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**Datasheet for the decision
of 13 January 2025**

Case Number: T 2053/22 - 3.4.02

Application Number: 17833702.8

Publication Number: 3360248

IPC: H03F1/02, H01Q1/00, H04B1/00

Language of the proceedings: EN

Title of invention:
Reduction of power consumption in integral ultra-wideband
power amplifiers

Applicant:
Elbit Systems Land and C4I Ltd.

Relevant legal provisions:
EPC Art. 84

Keyword:
Clarity of the claims - all requests (no)



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Case Number: T 2053/22 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 13 January 2025

Appellant: Elbit Systems Land and C4I Ltd.
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 10 March 2022
refusing European patent application No.
17833702.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: C.D. Vassoille
B. Müller

Summary of Facts and Submissions

- I. The applicant's appeal lies from the decision of the examining division to refuse European patent application no. 17 833 702.8.
- II. In the decision under appeal, the examining division concluded *inter alia* that the subject-matter of claim 1 of the main request did not meet the requirements of Article 84 EPC.
- III. With the statement setting out the grounds of appeal, the appellant submitted a main request and a new auxiliary request, the main request being the basis of the contested decision.
- IV. In a communication under Article 15(1) RPBA annexed to the summons to oral proceedings, the board informed the appellant of its preliminary view that claim 1 of the main request was not clear within the meaning of Article 84 EPC and that this also applied to claim 1 of the auxiliary request.
- V. With a letter of 13 December 2024 the appellant filed a new second auxiliary request and submitted arguments concerning the clarity of claim 1.
- VI. Oral proceedings before the board took place on 13 January 2025 in the format of a videoconference.

The appellant (applicant) requested that the decision under appeal be set aside and that a patent be granted on the basis of

- the main request or the first auxiliary request, both requests filed together with the statement setting out the grounds of appeal or
 - the second auxiliary request filed with a letter dated 13 December 2024
- or that the case be remitted to the examining division for further prosecution.

VII. Claim 1 of the main request has the following wording:

"A power amplification unit (100) configured to reduce or prevent amplification during periods between pulses of a radio frequency, RF, pulses signal (90), comprising:

an ultra-wideband, UWB, power amplifier, PA, (80) having a RF input for receiving a RF input signal (81), a PA output (78) for providing an amplified output, the UWB PA configured to be operated by control and power supply voltages (82),

a combiner (120) configured to receive the RF pulses signal (90) and an auxiliary signal (110) and to generate therefrom, the RF input signal (81) to the UWB PA,

a signal generator (130) configured to:

- a) generate the RF pulses signal (90);
- b) generate the auxiliary signal to have a pulse-shaped component (111) synchronized with an envelope (91) of the RF pulses signal (90); and
- c) generate the auxiliary signal to have a quiet period component (112) selected according to levels of the

control and power supply voltages (82) to set an internal working point of the UWB PA (80) in order to put the UWB PA (80) in a non-amplification state that reduces a power consumption of the UWB PA (80) comparative to a power consumption thereof during a period when the UWB PA (80) is in receipt of a zero RF input signal, and

an output matching circuit (86) connected to the PA output (78) and having signal filtering parameters selected to pass a portion of the PA output corresponding to an amplified output (79) which falls above a cutoff RF frequency, the cutoff RF frequency being lower than a frequency spectrum of the RF input signal (81); and, remove a remainder of the PA output which has a frequency spectrum lower than the cutoff RF frequency (110),

wherein the UWB PA (80) is configured to amplify input signal periods (81A) of the RF input signal (81) to yield output signal periods (79A) in the PA output (78), and wherein the UWB PA (80) is further configured to not amplify input quiet periods (81B) of the RF input signal (81) to yield output quiet periods (79B) in the PA output (78)."

VIII. Claim 1 of the first auxiliary request comprises the following relevant wording of feature c) of claim 1 of the main request in unamended form:

"c) generate the auxiliary signal to have a quiet period component (112) selected according to levels of the control and power supply voltages (82)..."

IX. In claim 1 of the second auxiliary request, the relevant wording in feature c) of claim 1 of the main request has been amended as follows:

"c) generate the auxiliary signal to have a quiet period component (112) having a direct current "DC" level selected according to levels of the control and power supply voltages (82)..." (emphasis added by the board)

X. The detailed arguments will be discussed in the reasons below.

Reasons for the Decision

1. Main request - Lack of clarity (Article 84 EPC)

- 1.1 Claim 1 of the main request does not meet the requirements of Article 84 EPC because it does not sufficiently clearly define the matter for which protection is sought.
- 1.2 Feature c) of claim 1 leaves the person skilled in the art in doubt as to how the quiet period component of the auxiliary signal is selected according to levels of the control and power supply voltages (82) in order to achieve the claimed objective to set an appropriate internal working point as defined in claim 1.
- 1.3 The wording in question clearly has a technical meaning and, in particular, implies that the claimed subject-matter goes beyond an adjustment of a bias voltage applied to the power amplifier stage resulting in a shift of the operating point of the power amplifier (PA), as is the case with conventional dynamic gate biasing (see e.g. document D7 (WO 2012/102342 A1)).

The skilled person would therefore understand the relevant part of feature c) as being a limitation of the claimed subject-matter, while it is not clear what exactly the limitation is, and in particular how a quiet period component is to be selected according to the levels of the control and power supply voltages.

- 1.4 The appellant essentially argued that the quiet period component was tailored to the circuit's architecture and component configuration to cancel background noise arising from the control and power supply voltages.

They further stated that a person skilled in the art, being familiar with control and power supply voltages, would be able to measure their levels and to set the quiet period component accordingly. It was further submitted that the skilled person would understand the term "levels" as corresponding to the DC levels of the control and power supply voltages in view of the further wording of claim according to which it sets an internal working point of the UWB PA. According to the appellant, such an internal working/operating point, defined by current and voltage under "no signal" conditions, could be adjusted by setting the bias to maximise signal output and minimise distortion. The appellant also contended that the quiet period component could accomplish this without altering the control and power supply voltages.

During the oral proceedings before the board, the appellant also argued that the person skilled in the art would understand that there was a difference between the control voltage and the power supply voltage corresponding to a DC voltage level and that the quiet period component was selected according to this difference so as to align it with the levels of the control and power supply voltages.

1.5 The board is not convinced by the appellant's arguments.

It should be noted at the outset that the board does not question that a quiet period component of an auxiliary signal as claimed in claim 1 can, in principle, set an internal working point of a UWB PA to a reduced power consumption working point. In particular, the board can accept in principle the appellant's explanations of the effects of the quiet

period component in the UWB PA, as illustrated in figure 2 of the application. The board can also accept the appellant's argument that the skilled person would at least understand that the quiet period component might have a DC level.

- 1.6 Rather, the problem with feature c) above lies in the specific way in which the quiet period component is defined, namely that it is "selected according to the levels of the control and power supply voltages". This definition is neither clear in itself, nor clear from the description or the drawings.

In particular, neither the claims nor the description indicate how the "levels of the control and power supply voltages" are defined. Claim 1 merely states that the "UWB PA [is] configured to be operated by control and power supply voltages (82)". It is therefore unclear whether the claimed "levels" refer to specific voltage ranges, thresholds or relative changes of the control and power supply voltages. For example, it is unclear if and how variations in the control and power supply voltages influence the selection of the quiet period component of the auxiliary signal. The appellant argued that the control and power supply voltages were not altered by the quiet period component. However, this condition is not reflected in the wording of claim 1.

- 1.7 The lack of any technical description of these "levels" and how the "quiet period component" is selected according to them to set an internal working point of the UWB PA in order to put the UWB PA in a non-amplification state therefore makes it impossible for the skilled person to determine how the "quiet period component" is selected or adjusted according to levels

of the control and power supply voltages referred to in claim 1.

- 1.8 Furthermore, a difference between the claimed control and power supply voltages which, as argued by the appellant, can be determined (or measured) and which is a DC voltage serving as a basis for selecting the quiet period component, is not apparent either from the wording of claim 1 or from the description.

In this context, the appellant referred mainly to two passages in the description: page 4, lines 14 to 15, and page 7, line 16 onwards. However, these passages essentially repeat the wording of the relevant part of feature c) of claim 1. They give no indication of how the quiet period component is actually selected according to the control and power supply voltages, let alone that a difference between these voltages is to be taken into account as a basis for selecting the quiet period component.

- 1.9 For the sake of completeness, it should also be noted that the architecture of the UWB PA and the arrangement of its components are neither described nor defined in claim 1. The power amplifier could therefore be designed in different ways, so that it is not even clear to which of the multiple possible control and power supply voltages required to operate a particular type of UWB PA claim 1 exactly refers. This remains unclear, even if the skilled person knows what voltages should generally be used for a particular type of power amplifier.

- 1.10 In conclusion, the appellant has not convincingly shown why the claimed subject-matter would be understood by a skilled person as having a clearly defined technical

definition in relation to the selection of the quiet period component. Since such reasons are not apparent to the board either, the board has concluded, in the light of the above considerations, that claim 1 does not meet the requirements of Article 84 EPC.

2. First auxiliary request - Lack of clarity (Article 84 EPC)

2.1 Claim 1 of the first auxiliary request comprises the relevant wording "a quiet period component (112) selected according to levels of the control and power supply voltages" in feature c) of claim 1 of the main request in unamended form.

2.2 The appellant did not submit any further arguments in respect of the first auxiliary request. Irrespective of the question of the admittance of this request into the appeal proceedings under Article 12(6) RPBA, the board therefore concluded that claim 1 of the first auxiliary request does not meet the requirements of Article 84 EPC for the reasons set out above in relation to claim 1 of the main request.

3. Second auxiliary request - Lack of clarity (Article 84 EPC)

3.1 Irrespective of the question of its admittance into the appeal procedure under Article 13(2) RPBA, the second auxiliary request does not overcome the objections under Article 84 EPC against the main request and the first auxiliary request.

3.2 Claim 1 of the second auxiliary request has been amended in that the quiet period component is further defined as "having a direct current "DC" level".

3.3 With regard to claim 1 of the second auxiliary request, the appellant essentially repeated the argument already made for the main request, asserting that a difference between the control voltage and the power supply voltage corresponded to a DC bias voltage, for which the quiet period component had to be selected accordingly.

3.4 The objection against claim 1 of the main request is not overcome by the further definition of the quiet period component, because it remains unclear how the quiet period component having a direct current "DC" level, is selected according to the levels of the control and power supply voltages. Furthermore, as stated above, the board does not question that the skilled person can understand, in particular also from claim 1 of the main request, that the quiet period component can have a DC level. The reasoning given by the board for the main request therefore applies *mutatis mutandis* to the second auxiliary request.

3.5 In the light of the above considerations, the board concluded that claim 1 of the second auxiliary request does not meet the requirements of Article 84 EPC.

4. Request for remittal

As none of the appellant's requests is allowable, the request for remittal has no purpose.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



D. Grundner

R. Bekkering

Decision electronically authenticated