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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte STEVEN C. THOMPSON and
FERNANDO LOPEZ DE VICTORIA

Appeal 2019-000738
Application 14/811,507
Technology Center 2400

Before MAHSHID D. SAADAT, CARL L. SILVERMAN, and MICHAEL J. ENGLE *Administrative Patent Judges*.

SILVERMAN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's Final Rejection[2] of claims 1–6, 8–12, 14–17, 20–22, and 24–31. We have jurisdiction under 35 U.S.C. § 6(b). A telephonic Hearing was held May 14, 2020.

We REVERSE.

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[1] Throughout this Decision, we use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42(a). Appellant identifies Acorn Technologies, Inc. as the real party in interest. Appeal Br. 2.

[2] The Examiner states claims 5, 11, 15, 22, and 24–31 are allowable. Ans. 46.

STATEMENT OF THE CASE

The invention relates to determining time of arrival in a wireless network using matching pursuit. Abstract; Spec. ¶¶ 17; Figs. 6, 7. Claim 1, reproduced below, is exemplary of the subject matter on appeal (emphases added):

> 1. A method of determining time of arrival in a wireless network, comprising:
>
> receiving at a receiver from a wireless network a signal comprising a plurality of orthogonal frequency division multiplexing signals from a single base;
>
> extracting location pilot signals from the received signal;
>
> *determining a power delay profile corresponding to the extracted location pilot signals;*
>
> *identifying a first path associated with the extracted location pilot signals by performing matching pursuit estimation on the power delay profile for the extracted location pilot signals*;
>
> determining a time of arrival based on the identified first path.

Appeal Br. (Claims App'x 1).

THE REJECTION

Claims 1–6, 8–12, 14–17, 20–22, and 24–31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kangas in view of Annavajjala. Final Act. 4–32.

REFERENCES

Prior art relied upon by the Examiner:

Name	Reference	Date
Kangas et al.	US 2011/0143773 Al	June 16, 2011
Annavajjala et al.	US 2012/0082252 Al	Apr. 5, 2012

ANALYSIS

The Examiner finds the combination of Kangas and Annavajjala teaches the limitations of claim 1. Final Act. 4–14; Ans. 31–44. The Examiner finds Kangas teaches equations utilized to estimate the arrival time but "does not elaborate MP–PDP." Final Act. 11 (citing Kangas ¶¶ 78, 80, 81, 116, 117; Figs. 2–6B). The Examiner's use of "MP–PDP" appears to refer to claim 1 terms "matching pursuit" and "power delay profile." The term "PDP" refers to "power delay profile" and the term "MP" refers to "matching pursuit." Spec. ¶¶ 24, 25, 57, 61, 62, 64 for "PDP;" ¶¶ 29, 30, 33, 41, 46, 48 for "MP;" ¶¶ 24, 25, Figs. 6, 7 for "MP–DP." The Examiner then finds Annavajjala teaches the claimed use of "matching pursuit" and "power delay profile." Final Act. 11–13 (citing Annavajjala ¶¶ 23, 25–30; Figs. 2, 3).

According to the Abstract, "[a] wireless receiver receives location pilots embedded in received symbols and uses the location pilots to detect the first path for every base station the network has designated for the receiver to use in time of arrival estimation" and "[t]he receiver preferably applies matching pursuit strategies to offer a robust and reliable identification of a channel impulse response's first path." Appellant asserts the claimed method determines a power delay profile (PDP) by computing the absolute value squared of the correlator output. Appeal Br. 2–3 (citing Figs. 6, 7; Spec. ¶ 61). Appellant asserts the receiver then determines a channel impulse response using matching pursuit on the power delay profile to determine time of arrival. *Id.* at 3 (citing Spec. ¶¶ 45, 56, 62, 64). According to Appellant, the claimed invention relates to identifying first paths using matching pursuit analysis on the power delayed profiles and this is a comparatively simple process using less complicated circuitry in part

because the power delay profile is real valued and does not contain phase information. *Id.* at 4 (citing Spec. ¶¶ 61, 63).

Appellant argues, *inter alia*, the Examiner errs because neither Kangas nor Annavajjala teaches performing matching pursuit estimation on a power delay profile as recited in claim 1 "identifying a first path associated with the extracted location pilot signals by performing matching pursuit estimation on the power delay profile for the extracted location pilot signals" (also referred to as "disputed limitation"). Appeal Br. 13–14. Appellant argues "power delay profile" is a well-understood term that describes the power received through a multipath channel as a function of delay and, because the power delay profile describes power, it is a real quantity. *Id.* at 13–14. Appellant argues Annavajjala does not teach the claimed "power delay profile:"

> In contrast, the Annavajjala publication describes performing matching pursuit on complex-valued signals to determine the complex-valued function h[k]. It is clear from how the Annavajjala publication describes the signals used to determine h[k] that these signals cannot be a power delay profile. This conclusion is confirmed by how the Annavajjala publication describes the power delay profile. Indeed, the Annavajjala publication teaches that the power delay profile is not available at the receiver and cannot be used in characterizing the channel. *See* Annavajjala at ¶ 26 ("a power delay profile (PDP) of the channel is assumed to be fixed even when the instantaneous channel gain is time-varying"), ¶ 30 ("PDP is a constant or exponentially decaying function").
>
> The present application teaches that performing matching pursuit on a power delay profile is a fast and efficient way to characterize a channel to facilitate identifying a first path, determining a time of arrival and, as desired, a receiver location. One of ordinary skill in the art reviewing the Annavajjala publication would find the claims of the present application to be directly contrary to the teachings of the

> Annavajjala publication. The Annavajjala publication refers to a power delay profile in two paragraphs, 26 and 30. In each, the Annavajjala publication makes clear that it does not use the power delay profile and instead makes assumptions about the power delay profile because, as explicitly stated in paragraph 30, the power delay profile "is not available at the receiver" (and so cannot be used to determine a power delay profile for a specific set of pilot signals). First, paragraph 26 states that the "power delay profile (PDP) of the channel is assumed to be fixed." Second, paragraph 30 states "that the PDP is a constant or exponentially decaying function." Thus, because the power delay profile "is not available at the receiver," Annavajjala at ¶ 30, the Annavajjala publication assumes that the power delay profile is a constant value or the same simplistic function. *Id.* at ¶ 30. By assuming that the power delay profile is always a constant value or the same simplistic function, the Annavajjala publication shows that it does not use the power delay profile in characterizing the channel.
>
> In addition, these assumptions show that the Annavajjala publication's power delay profile does not correspond to the set of extracted location pilot symbols. For any set of location pilot symbols, the Annavajjala publication would assume the same trivial power delay profile. As an example, the Annavajjala publication would assume the same power delay profile even if its system were presented with sets of location pilot symbols from two different, distinctly located servers. As an even more degenerate example, the Annavajjala publication would assume the same power delay profile even when there are no location servers and no location pilot signals present.
>
> Accordingly, the Annavajjala publication does not describe or suggest performing matching pursuit on a power delay profile for any purpose, much less for identifying a first path. Because neither of the cited references describe or suggest performing matching pursuit on a power delay profile, the rejections of the pending claims should be reversed.

Id. at 14–15.

Appellant argues neither Kangas nor Annavajjala teaches "performing matching pursuit on a power delay profile." Appeal Br. 13–14. According to Appellant, the Examiner acknowledges that Kangas does not disclose "MP-PDP," and Annavajjala's disclosure of matching pursuit is to determine a complex valued impulse response h[k]. *Id.* at 13 (citing Annavajjala ¶¶ 21, 25). Appellant additionally argues Annavajjala does not describe or suggest performing matched pursuit estimation on a (real-valued) power delay profile, as in claim 1. *Id.*

In the Answer, the Examiner utilizes a Table to map claim 1 to Kangas and Annavajjala. Ans. 32–37. The Examiner additionally finds Kangas discloses creating power spectra density, a type of received signals power profile. *Id.* at 33 (citing Table, row 4). The Examiner finds Kangas teaches "correlating or matching" delayed output signals. *Id.* at 35 (citing Table, row 6). The Examiner finds Annavajjala's complex values comprise real-value and imaginary-value components and "Annavajjala's invention is patentably equivalent and work with real-value operations." *Id.* at 40–41 (citing Annavajjala ¶ 96). The Examiner notes that the claim does not recite "*real-value* power delay profile" (emphasis added). *Id.* at 41.

In the Reply Brief, Appellant argues the Answer includes new arguments and does not correctly summarize Appellant's arguments. Reply Br. 2–3 (citing Ans. 32–37). Appellant argues the Examiner does not rebut Appellant's argument that neither Kangas nor Annavajjala performs matching pursuit on a power delay profile. *Id.* at 4. Appellant argues the Examiner errs in suggesting that the Kangas power spectral density is a power delay profile. *Id.* at 6. According to Appellant, Kangas does not describe or suggest a power delay profile, because Kangas' power spectral

density does not vary over time and, instead, the Examiner discusses another term ("a type of received signals power profile"). *Id.* at 6–7. Appellant argues the Examiner errs in finding Kangas' "correlation" corresponds to matching pursuit estimation because matching pursuit estimation involves signal modeling whereas correlation is a form of signal analysis. Reply Br. 5 (citing Ans. 35; Kangas equation 4). Additionally, Appellant argues Annavajjala and the Specification expressly describe correlation as a distinct operation *prior* to matching pursuit estimation. *Id.* at 15, 16 (citing Annavajjala ¶ 25; Spec. ¶¶ 44, 45, 60–62, Fig. 6).

Appellant argues the Examiner errs in finding Annavajjala teaches using power delay profile to detect pilot signals in the communication channel. *Id.* at 7 (citing Ans. 34). According to Appellant:

> There is simply nothing in Annavajjala to support the assertion that "Annavajjala discloses using 'Power Delay Profile' (PDP) to detect pilot signals in the communication channel." This is readily apparent because OFDM receivers receive pilot signals from the communication channel and use those received pilot signals to characterize the channel (i.e., channel estimation). There is no need to use a power delay profile or any calculation to detect the pilot signals; rather this is accomplished by the receiver front end electronics before any processing occurs.
>
> Thus, of course, the Annavajjala publication does not describe or suggest or otherwise "disclose" using "a power delay profile to detect pilot signals in the communication channel."

Id. at 7.

We are persuaded by Appellant's arguments because the Examiner has not sufficiently shown that either Kangas or Annavajjala teaches the claimed use of the "power delay profile" or the "matching pursuit" as recited in the disputed limitation. We agree that Kangas does not teach or suggest

the claimed PDP or MDP. Regarding the Examiner's finding in the Answer that Kangas' "correlation" is MDP, we are persuaded by Appellant's argument that correlation and MDP are two separate activities. The Annavajjala recitation to PDP and MP are to contexts significantly different from the disputed limitation. In Annavajjala, PDP is not available at the receiver, and Annavajjala does not utilize PDP in characterizing the channel and instead assumes PDP is a constant value. Annavajjala ¶¶ 26, 30. Additionally, the Examiner's determination that PDP can be interpreted to include the Annavajjala non-real value PDP is unreasonably broad as PDP is described in the Specification as absolute value squared from the correlators, and the phase information is removed. Spec. ¶ 61. The Examiner's interpretation is inconsistent with the claim and the Specification. During prosecution, claims must be given their broadest reasonable interpretation when reading claim language in light of the Specification as it would have been interpreted by one of ordinary skill in the art. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004).

Therefore, we do not sustain the rejection[3] of claim 1, independent claims 17 and 22 which include the disputed limitation, and dependent claims 2–4, 8–10, 14, 20, and 21. *Cf. In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992).

Because our decision with regard to the disputed limitation is dispositive of the rejections made, we do not address additional arguments raised by Appellant.

[3] *See* footnote 2. The Examiner states claims 5, 11, 15, 22, and 24–31 are allowable. Ans. 46. Appellant argues claim 16 is also allowable as it depends from allowable claim 15. Reply Br. 2.

DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	References/Basis	Affirmed	Reversed
1–6, 8–12, 14–17, 20–22, 24–31	103(a)	Kangas, Annavajjala		1–6, 8–12, 14–17, 20–22, 24–31

REVERSED