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**Datasheet for the decision  
of 25 July 2011**

**Case Number:** T 2232/10 - 3.4.02

**Application Number:** 05250276.2

**Publication Number:** 1560047

**IPC:** G02B6/16

**Language of the proceedings:** EN

**Title of invention:**

Monolithically integrated polarization splitter

**Applicant:**

LUCENT TECHNOLOGIES INC.

**Headword:**

**Relevant legal provisions:**

EPC Art. 123(2)

**Keyword:**

Added Subject matter-claim 1 (no)

**Decisions cited:**

**Catchword:**



Case Number: T2232/10 - 3.4.02

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.02**  
**of 25 July 2011**

**Appellant:** LUCENT TECHNOLOGIES INC.  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted 07 July 2010  
refusing European application No. 05250276.2  
pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman:** A. Klein  
**Members:** M. Rayner  
L. Bühler

## Summary of Facts and Submissions

I. The applicant has appealed against the decision of the examining division refusing European patent application number 05 250 276.2 concerning an integrated polarisation splitter. In the examination and/or appeal proceedings, reference has been made to, amongst others, the following documents:

- D1** EP-A-1 139 126
- D2** EP-A-1 191 364.

II. In a telephone conversation of 07 November 2008, the division informed the applicant that it was of the opinion that claim 1 then before it was not allowable due to added subject matter. In the application active and passive portions are on the same waveguide, whereas the claim active and passive portions can be placed anywhere in the polarisation splitter.

III. Reasons given for the decision under appeal can be summarised as follows.

An amendment made to claim 1 caused its subject matter to extend beyond the content of the application as filed, contrary to Article 123(2) EPC. The amendment concerned is the following: "at least one of said plurality of waveguides of unequal length includes both active and passive portions"

Page 5, lines 10 to 32 of the description give examples of integration techniques using passive/active integration. Nothing in this passage refers to one of the plurality of waveguides of unequal length which would include both active and passive portion. No other passage of the description could be found which refers

to waveguides including both active and passive portions. The division observed that the applicant had cited this passage and page 6, lines 12 to 14, dealing with the number waveguides of the polarization splitter yet completely silent about passive/active integration.

IV. The examination procedure in advance of the decision had also included other significant points, which can be summarised as follows.

(i) In its communication dated 18 May 2005 (see point 2.7), the examining division expressed the view that the following subject matter (i.e. that of claim 8 as then before it) did not involve an inventive step because of being one of a number of standard fabrication methods:

"said polarization splitter is fabricated from optical waveguides, each of said optical waveguides comprising: a shallow etched burned rib structure passive layer; and a thin layer of multi-quantum-wells (MQW) on top of the buried rib structure functioning as an active layer."

(ii) However, in a later communication of 11 July 2008 (see point 3), the division expressed the view that the prior art documents polarization control was realised by having different dimensions in waveguides, whereas according to the application either a thin layer of multiquantum wells or tilted valence band quantum well semiconductor double heterostructure is placed on the waveguide material. Such structures enable polarization dependent gain control and make polarization control easier. These features seemed to be essential to define the invention.

(iii) In the latter communication (see point 1), the examining division had also considered that document D1 disclosed an integrated polarization splitter comprising a number of features including being integrated using active/passive monolithic integration techniques such that the polarization splitter is adapted for being integrated with active devices as well as passive devices (q.v. column 6, lines 30-58 of document D1 disclosing integration techniques using InP and Figure 7a, 7b). The division thus reached the view that since document D1 disclosed all the technical features of claim 1 as then before it, the subject-matter of that claim was not new. A corresponding objection arose against the subject matter of claim 1 in view of document D2 (q.v. the Abstract and Figures 1 and 4 of document D2). Moreover, since the device itself was not novel, a corresponding objection arose against the subject matter of a corresponding claim to fabrication of the device, i.e. claim 10.

(iv) In a summons to oral proceedings, the division had remarked that although no opinion could be given concerning Article 54 and 56 EPC, as already explained in communications, document D1 discloses a polarization splitter based on an AWG which is clearly adapted for active/passive integration. Indeed the waveguides are made of InP which is clearly a material adapted for active/passive integration.

V. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of documents according to the documents already on file, i.e. the documents before the examining division.

VI. In support of its request, the appellant advanced arguments including the following.

Article 123 (2) EPC is not offended against as alleged, because the amendment is explicitly or implicitly disclosed in the original specification, which is replete with passages that refer explicitly or implicitly to the amendment objected to.

Passages cited by the appellant included the following.

A. "Waveguides Including Both Active and Passive Portions."

On page 5, lines 10 to 19, the specification discloses:

"The polarization splitter of the present invention, such as the polarization splitter 100 of FIG. 1, is integrated using active-passive monolithic integration (APMI) techniques. For example, according to one fabrication technique, a shallow etched buried rib structure is used for forming the passive waveguides of the polarization splitter of the present invention. Such a technique provides record low propagation loss in InP material systems. An active section is then formed by another thin layer of multi-quantum-wells (MQW) directly on top of the rib which is buried by the same re-growth that forms passive waveguides. As such, the polarization splitter of the present invention may be used as an active device and a passive device."

B. "Plurality of Waveguides of Unequal Length."

On page 4, lines 21-30, the specification discloses:

"FIG. 1 depicts a high level block diagram of an embodiment of an integrated channel-filtering polarization splitter of the present invention. The polarization splitter 100 of FIG. 1 comprises an AWG comprising an input waveguide 110, an input coupler (illustratively a star coupler) 120, an output coupler (illustratively a star coupler) 130, a plurality of waveguides of unequal lengths (waveguide array) 140 connecting the input coupler 120 and the output coupler 130, and a plurality of output waveguides 150. The AWG design of the polarization splitter 100 of FIG. 1 is a wavelength wrapping AWG design that has a FSR of 700 GHz and seven outputs separated by one channel spacing."

VII. During the examination procedure, the applicant had also addressed the questions of admissibility following the objection made by the division in the telephone conversation of 07 November 2008 and of patentability of the subject matter claimed (for example in the letter of 30 October 2008) and the arguments concerned can be summarised as follows.

#### Admissibility

Claim 1 was clarified to use the wording "... to provide thereby an integrated polarization splitter wherein at least one of said plurality of waveguides of unequal length includes...". The active and passive portions are on the same waveguide and the objection met.

#### Patentability

Documents D1 and D2 disclose devices falling into the group of integrated on chip devices but do not teach

all the features of claim 1 because they fail to disclose that the polarization splitter is integrated using active/passive monolithic integration techniques and has both active and passive portions. Figures 7a and 7b and the corresponding portion of the description of document D1 specification describe an integration technique and teach that the core material may be Indium Phosphate (InP). Document D1 discloses no active portion whatsoever. The figures and specification do not describe specifically active/passive monolithic integration at all but teach, more generally, a polarization splitter incorporating an AWG. Figure 4 of document D2 shows an integration technique, but not active/passive monolithic integration. While a chip in the latter group may always belong to the former group, the converse is not necessarily true. As with document D1, document D2 teaches no active components and is devoid of any teaching with regard to active/passive monolithic integration. Therefore, document D2 also fails to teach all technical features of claim 1. The subject matter of claim 1 as presented is new and allowable. Independent claim 10 is pending in the application and recites similar relevant features as found in claim 1. For at least the same reasons as stated above with respect to claim 1, claim 10 is likewise new and allowable.

Incorporation of the technical features of a thin layer of multiquantum wells or tilted valence band quantum well semiconductor double heterostructure into the independent claims would lead to narrower claims than necessary. Furthermore, forming a multi-quantum well on top of a buried rib structure is just one active-passive monolithic integration technique.



VIII. Independent claims 1 and 10 submitted by the appellant are worded as follows.

"1. An integrated polarization splitter, comprising:  
an arrayed waveguide grating, AWG, (100) including:  
an input coupler(120);  
an output coupler(130); and  
a plurality of waveguides of unequal length(140)  
connecting said input and output couplers characterized  
in that:

at least two output ports of said AWG are positioned  
relative to an input port such that a first  
polarization component and a second polarization  
component of a single channel input signal arriving at  
different phase fronts of a free space region at an  
output side of said AWG are respectively received by  
separate ones of said output ports such that said first  
polarization component and said second polarization  
component are split by said AWG; and  
said polarization splitter is integrated using active/  
passive monolithic integration techniques to provide  
thereby an integrated polarization splitter wherein at  
least one of said plurality of waveguides of unequal  
length includes both active and passive portions.

10. A method of fabricating a polarization splitter,  
characterized by:  
integrating an arrayed waveguide grating(140) using an  
active/passive monolithic integration technique to  
provide thereby an integrated polarization splitter  
wherein at least one of a plurality of waveguides of  
said arrayed waveguide grating includes both active and  
passive portions, wherein at least two output ports of  
said AWG are positioned relative to an input port such  
that a first polarization component and a second  
polarization component of a single channel input signal

arriving at different phase fronts of a free space region at an output side of said AWG are respectively received by separate ones of said output ports such that said first polarization component and said second polarization component are split by said AWG."

### **Reasons for the Decision**

1. The appeal is admissible.
2. Added subject matter
  - 2.1 The decision of the examining division was based on the following feature being considered added subject matter.

"at least one of said plurality of waveguides of unequal length includes both active and passive portions"

- 2.2 The appellant argued that waveguides including active and passive portions are clearly and unambiguously disclosed in the passage quoted in Section VI.A of the Facts and Submissions above from the application. This also tallies with the position of the examining division because even though the division was not very precise about exactly what technically relevant information which was not contained in the original application documents was provided by the amendment it considered inadmissible, it cannot have been active and passive portions are on the same waveguide because this is what the division itself said was disclosed during the telephone conversation of 07 November 2008.
- 2.3 Therefore, the division's problem must have resided in the recitation of "at least one of said plurality of

waveguides of unequal length". So far as "at least one" is concerned, the skilled person understands that this is the nub of the invention, a purely semantic analysis of the example given in the disclosure mentioned in Section VI.A of the Facts and Submissions above relating to an example of active passive monolithic integration does not lead the skilled person to consider that the invention requires anything other than at least one waveguide as claimed. It therefore seems the concern of the division was with the reference to unequal length, yet this feature was, as such, present ab initio in claim 1 as filed. Combining the unequal length concept with that of waveguides including active and passive portions also does not add any technical teaching because the skilled person directly and unambiguously derives from the passage quoted in Section VI.B of the Facts and Submissions above from the application that the waveguides are of unequal length.

2.4 The board therefore reached the view that the passages of the application show that the disclosure of the feature contested by the examining division was present in the documents as filed. The board is accordingly satisfied as to admissibility of the amendment.

### 3. Procedure

3.1 In assessing whether it is more appropriate to remit the case back to the first instance for further consideration or, itself, to exercise powers within the competence of the first instance, the board is mindful of the fact that the present case has a date of filing over six years before the present decision. Moreover, the positions of the first instance and the appellant

in relation to clarity and substantive patentability, are deducible from the file as can be seen in sections III and VI of the Facts and Submissions above. In this situation and as, as will become apparent subsequently, there is no loss of instance detrimental to the appellant, the board considered it appropriate to deal with the case without remittal.

#### 4. Clarity

4.1 The examining division considered that a feature concerning placing a thin layer of multiquantum wells or tilted valence band quantum well semiconductor double heterostructure on the waveguide material to be essential to the invention, which the board understands to mean it considered a claim lacking this feature as either not clear or possibly not supported by the description. However, the appellant pointed out that page 5, lines 31 to 33 of the description recite that the invention is capable of active passive monolithic integration (APMI) using other techniques known in the art. The examination division did not cast any doubt on this recitation. Since, therefore, the board has no reason to rule out such other techniques, it does not consider the subject matter identified by the examining division as essential and is thus satisfied both that the claim is clear and is supported by the description.

#### 5. Patentability

5.1 The examination division gave no opinion about patentability in its decision, yet referred to objections in relation to document D1 in its summons to oral proceedings, in particular that there the waveguides are made of InP which is clearly a material adapted for active/passive integration.

- 5.2 Since neither document D1 nor document D2 disclose active/passive monolithic integration, in other words, the last feature of claim 1 (said polarization splitter is integrated...), the board considers that this subject matter is novel. The remark of the examining division can therefore be understood to be a challenge to inventive step. This chimes with its view about claim 8 before it on the occasion of its communication of 18 May 2006 (see point 2.7) as referred to in section III of the Facts and Submissions above. That an inventive step objection is concerned can also be deduced from the fact that the examining division admitted novelty at least of quantum wells when it expressed the view that the prior art documents polarization control was realised by having different dimensions in waveguides, whereas according to the application either a thin layer of multiquantum wells or tilted valence band quantum well semiconductor double heterostructure is placed on the waveguide material.
- 5.3 The problem solved by the novel subject matter identified in point 5.1 above is to improve the polarisation splitter, especially as the examining division said to enable polarization dependent gain control and make polarization control easier.
- 5.4 Once the novel subject matter of the claim is on the table, it seems both the appellant and the examining division consider the skilled person can effect active/passive integration using known methods. However, the board has seen nothing in the arguments of the examining division which indicate why it was obvious to the skilled person to put it on the table, especially as the prior art, consistent with the approach of the

appellant disclose devices falling into the group of integrated on chip devices but do not teach that the polarization splitter is integrated using active/passive monolithic integration techniques and has both active and passive portions. In the absence of any disclosure or argument that active/passive monolithic integration would have been considered by the skilled person for polarisation splitters, the board is left in the position of having to conclude that only hindsight permitted the examining division to reach its view as to lack of inventive step during the examination procedure (e.g. as set out in Section III(i) of the Facts and Submissions above). Accordingly, the board was not convinced as to lack of patentability.

5.5 Method claim 10 was not mentioned in the decision under appeal. Nevertheless, the board observes that it corresponds generally to claim 1, a specific difference being that the "unequal length" feature is not mentioned. The claim does, however, recite that "...at least one of a plurality of waveguides...includes both active and passive portions". Accordingly, claim 10, for reasons corresponding to those give for claim 1, does not give rise to objection against substantive patentability of its subject matter based on the prior art on file.

6. The board is not aware of any other reason preventing the application from proceeding to grant.

## **Order**

### **For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent based on the following documents:

Description

Pages 1-9 as originally filed

Pages 2A, 2B filed with the letter dated 13  
September 2005

Claims

No. 1-10 filed with the letter dated 18  
March 2009

Drawings

Sheets 1/3-3/3 as originally filed.

The Registrar:

The Chairman:

M. Kiehl

A. Klein