

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DIGITAL GLOBAL SYSTEMS, INC.,
Petitioner,

v.

DEEPSIG INC.,
Patent Owner.

IPR2025-00194
Patent 11,777,540 B1

Before WILLIAM V. SAINDON, ROBERT J. WEINSCHENK, and
ANDREW L. NALVEN, *Administrative Patent Judges*.

WEINSCHENK, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background and Summary

Digital Global Systems, Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 1–10, 12–14, and 16–22 (“the challenged claims”) of U.S. Patent No. 11,777,540 B1 (Ex. 1001, “the ’540 patent”). DeepSig Inc. (“Patent Owner”) filed a Preliminary Response (Paper 6, “Prelim. Resp.”) to the Petition. Patent Owner also filed a statutory disclaimer of claims 1–3 and 7–11. Ex. 2001. For the reasons discussed below, we exercise our discretion under 35 U.S.C. § 314(a) to deny institution of an *inter partes* review.

B. Real Parties in Interest

The parties identify themselves as the only real parties in interest. Pet. 90; Paper 3, 1.

C. Related Matters

Patent Owner identifies IPR2024-01358 and IPR2025-00049 as related matters. Paper 3, 1.

D. The ’540 Patent

The ’540 patent relates to “integrating nonlinear pre-distortion machine learning into radio communication systems to correct for radio signal distortion and interference.” Ex. 1001, 1:19–21. The ’540 patent states that “[r]adio communication systems include . . . various sources, e.g., amplifiers, which distort or interfere with radio signals being communicated by the transmitters to the receivers.” *Id.* at 1:25–29. “In conventional radio communication systems, in order to obtain acceptable linear modulation performance or minimally distorted or interference-free output, amplifiers are carefully designed for linearity and operated at non-maximal output

powers,” which “can significantly increase cost and power consumption.” *Id.* at 4:13–21. To address this identified deficiency, the ’540 patent describes “[a] radio communication system with an integrated nonlinear pre-distortion machine learning model” that “can minimize interference and distortion while operating amplifiers at maximal or near maximal output power levels.” *Id.* at 4:22–26.

E. Illustrative Claim

Claim 12 is reproduced below.

12. A method comprising:
 - obtaining a transmit radio signal;
 - accessing a nonlinear pre-distortion machine learning model, wherein the nonlinear pre-distortion machine learning model includes model parameters and at least one nonlinear function to correct radio signal distortion;
 - generating a pre-distorted radio signal by processing the transmit radio signal using the nonlinear pre-distortion machine learning model;
 - processing the pre-distorted radio signal, including adding at least one of distortion or interference to the pre-distorted radio signal, to obtain a received radio signal; and
 - updating the model parameters based on a distance metric computed between the transmit radio signal and the received radio signal.

Ex. 1001, 15:45–61.

F. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Declaration of Zhi Ding, Ph.D.	1003
Jüschke, EP 2538553 A1, published Dec. 26, 2012 (“Jüschke”)	1005
Holt, US 10,552,738 B2, issued Feb. 4, 2020 (“Holt”)	1006
Dzierwa, US 10,122,479 B2, issued Nov. 6, 2018 (“Dzierwa”)	1007

G. Asserted Grounds

Petitioner asserts that the challenged claims are unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 7–10	103	Jüschke
1–10, 12–14, 16–22	103	Jüschke, Holt
2–6	103	Jüschke, Holt, Dzierwa

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner argues that a person of ordinary skill in the art would have had “a bachelor’s degree in electrical engineering, computer engineering, or equivalent and at least two years of experience working with radio communication systems and machine learning.” Pet. 3 (citing Ex. 1003 ¶¶ 33–34). Petitioner’s description of the level of ordinary skill in the art is supported by the testimony of Petitioner’s declarant, Dr. Zhi Ding. Ex. 1003 ¶¶ 33–34. Patent Owner does not dispute Petitioner’s description at this stage of the proceeding. We adopt Petitioner’s description for the purposes of this Decision.

B. Claim Construction

In an *inter partes* review proceeding, a patent claim is construed using the same standard used in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of the claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). Neither party proposes an express construction for any claim terms. Pet. 13; Prelim. Resp. 16. We determine that no claim terms require express construction for purposes of this Decision.

C. Asserted Obviousness of Claims 1–3 and 7–10 over Jüschke

Petitioner argues that claims 1–3 and 7–10 would have been obvious over Jüschke. Pet. 13–47. As discussed above, Patent Owner disclaimed claims 1–3 and 7–10. Ex. 2001. Thus, we do not institute an *inter partes* review of those claims. *See* 37 C.F.R. § 42.107(e).

D. Asserted Obviousness of Claims 1–10, 12–14, and 16–22 over Jüschke and Holt

Petitioner argues that claims 1–10, 12–14, and 16–22 would have been obvious over Jüschke and Holt. Pet. 48–83. As discussed above, Patent Owner disclaimed claims 1–3 and 7–10. Ex. 2001. Thus, we do not institute an *inter partes* review of those claims. *See* 37 C.F.R. § 42.107(e). Regarding the remaining claims, Petitioner does not demonstrate a reasonable likelihood of prevailing in showing that claims 4–6, 12, 14, and 16–22 would have been obvious over Jüschke and Holt. Petitioner may satisfy its burden for claim 13, but, as discussed below, that does not impact our decision to exercise discretion to deny institution. *See* Section II.F.

1. Claim 4

Claim 4 depends indirectly from claim 1, and thus includes the limitation from claim 1 that recites “generating a pre-distorted radio signal by processing the transmit radio signal using the nonlinear pre-distortion machine learning model” that “includes model parameters.” Ex. 1001, 14:29–38. Petitioner argues that Jüschke teaches processing a transmit signal using a pre-distortion neural network processor. Pet. 29–30 (citing Ex. 1005, code (57), ¶ 39, Fig. 1).

Claim 4 also recites “obtaining a received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers,” “determining a distance metric between the transmit radio signal and the received radio signal,” and “updating the values of the model parameters . . . based at least on the distance metric.” Ex. 1001, 15:4–11. Petitioner argues that Jüschke teaches training weight and/or bias parameters for the pre-distortion neural network processor based on a difference between a transmitter device’s input and output. Pet. 61–62 (citing Ex. 1005 ¶ 48, Figs. 4, 6). Petitioner argues that Holt teaches “calculating a loss function by comparing the inputs of a transmitter/encoder model and outputs of a receiver/decoder model sent over a communication channel.” *Id.* at 62 (citing Ex. 1006, code (57)). According to Petitioner, it would have been obvious to “modify Jüschke’s training techniques using Holt’s loss function.” *Id.* at 51–52.

Patent Owner contends that Petitioner does not show sufficiently that the Jüschke and Holt combination teaches updating the model parameters based on a distance metric computed between the transmit radio signal and the received radio signal. Prelim. Resp. 23–28, 41–47. Specifically, Patent

Owner argues that Jüschke “us[es] the output of the transmitter device 14 to correct for distortion that results at the transmitter device,” and thus “does not train its pre or post distortion neural network processor based on any received signal from one or more radio receivers.” *Id.* at 42. Patent Owner argues that Holt only uses “an actual communication channel . . . for training a decoder model.” *Id.* at 26–28. As such, according to Patent Owner, Holt “does not train its encoder model, or modify any transmit signal, based on any received radio signal from a radio receiver.” *Id.* at 28.

As discussed above, claim 4 includes the limitation from claim 1 that recites “generating a pre-distorted radio signal by processing the *transmit radio signal* using the nonlinear pre-distortion machine learning model.” Ex. 1001, 14:36–38 (emphasis added). This portion of claim 4 requires a machine learning model that processes a transmit signal. *Id.* Claim 4 also recites “obtaining a received radio signal that corresponds to a representation of the transmit output radio signal *received at the one or more radio receivers*,” “determining a distance metric between the transmit radio signal and the received radio signal,” and “updating the values of the model parameters . . . based at least on the distance metric.” *Id.* at 15:4–11 (emphasis added). This portion of claim 4 requires updating the model’s parameter values based on a distance metric computed using a signal received at a receiver. *Id.* Thus, together, these portions of claim 4 require updating parameter values for a model that processes a *transmit* signal (i.e., a transmit model) based on a distance metric computed using a signal *received* at a receiver.

For the reasons discussed below, Petitioner does not show sufficiently that the Jüschke and Holt combination teaches or suggests updating

parameter values for a transmit model based on a distance metric computed using a signal received at a receiver.

a. Jüschke

Jüschke teaches “training . . . parameters . . . of the pre-distortion neural network processor” based on “the transmitter device’s input - output signals.” Ex. 1005 ¶¶ 18, 48. Jüschke’s Figure 4 is reproduced below.

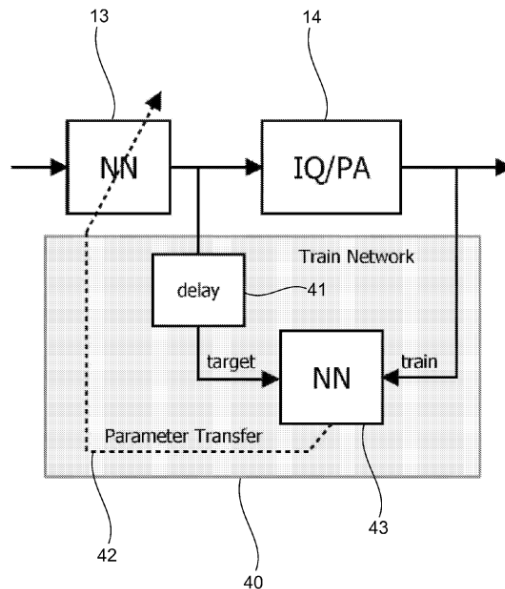


Fig. 4

Figure 4 shows how “pre-distortion neural network processor 13 may be trained at a transmitter.” *Id.* ¶47. Specifically, training processor 40 trains parameters for pre-distortion neural network processor 13 based on “[u]ndistorted . . . ideal digital baseband IQ samples 12a, 12b” and “[s]ampled output values of the non-ideal analog transmitter device 14.” *Id.* ¶ 48. In other words, Jüschke teaches training parameters for a model that processes a transmit signal based on a difference computed using a transmitted signal. *Id.* ¶¶ 18, 48; *see* Pet. 48 (“Jüschke trains its models using ‘[s]ampled [transmitter] output values’ and ‘ideal [input] samples.’”).

As discussed above, claim 4 requires updating parameter values for a *transmit* model based on a distance metric computed using a signal *received* at a receiver. Ex. 1001, 14:36–38, 15:4–11. The portions of Jüschke cited by Petitioner teach updating parameters for a model that processes a transmit signal based on a difference computed using a transmitted signal, not a received signal. Pet. 61–64; Ex. 1005 ¶¶ 17, 18, 48, 49, 72, Figs. 4, 6. Further, to the extent Petitioner argues that Jüschke’s transmitted signal is “the same” as a received signal (*see* Pet. 58), the evidence of record does not support that assertion. Specifically, the evidence of record indicates that a signal received at a receiver is different than Jüschke’s transmitted signal because a received signal accounts for the actual effects of the transmission, channel, and reception. Pet. 60; Ex. 1003 ¶ 233 (“[S]ignals actually received and recovered at a receiver . . . account[] for the actual effects of transmission, channel, and reception . . .”). Thus, on this record, the cited portions of Jüschke do not teach or suggest updating parameter values for a transmit model based on a distance metric computed using a signal received at a receiver.

b. Holt

Holt teaches a transmitter with an encoder model and a receiver with a decoder model. Ex. 1006, 4:33–39. Holt’s Figure 2 is reproduced below.

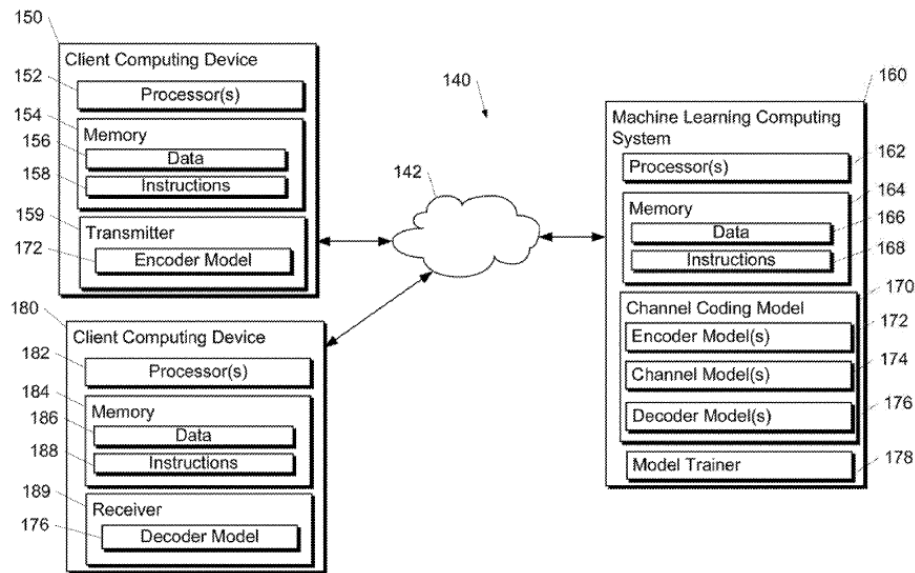


Figure 2

Figure 2 shows client computing device 150 that includes transmitter 159 with encoder model 172, as well as client computing device 180 that includes receiver 189 with decoder model 176. *Id.* at 14:49–50, 15:16–17, Fig. 2. Figure 2 also shows machine learning computing system 160 that includes model trainer 178 for training encoder model 172, channel model 174, and decoder model 176. *Id.* at 12:61–66, Fig. 2. Holt distinguishes between how it trains an encoder model and a decoder model. *Compare id.* at code (57), 5:52–56, 9:61–63, 13:4–20, 16:60–17:10, *with id.* at 6:34–43, 10:22–23, 13:56–63, 17:62–18:3, 18:37–48.

Holt teaches training *both* an encoder model and a decoder model using a channel model. Specifically, Holt teaches that Figures 3, 4, and 7 depict “aspects associated with training an encoder model” and “a decoder model.” *Id.* at 9:61–63, 10:22–23. Holt’s Figure 3 is reproduced below.

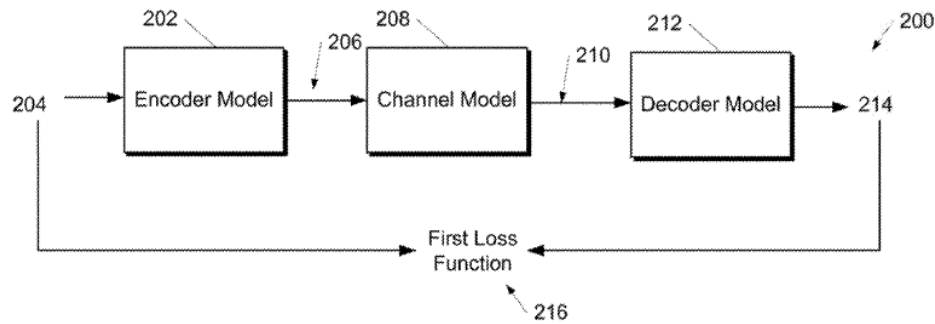


Figure 3

Figure 3 shows “an example model training technique” that includes encoder model 202, channel model 208, and decoder model 212. *Id.* at 15:43–49, 15:61–63, 16:13–14, Fig. 3. Channel model 208 “emulate[s] a communication channel” and “provides an ability to model the addition of noise to an output of the encoder model 202, such as would be present . . . when data is transmitted over a wired and/or wireless noisy communication channel before being received and evaluated by a decoder.” *Id.* at 15:61–63, 16:38–44. Holt teaches using a loss function to “train[] the encoder model *and* decoder model when the channel model is structurally provided between the encoder model and decoder model.” *Id.* at 5:52–56 (emphasis added); *see id.* at code (57), 9:61–63, 13:4–20, 16:60–17:10.

In contrast, Holt teaches training *only* a decoder model using an actual communication channel. Holt teaches that Figures 6, 10, and 11 depict “aspects associated with training a decoder model.” *Compare id.* at 9:61–63, *with id.* at 10:22–23. Holt’s Figure 6 is reproduced below.

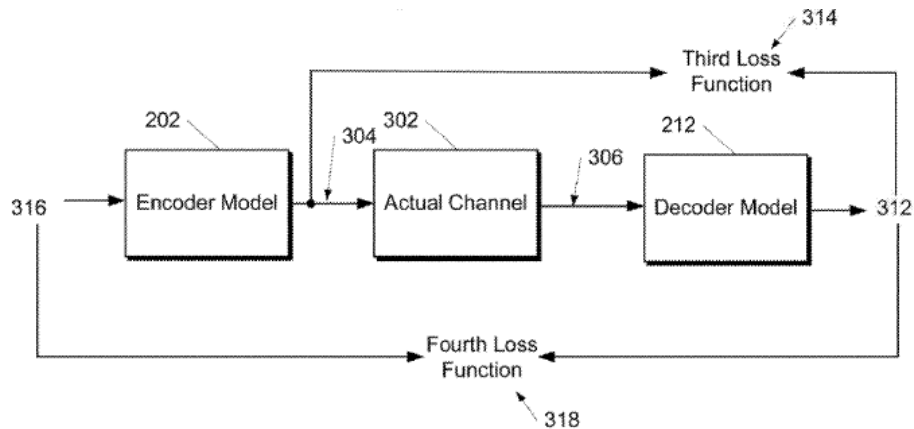


Figure 6

Figure 6 shows “an example model training technique” that includes encoder model 202, actual channel 302, and decoder model 212. *Id.* at 17:60–18:3, 18:33–37, Fig. 6. Holt teaches that in addition to training decoder model 212 based on “data coming out of the channel model 208, the decoder model 212 can be further trained . . . to learn how to decode data coming out of the communication channel 302 (e.g., the actual communication channel 302 used to train the channel model 208).” *Id.* at 17:62–18:3; *see id.* at 6:34–43, 10:22–23, 13:56–63, 18:37–48.

As discussed above, claim 4 requires updating parameter values for a *transmit* model based on a distance metric computed using a signal *received* at a receiver. Ex. 1001, 14:36–38, 15:4–11. The ’540 patent indicates that a signal received at a receiver is different than a modeled signal. Ex. 1001, 9:48–56 (“a modeled source of distortion or interference . . . produces a modeled received radio signal”); *id.* at 10:7–26 (“In the online tuning configuration, the receiver . . . sends the received signal . . . to the nonlinear pre-distortion system”). The portions of Holt cited by Petitioner teach training an encoder model (i.e., a model that processes a transmit signal) based on a loss function computed using a modeled signal, not a signal

received at a receiver.¹ Pet. 10–12, 48–54, 61–66; Ex. 1006, code (57), 4:4–7, 5:45–51, Fig. 3. The cited portions of Holt that mention using a signal received at a receiver only involve training a decoder model. Pet. 10–12, 48–54, 61–66; Ex. 1006, 17:62–18:3, 18:42–48, Fig. 6. Thus, on this record, Petitioner does not show sufficiently that Holt teaches or suggests updating parameter values for a transmit model based on a distance metric computed using a signal received at a receiver.

c. Proposed Combination of Jüschke and Holt

Petitioner asserts that it would have been obvious to modify Jüschke to use “Holt’s loss functions based on actually received transmissions” to improve Jüschke’s “accuracy.” Pet. 65. Even if Petitioner is correct that a person of ordinary skill in the art would have had reason to combine the cited teachings of Jüschke and Holt, the proposed combination does not teach all the limitations of claim 4. As discussed above, claim 4 requires updating parameter values for a *transmit* model based on a distance metric computed using a signal *received* at a receiver. Ex. 1001, 14:36–38, 15:4–11. But the portions of Holt cited by Petitioner teach training an encoder model based on a loss function computed using a modeled signal, not a signal received at a receiver. Pet. 10–12, 61–66; Ex. 1006, code (57), 4:4–7, 5:45–51, Fig. 3. Petitioner does not address this distinction. See Pet. 10–12, 48–54, 61–66. For example, Petitioner does not assert specifically that a person of ordinary skill in the art would have modified Holt’s techniques to

¹ Holt mentions training an encoder model “in the field,” but Holt does not explain how the loss function is computed in that scenario. Ex. 1006, 8:44–48, 13:51–53. Moreover, Petitioner does not rely on those portions of Holt in the Petition. See Pet. 10–12, 48–54, 61–66.

train a model that processes a transmit signal (such as Jüschke's) using a signal received at a receiver. *See id.* Thus, on this record, Petitioner's proposed combination does not teach or suggest updating the parameter values for a transmit model based on a distance metric computed using a signal received at a receiver.²

d. Summary

For the foregoing reasons, on this record, Petitioner does not show sufficiently that claim 4 would have been obvious over Jüschke and Holt.

2. Claims 5 and 6

Claims 5 and 6 depend from claim 4. Petitioner's arguments and evidence regarding claims 5 and 6 do not compensate for the deficiencies discussed above for claim 4. *See* Pet. 66–69. Thus, for the same reasons discussed above for claim 4, Petitioner does not show sufficiently that claims 5 and 6 would have been obvious over Jüschke and Holt.

3. Claim 12

Claim 12 recites limitations similar to those discussed above for claim 4.³ Ex. 1001, 15:52–61. Petitioner relies on arguments and evidence similar to that discussed above for claim 4. Pet. 69–71. Thus, for the same

² We addressed a similar issue in IPR2025-00049. *See Digit. Glob. Sys., Inc. v. DeepSig Inc.*, IPR2025-00049, Paper 7 at 5–14 (PTAB Mar. 27, 2025).

³ To the extent claim 12 may be interpreted to cover updating model parameter values based on a distance metric computed using a modeled signal, Petitioner does not propose modifying Jüschke to include Holt's loss function when computed using a modeled signal for claim 12. *See* Pet. 48–54, 61–66, 69–71. Rather, for claim 12, Petitioner only proposes modifying Jüschke to include "Holt's loss functions based on actually received transmissions." *Id.* at 65; *see id.* at 51–54, 69–71.

reasons discussed above for claim 4, Petitioner does not show sufficiently that claim 12 would have been obvious over Jüschke and Holt.

4. *Claim 13*

Claim 13 depends from claim 12, and recites “wherein processing the pre-distorted signal comprises generating the received radio signal using a modeled source of distortion or interference.” Ex. 1001, 15:62–65.

Petitioner argues that “Holt Figure 3 shows channel model 208 implemented with encoder/transmitter 202, decoder/receiver 212, and loss function 216.” Pet. 73 (citing Ex. 1006, Fig. 3). According to Petitioner, a person of ordinary skill in the art “would have understood that the combined Jüschke/Holt model training system could implement Holt’s channel model trained using a *modeled* form of noise.” *Id.* at 74 (citing Ex. 1003 ¶ 273).

In other words, for claim 13, Petitioner relies on Holt’s embodiments that include a channel model, rather than the embodiments that include an actual communication channel. Pet. 71–74. As discussed above, Holt teaches using a loss function to “train[] the encoder model *and* decoder model when the channel model is structurally provided between the encoder model and decoder model.” Ex. 1006, 5:52–56 (emphasis added); *see id.* at code (57), 9:61–63, 13:4–20, 16:60–17:10; Section II.D.1.b. Thus, Petitioner’s arguments for claim 13 do not suffer from the same deficiencies discussed above for claims 4 and 12. *See* Sections II.D.1, II.D.3.

5. *Claims 14 and 16–22*

Claims 14 and 16–22 depend, directly or indirectly, from claim 12. Petitioner’s arguments and evidence regarding claims 14 and 16–22 do not compensate for the deficiencies discussed above for claim 12. *See* Pet. 74–83. Thus, for the same reasons discussed above for claim 12, Petitioner does

not show sufficiently that claims 14 and 16–22 would have been obvious over Jüschke and Holt.

6. *Summary*

For the foregoing reasons, Petitioner does not demonstrate a reasonable likelihood of prevailing in showing that claims 4–6, 12, 14, and 16–22 would have been obvious over Jüschke and Holt. Petitioner may satisfy its burden for claim 13, but, as discussed below, that would not impact our decision to exercise our discretion under § 314(a) to deny institution. *See* Section II.F.

E. Asserted Obviousness of Claims 2–6 over Jüschke, Holt, and Dzierwa

Petitioner argues that claims 2–6 would have been obvious over Jüschke, Holt, and Dzierwa. Pet. 84–88. As discussed above, Patent Owner disclaimed claims 2 and 3. Ex. 2001. Thus, we do not institute an *inter partes* review of those claims. *See* 37 C.F.R. § 42.107(e). Further, Petitioner’s arguments and evidence regarding Dzierwa do not compensate for the deficiencies discussed above for the asserted ground based on Jüschke and Holt. *See* Pet. 84–88. Thus, for the same reasons discussed above, Petitioner does not demonstrate a reasonable likelihood of prevailing in showing that claims 4–6 would have been obvious over Jüschke, Holt, and Dzierwa.

F. 35 U.S.C. § 314(a)

Under 35 U.S.C. § 314(a), we have discretion to deny institution of an *inter partes* review. *SAS Inst. v. Iancu*, 584 U.S. 357, 366 (2018). Specifically, “[i]f a panel determines that a petition meets the standards for institution in relation to fewer than all the challenges presented, . . . the panel will evaluate all the challenges and determine whether, in the interests of

efficient administration of the Office and integrity of the patent system, the entire petition should be denied.” *See* Consolidated Trial Practice Guide, 64 (Nov. 2019), *available at* <https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf>. Here, thirteen challenged claims remain after Patent Owner’s statutory disclaimer. Petitioner at most demonstrates a reasonable likelihood of prevailing for one dependent claim, which has no claims depending therefrom. *See* Sections II.C–II.E. Thus, based on the particular facts of this case, we find that instituting trial would not be an efficient use of the Board’s time and resources, and we exercise our discretion to deny institution under § 314(a). *See Deeper, UAB v. Vexilar, Inc.*, IPR2018-01310, Paper 7 at 41–43 (PTAB Jan. 24, 2019) (informative); *Chevron Oronite Co. LLC v. Infineum USA L.P.*, IPR2018-00923, Paper 9 at 10–11 (PTAB Nov. 7, 2018) (informative).

III. CONCLUSION

For the reasons discussed above, we exercise our discretion under § 314(a) to deny the Petition.

IV. ORDER

It is hereby

ORDERED that the Petition is denied, and no trial is instituted.

IPR2025-00194
Patent 11,777,540 B1

For PETITIONER:

Brian Eutermoser
Christopher Campbell
KING & SPALDING LLP
beutermoser@kslaw.com
ccampbell@kslaw.com

For PATENT OWNER:

Wayne M. Helge
James T. Wilson
BUNSOW DE MORY LLP
whelge@bdiplaw.com
jwilson@bdiplaw.com

Amit Singhal
ROSSI, KIMMS & MCDOWELL LLP
amitsinghal@rkmlp.com