

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

U.S. Patent No. 11,018,704

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

Mail Stop PATENT BOARD
Patent Trial and Appeal Board
U.S. Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
II.	ARGUMENT	2
A.	Ground 1: Jüschke renders [1B.1] obvious.....	3
1.	Jüschke renders a “machine learning model <i>associated with</i> the base station” obvious.....	3
B.	Ground 1: Jüschke renders [1B.2] obvious.....	6
1.	[1B.2] does not require the “ <i>model parameters</i> ” be selected from a group of multiple “ <i>deployment scenario</i> ” configurations.....	7
2.	[1B.2] does not require that parameters be “use dependent.”	13
C.	Claims 9 and 17, and their dependent claims, are rendered obvious for the same reasons as claim 1 under Ground 1. Claims 1, 9, and 17 and the dependent claims are also rendered obvious for the same reasons under Grounds 2 and 3.	15
D.	Ground 2: Jüschke in view of Holt renders claim 4 obvious.....	16
1.	The [4B] “ <i>distance metric</i> ” can be determined using a modeled [4A] “ <i>received radio signal.</i> ”	17
2.	Even under Patent Owner’s construction of the claim language, Ground 2 still renders claim 4 obvious.....	25
E.	Dependent claims 5-6 rendered obvious based on their dependency to claim 4 under Ground 2.	30
III.	CONCLUSION	30

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Apple Inc. v. Andrea Elecs. Corp.</i> , 949 F.3d 697 (Fed. Cir. 2020)	25
<i>AT&T Corp. v. Dali Wireless Inc.</i> , IPR2022-01212, Paper 37 (PTAB Jan. 30, 2024)	25
<i>Caterpillar Inc. v. Wirtgen Am., Inc.</i> , IPR2022-01264, Paper 31 (PTAB Jan. 22, 2024)	25
<i>SuperGuide Corporation v. DirecTV Enterprises, Inc.</i> , 358 F.3d 870 (Fed. Cir. 2004)	12
<i>W. Digital Techs., Inc. v. Viasat, Inc.</i> , IPR2022-01171, Paper 33 (PTAB Dec. 13, 2023)	25

I. INTRODUCTION

Petitioner Digital Global Systems, Inc. (“DGS” or “Petitioner”) submits this Reply brief (“Reply”) in response to Patent Owner DeepSig, Inc.’s (“DeepSig” or “Patent Owner”) Response brief (Paper 12, “Response”) to the Petition (Paper 1, “Petition”.) Proffering no expert testimony and focusing its arguments solely on limitations [1B.1], [1B.2], and claim 4, Patent Owner fails to show that the prior art references asserted under Grounds 1-3 fail to render claims 1-24 of the ’704 patent obvious.

First, for limitation [1B.1], Patent Owner repeats its preliminary arguments (Paper 9, “POPR”) and interprets a “machine learning model *associated with* the base station” to somehow exclude said model being used or implemented in a base station. The Board rightfully rejected this argument in its decision to institute (Paper 10, “Institution Decision”), noting that “a model used in a base station is associated with that base station.” (Institution Decision, 12.) Patent Owner adds no new arguments or a claim construction to change the Board’s original decision.

Second, for limitation [1B.2], Patent Owner again repeats the same POPR arguments the Board previously rejected. Here Patent Owner incorrectly argues that [1B.2] requires a selection step for the parameters from a multitude of parameter sets to select from. (Response, 25-26.) The Board correctly rejected these arguments in the Institution Decision, finding “that the claims are not so limited” as to require that

the “model must have many configurations” to “be selected once placed in a given deployment scenario.” (Institution Decision, 13.) The Board further clarified that the “plain meaning of ‘one *or* more’ includes ‘one,’ i.e., one and no more.” (*Id.* (emphasis original).) The disclosure of one in the prior art is all that is required.

Third, for claim 4, Patent Owner incorrectly argues that the claim requires that the distance metric must be calculated using a signal that must have been received at a receiver. (Response, 38.) This is unsupported by both the claim language and the specification. Moreover, even under Patent Owner's faulty interpretation, Petitioner has demonstrated that Ground 2 renders claim 4 obvious by Jüschke in view of Holt.

Patent Owner's remaining attorney arguments do not mover the needle. Petitioner respectfully requests the Board confirm that all challenged claims are unpatentable.

II. ARGUMENT

Petitioner presented Ground 1 (Jüschke) for rendering obvious claims **1-3**, **7-8**, **9-11**, **15-16**, **17-19**, **23-24**; Ground 2 (Jüschke in view of Holt) for rendering obvious claims **1-24**; and Ground 3 (Jüschke in view of Holt and Dzierwa) for rending obvious claims **2-6**, **10-14**, and **18-22**. Patent Owner focuses its arguments solely on limitations [1B.1] and [1B.2] under Grounds 1-3 and claim 4 under Ground 2. As explained below, all limitations alleged to be missing by Patent Owner have

been demonstrated to be rendered obvious under Grounds 1-3 by Petitioner.

A. Ground 1: Jüschke renders [1B.1] obvious.

For limitation [1B.1] (“*accessing a nonlinear pre-distortion machine learning model associated with the base station*”), Patent Owner’s assertion against Ground 1 boils down to reading “*associated with*” to specifically exclude the model being implemented within or used within a base station. The Board correctly rejected this argument in its Institution Decision, finding that “it would seem that a model used in a base station is associated with that base station.” (Institution Decision, 12.) Patent Owner does not support its position with additional evidence or a construction based on the intrinsic record that would support construing “*associated with*” differently than its plain and ordinary meaning. The Board should once again reject Patent Owner’s arguments.

1. Jüschke renders a “machine learning model *associated with the base station*” obvious.

Patent Owner incorrectly argues that a machine learning model being implemented in a base station does not render obvious said model being “*associated with*” a base station. (Response, 31-32.)

Petitioner previously established that a “POSITA would have understood that Jüschke teaches that neural network 13...can be *associated with the base station* by being implemented in a flexible transmitter that is itself implemented in a base

station.” (Petition, 25 (emphasis original); *see also* Ding Declaration, ¶139.)¹ Relatedly, as explained for limitation [1A], a “POSITA would have understood that Jüschke’s transmitter can be ‘flexibl[y]’ implemented in scenarios and structures, including base stations such as ‘macro-cell base stations’ and ‘small-cell base stations’ and related transceiver infrastructure,” and that said flexible transmitter “can be implemented within a base station and that input signal 12 can be obtained at a base station.” (Petition, 22; *see also* Ding Declaration, ¶¶122, 131 (A POSITA also would have understood the flexible transmitter could be implemented in remote radio units (RRUs) or remote radio heads (RRHs).) Hence, Petitioner established that a POSITA would have understood that a model implemented in a base station that sends and receives radio signals (using a transmitter) teaches said model being *associated with* said base station as stated in the claims.

But rather than addressing the above directly, Patent Owner narrowly

¹ As opined by Dr. Ding, a POSITA would have understood that a macro-cell base station is a “cellular base station that sends and receives signals through large outdoor towers and antennas,” and a small-cell base station is a “lower-power cellular base station (possibly indoor), covering a limited area such as malls, hotels, or transportation hubs.” (Ding Declaration, ¶131, nn.7-8.)

interprets “*associated with*” as excluding a model being ***implemented*** in a base station. Patent Owner presents no literature or testimony demonstrating that the plain-and-ordinary meaning of a model “*associated with*” a base station excludes said model from being implemented in a base station. Nor does Patent Owner demonstrate from the intrinsic record that the ’704 patent intended to exclude a model being implemented in a base station as such.

Patent Owner relies solely on attorney argument. Patent Owner claims that “nothing in Jüschke supports an association between a base station and neural network 13,” and that “Jüschke fails to disclose whether the existence (or non-existence) of a base station supporting a transmitter would have any effect on the neural network 13 designed to approximate the transmitter’s inverse transfer function, and Petitioner fails to present any evidence of such an effect or association.” (Response, 31.) This is incorrect for at least two reasons.

First, Jüschke’s flexible transmitter, which includes neural network 13, “support[s] as many standards and signals as possible” and is implemented in “macro-cell base stations” and “small-cell base stations.” (Ex-1005, [006]; *see* Petition, 22-23, 41-42.) A neural network implemented within a base station transmitter as such performs machine learning predictions for said base station transmissions. Therefore, by being implemented within and part of the transmission functionality of a base station, Jüschke neural network 13 is “*associated with*” said

base station.

Second, Patent Owner admits that “Jüschke approximates the inverse transfer function for the transmitter device,” and said “base station [includes] a transmitter [that] is located” within it. (Response, 32.) Jüschke neural network 13 performing machine learning prediction (inverse transfer function) for base station transmitter device (and supporting signal transmission for said base station) further supports said model being implemented within said base station, which is all that is required to teach the “*associated with*” limitation as claimed.

For the reasons shown above, Petitioner has met its burden and demonstrated that Jüschke under Ground 1 renders [1B.1] obvious, and that Patent Owner's arguments do not prove otherwise. The Board should therefore find Ground 1 renders [1B.1] obvious as well as claim 1.

B. Ground 1: Jüschke renders [1B.2] obvious.

For limitation [1B.2] (“*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*”), Patent Owner again repeats the same failed arguments that the Board has already rejected.

First, Patent Owner incorrectly asserts that “*parameters associated with values corresponding to one or more deployment scenarios*” requires a **selection** step for the parameters. (See Response, 23-25.) The Board correctly rejected this

argument in its Institution Decision, finding “the claims are not so limited.” (Institution Decision, 13.) **Second**, Patent Owner improperly reads “*one or more*” to mean ***more than one***. (Response, 25.) The Board correctly rejected this in its Institution Decision as well. (Institution Decision, 13.) **Third**, Patent Owner incorrectly argues that [1B.2] include a “use dependent” requirement that is unsupported by the claim language and the intrinsic record. (See Response, 23-25.) As there is no such requirement, Patent Owner’s attempt to distinguish [1B.2] on this basis fails.

1. [1B.2] does not require the “*model parameters*” be selected from a group of multiple “*deployment scenario*” configurations.

Patent Owner incorrectly argues that there is a separate selection requirement of the “*model parameters*” amongst a group of distinct sets so that said parameters correspond to “*one or more deployment scenarios in the cellular communications system.*” (Response, 23-26.) But there is no such selection requirement for the “*parameters*” or “*one or more deployment scenarios*” in the claims.

Petitioner previously established that the “*deployment scenarios*” in the ’704 patent are hardware configurations for radio communications. In the only passage describing “*deployment scenarios*” in detail, the ’704 patent makes clear that these hardware configurations are for “sending a radio transmission” such as “sending a radio transmission from a cellular base station that includes the nonlinear pre-

distortion ***machine learning model inside a tower mounted amplifier in an inline mode.***” (Ex-1001, 2:38-41 (emphasis added); see Petition, 9; Ding Declaration, ¶¶84-91.)² Relatedly, '704 patent Figures 6A and 7A illustrate “in-line mode” configurations for a tower-mounted amplifier (6A) and a remote radio unit (7A). (*Id.*, 26-27 (citing Ex-1001, 10:39-48).) Both of these “in-line” hardware configurations (*deployment scenarios*) implement a linear structure from input (601/701) to neural network model (103) to amplifier (603/703). The Board agreed, ruling that “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).” (Institution Decision, 8.) Figures 6A and 7A from the '704 patent are illustrated below demonstrating these in-line hardware configurations:

² Passage 2:38-65 describes the “deployment scenarios” as eight hardware configurations for “sending a radio transmission” that mirror the language of claim 3. The '704 patent does not further limit these “deployment scenarios” in the intrinsic record.

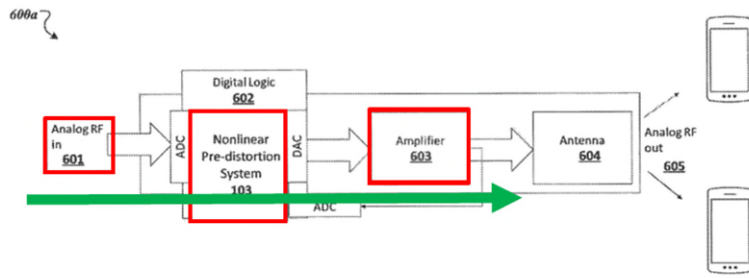


FIG. 6A

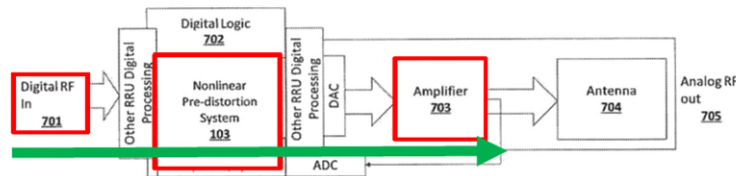
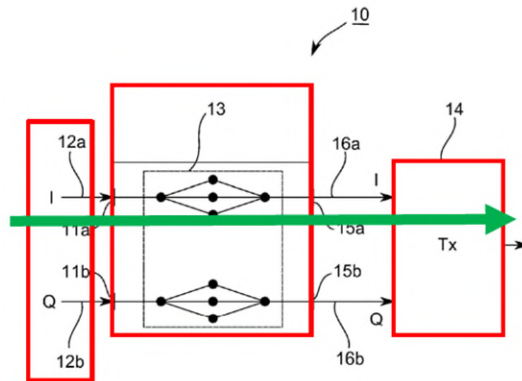


FIG. 7A

(Ex-1001, Figures 6A, 7A (annotations added).)

Petitioner further established that the neural network parameters in Jüschke “apply to [hardware] configurations mirroring the *deployment scenarios* explicitly described in the ’704 patent.” (Petition, 26 (emphasis original).) Petitioner showed that Jüschke apparatus 10 (Figure 1), applicable to Jüschke’s flexible radio transmitter implemented in a base station, would have rendered obvious model parameters corresponding to a hardware-based *deployment scenario* as claimed by [1B.2]. Jüschke Figure 1 below demonstrates a linear hardware structure implementation beginning from input (11) to neural network model (13) to amplifier (14), mirroring Figures 6A and 7A of the ’704 patent above:



(Ex-1005, Figure 1 (annotations added).)

Patent Owner ignores all this³—including the Board’s construction for “*deployment scenarios*” (Institution Decision, 8)—and incorrectly argues that [1B.2] requires that the model parameters must be **selected** from a **group** corresponding to

³ In addition to limitation [1B.2] discussed on pages 26-29 of the Petition, Petitioner points to its discussion of limitation [3A] (“*wherein the particular deployment scenario comprises one of: sending a radio transmission from the base station that includes the nonlinear pre-distortion machine learning model inside a tower mounted amplifier in an inline mode*”) on pages 40-45. Not only did Petitioner demonstrate that a “*deployment scenario*” would have been rendered obvious under Ground 1, Petitioner further demonstrated that the “*particular deployment scenario[s]*” of claim 3 were rendered obvious as well. Patent Owner fails to address these positions.

two or more “*deployment scenarios*.” (See Response, 25-26.) Patent Owner sets up this flawed position by first claiming that [1B.2] requires a “***use-dependent***...model for a base station that depends on the deployment scenarios in which it is used,” and that “[t]he ’704 patent decides what parameters to use for a given deployment scenario.” (Response, 23 (emphasis added).) But neither the claims nor the specification ever mention a “use-dependent” criteria for the model as Patent Owner argues. Indeed, Patent Owner’s citation of the ’704 patent over three pages does not demonstrate a single instance of the term “use-dependent” or similar language limiting “*parameters*” or “*one or more deployment scenarios*.” (See *id.*, 23-25.) All Patent Owner has shown, at best, is that different models and parameters can be used in general. (See, e.g., *id.*, 24 (“The ‘fixed model architecture’ may be chosen ‘from among a plurality of model architectures based on multiple training processes and comparison of distance metrics.’” (Citations omitted.))) That is not a “use-dependent” selection or criteria required in the claims.

Patent Owner then takes this manufactured “use-dependent” requirement to insert a non-existent parameter selection limitation into the claims. Patent Owner argues that the “parameters themselves are ***selected*** for the model to correspond to one or more deployment scenarios,” implying an extra step in which the parameters are first selected from a group of two or more sets of parameters corresponding to different “*deployment scenario*” configurations. (Response, 25 (emphasis added).)

But Patent Owner's position is unsupported and contradicted by the plain language of the claim.

The plain language of [1B.2] does not include a selection criteria for the model parameters. Limitation [1B.2] only requires that the parameters be "*associated with values corresponding to one or more deployment scenarios in the cellular communications system.*" There is no extraneous requirement that the parameters be selected from multiple sets of parameters corresponding to multiple configurations as Patent Owner asserts. The Board correctly rejected these arguments from Patent Owner in its prior Institution Decision, ruling "that the claims are not so limited" as to require that the "model must have many configurations" to "be selected once placed in a given deployment scenario." (Institution Decision, 13.)

Further, there is no requirement that the parameters correspond to multiple deployment scenarios as alluded to by Patent Owner. (Response, 25.) The Board previously made clear that the "plain meaning of 'one or more' includes 'one,' i.e., one and no more." (Institution Decision, 13.) Thus, a single deployment scenario is sufficient to teach this limitation. *See SuperGuide Corporation v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 884 (Fed. Cir. 2004) ("at least one" means "one or more"). As Petitioner has shown, Jüscke's model within its flexible transmitter includes parameters fitted for a hardware configuration (*deployment scenario*) that it is implemented for, such as a base station with a linear input to model to amplifier

configuration.⁴

Patent Owner has not presented any new arguments, literature, or testimonial evidence to change the Board's previous decision. Accordingly, the Board should once again reject Patent Owner's arguments and find limitation [1B.2] rendered obvious under Ground 1.

2. [1B.2] does not require that parameters be “use dependent.”

As explained above, there is no “use dependent” requirement for [1B.2]. Patent Owner's incorrect addition of “use dependent” is rooted in an improper attempt to narrow the claims and avoid Jüschke's teachings. Patent Owner asserts that “[b]y contrasting its disclosed system from “use dependent” systems, Jüschke confirms that it does not disclose or suggest the claimed features, which contemplate use-dependent ‘deployment scenarios.’” (Response, 26.) Patent Owner then narrowly interprets a self-learning embodiment of Jüschke as teaching away from Patent Owner's “use dependent” interpretation of the claims. (*Id.*) So, in addition to Patent Owner's incorrect claim interpretation, Patent Owner does not properly read Jüschke in its entirety.

⁴ Claim 3 exemplifies these “*one or more deployment scenarios*” such as the “*inline mode*” configurations discussed above. (See Petition, 40-45 ([3A] and [3C]).)

Patent Owner further argues that Jüschke's neural network, including its parameters trained for correcting radio transmissions, does not teach the claim limitation "[use-dependent] *deployment scenarios*," as interpreted by Patent Owner, because the model is "tuned to approximate the inverse transfer function of the transmitter device 14." (Response, 28.) Jüschke transmitter device 14, however, is implemented in radio transmission hardware (including base stations and remote radio units) and accounts for other downstream hardware such as amplifiers. (See Petition, 20.) Patent Owner's attempt to distinguish limitation [1B.2] from Jüschke, by arguing that the "downstream hardware component being accounted for is the 'analog transmitter device arranged downstream to the pre-distortion neural network,' and not any deployment scenario in which the transmitter...is being used," is simply incorrect. For example, Jüschke's "post distortion neural network processor...may be structurally adapted to additionally or alternatively invert a nonlinear transmitter transfer function of at least one nonlinear analog power ***amplifier*** device." (Ex-1005, [0020] (emphasis added); see Petition, 28, 34.) Petitioner has thus shown that Jüschke's neural network corrects transmitters implemented in infrastructure such as base stations and accounts for additional hardware such as amplifiers.

And as previously discussed, the '704 patent's "deployment scenarios" are simply hardware-based configurations such as a "*sending a radio transmission from*

the base station that includes the nonlinear pre-distortion machine learning model inside a tower mounted amplifier in an inline mode." (Ex-1001, claim [3A].) Jüschke clearly discloses its neural network model in an inline base station configuration including an amplifier. (Compare Ex-1005, Figure 1 with Ex-1001, Figure 6A.) The Board even noted in its Institution Decision that "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." (Institution Decision, 12.) Patent Owner has made no direct argument nor proffered any evidence against this "striking resemblance."

For the reasons shown above, Petitioner has met its burden and demonstrated that Jüschke under Ground 1 renders [1B.2] obvious, and that Patent Owner's arguments do not prove otherwise. The Board should therefore find Ground 1 renders [1B.2] obvious as well as claim 1.

C. Claims 9 and 17, and their dependent claims, are rendered obvious for the same reasons as claim 1 under Ground 1. Claims 1, 9, and 17 and the dependent claims are also rendered obvious for the same reasons under Grounds 2 and 3.

For the same reasons stated above, claims 9 and 17 are rendered obvious under Ground 1 for the same reasons as claim 1 because the claims share identical limitations at issue. (Compare [1B.1] with [9D.1] and [17B.1]; compare [1B.2] with [9D.2] and [17B.2].) Ground 2 (Jüschke in view of Holt) and Ground 3 (Jüschke in

view of Holt and Dzierwa) also render claims 1, 9, and 17 for the same reasons as Ground 1 (Jüschke).

Grounds 1-3 also render obvious dependent claims 2-3 and 7-8, 10-11 and 15-16, and 18-19 and 23-24 based on their respective dependencies to independent claims 1, 9, and 17. Patent Owner does not directly address these dependent claims but for their dependency to independent claims 1, 9, and 17.

Patent Owner's arguments with respect Ground 2 rendering dependent claims 4-6 obvious are addressed below.

D. Ground 2: Jüschke in view of Holt renders claim 4 obvious.

Patent Owner misreads limitations [4A] and [4B] by arguing that the “received radio signal that *corresponds* to a *representation* of the transmit output radio signal received at the one or more radio receivers” must be the same as the signal received from a radio receiver. Patent Owner's argument is unsupported by the claim language and the specification. Furthermore, Patent Owner fails to show that claim 4 is not obvious over Ground 2. For illustrative purposes, claim 4 as broken down into limitations [4A], [4B], and [4C] is presented below.

Claim 4	Limitation
[4A]	The method of claim 2, further comprising: obtaining a received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers;
[4B]	determining a distance metric between the transmit radio signal and the received radio signal; and
[4C]	updating the values of the model parameters for the particular deployment scenario based at least on the distance metric.

(Petition, Appendix 1, 4.)

1. The [4B] “distance metric” can be determined using a modeled [4A] “received radio signal.”

For claim 4, Patent Owner incorrectly interprets the “received radio signal” from [4A] as a signal that must be **received from a radio receiver** for the “distance metric” determination of [4B]. Based on this faulty interpretation, Patent Owner asserts that Ground 2 is deficient because a first loss function embodiment of Holt (Figure 3) demonstrates an encoder model (implemented in a transmitter) being trained using a channel model that represents a communication channel. Patent Owner argues that because Holt’s “first loss function is based on a modeled channel,” (Response, 38), “Holt does not train its encoder model, or modify any transmit signal, based on any **received radio signal from a radio receiver**, or on a distance metric [4B] computed between a ‘transmit radio signal and a received radio

signal” from **a radio receiver.**” (Response, 41 (emphasis added).)⁵ Patent Owner’s claim interpretation is contradicted by both the claim language and the specification.

A reading of claim 4 shows that the claimed “*received radio signal*” only needs to “**correspond[] to a representation of the transmit output radio signal received at the one or more radio receivers,**” e.g., a modeled signal. (Ex-1001, [4A] (emphasis added)). Indeed, [4A] treats separately the “*received radio signal that corresponds to a representation*” and the “*transmit output radio signal received at the one or more radio receivers.*” Thus, the “*received...representation*” signal need not itself be the separate “*transmit output radio signal **received at the one or more radio receivers***” as Patent Owner asserts. (*Id.* (emphasis added).) In other words, the [4A] “*received...representation*” signal “*corresponds*” to the “*transmit output radio signal received at the one or more radio receivers,*” but this “*received...representation*” signal need not itself **be** the signal received at a receiver. Limitation [4A] is shown below with highlighting illustrating the distinction between the “*received...representation*” signal and the separate “*received at the one*

⁵ It is unclear what Patent Owner is quoting from “transmit radio signal and a received radio signal.” Patent Owner does not leave a citation nor does this language appear in the claims.

or more radio receivers" signal.

Claim 4	Limitation
[4A]	The method of claim 2, further comprising: obtaining a received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers;

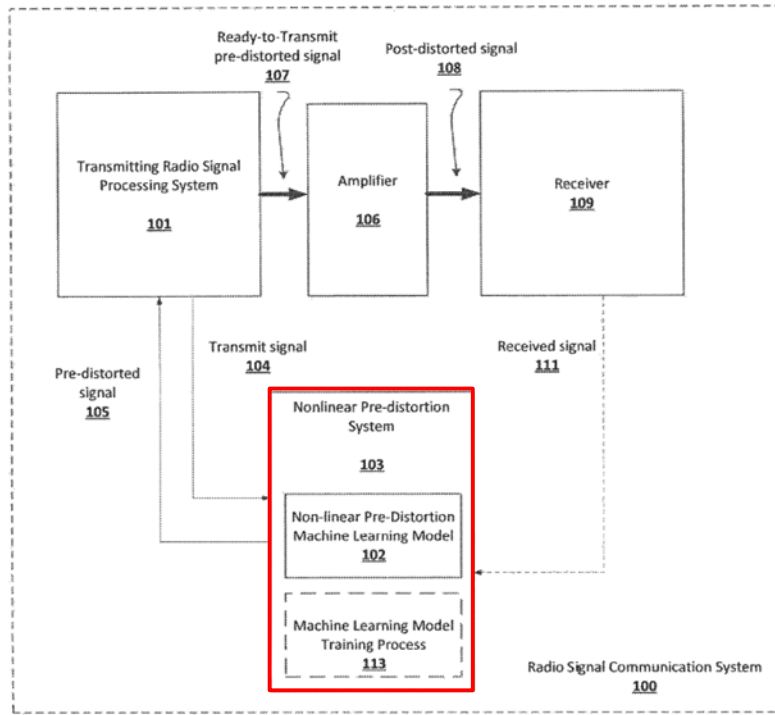
(Petition, Appendix 1, 4 (annotations added).)

Moreover, the [4B] “distance metric” is “determin[ed]” using “the received radio signal,” this “received radio signal” signal being the same signal that “corresponds to a representation” as claimed in [4A]. Hence, claim 4 does not require the “received radio signal” from which the “distance metric” is determined to be the same signal as the signal received at a radio receiver because “received” in [4A] modifies the “radio signal that corresponds to a representation.” (See Ex-1001, [4B] (“determining a distance metric between the transmit radio signal and the received radio signal”).) Claim 4 only requires that the “received radio signal...corresponds to a **representation**” of a signal received at a receiver. Limitation [4B] is shown below with highlighting illustrating the connection between the “received...representation” signal that is “obtain[ed]” and the “received” signal used for determining the “distance metric.”

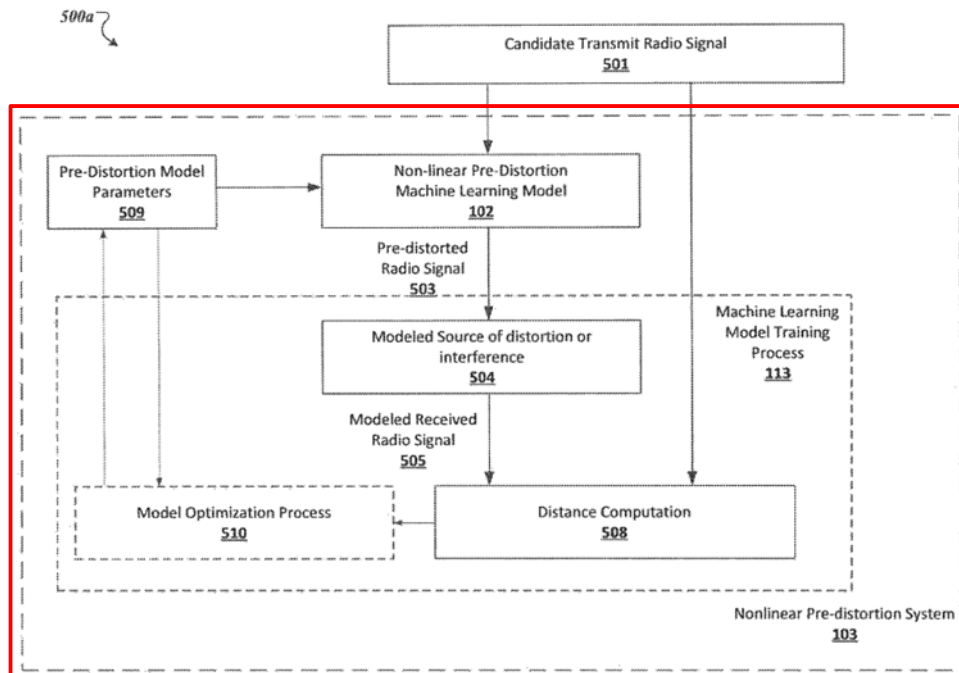
Claim 4	Limitation
[4A]	The method of claim 2, further comprising: obtaining a received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers;
[4B]	determining a distance metric between the transmit radio signal and the received radio signal; and
[4C]	updating the values of the model parameters for the particular deployment scenario based at least on the distance metric.

(Petition, Appendix 1, 4 (annotations added).)

The '704 patent specification confirms that the claim 4 “received...representation” signal need not be a signal received at a receiver as Patent Owner contends. For example, '704 patent Figure 5A outlines an embodiment corresponding to the processes claimed in claim 4 and includes a “Modeled Received Radio Signal 505.” (Ex-1001, Figure 5A) The specification further states that “[i]n some implementations, the nonlinear pre-distortion system 500 a is the same as the nonlinear pre-distortion system 103.” (*Id.*, 9:38-40.) An illustrative comparison of nonlinear pre-distortion system 103 and nonlinear pre-distortion system 500 is shown below form Figures 1 and 5A is shown below.

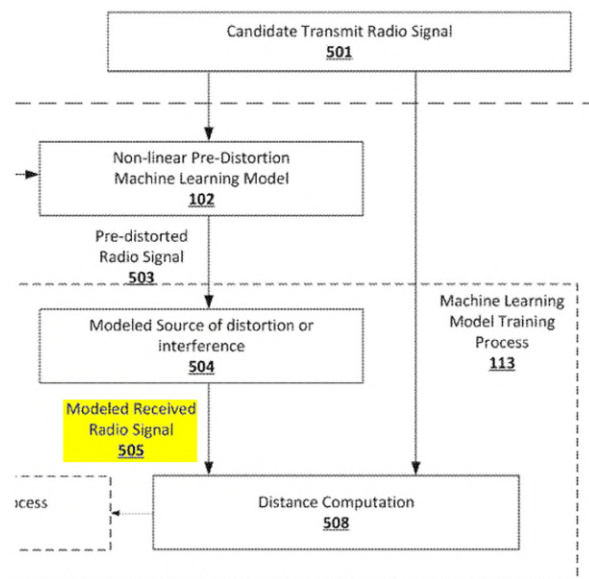


(Ex-1001, Figure 1 (annotations added).)



(Ex-1001, Figure 5A (annotations added).)

The '704 patent further states that a “distortion or interference source [504] produces a modeled received radio signal 505.” (Ex-1001, 9:43-45.) As shown above from Figure 5A, “Modeled Received Radio Signal 505” is produced from “Candidate Transmit Radio Signal 501,” which is received by machine learning model 102, which then produces “Pre-Distorted Radio Signal 503” to “Modeled Source of distortion or interference 504.” (*See also id.*, 3:14-16 (“A distance metric is computed between the candidate transmit radio signal and the received radio signal.”); Petition, 9.) Modeled signal 505 is then inputted into “Distance Computation 508” for “comput[ing] a distance metric between the candidate transmit radio signal 501 and the modeled received radio signal 505.” (Ex-1001, 9:46-48.) Modeled Received Radio Signal 505 as implemented in the in the '704 patent's model training in Figure 5A is highlighted below.



(Ex-1001, Figure 5A (annotations added); *see also id.*, 9:48-56, Figure 1.)⁶

The '704 patent specification thus clarifies that the “*distance metric*” in claim 4 can be determined using a modeled signal (i.e., representative signal) such as Modeled Received Radio Signal 505a. (See Ex-1001, [4A] (“*obtaining a received radio signal that **corresponds** to a **representation** of the transmit output radio signal received at the one or more radio receivers*”) (emphasis added).) Hence, the “*distance metric*” can be determined using modeled signals, and not solely a “received radio signal from a radio receiver” as Patent Owner argues. (Response, 41.) Patent Owner’s assertion that a “*received signal*” must be a signal that was received at a radio receiver is incorrect because the '704 patent itself clarifies that a “*radio signal received at the one or more radio receivers*” is distinct from a “*received radio signal.*” In other words, the former is a species (signals received at a receiver) and the latter is a genus (all received signals, including modeled received signals such as received signal 505).

⁶ Further, related U.S. Patent No. 11,777,540 claim 13 claims “*generating the received radio signal using a modeled source of distortion or interference.*” Hence, the '704 patent and its family does not require that a “*received radio signal*” strictly be a signal received by a receiver. (See IPR2025-00194, Paper 15, 8-9.)

Moreover, the “*distance metric*” determination of claim 4 is rendered obvious at least by Holt’s teaching of loss functions, including a first loss function calculated using the difference between input data that is input into the encoder model and output data received from the decoder model using a channel model that emulates a communication channel. An illustrative example of Holt’s first loss function is shown below from Figure 3:

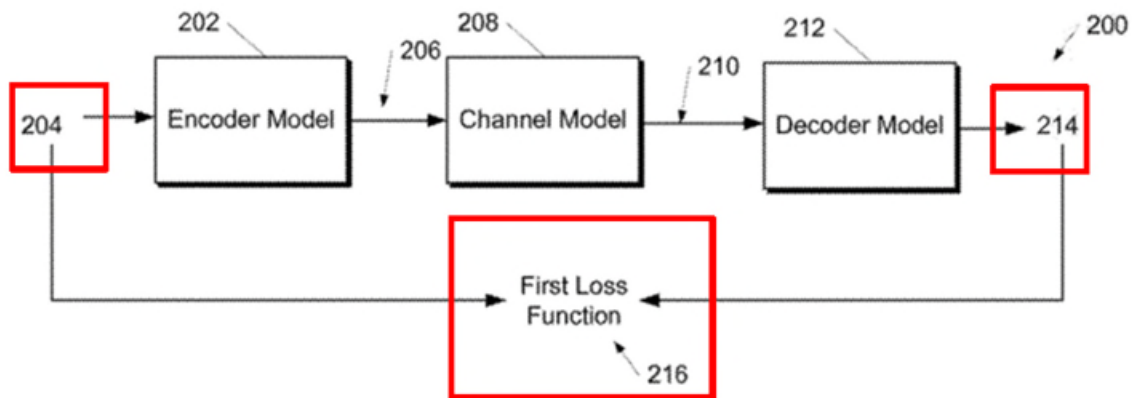


Figure 3

(Ex-1006, Figure 3 (annotations added); see Petition, 58-59, 69-73.)⁷

Therefore, Petitioner has shown that Ground 2 renders claim 4 of the '704 patent obvious. Furthermore, Petitioner has shown that Patent Owner's interpretation of claim 4 requiring that the "*distance metric*" must be calculated directly using a signal received at a radio receiver is unsupported by the claims and specification. The Board should thus reject Patent Owner's arguments and find claim 4 rendered obvious under Ground 2.

2. Even under Patent Owner's construction of the claim language, Ground 2 still renders claim 4 obvious.

Furthermore, even under Patent Owner's incorrect interpretation of claim 4 requiring that the "*distance metric*" be calculated using a signal received at a radio

⁷ To the extent Patent Owner argues Petitioner did not make this argument in the Petition, this argument directly replies to positions Patent Owner took in its POPR and Response, and this is the first opportunity Petitioner has had to respond. See *Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 706 (Fed. Cir. 2020); *AT&T Corp. v. Dali Wireless Inc.*, IPR2022-01212, Paper 37, 54 n.17 (PTAB Jan. 30, 2024); *Caterpillar Inc. v. Wirtgen Am., Inc.*, IPR2022-01264, Paper 31, 53 (PTAB Jan. 22, 2024); *W. Digital Techs., Inc. v. Viasat, Inc.*, IPR2022-01171, Paper 33, 20 (PTAB Dec. 13, 2023).

receiver (and not a signal that “*corresponds to a representation*”), Petitioner has still demonstrated that the claim was rendered obvious under Ground 2.

Under Ground 2, Petitioner showed that a “POSITA would have understood that Holt’s disclosure of transmitted and received communication data received by a decoder model implemented in a receiver device teaches a *received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers.*” (Petition, 70.) And that “Holt teaches calculating a loss function by comparing the inputs of an encoder model (implemented by a transmitter device) and outputs of a decoder model (implemented by a receiver device) sent over a communication channel.” (*Id.*, 72.) Petitioner further pointed to Holt embodiments for loss functions using a “Channel Model” and an “Actual Channel” exemplified respectively in Figures 3 and 6. (*Id.*, 58-60.)

As previously explained, Holt Figure 3 demonstrates an embodiment for first loss function 216 calculated using the difference between encoder model (implemented in a transmitter) input 204 and decoder model (implemented in a transmitter) output 214. (Petition, 58-59.) Channel model 208 in between the encoder and decoder models can “emulate a communication channel” (Ex-1006, 4:5-6.) Holt Figure 6 further demonstrates an embodiment for fourth loss function 318 calculated using the difference between encoder model input 316 and decoder model output 312. Holt Figures 3 and 6 are illustrated below.

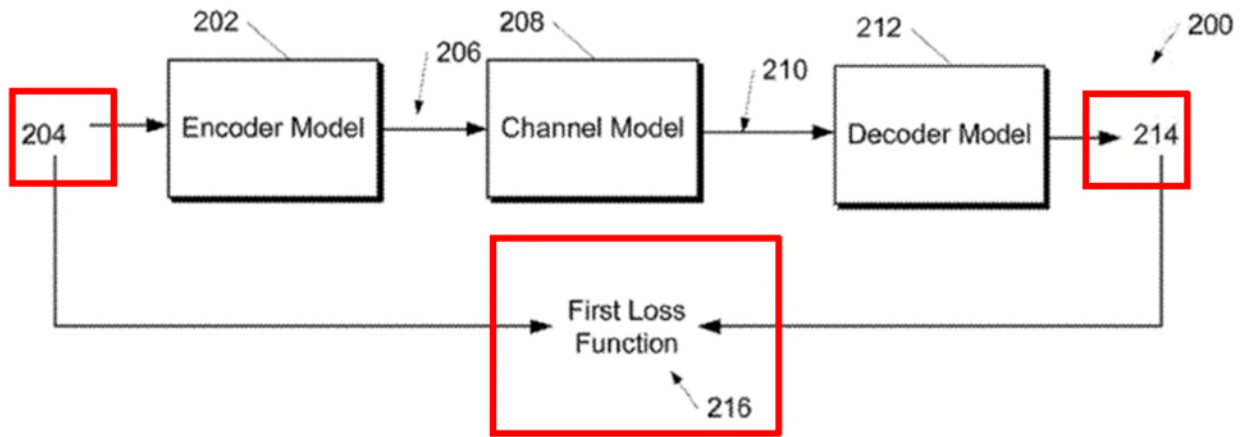


Figure 3

(Ex-1006, Figure 3 (annotations added.))

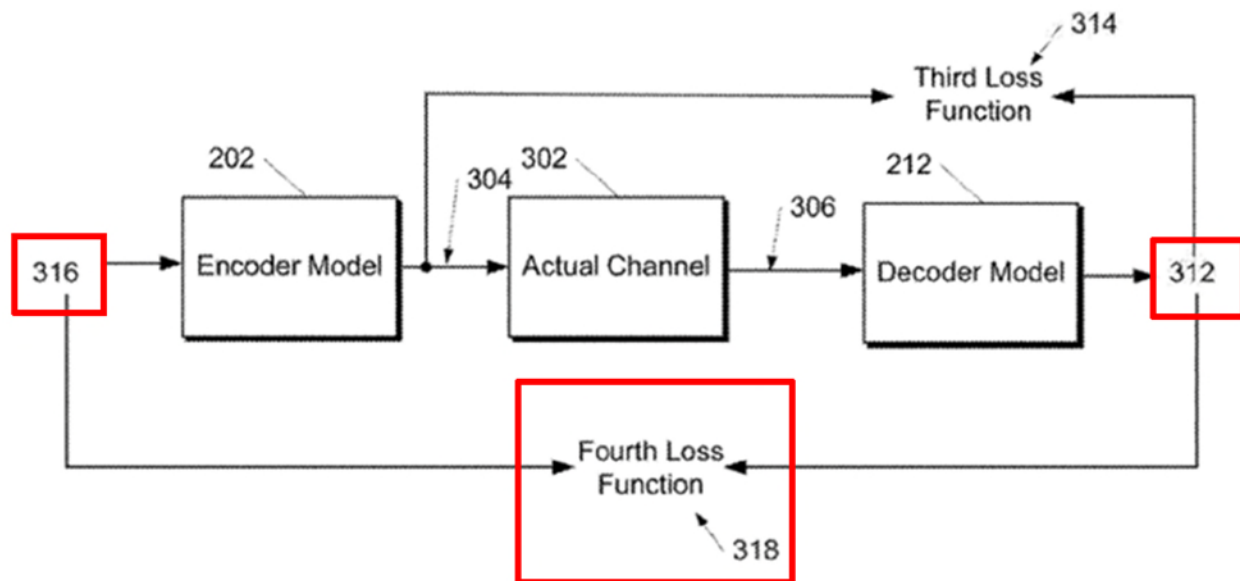


Figure 6

(Ex-1006, Figure 6 (annotations added.))

Petitioner further explained that a POSITA would have understood that the encoder and decoder models could be implemented in various embodiments using a channel model or an actual communication channel. (Petitioner, 59.) As explained

by Dr. Ding, “a 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 for loss functions.” (Ding Declaration, ¶224; *see also id.*, ¶57 (“[A] POSITA would have understood that Holt’s encoder and decoder models could be implemented in conjunction with either channel model or actual communication

channel.”).)⁸

In other words, a POSITA would have understood that an actual communication channel could have been implemented in the first lost function embodiment from in Figure 3, and vice versa the channel model could have been implemented in the fourth lost function embodiment from Figure 6. Given that the

⁸ To the extent Patent Owner argues that the updated “*model parameters*” in [4C] must solely be parameters for a transmitter model, that position is unsupported by the claims and specification. Limitation [4C] includes no such requirement. Further, ’704 patent Figure 1 illustrates “Non-linear Pre-Distortion Machine Learning Model 102” as modeling both transmissions (Pre-distorted signal 105) and reception (“Received signal 111”). Limiting the claimed model and updated parameters as being *solely* for a transmitter model would read out embodiments with models trained for devices with both transmitter and receiver components (e.g., a transceiver). (See Ex-1001, 8:5-6 (“OFDM or SC-FDMA modulator which might be used in a cellular transceiver.”)) For example, the model in claims 1 and 4 could generate a pre-distorted radio signal, and then update parameters related to signal reception to account for distortion and interference encountered between a signal being transmitted and received.

channel model is deigned to “emulate a communication channel,” a POSITA would have understood that an embodiment with a channel model could likewise be used with an actual communication channel. (Ex-1006, 4:5-6.) In addition, this understanding is consistent with how the '704 patent's nonlinear pre-distortion system 500 a and nonlinear pre-distortion system 103 are the “same...[i]n some implementations.” (Ex-1001, 9:38-40.) Patent Owner proffers no literature or testimony evidence disputing this understanding of a POSITA.

For the reasons shown above, Petitioner has met its burden and demonstrated that Jüschke in view of Holt under Ground 2 renders claim 4 obvious, and that Patent Owner's arguments do not prove otherwise. The Board should therefore find Ground 2 renders claim 4 obvious.

E. Dependent claims 5-6 rendered obvious based on their dependency to claim 4 under Ground 2.

Ground 2 (Jüschke in view of Holt) renders obvious dependent claims 5-6 and on their respective dependencies to dependent claim 4. Patent Owner does not directly address these dependent claims but for their dependency to claim 4.

III. CONCLUSION

The asserted prior art under Grounds 1-3 provides all limitations alleged missing by Patent Owner. Patent Owner's miscellaneous arguments in its Response

are wrong. Petitioner respectfully requests that the Board confirm its initial findings that the challenged claims are unpatentable.

Dated: September 2, 2025

/s/ Andrew J. Cochran
Andrew J. Cochran (Reg. No. 69,620)
CAHILL GORDON & REINDEL LLP
32 Old Slip
New York, NY 10005
Telephone: (212) 701-3000
Counsel for Petitioner
Digital Global Systems, Inc.

CERTIFICATION UNDER 37 C.F.R. § 42.24

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner's Reply to Patent Owner's Response totals 5,245 words, which is less than the 5,600 allowed under 37 C.F.R. § 42.24(c)(1).

Dated: September 2, 2025

/s/ Andrew J. Cochran
Andrew J. Cochran (Reg. No. 69,620)
CAHILL GORDON & REINDEL LLP
32 Old Slip
New York, NY 10005
Telephone: (212) 701-3000
Counsel for Petitioner
Digital Global Systems, Inc.

CERTIFICATE OF SERVICE

I certify that I caused to be served a true and correct copy of the foregoing:
PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE were served by
filing this document through the Patent Trial and Appeal Case Tracking System (P-
TACTS) on September 2, 2025, in its entirety on the following:

Wayne M. Helge (Reg. No. 56,905)
whelge@bdiplaw.com
James T. Wilson (Reg. No. 41,439)
jwilson@bdiplaw.com
BUNSOW DE MOREY LLP
277 S. Washington St., Suite 210, #1088
Alexandria, VA 22314

Amit Singhal (Reg. No. 71,021)
amitsinghal@rkmlp.com
ROSSI, KIMMS & MCDOWELL LLP
20609 Gordon Park Square, Suite 150
Ashburn, VA 20147

Dated: September 2, 2025

/s/ Andrew J. Cochran
Andrew J. Cochran (Reg. No. 69,620)
CAHILL GORDON & REINDEL LLP
32 Old Slip
New York, NY 10005
Telephone: (212) 701-3000
Counsel for Petitioner
Digital Global Systems, Inc.