

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Digital Global Systems, Inc.

Petitioner,

v.

DeepSig, Inc.,

Patent Owner.

IPR2025-00049

Patent 10,581,469

PETITIONER'S REQUEST FOR REHEARING

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I. INTRODUCTION

Petitioner Digital Global Systems, Inc. (“DGS” or “Petitioner”) requests rehearing of the Board’s March 27, 2025 Decision, Denying Institution of *Inter Partes* Review. Paper 7 (the “Decision”). The Decision rests on legal and factual errors that merit rehearing.

II. LEGAL STANDARD

“A party dissatisfied with a decision may file a single request for rehearing without prior authorization from the Board.” 37 C.F.R. § 42.71(d). On a motion for rehearing, the Board reviews its decision for an abuse of discretion. 37 C.F.R. § 42.71(c). Abuse of discretion occurs if a panel action is “[1] based on an erroneous interpretation of law, [2] if a factual finding is not supported by substantial evidence, or [3] if the decision represents an unreasonable judgment in weighing the relevant factors.” *Huawei Device Co. v. Optis Cellular Tech., LLC*, IPR2018-00816, Paper 19, 3 (PTAB Jan. 8, 2019) (precedential).

Consistent with 35 U.S.C. § 282(b), the Board applies the claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) and its progeny. 37 C.F.R. § 42.100(b). Under *Phillips*, the first step begins with the claims themselves. *Id.*, 1312-13. The second step of *Phillips* turns to the intrinsic record. *See id.*, 1315 (quoting *In re Fout*, 675 F.2d 297, 300 (CCPA 1982)) (“Claims

must always be read in light of the specification.”). The third step turns to prosecution history followed by extrinsic evidence, which is given the least weight. *See id.*, 1317.

III. ARGUMENT

The Board denied institution on two primary grounds. First, the Board incorrectly interpreted the *nonlinear pre-distortion machine learning model* (“NPDMLM”) recited in all independent claims as being limited to a “*transmit model*.” Decision, 7. Second, the Board overlooked Petitioner’s arguments and supporting evidence showing that Jüscke in view of Holt teaches all limitations of the independent claims. Each of these errors was an abuse of discretion.

A. Limiting the Claimed NPDMLM to a “*Transmit Model*” Was Legal Error

The Board erred by implicitly adding a “*transmit model*” requirement to the NPDMLM recited in independent claims 1, 8, 21, and 23. Neither the claim language itself nor the specification supports such an additional limitation. Independent claims 1, 8, 21, and 23 of the ’469 patent require, *inter alia*, (i) generating a pre-distorted radio signal by processing a (pre-output) transmit radio signal¹ using an NPDMLM

¹ The *transmit radio signal* of limitations [1B.1], [21D.1], and [23B.1] is a pre-output signal that is processed to generate a pre-distorted signal and is not transmitted. Compare to [1D] (*transmit output radio signal*). The *transmit radio signal* is functionally similar to the *candidate transmit radio signal* of limitation [8B.1].

([1B.1]); and (ii) updating the NPDMLM's parameters using a distance metric computed between the (pre-output) transmit signal and a received transmit output signal ([1E.1]). Claim 1 is reproduced below:

[1P] A method for correcting distortion of radio signals, the method comprising:

[1A] obtaining a transmit radio signal corresponding to an output of a transmitting radio signal processing system;

[1B.1] *generating a pre-distorted radio signal by processing the transmit radio signal using a nonlinear pre-distortion machine learning model,*

[1B.2] wherein the nonlinear pre-distortion machine learning model includes model parameters and at least one nonlinear function to correct radio signal distortion;

[1C] obtaining a transmit output radio signal by processing the pre-distorted radio signal through the transmitting radio signal processing system;

[1D] transmitting the transmit output radio signal to one or more radio receivers; and

[1E.1] *updating the model parameters based on a distance metric computed between the transmit radio signal and a received signal that is obtained from the one or more radio receivers,*

[1E.2] the received signal corresponding to the transmit output radio signal that was transmitted to the one or more radio receivers.

EX-1001, claim 1 (emphases added).

The Board interpreted limitation [1B.1] to require “processing a transmit signal using a machine learning model,” and limitation [1E.1] to require “updating model parameters based on a distance metric computed using a received signal obtained from a receiver.” Decision, 7. But the Board skipped over limitations [1B.2]-[1D] and erred by interpreting a combination of [1B.1] and [1E.1] to “require updating parameters for a *transmit* model based on a distance metric computed using a signal obtained from a *receiver*.” *Id.* (emphasis original). But neither the claims nor the intrinsic record limit the NPDMLM to a “*transmit* model.” The Board should grant rehearing to address this erroneous interpretation of the claim language.

1. The Claim Language Does Limit the NPDMLM to a “*Transmit* Model”

The claim language confirms that (i) the NPDMLM need not be a *transmit* model and (ii) the updated model parameters need not be part of a *transmit* model.

First, for limitation [1B.1], the NPDMLM does not transmit any signals, nor does it directly participate in any transmission processes. Limitation [1B.1] instead recites that the NPDMLM *processes* a transmit radio signal so that a separate *pre-distorted radio signal* can be generated. The *transmit radio signal* processed by the NPDMLM is a pre-output signal. It is not itself transmitted, and the claim language does not otherwise require that the NPDMLM transmit it or any other signal. This is made clear by limitation [1C], which requires that the pre-distorted radio signal (not

the transmit radio signal) be processed by a separate *transmitting radio signal processing system* to obtain a separate *transmit **output** radio signal*.

Hence, the claims require only that the NPDMLM processes a pre-output signal so that a separate pre-distorted signal can be generated. The NPDMLM need not transmit a radio signal, nor must the NPDMLM process or generate a signal that is then transmitted to a receiver. Although the pre-distorted signal generated by the NPDMLM is ultimately processed into a *transmit **output** radio signal*, this is a separate requirement performed by the *transmitting radio signal processing system*, rather than the NPDMLM. Accordingly, limiting the claimed NPDMLM to a *transmit* model is inconsistent with the limitations that recite a *transmit output radio signal* [1C], processing said output signal through the *transmitting radio signal processing system* [1C], and *transmitting* said output signal [1D].

Second, limitation [1E.1] does not require that the claimed updated model parameters be limited to a *transmit* model. Contrary to the Board's interpretation, limitation [1E.1] does not require that the updated *model parameters* affect *transmission* (or reception) of a radio signal. The limitation does not have any specific requirements for the *model parameters* other than that they be (i) included as part of the NPDMLM; and (ii) updated based on a *distance metric* computed between the (pre-output) *transmit radio signal* that is **not** transmitted (i.e., the signal

that is processed to generate a pre-distorted radio signal) and the *transmit output radio signal* that is received by a receiver. The claims require only that some parameter of the model (the NPDMLM) that generates a pre-distorted signal by processing a pre-output signal (that is not itself actually transmitted) be updated.

Further, limitation [1E.1] allows for the NPDMLM's parameters and the applied distance metric to account for distortion at multiple devices and locations within a communication system. For example, the claim language allows for the NPDMLM and its parameters to account for signal distortion after a signal has been transmitted and received at a receiver and for the updated model parameters to account for distortion found in a signal received by a receiver. *See* limitation [1E.1] (“*updating the model parameters based on a distance metric computed between the transmit radio signal and a received signal that is obtained from the one or more radio receivers*”). Nothing from limitation [1E.1] or the rest of claim 1 requires that the updated model parameters be limited to a *transmit* model.

As shown, independent claim 1 (as well as claims 8, 21, and 23) does not require that the NPDMLM be a *transmit* model. Limitation [1B.1] requires only that the NPDMLM generates a pre-distorted signal from a pre-output signal. Similarly, limitation [1E.1] requires only that an NPDMLM parameter is updated using a distance metric between the pre-output signal (that is not transmitted) and a *transmit*

output radio signal received by a receiver. Limiting the claimed NPDMLM to a *transmit model* is therefore unsupported by the claim language. The Board should therefore grant rehearing and institution.

2. The Specification Does Not Limit the NPDMLM to a “Transmit Model”

The '469 patent specification confirms that the claimed NPDMLM need not be a *transmit* model or implemented within a transmitter device. Nor must the NPDMLM parameters be limited to a *transmit* model.

First, the specification confirms that the NPDMLM is not used for transmitting a radio signal. Although the '469 patent discloses a nonlinear pre-distortion system (103) used to correct radio signal distortion and interference before a radio signal is transmitted, *see* EX-1001, 5:51-53, transmission is handled separately by the *transmitting radio signal processing system*. For example, “the nonlinear pre-distortion system 103 uses a nonlinear pre-distortion machine learning model 102 to determine pre-distorted radio signals that minimize a distance between the radio signals that the *transmitting radio signal processing system 107 transmits* and radio signals the receiver receives 108.” *Id.*, 5:54-59 (emphasis added). The NPDMLM simply generates a pre-distorted signal that is sent for further processing.

Second, the '469 patent contemplates that its machine learning models, parameters, and training are not limited to a particular location or device (such as a

transmitter). The specification discloses a nonlinear pre-distortion system that can remotely “perform online tuning and continue to train and update model parameters during real time execution.” EX-1001, 6:11-12; *see also id.*, 6:26-28 (“The process 200 can be performed by a system of one or more computing devices, located in one or more locations, and programmed appropriately in accordance with this specification.”). The specification also confirms that the NPDMLM is not tied to a transmitter or receiver device for its online tuning configuration: “In the online tuning configuration, the receiver 109 sends the received signal 111 to the nonlinear pre-distortion system in order for the system to compute the distance metric between the transmit signal 104 and the received signal 111.” *Id.*, 10:14-18. The model optimization process then “computes updated pre-distortion model parameters” for the NPDMLM to minimize the distance metric. *Id.*, 10:19-20. Nothing in the specification limits the claimed NPDMLM to a *transmit* model, nor the claimed parameters to transmission.

Therefore, the specification confirms that that the NPDMLM is not limited to a “*transmit* model,” and that the Board’s interpretation of the claim language was legal error. The Board should therefore grant rehearing and institution.

B. The Board Overlooked Petitioner’s Arguments and Evidence Regarding Holt’s Teachings Was an Abuse of Discretion

The Board further erred by relying on its improper interpretation of the claim language to overlook Petitioner’s arguments and evidence. After implicitly adding the “*transmit* model” limitation to the independent claims, the Board incorrectly concluded that the Holt reference did not disclose or suggest “updating parameters for a transmit model based on a distance metric computed using a signal obtained from a receiver.” Decision, 13. This conclusion was error for at least two reasons.

First, the Board’s decision was based on its implicit addition of “*transmit* model” to the claim language, which itself was error. *See* § III.A, *supra*. Properly interpreting the claim language would eliminate the Board’s basis for denying institution over Holt. Second, even if the Board’s interpretation was correct, the Board erred by overlooking Petitioner’s evidence demonstrating that Holt teaches updating parameters for a transmit model based on a distance metric, and that a person of ordinary skill in the art (“POSITA”) would have recognized the same.

1. Petitioner’s Arguments and Evidence Regarding Holt

Petitioner demonstrated that Holt teaches training techniques for a channel coding model that includes an encoder (transmitter) model, a channel model (that emulates an actual communication channel, including the addition of noise), and a decoder (receiver) model. Paper 1, 10-11. Petitioner also showed that Holt teaches

training its models based on a loss function describing the “difference between input data input into the encoder model and output data received from the decoder model.”

Id. (quoting EX-1006, Abstract).

Petitioner also showed that Holt discloses multiple examples of loss functions based on the difference between encoder and decoder model inputs and outputs, including a first loss function in which an emulated channel model is used and a fourth loss function in which an actual communication channel is used. Petitioner demonstrated that a POSITA would have understood that Holt’s encoder and decoder models and loss functions could be implemented in environments using an emulated communication channel model as well as an actual communication channel. Paper 1, 20.

2. The Board Applied its Incorrect “*Transmit Model*” Interpretation When Evaluating Holt’s Teachings

Based on its “*transmit model*” interpretation of the challenged claims, the Board concluded that Holt does not disclose or suggest the claimed NPDMLM. But as shown in Section III.A, *supra*, limiting the NPDMLM to a “*transmit model*” was legal error. And without so limiting the claim language, Petitioner has shown that Jüscke in view of Holt renders obvious teaches independent claims 1, 8, 21, and 23. *See* Paper 1, 13-47, 60-66, 75-77.

Petitioner demonstrated that Holt trains its models using loss functions, and that Holt's first loss function (exemplified in Holt Figure 1 with a channel model) and fourth loss function (exemplified in Figure 4 with an actual communication channel) are based on encoder and decoder inputs and outputs. *See* Paper 1, 10-11, 20 (Holt's first loss function 216 based on encoder model input 204 and decoder model output 214), 20-21 (Holt's fourth loss function 318 based on encoder model input 316 and decoder model output 312). In sum, Petitioner has shown that Holt trains its models using loss functions (a distance metric).

Petitioner also demonstrated that a POSITA would have been motivated to combine Holt with Jüschke to improve the accuracy of Jüschke's training techniques using Holt's loss functions based on actually received transmissions. Paper 1, 42-43, 46-47. Therefore, under a proper reading of the claims, Jüschke in view of Holt teaches all independent claims of the '469 patent. *See* § III.A, *supra*. The Board should therefore grant rehearing and institution.

3. The Board Overlooked Arguments and Evidence Showing Holt in view of Jüschke Teaches Claim 1

The second part of the Board's denial of institution in light of Holt was based on applying the added "*transmit* model" requirement to the teachings of Holt. The Board found that Holt does not teach (on its own or in combination with Jüschke) updating "transmit model parameters based on a distance metric computed using a

signal obtained from a receiver.” Decision, 13. But in reaching this conclusion, the Board overlooked arguments and evidence showing that a POSITA would have understood that Holt’s various loss functions were interchangeable, and that a loss function based on signal obtained from a receiver could be used to train a transmitter model. As a result, the Board reached a factual finding unsupported by the evidence, and rehearing should be granted.

First, the Board concluded that Holt does not disclose or suggest training an encoder model based on a loss function computed using a signal obtained from a receiver, despite finding that Holt “teach[es] training an encoder (i.e., transmit) model based on a loss function computed using a signal obtained from a model.” Decision, 13. The Board’s conclusion ignores evidence that Holt’s models are generally trained using loss functions (based on the difference between encoder and decoder model inputs and outputs) and that these loss functions can be applied in various environments including channel models and actual communication channels. Paper 1, 10-11. Holt Figures 3 and 6 (as annotated in the petition) are produced below. Figure 3 shows a first loss function based on encoder inputs and decoder outputs using an emulated channel model, and Figure 6 exemplifies a similar (fourth) loss function using an actual communication channel:

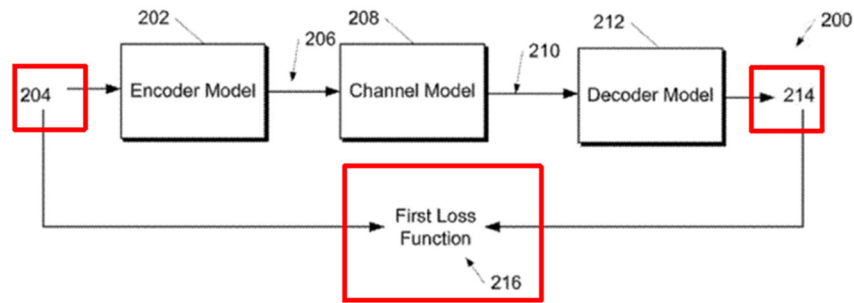


Figure 3

EX-1006, Figure 3 (annotations added); *see* Paper 1, 20 (same).

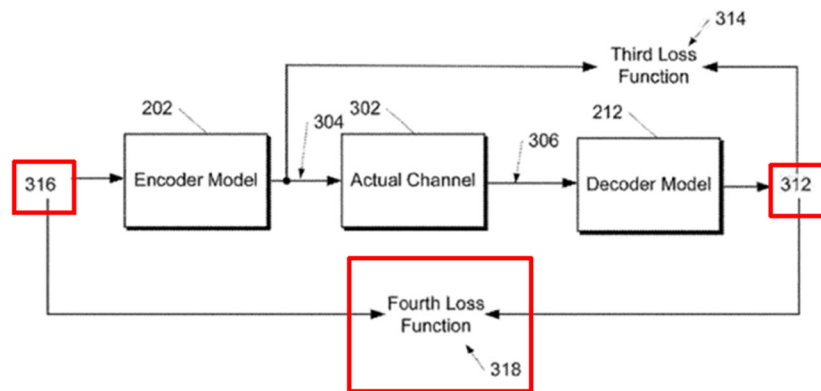


Figure 6

EX-1006, Figure 6 (annotations added); *see* Paper 1, 21 (same).

The Board’s primary issue with Holt’s teachings was finding that “Holt teaches training *only* a decoder model using an actual communication channel [Figure 6].” Decision, 11 (emphasis original). But this ignores Petitioner’s evidence that a POSITA would have understood that Holt’s loss functions could be applied interchangeably for different model setups, including both an emulated channel model and an actual communication channel. *See* EX-1001, 20 (“Holt’s encoder and decoder models and loss functions could be implemented with an actual

communication channel.”); EX-1003, ¶128 (“POSITA would have understood that Holt’s encoder and decoder models were not limited to a channel model and could be implemented with an actual communication channel for loss functions.”). Overlooking Petitioner’s evidence regarding a POSITA’s understanding of Holt’s teaching of its loss functions and their applicability to both modeled and actual communication channel environments led to an unsupported factual finding, an abuse of discretion that requires rehearing.

Second, the Board found that Petitioner did not assert that a POSITA “would have modified Holt’s techniques to train a transmit model (such as Jüschke’s) using a signal obtained from a receiver.” Decision, 14. This finding was incorrect. *See* EX-1001, 24 (“POSITA would have known that Holt’s encoder model can be implemented by a transmitter device...POSITA also would have known that Jüschke’s teachings are embodied in a flexible radio transmitter that can support as many standards and signals as possible. Therefore, POSITA would have had a reasonable expectation of success for improving output data sampling and model training in such systems by adding Holt’s receiver data into Jüschke’s transmission output feedback loop.” (cleaned up)); EX-1003, ¶135 (supporting the same); EX-1001, 43 (“POSITA would have understood that updating parameters using Holt’s loss functions based on actually received transmissions would have provided a

known accuracy improvement to Jüschke's training techniques by accounting for the actual effects of transmission and reception into Jüschke's output data sampling for NN training."); EX-1003, ¶180 (supporting the same); EX-1001, 46 ("POSITA would have understood that using transmit signals actually received and recovered at a receiver as taught in Holt would have provided a known improvement to Jüschke's training techniques by using more accurate training data."); EX-1003, ¶187 (supporting the same). The Board's failure to acknowledge Petitioner's assertions of evidence concerning a POSITA's motivation to combine Holt with Jüschke to train Jüschke's transmit model was also an abuse of discretion.

IV. CONCLUSION

The Board denied institution based on errors of fact and law, including improperly limiting the claims to a "*transmit* model" and overlooking Petitioner's arguments and evidence proffered with respect to Holt and its combination with Jüschke. The Board should therefore grant rehearing and institution.

Respectfully submitted,

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The undersigned hereby certifies that the foregoing **PATENT OWNER'S REQUEST FOR REHEARING** was served by filing these documents through the Patent Trial and Appeal Case Tracking System (P-TACTS) as well as by delivering a copy via electronic mail on April 28, 2025, in the entirety on the following:

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