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Datasheet for the decision of 11 October 2022

Case Number: T 1069/20 - 3.5.03

Application Number: 04002970.4

Publication Number: 1447922

IPC: H04B7/005, H04B7/185

Language of the proceedings: EN

Title of invention:
On orbit variable power high power amplifiers for a satellite communications system

Patent Proprietor:
The Boeing Company

Opponents:
Airbus Defence and Space GmbH/
Airbus Defence and Space SaS

Headword:
Minimum EIRP of variable-power HPAs/BOEING

Relevant legal provisions:
EPC Art. 83, 100(b), 116(1)
RPBA 2020 Art. 12(8)

Keyword:
Sufficiency of disclosure - all requests (no): parameters not sufficiently disclosed
Decision in written proceedings (yes): no need for oral proceedings

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Case Number: T 1069/20 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 11 October 2022

Joint appellants: (Joint opponents)	Airbus Defence and Space GmbH/ Airbus Defence and Space SaS Willi-Messerschmitt-Strasse 1 31, rue des Cosmonautes 85521 Ottobrunn/31402 Toulouse Cedex 4 (DE)
Representative:	LKGLOBAL Lorenz & Kopf PartG mbB Patentanwälte Brienner Straße 11 80333 München (DE)
Respondent: (Patent proprietor)	The Boeing Company 100 North Riverside Plaza Chicago, IL 60606-1596 (US)
Representative:	Witte, Weller & Partner Patentanwälte mbB Postfach 10 54 62 70047 Stuttgart (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 28 February 2020 rejecting the opposition filed against European patent No. 1447922 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	J. Eraso Helguera
	F. Bostedt

Summary of Facts and Submissions

I. This appeal concerns the decision of the opposition division rejecting the opposition under Article 101(2) EPC.

II. The joint appellants (joint opponents) requested that the decision under appeal be set aside and that the patent be revoked.

III. In the written reply to the appeal, the respondent (proprietor) requested as a **main request** that the appeal be dismissed, i.e. that the opposition be rejected and the patent maintained as granted, or, in the alternative, that the patent be maintained in amended form on the basis of the claims of one of **four auxiliary requests** filed during the opposition proceedings and re-submitted with the reply to the appeal.

Furthermore, in response to the board's summons to oral proceedings and the accompanying communication under Article 15(1) RPBA 2020, the respondent announced the following:

> "Regarding the oral proceedings scheduled on November 10, 2022, it is noted that neither the undersigned nor the proprietor will attend the oral proceedings."

It did not submit any comments on the substance of the board's communication.

IV. The board then cancelled the arranged oral proceedings.

V. Claim 1 as granted (**main request**) reads as follows:

"A satellite system, the satellite system comprising:

a receiver (22) for receiving command signals;
a power conditioner (41);
a plurality of variable power high power amplifiers (30) coupled to the power conditioner (41);
a controller (40) receiving command signals and generating control signals in response to the command signals; and
said power conditioner (41) generating a control voltage in response to the control signal, said control voltage coupled to said plurality of variable power high power amplifiers (30), said control voltage selectively reducing the saturated power of at least one of the plurality of variable power high power amplifiers (30), wherein said control voltage reduces the effective saturated power output of the plurality of variable power high power amplifiers (30) to a minimum effective isotropic radiated power of the plurality of variable power high power amplifiers (30)."

Claim 2 as granted (**main request**) reads as follows:

"A method for operating a satellite, the method comprising:

providing a plurality of variable power high power amplifiers (30) each having a minimum effective isotropic radiated power;
generating a control input for a plurality of variable power high power amplifiers (30); and

adjusting the effective saturated power output of the plurality of variable power high power amplifiers (30) to the minimum effective isotropic radiated power."

Claim 1 of the **first auxiliary request** is identical to claim 2 as granted.

Claim 1 of the **second auxiliary request** reads as follows:

"A method for operating a satellite, the method comprising:

providing a plurality of variable power high power amplifiers (30) each having a minimum effective isotropic radiated power, wherein each of the variable power high power amplifiers includes a power conditioner (41);
receiving a command signal and generating a control input for the plurality of variable power high power amplifiers (30) as a function of the command signal (16) to change the saturated output power point of each variable power high power amplifier (30); and
adjusting the effective saturated power output of each of the plurality of variable power high power amplifiers (30) to the respective minimum effective isotropic radiated power."

Claim 1 of the **third auxiliary request** reads as follows:

"A method for operating a satellite, the method comprising:

providing a plurality of variable power high power amplifiers (30) each having a minimum effective isotropic radiated power, wherein each of the variable power high power amplifiers includes a power conditioner (41), wherein the plurality of variable power high power amplifiers (30) is within a redundancy ring, and wherein each of the plurality of variable power high power amplifiers (30) is a solid-state power amplifier;
receiving a command signal and generating a control input for the plurality of variable power high power amplifiers (30) as a function of the command signal (16) to change the saturated output power point of each variable power high power amplifier (30); and
adjusting the effective saturated power output of each of the plurality of variable power high power amplifiers (30) to the respective minimum effective isotropic radiated power."

Claim 1 of the **fourth auxiliary request** reads as follows:

"A method for operating a satellite, the method comprising:

providing a plurality of variable power high power amplifiers (30) each having a minimum effective isotropic radiated power, wherein each of the variable power high power amplifiers includes a power conditioner (41) having a DC power input (42) that is used to ultimately control the saturated output power of the respective variable high power amplifier (30), wherein the plurality of variable power high power amplifiers (30) is within a redundancy ring, and wherein each of the plurality

of variable power high power amplifiers (30) is a solid-state power amplifier, wherein a drain voltage of a field effect transistor of the respective variable power high power amplifier (30) is used to control the saturated output power;
receiving a command signal and generating a control input for the plurality of variable power high power amplifiers (30) as a function of the command signal (16) to change the saturated output power point of each variable power high power amplifier (30); and
adjusting the effective saturated power output of each of the plurality of variable power high power amplifiers (30) to the respective minimum effective isotropic radiated power."

Reasons for the Decision

1. Decision in written proceedings

1.1 Where oral proceedings are appointed upon a party's request and that party subsequently expresses its intention not to attend, such statement is normally considered to be equivalent to a withdrawal of the request for oral proceedings.

1.2 The appellants requested oral proceedings as a subsidiary measure in the event that their requests were not granted by the board. In view of the board's decision, there is no need to accede to the appellants' request for oral proceedings.

1.3 As the board did not regard it expedient or necessary to hold oral oral proceedings in this case either (cf. Article 116(1) EPC), these were cancelled and a

decision is handed down in written proceedings (Article 12(8) RPBA 2020).

2. Technical background

The patent relates generally to communication satellites. In this technical field, for a transmitting system with a given transmitting antenna configuration, the effective isotropic radiated power (EIRP) is defined as the amount of power that a theoretical isotropic (spherical) antenna would have to emit to produce the same peak power density as observed in the direction of the maximum antenna gain of the transmitting system. More specifically, the EIRP gives an indication of the power density or signal strength radiated by the main lobe of the antenna, rather than the actual total radiated power. In a multi-beam antenna configuration, the EIRP can be defined on a per-(spot)-beam basis.

3. MAIN REQUEST

Claim 1 as granted comprises the following limiting features (outline used in the appealed decision):

M1.0 A satellite system, the satellite system comprising:
M1.1 a receiver for receiving command signals;
M1.2 a power conditioner;
M1.3 a plurality of variable-power high-power amplifiers (HPAs)
M1.3.1 coupled to the power conditioner;
M1.4 a controller
M1.4.1 receiving command signals and generating control signals in response to the command signals;

M1.5 said power conditioner generating a control voltage in response to the control signal,
M1.5.1 said control voltage coupled to said plurality of variable-power HPAs,
M1.5.2 said control voltage selectively reducing the saturated power of at least one of the plurality of variable-power HPAs,
M1.5.3 said control voltage reduces the effective saturated power output of the plurality of variable-power HPAs to a minimum effective isotropic radiated power (EIRP) of the plurality of variable-power HPAs.

Claim 2 as granted comprises the following limiting features (outline used in the appealed decision):

M2.0 A method for operating a satellite, the method comprising:
M2.1 providing a plurality of variable-power HPAs
M2.1.1 each having a minimum EIRP;
M2.2 generating a control input for a plurality of variable-power HPAs;
M2.3 adjusting the effective saturated power output of the plurality of variable-power HPAs to the minimum EIRP.

3.1 Sufficiency of disclosure (Article 100(b) EPC)

3.1.1 The joint appellants argued that the opposed patent did not describe what the minimum EIRP was. This was described as a characteristic of an individual HPA (see paragraphs [0007] and [0021] of the patent: "each power amplifier having a minimum effective isotropic radiated power"). The patent did not disclose how a single control voltage value generated by a single power conditioner (**feature M1.5**) could reduce the effective

saturated power output of the plurality of variable-power HPA to a minimum EIRP of the plurality of variable-power HPA (**feature M1.5.3**). The skilled person did not know how to adjust the control voltage to obtain the claimed effect.

Worse still, paragraph [0002] of the patent described that not all of the HPA have identical EIRP requirements. Therefore, there seemed to be a difference between the "minimum EIRP" of *the individual HPA* (see **feature M2.1.1**) and the minimum EIRP of *the plurality of variable-power HPAs* (see **feature M1.5.3**). Therefore, the skilled person was left alone with determining the required value for the control voltage. **Features M1.5.3 and M2.1.1** assigned the EIRP to the variable-power HPA. However, on page 3 of D1, the section "Relation to transmitter output power" described that the EIRP was a characteristic of a system consisting of a transmitter that was connected to an antenna through a transmission line. In order to determine the EIRP of this system, the losses of the transmission line had to be considered in addition to the output power of the transmitter and the antenna gain. An amplifier as such did not have an EIRP. The patent did not provide a definition of the EIRP in the context of an HPA. Rather, the patent merely stated that *an HPA has a minimum EIRP* (see paragraph [0006], 2nd sentence, and paragraph [0007], 1st sentence). With respect to Fig. 2, a transmit antenna 34 and an output multiplexer 32 were described (see paragraph [0015] of the patent). Nevertheless, the EIRP was used in the context of the HPA only. The patent did not give a technical teaching about the meaning of the EIRP in the context of an HPA. The person skilled in the art could thus not reproduce the claimed invention.

3.1.2 The respondent replied that in a commercial satellite the EIRP requirements referred to the EIRP which was set, for example, by the customer and/or a performance specification. The minimum EIRP referred to the minimum EIRP to just meet the set or specified EIRP in the performance specification (see e.g. paragraph [0002] of the patent). The granted claims referred to a satellite system (claim 1) and a method for operating a satellite (claims 2 and 3). For satellites the EIRP was a well-known physical quantity. As already identified by the joint appellants, HPAs outputted transmission signals to antennas of the satellite, wherein the EIRP depended on the transmission power of the corresponding HPAs. It was apparent for a skilled person that an EIRP in the context of an HPA meant that the *output power* of the HPA was related to the respective EIRP by a fixed function describing *the transmission line* between the output of the respective HPA and the *antenna*. Therefore, a skilled person, knowing the specific satellite system, would readily be able to mathematically implement the functional relationship between the *output power* of any individual variable-power HPA and the corresponding *EIRP of the actual satellite system*. The opposition division agreed with this interpretation in point II.17.5 of the appealed decision.

3.1.3 The board agrees with the joint appellants, for the following reasons:

The "minimum EIRP requirement" with respect to a *satellite system* is set on the basis of both technical and regulatory constraints, e.g. operating frequency band, antenna size and altitude. Typically, the minimum EIRP of the satellite system must be such that the downlink can be closed at a given location with a

minimum spectral efficiency (measured in bits per second/Hz). Moreover, the common understanding is that, in a variable-power HPA, the saturated power output can be varied by means of a control voltage. However, the question at stake is whether the skilled person would indeed be able to make said control voltage reduce the effective saturated power output of the plurality of variable-power HPAs to *a minimum EIRP of the plurality of variable-power HPAs* as per feature M1.5.3 or *to the minimum EIRP* [of each variable-power HPA] as per features M2.3 and M2.1.1. For that purpose, the skilled person would need to know how to obtain the minimum EIRP of the plurality of variable-power HPAs and the minimum EIRP of each variable-power HPA.

The board agrees with the joint appellants that there is a difference between the minimum EIRP of an *individual* HPA and the minimum EIRP of the *plurality* of variable-power HPAs. Neither of the two is a well-known parameter, similar to those found in the data sheet of a commercially available HPA, e.g. gain (in dB) or output power P_{OUT} (in dBm or dBW). The respondent alleged that the minimum EIRP requirement of an individual HPA actually referred to the output power of the same individual HPA obtained from the EIRP of the satellite system. However, in Fig. 2 of the patent, all the HPAs seem to be connected to the same output multiplexer and the same transmit antenna. The respondent has failed to explain why, according to paragraph [0002] of the patent, "not all of the high power amplifiers have the identical EIRP requirements". If more than one HPA is active simultaneously, the respondent has not elucidated how the different minimum EIRP requirements of each *individual* HPA are calculated on the basis of the minimum EIRP requirement of the *plurality* of HPAs and/or the EIRP *of the satellite*

system. In any event, the respondent has failed to provide at least one example of such calculations.

3.1.4 It follows that the opposed patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

3.2 The ground for opposition under Article 100(b) EPC thus prejudices the maintenance of the opposed patent.

4. AUXILIARY REQUESTS

4.1 Claim 1 of the **first auxiliary request** is identical to claim 2 as granted.

4.2 Claim 1 of the **second auxiliary request** comprises all the limiting features of claim 2 as granted, with the following additions (board's outline and highlighting):

M2.4 each of the variable-power HPAs includes a power conditioner;

M2.2.1 receiving a command signal and generating a control input for the plurality of variable-power HPAs as a function of the command signal to change the saturated output power point of each variable-power HPA;

M2.3.1 adjusting the effective saturated power output of each of the plurality of variable-power HPAs to the respective minimum EIRP.

4.3 Claim 1 of the **third auxiliary request** comprises all the limiting features of claim 1 of the second auxiliary request, with the following additions (board's outline and highlighting):

M2.1.2 the plurality of variable-power HPAs is within a redundancy ring;

M2.1.3 each of the plurality of variable-power HPAs is a solid-state power amplifier.

4.4 Claim 1 of the **fourth auxiliary request** comprises all the limiting features of claim 1 of the third auxiliary request, with the following additions (board's outline and highlighting):

M2.4.1 [the power conditioner] having a DC power input that is used to ultimately control the saturated output power of the respective variable[-power] HPA,

M2.1.4 a drain voltage of a field effect transistor of the respective variable-power HPA is used to control the saturated power output.

4.5 Hence, the observations on insufficiency of disclosure set out in point 3.1 above apply *mutatis mutandis* to the present auxiliary requests.

4.6 Consequently, the present auxiliary requests are not allowable under Article 83 EPC.

5. Since there is no allowable claim request on file, the patent must be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated