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**Datasheet for the decision
of 12 May 2009**

Case Number: T 0891/05 - 3.5.04

Application Number: 97952447.7

Publication Number: 0946943

IPC: G11C 8/00

Language of the proceedings: EN

Title of invention:

Memory and method for sensing sub-groups of memory elements

Patentee:

RAMBUS INC.

Opponent:

MICRON EUROPE Ltd
MICRON Semiconductor Deutschland GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 123(3)
RPBA Art. 13(1)

Keyword:

"Main request admitted to proceedings (no)"
"Auxiliary request 1 admitted to proceedings (yes)"
"Amendments - added subject-matter (yes)"
"Amendments - extension of protection conferred (yes)"

Decisions cited:

G 0002/98

Catchword:

See points 2.6 and 10



Case Number: T 0891/05 - 3.5.04

D E C I S I O N
of the Technical Board of Appeal 3.5.04
of 12 May 2009

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
17 May 2005 concerning maintenance of European
patent No. 0946943 in amended form.

Composition of the Board:

Chairman: F. Edlinger
Members: A. Teale
T. Karamanli

Summary of Facts and Submissions

I. Two oppositions were filed against European patent 0 946 943, which derives from an international patent application published as WO 98 28747 A1. Both opponents relied on the grounds of opposition under Article 100(a) EPC 1973 (novelty and inventive step) as well as 100(b) and (c) EPC 1973. In its interlocutory decision the opposition division found that the subject-matter of the independent claims of the patentee's then main request extended beyond the content of the application as filed, and that the patent as amended during the oral proceedings before the opposition division according to the then auxiliary request I and the invention to which it related met the requirements of the EPC. All three parties filed notices of appeal against this decision.

II. The claims as originally filed comprised four independent claims which read as follows.

"1. A memory comprising: a memory array of storage locations; a plurality of word lines for selecting rows of the memory array, each word line comprising a plurality of segments, each segment spanning a portion of the distance of the word line; a plurality of sets of sense amplifiers, each sense amplifier of the sets of sense amplifiers selectively coupled to one storage location associated with the word line, each set of sense amplifiers corresponding to a segment; a first select logic for selecting at least one segment of a word line during a sense operation; and a second select logic for selecting at least one corresponding set of sense amplifiers."

"8. A method for accessing a memory comprising a plurality of storage locations, said method comprising the steps of: providing a plurality of word lines for selecting rows of a memory array, each word line comprising a plurality of segments, each segment spanning a portion of the distance of the word line; identifying sets of sense amplifiers, each sense amplifier of the sets of sense amplifiers coupled to one storage location associated with a word line, each set of sense amplifiers corresponding to a segment; selecting at least one segment of a word line that is to be activated during a sense operation; and selecting at least one corresponding set of sense amplifiers."

"15. A memory comprising: a plurality of word lines for selecting a row of a memory array, each word line comprising a plurality of segments, each segment spanning a portion of the distance of the word line; a plurality of sets of sense amplifiers, each sense amplifier of the sets of sense amplifiers selectively coupled to one storage location associated with a word line, each set of sense amplifiers corresponding to a segment; a first select logic for selecting during a sense operation at least one segment from a first word line and at least one segment from a second word line; and a second select logic for selecting corresponding sets of sense amplifiers to access storage locations along the first segment and the second segment."

"22. A method for accessing a memory comprising a plurality of storage locations, said method comprising the steps of: providing a plurality of word lines for selecting rows of a memory array, each word line

comprising a plurality of segments, each segment spanning a portion of the distance of the word line; identifying sets of sense amplifiers, each sense amplifier of the sets of sense amplifiers coupled to one storage location associated with a word line, each set of sense amplifiers corresponding to a segment; selecting at least one segment of a first word line to activate during a sense operation; selecting at least one segment of a second word line that is to be activated during a sense operation; and selecting sets of sense amplifiers corresponding to the at least one segment of the first word line and at least one segment of the second word line to access storage locations along the first segment and the second segment."

III. The claims of the patent as granted comprised three independent claims which read as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a first word line (100, 200, 300, ...) to select a first row of the storage locations (401, 402, 403, ...), the first word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row; characterized by a first selection circuit to selectively activate a variable number of the word line segments (365, 366, ...) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated."

"12. A memory comprising: a memory array of storage locations (401, 402, 403, ...); sense amplifier

circuitry, including a plurality of sets of sense amplifiers (260; 361, 362, ...) coupled to respective sub-groups of the storage locations (401, 402, 403, ...), characterized by first selection circuitry to selectively activate a variable number of the sets of sense amplifiers (260; 361, 362, ...) in accordance with a control value that indicates a pattern of the sets of sense amplifiers (260; 361, 362, ...) to be activated."

"19. A method of operation in a memory, the method being characterized by receiving a control value that indicates sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and activating more than one and fewer than all of a plurality of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row."

IV. In the oral proceedings before the opposition division the patentee filed an amended text for claim 19 according to the then main request which reads as follows (see point 3 of the minutes).

"A method of operation in a memory, the method being characterized by receiving a control value that indicates a number of sub-groups of a row of a [sic] storage locations (401, 402, 403, ...) within a first row of the memory, and selectively activating more than one and fewer than all of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding

sub-groups of the storage locations (401, 402, 403, ...) in the first row."

- V. In the oral proceedings before the opposition division the patentee also filed amended claims 1 to 18 according to the then auxiliary request I and further sets of claims according to the then auxiliary requests II and III. The claims of auxiliary request I comprise two independent claims which read as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a first word line (100, 200, 300, ...) to select a first row of the storage locations (401, 402, 403, ...), the first word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row; said memory further comprising a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); and a first selection circuit to selectively activate a variable number of the word line segments (365, 366, ...) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated; wherein the plurality of sets of sense amplifiers (260; 361, 362, ...) are coupled to the first selection circuit and a variable number of corresponding sets of sense amplifiers (260; 361, 362, ...) are activated in accordance with the control value."

"10. A method of operation in a memory, the method including receiving a control value that indicates a number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating more than one and fewer than all of a plurality of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row; wherein the memory further includes a plurality of sets of sense amplifiers (260; 361, 362, ...) each coupled to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row, the method further including transferring data from storage locations (401, 402, 403) corresponding to the selectively activated variable number of word line segments (365, 366, ...) in the first row to the corresponding variable number of sets of sense amplifiers (260; 361, 362, ...)."

VI. According to the reasons for the decision, the patentee's main request was not allowable essentially because, while the application as originally filed, in particular each of the independent claims, consistently presented the activation of a segment of a word line and of a corresponding set of sense amplifiers in combination, such a combination had been dissected in the independent claims of the main request; claims 1 and 19 did not contain activation of a set of sense amplifiers, and claim 12 was not limited to word line segment activation. In the application as originally filed activation of a segment of a word line and of a corresponding set of sense amplifiers was consistently presented in combination and achieved each of the three objects stated at the bottom of page 2 of the

description. The application as originally filed contained no express or implied disclosure that one of the elements of that combination could be omitted. Thus the invention contemplated in the application as originally filed was intended to achieve all of the stated objects of the invention and was directed to a combination of activation of word line segments and corresponding sets of sense amplifiers. Hence the subject-matter of the independent claims extended beyond the content of the application as originally filed.

VII. According to the reasons for the appealed decision, the patent amended according to auxiliary request I complied with the EPC. Regarding the requirements of Article 100(c) EPC 1973, each of independent claims 1 and 10 was limited to activation of word line segments and corresponding sets of sense amplifiers. Hence, compared with the claims as originally filed, essential integers had not been omitted from the independent claims.

VIII. The appellant patentee filed a notice of appeal and requested that the decision be set aside and the patent be maintained as granted. In a subsequently filed statement of grounds of appeal and in a further submission dated 28 February 2006 the appellant patentee argued *inter alia* that the terms in the patent "selectively" and "variable number" meant that controller 118 could independently turn on different numbers of word line segments and sets of sense amplifiers. As to the ground for opposition under Article 100(c) EPC 1973, the disclosure of the patent application was not bound by the preferred embodiments.

Instead the invention was to be acknowledged in the light of the objective problem and the given solution in view of the whole application as originally filed. The technical teaching given therein was the selective activation of a varying or arbitrary number of either word line segments or sets of sense amplifiers in order to save power. The appellant patentee also submitted arguments concerning the grounds for opposition under Article 100(a) and (b) EPC 1973.

- IX. Appellant opponent 1 filed a notice of appeal against the entire decision, requesting that the patent be revoked. In a subsequently filed statement of grounds of appeal and in a further submission dated 28 February 2006 appellant opponent 1 argued essentially, regarding the ground of opposition under Article 100(c) EPC 1973, that the patentee bore the burden of proof to show "beyond reasonable doubt" that an amendment was allowable and that the appealed decision had been wrong in finding that the amendments to the claims satisfied Article 100(c) EPC 1973 or Article 123(2) EPC. Claims 1 and 10 as maintained by the appealed decision did not read onto the original disclosure, since the application as originally filed did not contain the slightest suggestion of a modifiable control value being used to select different integer numbers of word line segments in different patterns in the single row embodiment. Neither did the original application suggest, in the single row or multiple row embodiments, that different integer numbers of sub-groups of sense amplifiers could be selected at different times. Since the amended claims clearly required that functionality, the amended claims contained added subject-matter.

X. Appellant opponent 2 also filed a notice of appeal and requested that the decision be reversed. In a subsequently filed statement of grounds of appeal and in a further submission dated 28 February 2006 appellant opponent 2 argued essentially, regarding the ground of opposition under Article 100(c) EPC 1973, that neither the single word line or multiple word line embodiments in the application as originally filed disclosed the activation of a variable number of word line segments and sets of sense amplifiers. The subject-matter of granted claims 1 and 10 was an unallowable intermediate generalisation, since multiple sub-word line and multiple sub-sensing circuitry were required, the claims not being limited to the multiple row embodiment. Moreover none of the embodiments of the application as originally filed mentioned having a "variable number" of selectable word line segments. Instead several embodiments were disclosed, each using a fixed number. Appellant opponent 2 also submitted arguments concerning the grounds for opposition under Article 100(a) and (b) EPC 1973.

XI. In an annex to a summons to oral proceedings the board set out its preliminary opinion on the case, namely that it had doubts concerning the grounds of opposition under Article 100(a) (novelty and inventive step), (b) and (c) EPC 1973. Relating to Article 100(c) EPC 1973, the board stated that a key question would be whether the European patent application (or the amended European patent) had been amended in such a way that it contained subject-matter which extended beyond the content of the application as filed, interpreted as the whole technical content. The board had doubts as to whether the possibility that the segments or the sense

amplifiers could be deleted, resulting in there no longer being a correspondence, was directly and unambiguously derivable from the application as originally filed. The board also had doubts whether the application as originally filed provided a basis (see granted claim 1) for the selective activation of a variable number of the word line segments in accordance with a control value that indicates a pattern of the word line segments to be activated (emphasis added by the board). The board also had doubts concerning the basis (see granted claim 12) for the selective activation of a variable number of the sets of sense amplifiers in accordance with a control value that indicates a pattern of the sets of sense amplifiers to be activated. Similarly the board had doubts about the basis (see granted claim 19) for activating more than one and fewer than all of a plurality of word line segments in accordance with the control value to enable access to the corresponding sub-groups of the storage locations in the first row. It seemed that the terms "variable", "control value", "pattern" and "fewer than all" were not used in the application as originally filed.

XII. In a letter dated 22 January 2009 appellant opponent 2 stated that it would not attend the oral proceedings, but made no further comments as to the substance of the case.

With a letter dated 7 April 2009 the appellant patentee filed sets of amended claims according to a main request and auxiliary requests I, II, III and IV. In the letter the appellant patentee argued, regarding the ground of opposition under Article 100(c) EPC 1973,

essentially that the terms "variable", "control value", "pattern" and "fewer than all" all had a basis in the application as originally filed. They derived from the disclosed signal lines and expandable (multiple bit) control signals which served to selectively and independently activate word line segments and sets of sense amplifiers. The expression "fewer than all" (of a variable number of word line segments) merely excluded the prior art case of all word line segments being activated. The appellant patentee also submitted arguments concerning the grounds for opposition under Article 100(a) and (b) EPC 1973. The claims according to the main request and auxiliary requests I, II, III and IV subsequently became those of the patentee's final auxiliary requests 2, 3, 4, 5 and 6, respectively (see points XVII to XXI below).

- XIII. In a letter received by fax on 6 May 2009 appellant opponent 1 stated that it would not be represented at the oral proceedings, but made no further comments as to the substance of the case.
- XIV. Oral proceedings were held on 12 May 2009 in the absence of both opponent appellants, as both had announced in advance.

The appellant patentee argued, regarding the ground of opposition under Article 100(c) EPC 1973 and the requirements of Article 123(2) EPC, essentially that the control values set out in the claims were supported by the "SADR[3:0]" value in the case of word line segments (see page 6, lines 11 to 24, of the published application) and the "SUBSAP[3:0]" and (inverted) "SUBSAN[3:0]" values in the case of the sets of sense

amplifiers; see page 7, lines 3 to 16, of the published application. References in the claims to selectively activating fewer than all of a variable number of word line segments disclaimed the prior art situation where a whole word line was activated.

The board raised the following objections under Article 123(2) EPC regarding the claims according to the main and auxiliary requests I to IV filed with the letter dated 7 April 2009. The independent claims of all five requests used the expressions "variable", "control value", "pattern" and "more than one and fewer than all", which had not been used in the application as originally filed. The independent claims of the main request separated the approaches of selective activation of word line segments and selective activation of sets of sense amplifiers. The memory address tag set out in the independent claims according to auxiliary requests II and III had a different function to that disclosed on page 12, last paragraph, of the description as originally filed. In claim 1 according to auxiliary requests III and IV the same control value indicated both a pattern of word line segments and sets of sense amplifiers, which was not disclosed in the application as originally filed. Claim 1 according to all five requests separated the first and second selection circuits, which had consistently been presented together in the independent apparatus claims as originally filed. Moreover, whilst the application as originally filed consistently set out a plurality of word lines, each word line comprising a plurality of segments, claim 1 of all five requests merely set out a first word line including a plurality of word line segments, thus adding the

concept that the word lines other than the first one need not comprise word line segments.

After two breaks the appellant patentee submitted claims 1 to 14 of a new request, which ultimately became the appellant patentee's auxiliary request 1. The board raised the following objections against the claims of this request. The independent claims used the expressions "variable", "control value" and "pattern", which had not been used in the application as originally filed, Article 123(2) EPC. Claim 1 set out a first selection circuit and a second selection circuit both activating sense amplifiers, which was not disclosed in the application as originally filed and was also unclear, Articles 123(2) EPC and 84 EPC 1973. Moreover, whilst granted independent method claim 19 had referred to "activating more than one and fewer than all of a plurality of word line segments", independent method claim 6 of the new request set out "selectively activating at least one of a variable number of word line segments", thus extending the protection conferred by the patent, Article 123(3) EPC, in also covering the case of all the word line segments being activated. Claim 6 also did not set out a plurality of word lines, each comprising a plurality of segments, thus adding subject-matter, Article 123(2) EPC.

After a third break the appellant patentee submitted claim 1 of a new request, which ultimately became his main request. In contrast to what ultimately became auxiliary requests 1 to 6, the new request consisted of a single apparatus claim and lacked an independent method claim. The board raised the following objections

against the admissibility of this request. The new request could have been filed earlier in the proceedings, for instance before the first break in the oral proceedings once the objection under Article 123(2) EPC had been raised against the expression in the independent method claims according to the requests filed with the letter dated 7 April 2009 "more than one and fewer than all" or after the second break when the objection under Article 123(3) EPC was raised against what ultimately became auxiliary request 1, rather than waiting until after the third break. The appellant patentee had also not provided any explanations as to why the new request overcame the objections already raised against the lower ranking requests.

The appellant patentee conceded that the expression "more than one and fewer than all" had been objected to before the first break. However the amendments made in what ultimately became auxiliary request 1 were not directed to overcoming this objection. The objection concerning only one word line being defined as comprising segments had however been raised in the discussion of what became auxiliary request 1. Hence further requests had not been filed at that time, although this could have been done. Moreover deleting the method claim in what became the appellant patentee's main request reduced the complexity of the procedure.

The appellant patentee's final requests were that the decision under appeal be set aside and that the patent be maintained on the basis of the following requests:

- main request: claim 1 filed in the oral proceedings;
- auxiliary request 1: claims 1 to 14 filed in the oral proceedings;
- auxiliary request 2: claims 1 to 28 filed as "main request" with the letter dated 7 April 2009;
- auxiliary request 3: claims 1 to 18 filed as "auxiliary request I" with the letter dated 7 April 2009;
- auxiliary request 4: claims 1 to 24 filed as "auxiliary request II" with the letter dated 7 April 2009;
- auxiliary request 5: claims 1 to 16 filed as "auxiliary request III" with the letter dated 7 April 2009 and
- auxiliary request 6: claims 1 to 18 filed as "auxiliary request IV" with the letter dated 7 April 2009.

XV. The main request consists of a single claim which reads as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a plurality of word lines (100, 200, 300, ...) each to select an individual row of the storage locations (401, 402, 403, ...), each word line (100, 200, 300, ...) including a plurality of

word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the individual row; characterized by a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); a first selection circuit to selectively activate a variable number of word line segments (365, 366, ...) of a word line (100, 200, 300) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated; and a second selection circuit configured to selectively activate a variable number of sets of sense amplifiers (260; 361, 362, ...)."

XVI. The claims according to auxiliary request 1 consist of fourteen claims, the independent claims reading as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a plurality of word lines (100, 200, 300, ...) each to select an individual row of the storage locations (401, 402, 403, ...), each word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the individual row; characterized by a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); a first selection circuit to selectively activate a variable number of word line segments (365,

366, ...) of a word line (100, 200, 300) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated; wherein the plurality of sets of sense amplifiers (260; 361, 362, ...) are coupled to the first selection circuit for activating a variable number of the sets of sense amplifiers (260; 361, 362, ...) and a second selection circuit configured to selectively activate a variable number of sets of sense amplifiers (260; 361, 362, ...)."

"6. A method of operation in a memory, the method being characterized by receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating at least one of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row; wherein the memory further includes a plurality of sets of sense amplifiers (260; 361, 362, ...) each coupled to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row, the method further including transferring data from storage locations (401, 402, 403) corresponding to the selectively activated variable number of word line segments (365, 366, ...) in the first row to the corresponding variable number of sets of sense amplifiers (260; 361, 362, ...)."

XVII. The claims according to auxiliary request 2 consist of 28 claims, claims 1 to 18 and 20 to 28 being the same as the respective granted claims. Claim 19 reads as follows.

"A method of operation in a memory, the method being characterized by receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating more than one and fewer than all of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row."

Except for the added term "variable" in claim 19 the claims according to auxiliary request 2 were the same as those according to the main request upon which the appealed decision had been based.

XVIII. The claims according to auxiliary request 3 consist of eighteen claims, the independent claims reading as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a first word line (100, 200, 300, ...) to select a first row of the storage locations (401, 402, 403, ...), the first word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row; characterized by a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); a first selection circuit to selectively activate a variable

number of the word line segments (365, 366, ...) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated; wherein the plurality of sets of sense amplifiers (260; 361, 362, ...) are coupled to the first selection circuit and a variable number of the sets of sense amplifiers (260; 361, 362, ...) are activated in accordance with the control value."

"10. A method of operation in a memory, the method being characterized by receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating more than one and fewer than all of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row; wherein the memory further includes a plurality of sets of sense amplifiers (260; 361, 362, ...) each coupled to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row, the method further including transferring data from storage locations (401, 402, 403) corresponding to the selectively activated variable number of word line segments (365, 366, ...) in the first row to the corresponding variable number of sets of sense amplifiers (260; 361, 362, ...)."

XIX. The claims according to auxiliary request 4 consist of 24 claims, the independent claims reading as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a first word line (100, 200,

300, ...) to select a first row of the storage locations (401, 402, 403, ...), the first word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row; characterized by a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); a first selection circuit to selectively activate a variable number of the word line segments (365, 366, ...) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be activated and a memory address tag to store an address, the address corresponding to a first storage location (401, 402, 403, ...) of the sub-groups of the storage locations (401, 402, 403, ...)."

"10. A memory comprising: a memory array of storage locations (401, 402, 403, ...); a sense amplifier circuitry, including a plurality of sets of sense amplifiers (260; 361, 362, ...) coupled to respective sub-groups of the storage locations (401, 402, 403, ...), characterized by first selection circuitry to selectively activate a variable number of the sets of sense amplifiers (260; 361, 362, ...) in accordance with a control value that indicates a pattern of the sets of sense amplifiers (260; 361, 362, ...) to be activated; and a memory address tag to store an address, the address corresponding to a storage location (401, 402, 403, ...) of data sensed in at least one set of the sets of sense amplifiers (260; 361, 362, ...)."

"16. A method of operation in a memory, the method being characterized by receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating more than one and fewer than [sic] all of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row; and storing an address in an address tag, the address tag being representative of a storage location (401, 402, 403, ...) of the storage locations (401, 402, 403, ...) in the first row."

XX. The claims according to auxiliary request 5 consist of sixteen claims, the independent claims reading as follows.

"1. A memory comprising: storage locations (401, 402, 403, ...) arranged in rows; a first word line (100, 200, 300, ...) to select a first row of the storage locations (401, 402, 403, ...), the first word line (100, 200, 300, ...) including a plurality of word line segments (365, 366, ...) coupled to enable access to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row; characterized by a plurality of sets of sense amplifiers (260; 361, 362, ...), the sets of sense amplifiers (260; 361, 362, ...) coupled respectively to the sub-groups of the storage locations (401, 402, 403, ...); a first selection circuit to selectively activate a variable number of the word line segments (365, 366, ...) in accordance with a control value that indicates a pattern of the word line segments (365, 366, ...) to be

activated; and a memory address tag to store an address, the address corresponding to a first storage location (401, 402, 403, ...) of the sub-groups of the storage locations (401, 402, 403, ...); wherein the plurality of sets of sense amplifiers (260; 361, 362, ...) are coupled to the first selection circuit and a variable number of the sets of sense amplifiers (260; 361, 362, ...) are activated in accordance with the control value."

"9. A method of operation in a memory, the method being characterized by receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory; and selectively activating more than one and fewer than all of a variable number of word line segments (365, 366, ...) in accordance with the control value to enable access to the corresponding sub-groups of the storage locations (401, 402, 403, ...) in the first row; wherein the memory further includes a plurality of sets of sense amplifiers (260; 361, 362, ...) each coupled to respective sub-groups of the storage locations (401, 402, 403, ...) in the first row, the method further including transferring data from storage locations (401, 402, 403) corresponding to the selectively activated variable number of word line segments (365, 366, ...) in the first row to the corresponding variable number of sets of sense amplifiers (260; 361, 362, ...); the method further comprising the step of storing an address in an address tag, the address tag being representative of a storage location (401, 402, 403, ...) of the storage locations (401, 402, 403, ...) in the first row."

- XXI. The claims of auxiliary request 6 consist of eighteen claims having the same wording as those of auxiliary request I on the basis of which the amended patent was found to comply with the EPC in the appealed decision (see point VII above).
- XXII. At the end of the oral proceedings the board announced its decision.

Reasons for the Decision

1. *Admissibility of the appeals*

All three appeals are admissible.

1.1 *The effect of the appellant opponents' absence at the oral proceedings*

As both had announced in advance, the duly summoned appellant opponents did not attend the oral proceedings. In accordance with Article 15(3) RPBA (Rules of Procedure of the Boards of Appeal of the European Patent Office, OJ EPO 2007, 536), the board relied for its decision only on the appellant opponents' written submissions. The board was in a position to decide at the conclusion of the oral proceedings, since the case was ready for decision (Article 15(5) and (6) RPBA), and the voluntary absence of the appellant opponents was not a reason for delaying a decision (Article 15(3) RPBA).

2. *The original disclosure*

2.1 The application concerns the sensing, in other words reading, of sub-groups of memory cells in a semiconductor memory organised in rows and columns with one or more columns of sets of sense amplifiers used to read the memory cells. The invention allows the sensing of only part of a row, termed "sub-word memory accesses". This involves activating the appropriate parts of the word line, termed "word line segments" and the appropriate sets of sense amplifiers to sense the data stored in the memory cells; see, for instance, figure 3 and page 6, line 8, to page 7, line 2, of the published application. In one embodiment each word line contains 2048 bits and is subdivided into four sub-groups. The four sub-groups are coupled to four corresponding sets of sense amplifiers, each set consisting of 512 sense amplifiers (see page 9, lines 22 to 26, and figures 2 and 3 of the published application). The sub-groups of cells in a row to be sensed can be indicated by the four-bit SADR[3:0] value generated by the memory controller 117, each bit corresponding to one of the four sub-groups of cells, and the sets of sense amplifiers to be activated can be indicated by the four-bit SUBSAP[3:0] and (inverted) SUBSAN[3:0] values generated by controller 118, each bit corresponding to a set of sense amplifiers; see page 6, lines 13 to 16, page 6, last line, to page 7, line 2, and claim 7 of the published application.

2.2 As well as embodiments where one or more sub-groups of cells in the same row can be read, the application also discloses embodiments in which one or more sub-groups of cells in different rows can be read substantially

concurrently; see page 3, lines 13 to 16, and page 7, line 24, to page 8, line 4, of the published application. Figure 7 and page 11, line 7, to page 12, line 19, of the published application disclose the reading of two sub-words from a row, repeated for three different rows. According to page 12, line 20, to page 13, line 2, the memory controller can maintain a "memory address tag" to determine whether the address indicated in a request matches the address of the data in the sense amplifier. This tag in combination with further tags allow the memory to respond to a read request without explicit restores.

2.3 Activating only a part of the word line and only some of the sets of sense amplifiers has the advantage of saving power when compared with a situation where an entire word line and an entire column of sense amplifiers is activated for every read operation. The published application lists three objects of the invention on page 2, lines 24 to 31: "to provide a memory in which power efficient memory accesses can be performed", "to provide for sub-word memory accesses" and "to provide for a memory in which sets of sense amplifiers corresponding to different sub-words of rows of memory can communicate data to different rows of the memory".

2.4 The claims of the application as originally filed comprised four independent claims (see point II above), all of which set out *inter alia* the following features: a plurality of word lines for selecting rows of the memory array, each word line comprising a plurality of segments, each segment spanning a portion of the distance of the word line; sets of sense amplifiers,

each set corresponding to a segment and each amplifier coupled to one storage location associated with a word line; selecting at least one segment of a word line and selecting at least one corresponding set of sense amplifiers.

2.5 The appellant patentee has argued essentially that the skilled person reading the application as originally filed would have realized that the approaches of selective activation of word line segments and selective activation of corresponding sets of sense amplifiers could be separated and that both approaches could achieve the first object (to provide a memory in which power efficient memory accesses can be performed) on their own. Moreover the first two objects did not mention corresponding sets of sense amplifiers. Hence the original application did not consistently present the activation of word line segments and sets of sense amplifiers in combination. There was also no need to solve all the objects at once.

2.6 The board is not convinced by these arguments. According to established case law of the boards of appeal of the EPO (see, for instance, G 2/98, OJ EPO 2001, 413), the disclosure of a European patent application is determined by what the skilled person would directly and unambiguously derive from the original application as a whole in the light of common general knowledge. In the present case there is no basis in the original application for regarding the mere stating of the first object as a sufficient indication that all possible arrangements which would achieve this object constitute an invention. The disclosure of an invention also requires that a way be

described for a person skilled in the art to carry it out. The disclosure should also enable a person skilled in the art to understand the technical problem and its solution over the prior art as indicated in the background to the invention. The claims, which should indicate the technical features necessary for the definition of the invention, constitute an important element for determining what was presented to the skilled reader as constituting an invention in the application as filed because the claims usually define the invention in the broadest terms which are considered to comply with said requirements. In the present case, concerning the solution of the technical problem, namely the invention considered to achieve the first object in view of the content of the application as a whole, there is no suggestion that the approaches of selective activation of word line segments and selective activation of corresponding sets of sense amplifiers could be separated. Indeed these features are consistently presented in each of the independent claims as originally filed. Hence the board generally agrees with the finding in the appealed decision that the invention contemplated in the application as originally filed was intended to achieve all of the stated objects of the invention except for the restriction to sub-words in different rows which is only set out in original claims 15 and 22. The original invention in the broadest terms was directed to a combination of activation of word line segments and corresponding sets of sense amplifiers.

3. *The order of treatment of the appellant patentee's requests*

Since the appellant patentee only filed his auxiliary request 1 and main request in the latter stages of the oral proceedings after auxiliary requests 2 to 6 had already been discussed, the order of the appellant patentee's final requests differs from the order in which they were actually discussed in the oral proceedings. Hence the board's decisions to admit auxiliary request 1, but not the main request, can be most readily understood by considering the requests in the order in which they were discussed at the oral proceedings, namely first auxiliary requests 2 to 6, then auxiliary request 1 and finally the main request.

4. *The appellant patentee's auxiliary request 2*

4.1 The claims are the same as those according to the main request upon which the appealed decision was based with the exception that the expression in independent claim 19 forming the basis of the appealed decision

"receiving a control value that indicates a number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory," had been amended to read "receiving a control value that indicates a variable number of sub-groups of a row of storage locations (401, 402, 403, ...) within a first row of the memory;" (emphasis added by the board).

4.2 The independent claims separate the approaches of selective activation of word line segments and selective activation of sets of sense amplifiers, and the first and second select logic for generating the

(formerly corresponding) selection signals, apparatus claim 1 and method claim 19 not mentioning sense amplifiers and apparatus claim 12 not mentioning word line segments. As set out in point 2.6 above, such a separation was not disclosed in the application as originally filed. Hence the board comes to essentially the same conclusion as was reached by the opposition division regarding the then main request (see points VI and XVII above) - albeit on the basis of a slightly modified claim 19 - that this amendment to the independent claims causes the subject-matter of the patent to extend beyond the content of the application as filed.

- 4.3 While the application as originally filed disclosed, in an embodiment comprising four sub-groups and four sets of sense amplifiers, control values in the form of SADR[3:0] for activating word line segments and SUBSAP[3:0] and (inverted) SUBSAN[3:0] for activating sets of sense amplifiers, there is no basis for interpreting the control value as being variable or defining a pattern. The term in claims 1 and 19 "variable number of word line segments" and that in claim 12 "variable number of the sets of sense amplifiers" cover any variation of these numbers and, for instance, introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed, the embodiments in the original application, for example that shown in figure 7, all involving fixed numbers of word line segments and corresponding sets of sense amplifiers.

- 4.4 Moreover the expression in claim 1 "a control value that indicates a pattern of the word line segments" in the light of sub-groups being sensed in different word lines introduces the concept of a two-dimensional control value, which again is not directly and unambiguously derivable from the application as originally filed.
- 4.5 Furthermore the expression in claim 19 "more than one and fewer than all" of a variable number of word line segments introduces the concepts of two as a minimum and all-but-one as a maximum, which are also not directly and unambiguously derivable from the application as originally filed. The appellant patentee has argued that activating all word line segments or sets of sense amplifiers was prior art, and that removing a feature from a claim did not contravene Article 123(2) EPC if its substitute could be prior art. The board is not convinced by this argument. Whilst, under certain conditions, an undisclosed disclaimer may be allowable without contravening Article 123(2) EPC (see Case law of the Boards of Appeal of the EPO, 5th edition, III.A.1.6.3), the present case does not fulfil these conditions, since, for instance, the appellant patentee has not identified a specific piece of prior art that this amendment disclaims.
- 4.6 Although the application as originally filed, in particular all the independent claims, consistently set out a plurality of word lines, each word line comprising a plurality of segments, claim 1 only sets out a first word line including a plurality of word line segments, thus adding the concept that further word lines need not include word line segments, which

was also not directly and unambiguously derivable from the application as originally filed.

4.7 Hence the amendments to the independent claims cause the patent according to auxiliary request 2 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC.

5. *The appellant patentee's auxiliary request 3*

5.1 For analogue reasons to those set out above for auxiliary request 2, the expressions in claims 1 and 10, respectively, "variable number of the word line segments" and "variable number of word line segments" and that in claim 1 "variable number of the sets of sense amplifiers" introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed.

5.2 Moreover the expression in claim 1 "a control value that indicates a pattern of the word line segments" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

5.3 The expression in claim 10 "more than one and fewer than all" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

5.4 Furthermore as claim 1 only mentions a first word line including a plurality of word line segments it has been

amended contrary to Article 123(2) EPC for the same reasons as are given for auxiliary request 2.

5.5 Claim 1 also sets out a first selection circuit selectively activating a variable number of the word line segments in accordance with a control value, a variable number of sets of sense amplifiers being activated in accordance with the same control value. This concept was also not directly and unambiguously derivable from the application as originally filed.

5.6 Hence the amendments to the independent claims cause the patent according to auxiliary request 3 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC.

6. *The appellant patentee's auxiliary request 4*

6.1 For analogue reasons to those set out above for auxiliary request 2, the expression in claim 1 "variable number of the word line segments" and that in claim 10 "variable number of the sets of sense amplifiers" introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed.

6.2 Moreover the expression in claim 1 "a control value that indicates a pattern of the word line segments" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

- 6.3 The expression in claim 16 "more than one and fewer than [*sic*] all" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.
- 6.4 Furthermore as claim 1 only mentions a first word line including a plurality of word line segments it has been amended contrary to Article 123(2) EPC for the same reasons as are given for auxiliary request 2.
- 6.5 The purpose of the memory address tag on page 12, last paragraph, of the description as originally filed was to determine whether the address indicated in a request matched the address of data in the sense amplifier. The claimed purposes of the memory address tag set out in claim 1 ("corresponding to a first storage location ... of the sub-groups of the storage locations") and claim 16 ("being representative of a storage location ... of the storage locations ... in the first row") differ from the purpose disclosed in the application as originally filed (see also point 2.2 above) and are not directly and unambiguously derivable from the application as originally filed.
- 6.6 Hence the amendments to the independent claims cause the patent according to auxiliary request 4 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC.
7. *The appellant patentee's auxiliary request 5*
- 7.1 For analogue reasons to those set out above for auxiliary request 2, the expressions in claims 1 and 9, respectively, "variable number of the word line

segments" and "variable number of word line segments" and those in claims 1 and 9, respectively, "variable number of the sets of sense amplifiers" and "variable number of sets of sense amplifiers" introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed.

7.2 Moreover the expression in claim 1 "a control value that indicates a pattern of the word line segments" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

7.3 The expression in claim 9 "more than one and fewer than all" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

7.4 Furthermore as claim 1 only mentions a first word line including a plurality of word line segments it has been amended contrary to Article 123(2) EPC for the same reasons as are given for auxiliary request 2.

7.5 The purpose of the memory address tag on page 12, last paragraph, of the description as originally filed was to determine whether the address indicated in a request matched the address of data in the sense amplifier. The claimed purposes of the memory address tag set out in claim 1 ("the address corresponding to a first storage location ... of the sub-groups of the storage locations") and claim 9 ("being representative of a storage location ... of the storage locations ... in the first row")

differ from the purpose disclosed in the application as originally filed (see also point 2.2 above) and are not directly and unambiguously derivable from the application as originally filed.

7.6 Hence the amendments to the independent claims cause the patent according to auxiliary request 5 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC.

8. *The appellant patentee's auxiliary request 6*

8.1 The claims of auxiliary request 6 are the same as those of the then auxiliary request I on the basis of which the amended patent was found to comply with the EPC in the appealed decision.

8.2 For analogue reasons to those set out above for auxiliary request 2, the expressions in claims 1 and 10, respectively, "variable number of the word line segments" and "variable number of word line segments" and those in claims 1 and 10, respectively, "variable number of corresponding sets of sense amplifiers" and "variable number of sets of sense amplifiers" introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed.

8.3 The expression in claim 1 "a control value that indicates a pattern of the word line segments" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

- 8.4 Moreover the expression in claim 10 "more than one and fewer than all" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.
- 8.5 Furthermore as claim 1 only mentions a first word line including a plurality of word line segments it has been amended contrary to Article 123(2) EPC for the same reasons as are given for auxiliary request 2.
- 8.6 Claim 1 also sets out a first selection circuit selectively activating a variable number of the word line segments in accordance with a control value, a variable number of corresponding sets of sense amplifiers being activated in accordance with the same control value. This concept was also not directly and unambiguously derivable from the application as originally filed.
- 8.7 Hence the amendments to the independent claims cause the patent according to auxiliary request 6 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC.

9. *The appellant patentee's auxiliary request 1*

- 9.1 According to Article 13(1) RPBA, any amendment to a party's case after it has filed its grounds of appeal may be admitted and considered at the board's discretion. The discretion shall be exercised in view of *inter alia* the complexity of the new subject matter submitted, the current state of the proceedings and the need for procedural economy. Article 13(3) RPBA further

specifies that amendments sought to be made after oral proceedings have been arranged shall not be admitted if they raise issues which the board or the other party or parties cannot reasonably be expected to deal with without adjournment of the oral proceedings.

9.2 The board, exercising its discretion under Article 13(1) RPBA, decided to admit this request filed in the oral proceedings as it was in reaction to objections raised by the board in the oral proceedings against the amended claims according to auxiliary requests 2 to 6 and could be dealt with by the board without delaying the proceedings.

9.3 For analogue reasons to those set out above for auxiliary request 2, the terms in claims 1 and 6 "variable number of word line segments" and in claims 1 and 6, respectively, "variable number of the sets of sense amplifiers" and "variable number of sets of sense amplifiers" introduce possibilities of time-varying numbers of word line segments or sets of sense amplifiers which are not directly and unambiguously derivable from the application as originally filed.

9.4 The expression in claim 1 "a control value that indicates a pattern of the word line segments" is not directly and unambiguously derivable from the application as originally filed for the same reasons as are given for auxiliary request 2.

9.5 Moreover, whilst granted independent method claim 19 had referred to "activating more than one and fewer than all of a plurality of word line segments", independent method claim 6 according to auxiliary

request 1 sets out "selectively activating at least one of a variable number of word line segments", thus extending the protection conferred by the patent, Article 123(3) EPC, in also covering the case of all the word line segments being activated.

- 9.6 Hence the amendments to the independent claims cause the patent according to auxiliary request 1 to contain subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC, and to extend the protection the patent confers, contrary to Article 123(3) EPC.

10. *The appellant patentee's main request*

In contrast to the appellant patentee's auxiliary request 1, the board, exercising its discretion under Article 13(1) RPBA, decided not to admit this request as it could have been filed earlier in the oral proceedings, for instance with auxiliary request 1. Moreover the objection under Article 123(3) EPC against auxiliary request 1 was foreseeable as soon as the objections were made before the first break in the oral proceedings under Article 123(2) EPC against the expression "more than one and fewer than all" in the claims according to auxiliary requests 2 to 6. To wait until after the third break in the oral proceedings to submit a request aimed at overcoming this objection was regarded by the board as contrary to the principle of procedural economy even if it did reduce the number of claims to one. In the board's view it is not the purpose of oral proceedings in opposition appeal proceedings to afford the proprietor an unlimited opportunity to put forward and have considered

different claim versions. Moreover the claim according to the main request contained expressions such as "variable" and "pattern" which the board had already objected to before the first break in the oral proceedings under Article 123(2) EPC in connection with the lower ranking requests, the appellant patentee not having made any further arguments in support of these expressions. Since these terms were not used in the application as originally filed, as the board had indicated in the annex to the summons (see point XI above), it had to be expected that the debate in the oral proceedings would focus on possible alternative definitions which were clearly disclosed in the application as filed and which did not extend the protection conferred by the patent.

11. *Conclusion*

Since the appellant patentee's main request is not admitted and the board finds that the patent amended according to the appellant patentee's auxiliary requests 1 to 6 does not meet the requirements of the EPC, the patent must be revoked, Article 101(3)(b) EPC. Thus the board decides to allow the appeals by the appellant opponents.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

L. Fernández Gómez

F. Edlinger