

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DIGITAL GLOBAL SYSTEMS, INC.,
Petitioner,

v.

DEEPSIG, INC.,
Patent Owner.

IPR2024-01358
Patent 11,018,704 B1

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

SAINDON, *Administrative Patent Judge*.

DECISION
Granting 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 1, “Pet.”) requesting an *inter partes* review of claims 1–24 (“the challenged claims”) of U.S. Patent No. 11,018,704 B2 (Ex. 1001, “the ’704 patent”). DeepSig, Inc. (“Patent Owner”) filed a Preliminary Response (Paper 9, “Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314(b) and 37 C.F.R. § 42.4(a). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” For the reasons provided below, we determine that Petitioner has demonstrated a reasonable likelihood that at least one claim of the ’704 patent is unpatentable, and we institute an *inter partes* review. 37 C.F.R. § 42.108(a).

Our findings of fact, conclusions of law, and reasoning discussed below are made for the sole purpose of determining whether the Petition meets the threshold for initiating review. This decision to institute trial is not a final decision as to the patentability of any challenged claim or the construction of any claim limitation.

B. Real Parties in Interest

The parties both assert that they are the sole real parties in interest. Pet. 88; Paper 4, 1 (Patent Owner’s Mandatory Notice).

C. Related Matters

Neither party identifies any co-pending litigation. *See* Pet. 88; Paper 4, 1.

D. Prior Art and Asserted Grounds

Petitioner's grounds rely on the following prior art references:

Name	Reference	Exhibit No.
Dzierwa	US Pat. 10,122,479 B2, iss. Nov. 6, 2018	1007
Holt	US Pat. 10,552,738 B2, iss. Feb. 4, 2020	1006
Jüschke	EP 2,538,553 A1, pub. Dec. 26, 2012	1005

Petitioner asserts that the challenged claims would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 7–11, 15–19, 23, 24	103	Jüschke
1–24	103	Jüschke, Holt
2–6, 10–14, 18–22	103	Jüschke, Holt, Dzierwa

E. Overview of the '704 Patent

The '704 patent is directed to a method for correcting distortion of radio signals. Ex. 1001, code (57). As the '704 patent explains:

A transmit radio signal corresponding to an output of a transmitting radio signal processing system is obtained. A pre-distorted radio signal is then generated by processing the transmit radio signal using a nonlinear pre-distortion machine learning model. The nonlinear pre-distortion machine learning model includes model parameters and at least one nonlinear function to correct radio signal distortion or interference. A transmit output radio signal is obtained by processing the predistorted radio signal through the transmitting radio signal processing system.

The transmit output radio signal is then transmitted to one or more radio receivers.

Id.

F. Challenged Claims

Claims 1–24 are challenged. Claims 1, 9 and 17 are independent.

Claim 1 is reproduced below.

1. A method for correcting distortion of radio signals in a cellular communications system, the method comprising:

obtaining, at a base station in the cellular communications system, a transmit radio signal that is prepared for transmitting to one or more radio receivers associated with the cellular communications system;

accessing a nonlinear pre-distortion machine learning model associated with the base station, wherein the nonlinear pre-distortion machine learning model includes model parameters associated with values corresponding to one or more deployment scenarios in the cellular communications system, 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;

obtaining a transmit output radio signal by processing the pre-distorted radio signal through a transmitting radio signal processing stage of the base station; and

transmitting the transmit output radio signal to the one or more radio receivers.

II. ANALYSIS

A. Legal Standards Used in the Merits Analysis

“In an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious . . . to a person having ordinary skill in the art to which the claimed invention pertains.” *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that:

Persons of ordinary skill in the art (“POSITA”) would have a bachelor’s degree in electrical engineering, computer engineering, or an equivalent degree and at least two years of experience working with of radio communication systems and

machine learning. Additional work or research experience can substitute for less or different education, and vice-versa.

Pet. 3–4 (citing Ex. 1003 ¶¶ 33–34). Patent Owner does not appear to challenge this level of skill. We use Petitioner’s definition for purposes of this Decision because it appears consistent with the level of skill reflected in the prior art and ’704 patent.

C. Claim Construction

Under 37 C.F.R. § 42.100(b), we apply the claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). That is, “the words of a claim ‘are generally given their ordinary and customary meaning’ . . . that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1312–13.

Petitioner and Patent Owner both assert that no terms require express construction. Pet. 15; Prelim. Resp. 10. However, the issues before us implicate at least one latent claim construction dispute between the parties. Accordingly, we will present a preliminary claim construction analysis of “deployment scenarios.”

1. “deployment scenarios”

Claim 1 recites a machine learning model that “includes model parameters associated with values corresponding to one or more deployment scenarios.” Ex. 1001, 14:23–25. The ’704 patent provides a list of “deployment scenarios” that includes “a cellular base station . . . in an in-line mode.” *Id.* at 2:39–41; *see also id.* at 2:38–65 (entire list). The “in-line mode” is shown in Figures 6A and 7A, in which machine learning model 103 is placed “between an input 601 and an amplifier 603.” *Id.* at 10:38–42, 10:47–50. Figure 6A depicts the in-line mode and is reproduced below:

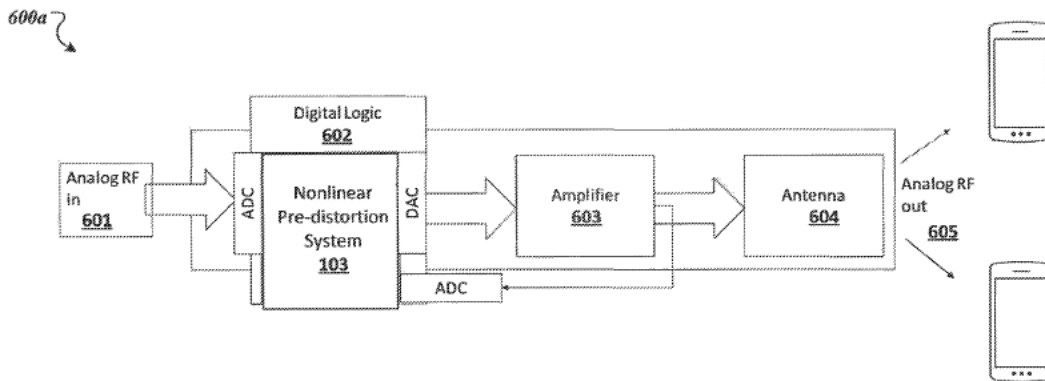
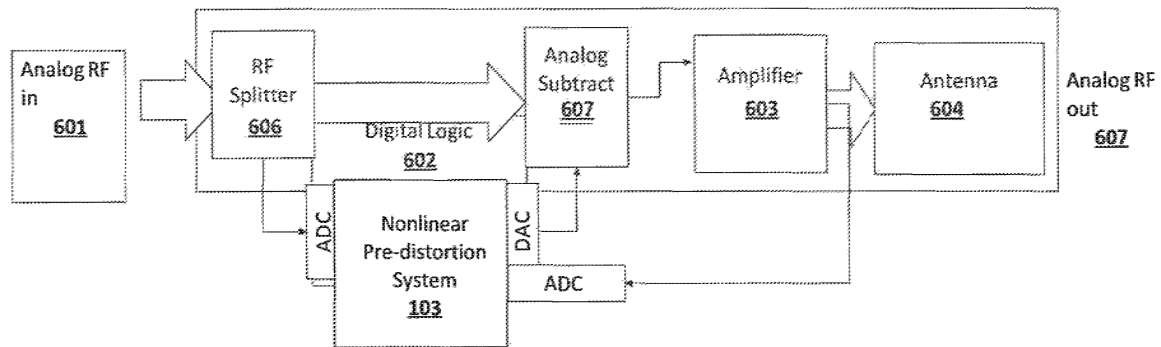


FIG. 6A

Ex. 1001, Fig. 6A. Figure 6A of the ’704 patent depicts analog RF in 601 with arrows connecting nonlinear pre-distortion system 103, amplifier 603, and antenna 604. *Id.* This arrangement can be contrasted with Figures 6B and 7B, which depict a “fault-tolerant subtractive mode” and show nonlinear pre-distortion system 103 not in-line with analog RF in 601, amplifier 603, and antenna 604, but rather off to the side. *Id.* at 10:42–45, 10:50–54, Figs. 6B, 7B. Figure 6B of the ’704 patent is reproduced below:



Ex. 1001, Fig. 6B. In contrast to the “in-line” model 103 of Figure 6A, Figure 6B depicts a “fault-tolerant subtractive mode” for the model 103. *Id.* at 4:61–62, 10:42–45. Notably, in Figure 6B, model 103 is not directly in-line with analog RF in 601 and amplifier 603.

Other deployment scenario permutations are based on whether the signal is “inside a tower” or “inside a remote radio unit.” *Id.* at 38–65. In sum, the “deployment scenarios” claimed in the ’704 patent include the model’s physical location (e.g., tower/remote) and the model’s configuration relative to the input and amplifier (e.g., in-line/fault-tolerant).

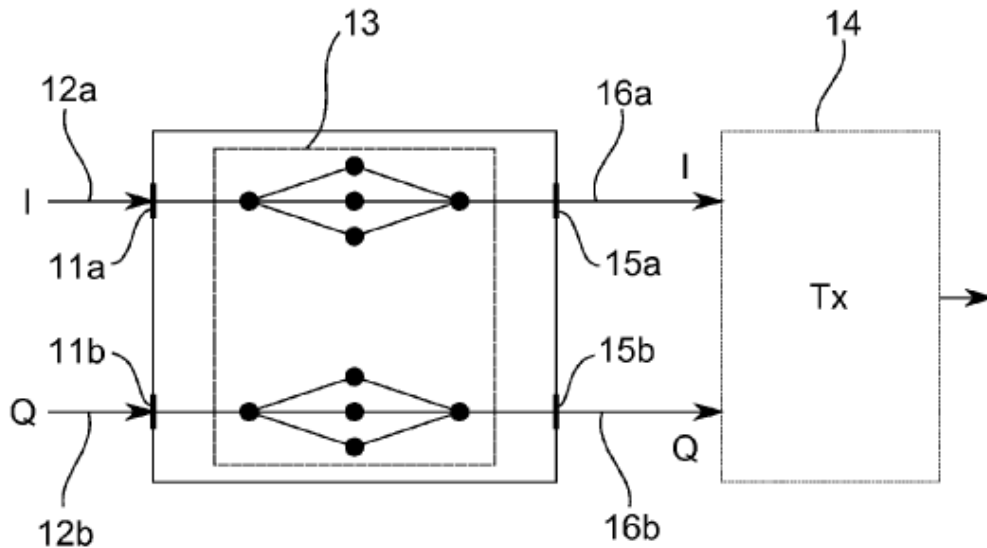
2. Remaining Terms

We do not construe any other terms at this time. *Realtime, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

*D. Asserted Obviousness Over Jüschke
(Claims 1–3, 7–11, 15–19, 23, and 24)*

Petitioner asserts that claims 1–3, 7–11, 15–19, 23, and 24 would have been obvious over Jüschke. Pet. 15–56. At this time, Patent Owner’s arguments are focused on limitations in claim 1. Prelim. Resp. 17–28. Thus, we will limit our analysis to claim 1. At a high level, claim 1 is directed to a method of correcting distortion in radio signals of a cellular communication system, using pre-distortion. A base station first obtains a radio signal to transmit, then a pre-distorted radio signal is generated using a nonlinear pre-distortion machine learning model, and then the signal is transmitted.

Petitioner largely relies on Figure 1 of Jüschke, reproduced below.



Ex. 1005, Fig. 1. Figure 1 of Jüschke depicts a block diagram of an apparatus “for mitigating impairments of a transmit signal.” *Id.* ¶ 38. Inputs 11a, 11b receive input signals 12a, 12b, which are fed into “a pre-distortion neural network processor 13 for pre-distorting the input digital baseband

transmit signal 12 in order to obtain a pre-distorted digital baseband signal 16.” *Id.* ¶ 39. Signal 16 is sent to outputs 15a, 15b, which are coupled to transmitter device 14. *Id.*

Petitioner asserts that Jüschke discloses “obtaining a transmit radio signal” as required by claim 1 given that it obtains signal 12, processes it, and then sends it to transmitter 14. Pet. 21–22. As to the requirement in claim 1 that the device is a “base station” and “in the cellular communication system,” Petitioner asserts that Jüschke teaches that the transmitter can be “‘flexibly’ implemented in scenarios and structures, including base stations such as ‘macro-cell base stations’ and ‘small-cell base stations’” (*id.* at 22–23 (citing Ex. 1005 ¶ 6)), and also that the system is applicable to “cellular systems” (Pet. 23 (citing Ex. 1005 ¶ 2)). Patent Owner does not focus its Preliminary Response on this aspect of the ground at this time.

Petitioner then asserts that Jüschke discloses “a non-linear pre-distortion machine learning model associated with the base station” as required by claim 1. Pet. 23–25. In particular, Petitioner points to “pre-distortion neural network processor 13” in Jüschke. *Id.* (citing Ex. 1005 ¶¶ 8, 9, 13, 39, 72, Fig. 1; Ex. 1003 ¶¶ 136–140). As explained with the prior limitation, Petitioner asserts that Jüschke is intended to be used in “mobile communication systems,” and in particular, “base stations.” *Id.* at 22–23 (citing Ex. 1005 ¶¶ 2, 6). Patent Owner disputes whether Jüschke discloses that the model is associated with the base station as claimed. Prelim. Resp. 26–28. We will address this first dispute later, in the next section.

Petitioner next asserts that Jüschke discloses that “the nonlinear pre-distortion machine learning model includes model parameters associated

with values corresponding to one or more deployment scenarios.” Pet. 26–29. Petitioner asserts that the claimed “model parameters” are taught by Jüschke’s “weight and/or bias parameters (w_{kj} , b_k) of neurons.” *Id.* at 26 (quoting Ex. 1005 ¶ 17). Petitioner asserts that the values correspond to one or more deployment scenarios because the values are used in a model deployed in an in-line mode, like the deployment scenario of the ’704 patent. *Id.* at 26–28. In particular, Petitioner compares Figure 6a of the ’704 patent with Figure 1 of Jüschke, noting that both show an in-line mode because the input signal goes directly into the model and then directly to the amplifier. *Id.* at 27–28. Patent Owner disputes whether Jüschke discloses both parameters and values corresponding to deployment scenarios as claimed. Prelim. Resp. 12–21. We will address this second dispute later.

Petitioner then asserts that Jüschke renders obvious “generating a pre-distorted radio signal by processing the transmit radio signal using the nonlinear pre-distortion machine learning model” as well as “obtaining a transmit output radio signal” and transmitting that signal. Pet. 30–37. In particular, Petitioner points to Jüschke’s teaching of a “pre-distortion neural network processor 13” that uses “nonlinear transfer or activation functions” in its model to send signals to transmitter 14. *See id.* Patent Owner does not focus its Preliminary Response on this aspect of the ground at this time.

We now turn to the two disputed limitations.

1. “nonlinear pre-distortion machine learning model associated with the base station”

Petitioner asserts that Jüschke discloses a system “for mobile communications” that uses “base stations.” Pet. 22–23 (citing Ex. 1005 ¶¶ 2, 6). Patent Owner disputes whether Jüschke discloses the model

associated with the base station as claimed, focusing on the words “associated with.” Prelim. Resp. 26–28. Patent Owner argues that Petitioner’s position is that the model is “implemented within” the base station, but that the claim requires the model to be “associated with” the base station. *Id.* at 27. On this record, with no claim construction offered, we fail to see how Patent Owner construes a model “implemented within,” i.e., used in, a base station to not also be “associated with” the base station. That is, it would seem that a model used in a base station is associated with that base station. Accordingly, we do not find Patent Owner’s argument persuasive on this preliminary record.

2. *“model parameters associated with values corresponding to one or more deployment scenarios”*

Petitioner asserts that the “model parameters associated with values” are the “weight and/or bias parameters” of the model. Pet. 26–27. Petitioner further asserts that the configuration of the model in Jüschke is the same configuration as the “in-line” deployment scenario described in the ’704 patent. *Id.* at 26–29. Patent Owner argues that “Jüschke does not disclose any association of the weight or bias parameters, which are used to approximate the transmitter device’s inverse transfer function, to any deployment scenario.” Prelim. Resp. 15; *see also id.* at 12–16 (entire argument). However, the in-line deployment scenario depicted in Figure 6a of the ’704 patent bears a striking resemblance to the arrangement depicted in Figure 1 of Jüschke. In particular, both figures show the analog radio signal fed directly into the model and then directly into the amplifier. *Compare* Ex. 1001, Fig. 6A *with* Ex. 1005, Fig. 1. As we explained in our preliminary claim construction section, the claimed “deployment scenarios”

include the model's configuration relative to the input and amplifier, such as "in-line." Thus, on the present record, we do not find Patent Owner's arguments regarding the "deployment scenarios" limitation persuasive.

Patent Owner similarly argues that the parameters and values of Jüschke do not meet the claim language. Prelim. Resp. 18–21. For example, Patent Owner argues that Jüschke's parameters are "generic" and that Petitioner has not shown "that the parameters themselves are selected for the model to correspond to one or more deployment scenarios."

Id. at 21. However, as we explained above, Petitioner has shown preliminarily that Jüschke teaches or suggests a model that is deployed in-line in the base station, i.e., a "deployment scenario" as claimed. Given that the model is functioning in a claimed "deployment scenario," then it stands to reason that its parameters and values correspond to that scenario. To the extent Patent Owner is asserting that the model must have many configurations, which can be selected once placed in a given deployment scenario, we note that the claims are not so limited. Ex. 1001, 14:25. The plain meaning of "one *or* more" includes "one," i.e., one and no more. Thus, on the present record, we do not find Patent Owner's arguments regarding the "parameters" limitation persuasive.

3. Conclusion for Claim 1

Having reviewed the Petition and the Preliminary Response, we determine that Petitioner has established a reasonable likelihood of success in showing that claim 1 would have been obvious in view of Jüschke.

E. Remaining Claims and Grounds

Patent Owner argues that Petitioner's grounds for claims 9 and 17 are deficient for the same reasons as claim 1. Prelim. Resp. 28–29. Patent Owner also argues that the additional references in the other two grounds do not cure the underlying deficiencies of Jüschke. *Id.* at 29. Absent particular dispute, and having already determined that Petitioner has met the threshold for institution, we do not review the remaining claims and grounds at this time.

III. CONCLUSION

For the reasons given above, we determine that Petitioner has established a reasonable likelihood of success in showing that at least one claim of the '704 patent would have been obvious in view of the prior art cited. Accordingly, we institute *inter partes* review of all claims and grounds raised in the Petition. 37 C.F.R. § 42.108(a).

IV. ORDER

In consideration of the foregoing, it is hereby

ORDERED that the Petition requesting *inter partes* review of claims 1–24 of the '704 patent is *granted*; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), the *inter partes* review of the '704 patent commences on the entry date of this Decision, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

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