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**Datasheet for the decision
of 18 August 2016**

Case Number: T 2339/11 - 3.5.02

Application Number: 04750107.7

Publication Number: 1620943

IPC: H03F3/68

Language of the proceedings: EN

Title of invention:

N-Way RF Power Amplifier Circuit with Increased Back-Off
Capability and Power Added Efficiency Using Selected Phase
Lengths and Output Impedances

Applicant:

Cree, Inc.

Relevant legal provisions:

EPC Art. 123(2)

Keyword:

Amendments - extension beyond the content of the application
as filed (yes)



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Case Number: T 2339/11 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 18 August 2016

Appellant: Cree, Inc.
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Representative: Boulton Wade Tennant
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 17 June 2011
refusing European patent application No.
04750107.7 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman R. Lord
Members: M. Léouffre
W. Ungler

Summary of Facts and Submissions

- I. The applicant appealed against the decision of the examining division, posted on 17 June 2011, to refuse the European patent application No. 04 750 107.7. The statement setting out the grounds of appeal was received on 27 October 2011.

- II. The examining division held that the application did not meet the requirements following from Article 123(2) EPC and that the claimed subject-matter was obvious in the light of document:
Y. Yang et al. "A Fully Matched N-Way Doherty Amplifier With Optimized Linearity", IEEE Transactions on Microwave Theory and Techniques, vol. 51, no. 3, March 2003, pages 986 to 993 (D5).

- III. In a communication accompanying the summons to oral proceedings dated 1 April 2016 the Board indicated that it was inclined to share the view of the examining division.

- IV. Oral proceedings before the board took place as scheduled on 18 August 2016. The appellant, who had informed the board with a letter dated 10 August 2016, that they would not be represented, had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the claims of a main request, or on the basis of the claims of one of the auxiliary requests 1 and 2, all filed with a letter dated 18 July 2016.

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

"An RF power amplifier circuit for amplifying an RF signal over a first range of power comprising:

a) a carrier amplifier (40) for amplifying the RF signal over a second range of power and with a power saturation level below the maximum of the first range of power, the carrier amplifier having an output impedance,

b) a plurality of peak amplifiers (41, 42, 43) connected in parallel with the carrier amplifier, each of the peak amplifiers being biased to sequentially provide an amplified output signal after the carrier amplifier approaches saturation, each of the peak amplifiers having a respective output impedance,

c) a signal splitter (44, 46, 48) for splitting an input signal and applying the split input signal to the carrier amplifier and to the plurality of peak amplifiers,

d) a plurality of input matching circuits (54), each of which is coupled to respective inputs of the carrier amplifier (40) and the plurality of peak amplifiers (41, 42, 43),

e) a 90° transformer (50) connecting the signal splitter to the input matching circuit coupled to the input of the carrier amplifier,

f) an output of the power amplifier circuit (62) for receiving amplified output signals from the carrier amplifier (40) and from the plurality of peak amplifiers (41, 42, 43), the output of the power amplifier circuit (62) having an impedance of 50 Ohms,

g) an output matching network, coupled between the carrier amplifier (40) and plurality of peak amplifiers (41, 42, 43), and the output of the power amplifier circuit (62), the output matching network comprising:

a combiner node arranged to combine the amplified output signals from the carrier amplifier (40) and from the plurality of peak amplifiers (41, 42, 43),

a plurality of output matching circuits (58), each of which is coupled to respective ones of the carrier

amplifier (40) and plurality of peak amplifiers (41, 42, 43), and

phase lengths (60), serially connected between each of the plurality of output matching circuits (58) and the combiner node, the phase lengths (60) selected to provide an impedance that reduces or eliminates the reactance portion of the impedance seen by the respective amplifiers over a range of RF signal power levels, and

a plurality of 90° transformers (66) each connected between the respective output of the phase lengths (60) of the plurality of peak amplifiers (41, 42, 43) and the combiner node,

wherein each of the plurality of output matching circuits (58) is further arranged to match the output impedance of the respective one of the carrier amplifier (40) and the plurality of peak amplifiers (41, 42, 43) to an impedance of less than 50 Ohms and

wherein the output matching network further comprises an impedance transformer (64) coupled between the combiner node and the output of the power amplifier circuit (62), configured to match an output impedance of the combiner node to the 50 Ohms impedance of the output of the power amplifier circuit (62)."

VI. Claim 1 of the first auxiliary request is based on claim 1 of the main request wherein:

- the passage "an output matching network, coupled between the carrier amplifier (40) and plurality of peak amplifiers (41, 42, 43), and the output of the power amplifier circuit (62), the output matching network comprising:" and the expression in the last feature "wherein the output matching network further comprises" have been deleted;
- the feature "a plurality of output matching circuits (58), each of which is coupled to

- respective ones of the carrier amplifier (40) and plurality of peak amplifiers (41, 42, 43)," has been amended to read "a plurality of output matching circuits (58), each of which is coupled to respective outputs of the carrier amplifier (40) and plurality of peak amplifiers (41, 42, 43)"; and
- the order of the last two features has been reversed.

- VII. The subject-matter of claim 1 of the second auxiliary request corresponds to that of claim 1 of the first auxiliary request, with the following modifications:
- it is limited to the case comprising three peak amplifiers and three two-way signal splitters;
 - the plurality of output matching circuits (58) is specified as matching the output impedance of the respective one of the carrier amplifier (48) and the plurality of peak amplifiers (41, 42, 43) to an impedance of less than 50 Ohms before the combiner node;
 - the feature "an impedance transformer (64) coupled between the combiner node and the output of the power amplifier circuit (62), the impedance transformer (64) configured to match the impedance at an output of the combiner node to the 50 Ohms impedance of the output of the power amplifier circuit (62)" is amended to read "an impedance transformer (64) and resistive load (65) coupled between the combiner node and the output of the power amplifier circuit (62), the impedance transformer (64) configured to match the impedance of less than 50 Ohms after the combiner node to the 50 Ohms impedance of the output of the power amplifier circuit (62)" [emphasis added by the board]; and

- the following feature is added: "wherein the range of extended near peak efficient power amplification of the RF power amplifier circuit is approximately 18 dB".

VIII. The arguments presented by the appellant in the grounds of appeal and the letter of 18 July 2016 concern respectively the grounds for the decision under appeal and the objections raised in the board's communication, and do not address the objection which is the basis of the present decision.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
 - 2.1 According to claim 1 "each of the plurality of output matching circuits (58) is further arranged to match the output impedance of the respective one of the carrier amplifier (40) and the plurality of peak amplifiers (41, 42, 43) to an impedance of less than 50 Ohms".
 - 2.2 This feature does not have any basis in the application as filed.
 - 2.2.1 According to section [0032] of the original description, "In addition to the phase length effect on efficiency, lowering the output impedances to appropriate values and then transforming to 50 ohms after the combiner node further increases operating effectiveness". Section [0033] confirms that "Effective Doherty operation is not realized with 50 Ohm nominal output impedances in the carrier and peak amplifiers",

and sections [0034] and [0035] propose therefore to match the drains to 17 or 10 ohms to increase the power added efficiency (PAE) by 5% and 7% respectively, while section [0039] recites further "In accordance with the invention, effectiveness of a Doherty amplifier is increased by introducing additional phase lengths between the outputs of the amplifiers and the combiner node, and by reducing the individual load impedances of the carrier and peak amplifier, as well as the relative phases between them". The output matching circuits are not mentioned in connection with the reduction of the individual load impedances of the carrier and peak amplifiers.

The original description does not clearly disclose which of the phase lengths 60 and the output matching circuits 58 contribute to the reduction of the individual load impedances of the carrier and peak amplifiers. It must however be assumed that both contribute as parts of an output matching network to the matching of the output impedance of the respective one of the carrier amplifier and the plurality of peak amplifiers to an impedance of less than 50 Ohms. This interpretation is in line with feature e) of original independent claim 9 which reads "a plurality of output-matching networks connecting the carrier amplifier and the at least one peak amplifier to the output combiner node, each output-matching network presenting an output impedance to each amplifier of less than Z ", noting that from claim 10, which is dependent on this claim, it is clear that the output-matching networks include the phase lengths.

The board has not found any other passage of the original application which clearly and unambiguously discloses that "each of the plurality of output matching circuits (58) is further arranged to match the output impedance of the respective one of the carrier

amplifier (40) and the plurality of peak amplifiers (41, 42, 43) to an impedance of less than 50 Ohms" as recited in claim 1. The board concludes therefore that claim 1 of the main request contravenes Article 123(2) EPC.

3. *First and second auxiliary requests*

A feature corresponding to the feature recited under item 2.1 is also present in claim 1 of each of the first and second auxiliary requests, so that these requests also contravene Article 123(2) EPC.

4. *Right to be heard and basis of the decision*

4.1 Claim 1 of the main request filed with the statement of grounds of appeal specified an output-matching network comprising output matching circuits which comprised phase lengths (see the features referred to as f), g) and h) in the communication accompanying the summons to oral proceedings).

Hence, in line with the original description, claim 1 filed with the statement of grounds of appeal left open which of the phase lengths 60 and the output matching circuits 58 contributed to the reduction of the individual load impedances of the carrier and peak amplifiers, so that in the annex to the summons to oral proceedings no objection was raised under Article 123(2) EPC in connection with the feature relating to the output matching circuits discussed above.

4.2 The appellant redrafted the claims to address the further objections raised in that communication. In so doing, the appellant introduced the added subject-matter which was the basis of above objection.

- 4.3 The appellant filed the amended claims with the letter dated 18 July 2016, i.e. one month before the oral proceedings, and subsequently announced, in a letter dated 10 August 2016, that they would not be represented at the hearing.
The appellant therefore did not make use of the opportunity that was granted to them in accordance with Article 113(1) EPC to respond to the objection raised under item 2 above.
- 4.4 An appellant who does not attend oral proceedings to which they were duly summoned must expect that the board might decide that such new claims are not allowable because of deficiencies which were not mentioned in the communication accompanying the summons. The voluntary absence of the appellant cannot be a reason for the board not to raise new issues, and cannot put the appellant in a more advantageous position than it would have been, had it been present. The board is not obliged to delay its decision by reason of the absence at the oral proceedings of a party duly summoned (see Article 15(3) of the Rules of Procedure of the Boards of Appeal). The board facing the absence of the appellant has a number of different options available, among which is the refusal of the claims for legal reasons, even if the new claims have not been discussed before and were filed in good time before the oral proceedings.
- 4.5 Hence in accordance with the established Case Law of the Boards of Appeal of the European Patent Office 7th edition 2013, Chapter IV.E.4.2.3 c) (see pages 991 to 993), the board decided that the main, first and second auxiliary requests were not allowable because they contravened Article 123(2) EPC. Thus, since none of the

appellant's request is allowable, the appeal has to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

R. Lord

Decision electronically authenticated