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Datasheet for the decision of 25 January 2007

Case Number: T 0565/05 - 3.5.03

Application Number: 99919728.8

Publication Number: 1068684

IPC: H04B 10/17

Language of the proceedings: EN

Title of invention:
Optical fiber amplifier having a gain flattening filter

Applicant:
TELEFONAKTIEBOLAGET LM ERICSSON (publ)

Opponent:
-

Headword:
Optical fiber amplifier/ERICSSON

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (yes) after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0565/05 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 25 January 2007

Appellant: TELEFONAKTIEBOLAGET LM ERICSSON (publ)
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 17 November refusing European application No. 99919728.8 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. S. Clelland
Members: A. J. Madenach
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division to refuse the application on the ground that the subject-matter of claim 1 did not involve an inventive step (Article 56 EPC) having regard to the disclosure of the following document:

D1: US 5260823 A

II. In the notice of appeal of 17 January 2005, the appellant requested that the examining division's decision be set aside. A statement setting out the grounds of appeal was submitted by letter of 21 March 2005.

III. In a communication of 1 August 2006 the board summoned the appellant to oral proceedings and gave its preliminary opinion on the case under appeal.

The following further documents were considered to be relevant for this decision:

D2: US 5115338 A
D3: US 5696615 A
D4: "Theoretical Study of the Gain Equalization of a Stabilized Gain EDFA for WDM Applications", Ronan Lebref et al., Journal of Lightwave Technology, Vol. 15, no. 5, May 1997, pages 766-770

IV. In a letter of 17 January 2007 the appellant filed amended claims 1 to 7 and announced that it would not take part in the scheduled oral proceedings. No explicit request was made.

V. Oral proceedings took place in the absence of the appellant on 25 January 2007.

After deliberation the chairman announced the board's decision.

VI. The sole independent claim 1 as submitted with letter of 17 January 2007 reads as follows:

"An optical fiber amplifier for amplifying light signals having wavelengths within a wavelength band, the optical fiber amplifier comprising
- an active optical fiber (1) having an input end adapted to receive light signals to be amplified and an output end adapted to forward amplified light signals,
- a first pump source (9) connected to inject pumping light of a first pump wavelength into the active optical fiber,
- a gain flattening filter (39) connected between two lengths of the active optical fiber, between a first length (21, 23) at the input end of the active optical fiber and a second length (41) [sic] at the output end of the active optical fiber,
- wherein a noise filter (37) is connected in the first length, between two portions (21; 23) of the first length, the noise filter being is [sic] a notch filter adapted to substantially block, with substantially 15 - 20 dB, light waves having wavelengths at a gain peak of the pumped active optical fiber (1) existing when there are no filters in the optical fiber amplifier, and
- the gain flattening filter (39) has a much lower attenuation than the noise filter for the wavelengths within the wavelength band."

This claim corresponds to claim 1 on which the examining division's decision was based with the feature of the then claim 3 added.

Reasons for the Decision

1. *Procedural questions*

1.1 The appellant announced that it would not take part in the scheduled oral proceedings. According to Article 116(1) EPC, oral proceedings shall take place either at the instance of the European Patent Office if it considers this to be expedient or at the request of any party to the proceedings. Oral proceedings are an effective way to discuss cases mature for decision, since the appellant is given the opportunity to present its concluding comments on the outstanding issues (Article 113(1) EPC), and a decision can be made at the end of the oral proceedings on the basis of the current requests (Rule 68(1) EPC).

The board considers that, despite the appellant's announced intention not to attend, the twin requirements of fairness and procedural economy were still best served by holding the oral proceedings as scheduled.

1.2 In the board's communication of 1 August 2006 it was observed that apart from requesting that the decision be set aside the appellant had not specified the documents forming the request. The appellant has still not made a clear request, but given the filing of new

claims the board assumes that the appellant's request is for grant of a patent based on the set of claims filed with letter of 17 January 2007.

1.3 The set of claims filed with letter of 17 January 2007 and received on the same day were received after expiry of the four week time limit set by the board for amendments and new evidence to be filed prior to the oral proceedings of 25 January 2007. However, given that the main amendment to claim 1 was to incorporate the subject-matter of claim 3 as filed and that this claim was discussed by the board in its communication of 1 August 2006 the amended claims are admitted into the procedure.

2. *Original disclosure and interpretation*

2.1 The board is satisfied that the additional matter in present claim 1 as compared with the original claim 1 was disclosed in the application as filed at page 6, lines 27 and 28, page 8, lines 7 and 8, and original claim 3. It thus satisfies the requirements of Article 123(2) EPC.

2.2 The term "having a much lower attenuation" is, in the absence of a precise definition in the description, understood as merely meaning "having a lower attenuation".

2.3 Similarly, the term "substantially 15 - 20 dB" is interpreted as "15 - 20 dB"

3. *Inventive step (Article 56 EPC):*

3.1 The present invention relates to an optical amplifier of the kind used for amplifying optical signals transmitted over a long distance in optical fiber transmission. Optical amplifiers typically consist of an erbium doped section within the optical fiber. The erbium ions are pumped into higher energy states by an optical pump light source and release the acquired energy into the optical signals, resulting in their amplification. This kind of amplification does however give rise to problems which the present invention aims to solve, namely that the amplification gain differs for the various signal wavelengths and that noise in the form of spontaneous emission resulting form the interaction of the pump light with the erbium ions is generated and also amplified.

The problems as such are well known in the technical field.

3.2.1 The board concurs with the examining division in that D1, which discusses both of these problems, can be considered to represent the closest prior art.

3.2.2 The subject-matter of claim 1 differs from the disclosure of D1 firstly in that of the two filters the filter closer to the output end has a lower attenuation than the filter closer to the input end. In D1, no distinction is made as to the attenuation of the band-rejection filters within the at least two sections of optical fibre (column 3, lines 59-64).

Regarding the relative attenuation of the second filter with respect to that of the first filter the skilled person could arguably be expected to determine the appropriate attenuation through routine testing among the three possibilities: higher, lower or same attenuation as the first filter. Therefore, this difference cannot, considered on its own, justify an inventive step.

3.2.3 A second difference with respect to the disclosure of D1 is that the claim specifies the attenuation of the noise filter, which is the filter closer to the input end, as being "adapted to substantially block, with substantially 15 - 20 dB, light waves having wavelengths at a gain peak of the pumped active optical fiber existing when there are no filters in the optical fiber amplifier". The filters in D1 are described as "band-rejection filters" (col. 3, line 62). The attenuation of the filters (in the preferred embodiment) is chosen so "that it exactly cancels the larger gain at the peak wavelength ... This does not necessarily mean that the attenuation of the filter should be equal to the difference in the spectral gain of the fibre amplifier between the peak and plateau wavelengths" (col. 4, lines 1-8; see also Figure 2), which difference is about 8dB (col. 2, lines 38-47). The further reference at column 5, lines 3-16 relates, according to the board's understanding, to a filter placed at the output of an optical fiber amplifier and is not a part of the invention disclosed in D1. It thus has no bearing on the attenuation characteristic of the filter within the optical amplifier.

Thus, the only statement regarding the attenuation of the relevant filter in D1 is that it is a band rejection filter which serves to cancel the larger gain at the peak wavelength. This rather vague statement does not imply the claimed attenuation of 15 - 20 dB.

The board notes that the band rejection filter in D1 leads to a reduction in the spectral gain of 8 dB at its peak(see Figure 2 and column 2, lines 38-47). This is not to say that D1 implies the use of a filter having the same attenuation since the effect of a filter might be modified by its interaction with the optical amplifier as a whole, as is pointed out in D1 (column 4, lines 1-8). However, the board considers an attenuation of about 8 dB as an obvious starting point for the skilled person faced with the problem of optimising the spectral response of an optical amplifier.

The further prior art document D4 discloses a detailed numerical study of an optical amplifier based on a specific set of parameters. The optical amplifier of D4 (see Figure 2) comprises, similar to D1, a filter within the optical amplifier (Filter 1) together with a second filter (Filter 2). The position of the second filter is left open ("the second rejection filter ... **can** be located at the amplifier output", page 768, left column, last 4 lines, emphasis by the board), i.e. it can be placed outside of the doped fibres and, thus, outside the optical amplifier. For the specific set of parameters forming the basis of the study of D4 an optimum attenuation for Filter 1, which corresponds to the claimed noise filter, of 5.2 dB is obtained (Page 768, right column, first paragraph).

Since the optimum attenuation obtained for Filter 1 in D4 is based on a study with a specific set of device parameters it is only of limited value for general considerations concerning the optimal attenuation of such filters. However, with an attenuation of about 8 dB as a reasonable starting point as derived from D1, it leads the skilled person away from the claimed attenuation range.

3.2.4 Furthermore, the solution contemplated by the present invention involves the **simultaneous** adaptation of two parameters, i.e. the gain of the noise filter and the relative gain of the gain flattening filter. However, the optical fiber amplifier to which these parameters apply is a non-linear device. This means that varying two parameters does not result in the outputted signal corresponding to a linear superposition of the signals obtained with the first parameter fixed and the second varied or with the first parameter varied and the second fixed.

This fact together with the finding that the teaching of D1 and D4 rather leads away form the claimed attenuation range, leads the board to conclude that in the light of the cited prior the skilled person would have had no reason to investigate attenuation values of the noise filter much higher than 8 dB.

Therefore, the subject-matter of claim 1 fulfils the requirements of Article 56 EPC.

3.3 For completeness, it is noted that the physical arrangement shown in D2 (see Figure 1) is similar to

that of D1. D2 is, however, silent as to the attenuation of the filter element 16.

Likewise, the generally similar arrangement of D3 (see Figure 4) is silent as to the attenuation of the passive optical component 59, which can optionally be an optical filter (see abstract).

4. The board notes that the description and the claims contain a variety of inconsistencies and clerical errors.

Without being exhaustive, the following points have been noted. It appears that the reference numeral 41 at line 9 of claim 1 is incorrect. It also appears that the quotation of D1 at page 2, lines 19 to 20 of the present application is based on an incorrect interpretation of D1 (see point 3.2.3 above). It furthermore appears that the captions for the solid and dashed lines in Figure 3 are incorrect.

It is also noted that clarification is necessary as regards the meaning of expressions such as "substantially 15-20 dB" in claim 1, "about -15 to -20 dB" at page 8, lines 5 and 6, and "much lower attenuation" in claim 1 (cf. Guidelines for Examination in the European Patent Office CIII, 4.5a).

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

D. Magliano A. S. Clelland