *Id.* Petitioner argues that “dependent claim 7 requires a ‘three-phase grid-interactive inverter as in Fig. 16,’ as taught by Tracy in Petition 1, but Tracy “requires structural changes to meet the single-phase implementation covered by claims 5, 12, and 13.” *Id.* Petitioner contends that Schmidt in Petition 3 provides the simplest explanation of “‘common-mode’ recited in all the claims, but requires more structural changes than Tracy and Mori to meet many of the dependent claims.” *Id.* at 2–3.

¹⁴ U.S. Patent Application Publication No. 2008/0080106.

Noting the general expectation that a single petition usually is sufficient to challenge the claims of a patent, Patent Owner argues that the factors articulated by Petitioner are not factors identified in the Office Trial Practice Guide as ones that could justify multiple petitions. Prelim. Resp. 1–6 (discussing Office Trial Practice Guide’s identification of priority disputes and large numbers of claims in co-pending litigation as considerations in allowing multiple petitions). Patent Owner further argues that “Petitioner does not concede that any of [the] grounds [in its petitions] standing alone could not justify cancellation of the challenged claims.” *Id.* at 7–8. According to Patent Owner, Petitioner’s explanation amounts to little more than assertions that the references teach the limitations, but differ in how they teach the limitations. *Id.* at 8 (citing *Intel Corp. v. TelaInnovations, Inc.*, IPR2019-01220, Paper 19 at 5–7 (PTAB Jan. 30, 2020)).

As to the Group 1 claims, we agree with Patent Owner. The instant Petition contends that Schmidt anticipates challenged claims 1–3, 8–10, and 12 and that all the challenged claims are at least obvious. For example, Petition 1 asserts that Tracy anticipates claims 1–3, and 8–10 and that all the claims are obvious. Petition 2 asserts that Mori anticipates claims 1–3, 8–10, and 12 and that all the claims are obvious.

Petitioner contends that the question of which of the Petitions is most paramount could also depend upon the constructions applied to the claims, particularly if the claims are construed to include means plus function limitations. Ranking 3. As an example, Petitioner argues that, if independent claim 8 is construed “to allow for the single-phase output and control scheme of the Fig. 15 inverter, Schmidt (Petition 3) provides the most straightforward teaching of the claim 8 ‘sequence.’ But if claim 8

requires multiple phases and in Fig. 16, Tracy (Petition 1) would be the only reference to address this construction.” *Id.*

We decline Petitioner’s invitation to provide advisory opinions by entertaining different Petitions advancing alternative claim constructions. As Petitioner has expressed its preference for Petition 1, which cites Tracy as the primary reference, we exercise our discretion to entertain Petition 1. We decline to institute *inter partes* review based on Petitions 2 and 3.

C. Group 2 Claims 14–19

Claims 14–19, drawn to a method of detecting a ground leak, are not the subject of the instant Petition. We are mindful of the guidance concerning parallel petitions challenging the same patent provided in the Consolidated Office Trial Practice Guide, 84 Fed. Reg. 64,280 (Nov. 19, 2019) (“Consolidated Trial Practice Guide”) <https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf?MURL=>. Although it explains that parallel petitions challenging the same patent are generally disfavored, the Consolidated Trial Practice Guide nevertheless recognizes that there may be circumstances in which more than one petition may be necessary, and that the panel has discretion to review whether fairness warrants allowing multiple petitions by a single petitioner. Consolidated Trial Practice Guide, 59. In particular, petitioners are required to file lengthy petitions that fully elaborate their arguments for canceling the challenged patent. 37 C.F.R. § 42.22(a)(2); *see also id.* § 42.21(a), (c); 35 U.S.C. § 312(a)(3) (“A petition . . . may be considered only if . . . the petition identifies, in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim”). Thus, the Board recognizes that, with the strict limits set on the length of petitions (*see* 37

C.F.R. § 42.24(a)(1)), in some cases, it may be impossible to adequately present all legitimate grounds for cancelation in a single petition.

Having reviewed the petitions we note that the explanations of the technology relevant to the various claim limitations is lengthy and find that separate petitions for claim groups 1 and 2 are justified. We address Group 2 claims 14–19 separately in our decision(s) concerning petitions challenging those claims.

VIII. ORDER

In consideration of the foregoing, we exercise our discretion and decline to institute *inter partes* review based on the Petition.

IPR2022-00009
Patent 8,937,822 B2

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