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**Datasheet for the decision  
of 22 October 2009**

**Case Number:** T 1797/06 - 3.5.02

**Application Number:** 04252281.3

**Publication Number:** 1473829

**IPC:** H03F 1/32

**Language of the proceedings:** EN

**Title of invention:**

Enhanced predistortion method and apparatus

**Applicant:**

Lucent Technologies Inc.

**Opponent:**

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**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56, 83, 123(2)

**Keyword:**

"Main request - Inadmissible extension (yes); Insufficiency of disclosure (yes)"

"First and second auxiliary requests - Inventive step (no)"

**Decisions cited:**

-

**Catchword:**

see point 2 of the reasons



Case Number: T 1797/06 - 3.5.02

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.02  
of 22 October 2009

**Appellant:** Lucent Technologies, Inc.  
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**Representative:** Sarup, David Alexander  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 6 July 2006  
refusing European application No. 04252281.3  
pursuant to Article 97(1) EPC 1973.

**Composition of the Board:**

**Chairman:** M. Ruggiu  
**Members:** J.-M. Cannard  
H. Preglau

## Summary of Facts and Submissions

- I. The appellant contests the decision of the examining division to refuse European patent application No. 04 252 281.3. The reason for the refusal was that the application did not meet the requirements of Article 52(1)EPC, because the subject-matter of claim 1 then on file was not new in the sense of Article 54(1) and (2) EPC.
- II. The prior art document:
- D1: US-B1-6 342 810,
- considered in the first instance, remains relevant to the present appeal.
- III. With a letter faxed on 22 September 2009 in response to a communication of the Board dated 24 June 2009 annexed to summons to oral proceedings, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 10 filed with a letter dated 2 November 2006 (primary request claim set), subsidiarily, claims 1 to 10 of the first auxiliary request, or claims 1 to 6 of the second auxiliary request, both filed with the letter dated 22 September 2009. The appellant further announced that he would not be attending the oral proceedings of 22 October 2009, and requested that the oral proceedings be cancelled and the procedure be continued in writing.
- IV. As announced the appellant did not attend the oral proceedings before the Board held on 22 October 2009.

V. Claim 1 of the main request reads as follows:

"A method, comprising:

predistorting an input signal for amplification by an amplifier to generate a predistortion signal, the predistorting being based on a power level of the generated predistortion signal, a temperature level of the amplifier and an output signal from the amplifier; and

supplying the generated predistortion signal to the amplifier."

VI. Claim 1 of the first auxiliary request reads as follows:

"A method, comprising:

predistorting an input signal for amplification by an amplifier to generate a predistortion signal, the predistorting being based on a power level of the generated predistortion signal and one of a temperature level of the amplifier and an output signal from the amplifier; and

supplying the generated predistortion signal to the amplifier."

VII. Claim 1 of the second auxiliary request reads as follows:

"A method, comprising:

determining a power level of a predistorted signal being sent to an amplifier;

determining a temperature level of the amplifier

comparing the determined power and temperature levels to a plurality of power level thresholds and a plurality of temperature level thresholds;

predistorting an input signal for amplification by an amplifier based on the comparison, and

if the determined power level is below a first power value, predistorting the signal with stored coefficients irrespective of the determined temperature level."

VIII. The applicant's arguments can be summarized as follows:

In the application as originally filed, figure 1 showed that an output  $z(m)$  of the amplifier 140, a temperature sensed from the amplifier 140 and an output  $y(n)$  of the predistortion unit were all inputs to the predistortion unit 110; paragraph [0016] described predistortion which was based on feeding back the predistortion signal  $y(n)$  and the output signal  $z(n)$  to the predistortion block 110 to estimate a predistortion function; paragraph [0017] described predistorting the source signal  $x(n)$  based upon a power level of the predistortion signal  $y(n)$  and a temperature value supplied by the temperature sensor 120; paragraph [0017] and figure 2 were linked together to show predistortion

based on power and temperature; figure 3 and paragraph [0025] were concerned with an initialization period. Therefore, the originally filed application did support predistortion based on the generated predistortion signal, the temperature of the amplifier and the output from the amplifier. The main request neither contravened Article 123(2) EPC, nor Article 83 EPC.

As shown in figure 30 of document D1, a predistortion circuit 52 received an input signal  $V_m(t)$  and an output of the amplifier to generate a predistortion signal. According to figure 46 of D1, the predistortion circuit 52 was further affected by the temperature of the amplifier. Instead, claim 1 of the main request recited that predistortion was based on "a power level of the generated predistortion signal, a temperature level of the amplifier and an output signal from the amplifier". An algorithm or model entirely different from that used in D1 was required to predistort based on the inputs recited in claim 1. Therefore, the subject-matter of claim 1 of the main request was novel and involved an inventive step. Similar considerations applied to claim 1 of the first auxiliary request.

According to figure 46 of D1, the inputs to the lookup table 52H were discrete and quantized values of the input signal  $V_m(t)$  and the output of the temperature sensor. In D1, there was clearly no comparison prior to selecting the coefficients for predistorting, only a direct use of quantized values. Therefore, D1 did not teach or suggest "comparing the determined power and temperature levels to a plurality of power level thresholds and a plurality of temperature level

thresholds", as recited in claim 1 of the second auxiliary request.

### **Reasons for the Decision**

1. The appeal is admissible.

#### *Procedural matters*

2. The main request and the second auxiliary request, which corresponds to the auxiliary request filed with the statement of grounds of appeal, have already been considered in the communication of the Board annexed to summons to oral proceedings. The Board is in a position to decide on the first auxiliary request based on grounds and evidence on which the applicant has had an opportunity to present in writing its comments in response to the Board's communication. Thus, the Board decides not to grant the appellant's requests to cancel the oral proceedings and continue the procedure in writing.

#### *Main request*

3. Claim 1 of the present main request specifies a step of "predistorting being based on a power level of the generated predistortion signal, a temperature level of the amplifier and an output signal from the amplifier". Claim 1 therefore covers a method for predistorting an amplifier input signal in which each of the three quantities specified in the claim is taken into account for determining the predistortion. Such a method is not disclosed in the application as originally filed.

- 3.1 The method recited in the claims as originally filed is based on a power level of the signal of a transmitter and a temperature level of the amplifier.
- 3.2 According to paragraph [0017] of the application as originally filed (see the published specification: EP 1 473 829 A1), the "predistortion block 110 is capable of predistorting the source signal  $x(n)$  based upon a power level (averaged or instantaneous) of the predistortion signal  $y(n)$  and a temperature value supplied by the temperature sensor 120". Said power level and temperature value are also considered in the embodiments described in paragraphs [0018] to [0021] with reference to figure 2 and shown in figures 3 to 7 (functions S250, S410 and S610). Furthermore, the description as originally filed specifies that both "the predistortion signal  $y(n)$  and the output signal  $z(n)$  are fed back to the predistortion block 110 to estimate a predistortion function" (paragraph [0016]).
- 3.3 Figure 1 shows a predistortion block 110 which receives the predistortion output signal  $y(n)$ , the output signal of a temperature sensor 120 and the output signal  $z(m)$  of the amplifier 140. It cannot however be derived from figure 1 that the predistortion signal is based **on each of said three output signals taken in combination** in the absence of any specific reference to this effect in the description as originally filed. More specifically, in the present case, it is only possible to derive from figure 1 that the block 110 receives said three signals, but it is not possible to derive from figure 1 how the block 110 generates the predistorted signal. Therefore,



claim 1 of the main request contravenes Article 123(2) EPC.

4. Furthermore, the application does not indicate how to estimate the predistortion function from the predistortion signal  $y(n)$  and the output signal  $z(n)$ . Thus, the application does not clearly and completely disclose at least one way enabling the skilled person to carry out the invention claimed in the main request. Therefore, the application according to the main request contravenes Article 83 EPC.

*First auxiliary request*

5. The alternative recited in claim 1 of the first auxiliary request that the predistorting is based on a power level of the generated predistortion signal and an output signal from the amplifier is not sufficiently disclosed in the application as filed for the reasons given for the main request (*supra* paragraph 4.). Furthermore, claim 1 of the first auxiliary request covers a method in which a step of predistorting an input signal before amplification by an amplifier is based on a power level of the generated predistortion signal and a temperature level of the amplifier. Such a method does not involve an inventive step having regard to document D1 and the general common knowledge of the skilled person (Article 56 EPC).

- 5.1 With reference to figure 46, D1 (column 54, lines 47 to 67) discloses a method in which an input signal  $V_m(t)$  is predistorted before amplification in an amplifier (ch 1) (FIR, Modified DCSP) based on a power level of the input signal  $V_m(t)$  (see column 12, lines 45 to 49;

column 16, lines 34 to 66, which specify that the magnitude, square magnitude, or power of the input signal can be used) and a temperature level of the amplifier. Thus, the method of claim 1 of the first auxiliary request differs from the method disclosed with reference to figure 46 of D1 only in that a power level of a generated predistortion signal is used for predistorting the input signal while, in D1, a power level of the input signal is used for predistorting said input signal.

5.2 In the embodiment according to figure 46 of D1, a power level of the input signal and a temperature level of the amplifier are used to index a lookup coefficient table 52H whose coefficients determine the predistortion. In other embodiments of D1, the lookup table 52H is indexed by the output signal  $V_f(t)$  of the amplifier. Moreover, feedback control and feed forward control are according to the common general knowledge of the skilled person well know alternatives in the relevant art. In the view of the Board, it would thus be obvious to the skilled person that a power level suitable for indexing the lookup table could be measured at other places of the circuit of D1, in particular at the output of the FIR 52, so that the input signal would be predistorted based on a power level of the predistortion signal generated in the FIR. Doing so, the skilled person would arrive in an obvious way at the subject-matter of claim 1 of the first auxiliary request.

*Second auxiliary request - Lack of inventive step*

6. In figure 46 of D1, the lookup coefficient table 52H is indexed according to predetermined values of the power level of the input signal and a temperature level of the amplifier. That means that each coefficient in the table corresponds to a couple of predetermined values of said power level and temperature level and is then selected when said predetermined values are entered into the table. In the embodiment of figure 46, the determined power and temperature levels are therefore implicitly compared to respective thresholds and the coefficients for predistorting based on said comparison. Thus, the method of claim 1 according to the second auxiliary request differs from the method disclosed with reference to figure 46 of D1 only in two respects:

i) the predistortion is based on the power level of the predistorted signal, and

ii) if the power level of the predistorted signal is below a first value, the predistortion is performed irrespective of the temperature level of the amplifier.

7. Having regard to feature i), it would be obvious to the skilled person that a power level suitable for indexing the lookup table could be measured at other places of the circuit of figure 46 of D1, in particular at the output of the FIR 52, so that the input signal would be predistorted based on a power level of the generated predistortion signal (*supra* paragraph 5.2).

8. Having regard to feature ii), the application (see for instance paragraph [0003] of the published application)

states that the problem addressed by the invention is to compensate for non-linearity occurring in power amplifiers of base transceiver stations (BTSs) operated at a high power level, because the power consumption and the heat produced by the amplifiers are increased. In the circumstances, a problem that could be solved by feature ii) of claim 1 is apparently to simplify the determination of the predistortion to be carried out. The skilled person is aware of the fact that, for low power levels of the input signal, the amplifier temperature would not reach such a level that it could affect the distortion caused by the amplifier. Thus, it would be obvious to the skilled person to disregard the temperature level for generating a predistortion signal if the power level of the predistorted signal is below a first value.

9. As the skilled person aware of D1 would consider the features i) and ii) independently from one another and, doing so, arrive in an obvious way at the subject-matter of claim 1 of the second auxiliary request, said second auxiliary request does not involve an inventive step (Article 56 EPC).
10. Since the application amended according to the main and auxiliary requests on file does not meet the requirement of the EPC, the appeal has to be dismissed.

**Order**

**For these reasons it is decided that :**

The appeal is dismissed.

The Registrar:

The Chairman:

U. Bultmann

M. Ruggiu