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**Datasheet for the decision
of 13 September 2006**

Case Number: T 1080/04 - 3.5.02

Application Number: 01301947.6

Publication Number: 1189339

IPC: H03F 1/32

Language of the proceedings: EN

Title of invention:

System and method for producing a pilot signal in a distortion reduction system

Applicant:

LUCENT TECHNOLOGIES INC.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54

Keyword:

"Novelty - no (all requests)"

Decisions cited:

-

Catchword:

-



Case Number: T 1080/04 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 13 September 2006

Appellant: LUCENT TECHNOLOGIES INC.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 23 April 2004
refusing European application No. 01301947.6
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. Rognoni
E. Lachacinski

Summary of Facts and Submissions

- I. The appellant (applicant) appealed against the decision of the examining division refusing the European patent application No. 01 301 947.6.
- II. In the contested decision, the examining division found, *inter alia*, that the subject-matter of claim 1 according to the main and the auxiliary requests lacked novelty with respect to each of the following documents:
- D5: US-A- 5 485 120
- D8: WO-A-99/45 639.
- III. In a communication dated 16 February 2006 accompanying the summons to attend oral proceedings, the Board essentially expressed its agreement with the conclusions reached by the examining division in the contested decision.
- IV. In reply to the Board's communication, the representative of the appellant informed the Board by a letter dated 4 August 2006, received on 12 August 2006, that they would not be attending the oral proceedings set for 13 September 2006. Furthermore they requested that the oral proceedings be cancelled and that the procedure be continued in writing.
- V. Following the appellant's requests of 4 August 2006, the Board informed the appellant by a communication dated 11 August 2006 that a continuation in writing would not be expedient and only cause unnecessary delay to the appeal procedure. Thus, the Board intended to

hold the oral proceedings as scheduled on 13 September 2006, whether or not the appellant attended.

VI. Oral proceedings were held on 13 September 2006 in the absence of the appellant.

VII. The appellant had requested in writing that the decision of the examining division be set aside in its entirety and a patent be granted on the basis of claims 1 to 11 of the main request filed with letter dated 1 March 2004, or failing that, on the basis of claims 1 to 12 of the auxiliary request filed with letter dated 1 March 2004.

VIII. Claim 1 according to the main request reads as follows:

"A method of producing an amplified signal,
comprising:

determining at least one frequency for a pilot
signal; and

placing said pilot signal with a signal to be
amplified, said signal to be amplified including a
plurality of carrier frequencies of radio channels
(84a-n) to be used for communication; CHARACTERIZED IN
THAT:

said determining step comprises determining said
at least one frequency based on said carrier
frequencies to be used for communications; and

adjusting at least one of gain and phase of said
pilot signal based on an amplitude of the pilot
signal."

Claim 1 according to the auxiliary request reads as follows:

"A method of producing an amplified signal,
comprising;

combining a plurality of carrier frequencies of radio channels (84a-n) to be used for communication between a base station and one or more wireless units of a communication system into a signal to be amplified;

determining at least one pilot frequency based on the carrier frequencies of the signal to be amplified;

generating a pilot signal that [sic] at said at least one pilot frequency;

placing said pilot signal with said signal to be amplified; and

amplifying said signal to be amplified and said pilot signal."

IX. The appellant's arguments can be summarised as follows:

The present invention solved a problem in prior art feed-forward and noise reduction systems, where there was rarely an absolute cancellation of distortion and pilot signals, since such systems required tight operating tolerances. In these prior art feed-forward and noise reduction systems, if the pilot frequency was too close to the carrier frequencies, the pilot signal was difficult to detect. However, positioning the pilot signals too far from the carrier signals limited the cancellation of distortion due to non-linearities.

In order to solve this problem, the present invention used the carrier frequencies of the radio channels that were to be used for communication to determine the pilot frequency. Processing circuitry determined the pilot frequency from the carrier frequencies included in the input signal to be amplified so as to send a tuning signal to a pilot signal generator which produced a pilot signal. Thus, the pilot signal could be generated at a desired location relative to the radio channel frequencies, where the pilot signal could be better detected and/or could better reflect the nonlinearities of the amplifier.

Document D5 did not determine the pilot frequency from the carrier frequencies of radio channels that were to be used for communication. D5 tuned to a range of pilot frequencies to generate pilot signals of equivalent amplitude that were injected at a combiner. In other words, no carrier frequencies to be used for communication were actually employed according to D5 in order to determine a pilot frequency for producing a pilot signal.

Furthermore, D5 used a calibration routine to periodically calibrate analog system components to account for imperfections that might have occurred during manufacture and repair, so as to refine the accuracy and applicability of amplifier control signals. However, the calibration routine known from D5 was directed to avoiding interference with desired carrier signals and did not generate a pilot signal at a desired location relative to the radio channel frequencies so that the pilot signal could be better detected and/or could better reflect the nonlinearities of the amplifier. In fact, the automatic

calibration according to D5 carried out calibration on a channel by channel basis, wherein calibration operations were avoided temporarily if the channel was not in use. In other words, no automatic calibration routine took place in channels that were not transmitting data. In summary, D5 did not determine the pilot signal frequencies from the carrier frequencies or radio channels that were to be used for communication, but instead merely avoided calibration operations within channels that were not in use. This was distinctly different from the determining step as recited in claim 1 according to the main request.

D8 was directed to a feed-forward arrangement which produced an error correction signal that was combined with an output signal of a distorting element, such as an amplifier, to produce an output signal. Specifically, D8 taught the derivation of the pilot signal from an input signal "in some way". However, D8 did not determine the pilot signal frequency from the carrier frequencies of radio channels that were used for communication. This was distinctly different from the determining step of the method according to the present invention.

Claim 1 according to the auxiliary request recited the step of combining a plurality of carrier frequencies into a signal to be amplified. In D5, the combiner combined a pilot signal with an input signal that had been attenuated and phase adjusted and was thus different from the combiner recited in claim 1. The subject-matter of claim 1 of the auxiliary request was therefore further distinguished from the disclosure of D5.

Reasons for the Decision

1. The appeal is admissible.

Main request

2.1 Document D5 (column 1, first paragraph and column 2, lines 41 to 47) relates, *inter alia*, to methods for minimising distortion by employing adaptive control circuitry in feed-forward multi-carrier radio frequency amplifiers. As shown in Figure 5, a standard feed-forward amplifier comprises a signal combiner 104 for injecting a pilot signal of a given frequency into the amplifier's main loop. An attenuator 111 and a phase shifter 112 arranged in the error loop are adjusted by a control signal derived from the pilot signal sampled at the output 116 by a sampler 115 in order to minimize the pilot signal, and consequently the distortion signal, at the amplifier's output 116.

2.2 Hence, the methods described in D5 comprise the following steps recited in claim 1 according to the appellant's main request:

- determining a frequency for a pilot signal,
- placing said pilot signal with a signal to be amplified, said signal to be amplified including a plurality of carrier frequencies of radio channels to be used for communication,
- adjusting the gain and phase of said pilot signal based on an amplitude of the pilot signal.

2.3 The method according to claim 1 further comprises the following step:

(a) *"determining said at least one frequency based on said carrier frequencies to be used for communications"*.

The appellant has essentially argued that in D5 no carrier frequencies to be used for communication were actually employed in order to determine a frequency for a pilot signal, and that D5 did not teach or suggest step (a) (see statement of grounds dated 2 August 2004, page 3 second and last paragraphs).

3.1 The wording of step (a), however, does not define any particular method for deriving the frequency of the pilot signal from the carrier frequencies during the operation of the amplifier, and, in particular, does not imply a method which *"reacts to changing numbers of transmit frequencies"* (cf. statement of grounds, page 4, third paragraph). On the contrary, it covers any possible way of determining the frequency of a pilot signal taking into account the carrier frequencies which are employed by a certain telecommunications system.

3.2 As to the frequency of the pilot signal, D5 teaches, *inter alia*, that a pilot signal injected into the main loop may be an in-band or an out-of-band signal (column 3, lines 24 to 26; column 5, lines 31 to 35). An in-band pilot signal could be used for sampling purposes by the adaptive controller, provided no wanted signal or carrier was operating at the same frequency (column 14, lines 49 to 52). In fact, the function of

the pilot signal, which is to provide a control signal for determining the gain and phase shift in the error loop in order to minimize the distortion signal, implies that the pilot signal should experience the same distortion as the amplified input signal, and, consequently, that its frequency should be located near the transmission channels or carriers without, however, interfering with them. As far as a frequency suitable for a pilot signal can only be defined with respect to the frequency spectrum occupied by the transmission channels, its determination is necessarily based on the corresponding carrier frequencies to be used for communication, as specified in claim 1.

- 3.3 In summary, the Board concurs with the examining division that the teaching of D5 anticipates the method of claim 1 according to the main request (Article 54 EPC).
- 4.1 As pointed out in the contested decision, the subject-matter of claim 1 is also not new with respect to D8, which relates to a feed-forward amplifier having the same basic structure as the amplifier shown in Figure 5 of D5.
- 4.2 According to D8 (see page 3, lines 7 to 9), "*the pilot signal may be chosen such that it fits in the gaps of the input signal frequency spectrum, which will depend on, for example, the channel width and channel spacing of the signal*". The implementation of this teaching requires that the frequency of the pilot signal be determined with respect to the location of the channels and their carriers within the frequency band used for communication.

Auxiliary request

- 5.1 Claim 1 according to the appellant's auxiliary request differs from claim 1 of the main request in that it further comprises the following step:

"combining a plurality of carrier frequencies of radio channels (84a-n) to be used for communication between a base station and one or more wireless units of a communication system into a signal to be amplified".

As correctly pointed out by the examining division, the above step is already known from D5 or D8 which explicitly relate to multi-carrier amplifiers comprising means for amplifying an input signal having one or more carriers in a specified frequency band (see D5: column 1, lines 8 to 13 and column 2, lines 41 to 47, and D8: page 11, last paragraph and Figure 2).

- 5.2 Hence, the objection of lack of novelty over D5 or D8 raised against claim 1 of the main request applies, *mutatis mutandis*, to the subject-matter of claim 1 according to the auxiliary request.

6. As the subject-matter of claim 1 of both the appellant's requests is not new, the application has to be refused.

Order

For the above reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

U. Bultmann

W. J. L. Wheeler