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**Datasheet for the decision
of 19 March 2014**

Case Number: T 0031/13 - 3.4.02

Application Number: 08794636.4

Publication Number: 2171528

IPC: G02F1/01

Language of the proceedings: EN

Title of invention:

METHOD OF CONTROLLING THE DC BIAS OF AN ELECTRO-OPTIC SWITCH
DRIVEN WITH POSITIVE AND NEGATIVE RF VOLTAGES

Applicant:

Northrop Grumman Guidance
and Electronics Company, Inc.

Headword:

Relevant legal provisions:

EPC Art. 123(2), 84

Keyword:

Amendments - added subject-matter (no)
Claims - clarity after amendment (yes)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 0031/13 - 3.4.02

**D E C I S I O N
of Technical Board of Appeal 3.4.02
of 19 March 2014**

Appellant: Northrop Grumman Guidance
(Applicant) and Electronics Company, Inc.
21240 Burbank Boulevard
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Representative: Maury, Richard Philip
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 20 July 2012
refusing European patent application No.
08794636.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. Klein
Members: H. von Gronau
B. Müller

Summary of Facts and Submissions

- I. The appeal of the applicant is directed against the decision to refuse European patent application number 08794636.4. The examining division refused the application in particular on the grounds that the subject-matter of the independent claims extended beyond the content of the application as filed (Article 123(2) EPC), and that the claims did not comply with Article 84 EPC because they were not clear.
- II. The applicant's sole request is that the decision under appeal be set aside and a patent be granted on the basis of claims 1 to 6 as filed with a letter dated 17 February 2014.
- III. The independent claims read as follows:

"1. A method for utilizing optical feedback to maintain minimum optical transmission in an OFF state of a Mach-Zehnder electro-optic switch (706) having an RF input port (704) and a DC port (708), which exhibits first and second ON states upon respective application of positive and negative RF voltage pulses of substantially equal magnitude, by adjusting a DC bias voltage of the electro-optic switch, the method comprising the steps of:

selecting an initial DC voltage level and an initial RF port voltage by measuring visibility over a range of predetermined DC voltages and a range of predetermined RF port voltages, then selecting the initial DC voltage associated with minimum measured visibility;

determining visibility over a range of DC voltages proximate the initial DC voltage level in accordance with the relation:

$$VIS(V,VP) = \frac{I_1(V,VP) - I_2(V,VP)}{I_1(V,VP) + I_2(V,VP)}$$

where:

V is applied DC voltage;

VP is applied RF voltage pulse magnitude;

I₁ is the normalized output of the electro-optic switch (706) corresponding to its first ON state; and

I₂ is the normalized output of the electro-optic switch (706) corresponding to its second ON state;

computing visibility slope in accordance with the relation:

$$SLOPE = \Delta VIS / \Delta V,$$

where:

ΔVIS is change in visibility value; and

ΔV is change in applied DC voltage; and

applying a correction voltage to the initial DC voltage level, where the correction voltage is

$$\Delta V_{CORR} = \frac{-VIS_M}{SLOPE}$$

where:

ΔV_{CORR} is the correction voltage;

VIS_M is the measured visibility; and

SLOPE is the visibility slope."

"4. A Mach-Zehnder electro-optic switch (706) which exhibits first and second ON states upon respective application of positive and negative RF voltage pulses of substantially equal magnitude, having an RF input port (704) and a DC port (708) and further comprising:

means for determining an optimum DC bias point including:

means for selecting an initial DC voltage level and an initial RF port voltage by measuring visibility over a range of predetermined DC voltages and a range of predetermined RF port voltages, then selecting the initial DC voltage associated with minimum measured visibility;

means for determining visibility over a range of DC voltages proximate the initial DC voltage level in accordance with the relation:

$$VIS(V, V_P) := \frac{I_1(V, V_P) - I_2(V, V_P)}{I_1(V, V_P) + I_2(V, V_P)}$$

where:

V is the applied DC voltage;

V_P is the applied RF voltage pulse magnitude;

I₁ is the normalized output of the electro-optic switch (706) corresponding to the first ON state; and

I₂ is the normalized output of the electro-optic switch (706) corresponding to the second ON state;

means for computing visibility slope in accordance with the relation:

$$SLOPE = \Delta VIS / \Delta V,$$

where:

ΔVIS is change in the visibility value; and

ΔV is change in the applied DC voltage; and

means for applying a correction voltage to the initial DC voltage level, where the correction voltage is

$$\Delta\text{V}_{\text{CORR}} = \frac{-\text{VIS}_M}{\text{SLOPE}}$$

where:

$\Delta\text{V}_{\text{CORR}}$ is the correction voltage;

VIS_M is the measured visibility; and

SLOPE is the visibility slope."

Reasons for the Decision

1. Support of the amended claims in the originally filed application documents (Article 123(2) EPC)
- 1.1 The wording of independent claim 1 corresponds largely to the wording of originally filed claim 7. In addition the claim defines that
 - the method utilizes optical feedback to maintain minimum optical transmission in an OFF state of a Mach-Zehnder electro-optical switch which is disclosed on page 3, paragraph 13,
 - the switch exhibits first and second ON states upon respective application of positive and negative RF voltage pulses of substantial equal magnitude which feature is also disclosed in paragraph 13 of the original application,

- the DC bias voltage of the switch is adjusted, as disclosed in paragraph 13 of the original application document: "The balancing is accomplished by adjusting a common DC voltage for the purpose of obtaining the minimum optical transmission of the OFF state of the switch".

- 1.2 Dependent claims 2 and 3 correspond to the originally filed claims 8 and 9.

- 1.3 Claims 4 to 6 are corresponding apparatus claims based on original claims 16 to 18 with similar amendments.

- 1.4 Therefore, due to the amendments made, the subject-matter of the claims does not extend beyond the content of the application as filed.

- 2. Clarity of the independent claims (Article 84 EPC)

- 2.1 The examining division, in the decision under appeal, objected that the term "visibility" was used in the claims without giving a definition and that the visibility of a Mach-Zehnder interferometer could have a different meaning.

- 2.2 With the amendments to the claims the definition of the visibility in the present application (cf. original claim 7) has been introduced into the independent claims. Deviating interpretations have been deleted.

- 2.3 The board is therefore of the opinion that the claims so amended meet the requirements of Article 84 EPC.

- 3. The amended application documents thus overcome the reasons on which the refusal by the examining division was founded.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance for further prosecution.

The Registrar:

The Chairman:



M. Kiehl

A. Klein

Decision electronically authenticated