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**Datasheet for the decision  
of 9 July 2019**

**Case Number:** T 1184/14 - 3.4.01

**Application Number:** 09730146.9

**Publication Number:** 2265968

**IPC:** G01R33/34, G01R33/3415

**Language of the proceedings:** EN

**Title of invention:**

DOUBLE LAYER MULTI ELEMENT RF STRIP COIL ARRAY FOR SAR REDUCED  
HIGH FIELD MR

**Applicant:**

Koninklijke Philips N.V.  
Philips Intellectual Property & Standards GmbH

**Headword:**

STRIP COIL ARRAY / PHILIPS

**Relevant legal provisions:**

EPC Art. 123(2), 56

**Keyword:**

Amendments - added subject-matter (yes)  
Inventive step - (no)

**Decisions cited:**

T 0667/08



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Case Number: T 1184/14 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 9 July 2019**

**Appellant:** Koninklijke Philips N.V.  
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**Appellant:** Philips Intellectual Property & Standards GmbH  
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**Representative:** van Velzen, Maaïke Mathilde  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 3 January 2014  
refusing European patent application No.  
09730146.9 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** P. Scriven  
**Members:** P. Fontenay  
J. Geschwind

## Summary of Facts and Submissions

- I. The applicant appealed the decision of the Examining Division to refuse European patent application 09 730 146.
- II. The application was refused because none of the requests on file (main request and three auxiliary requests) was considered to meet the requirements of the EPC, in particular the requirements of Article 84 EPC as to clarity, of Article 123(2) EPC as to added subject-matter, and of Article 52 EPC as to novelty and inventive step.

With regard to the objection of lack of novelty, reference was made to document:

D3: WO-A-2006/090293,

which was considered to disclose a double-layer transmit and receive coil array as defined in claim 1 of each of the four requests.

Inventive step was considered lacking in view of documents

D1: US-A-2005/264291, or

D2: WO-A-2005/111646.

It was held, in this respect, that inductive decoupling by means of transformers referred to a routine implementation of a well-known technique. Reference was made in this context to document D3 (above) and

D4: US-A-2006/061360.

III. With its statement setting out the grounds of appeal, the appellant requested that the Examining Division's decision be set aside and a patent granted on the basis of independent claim 1 filed with the statement of grounds. Alternatively, the appellant requested that oral proceedings be held, or that the case be remitted with the instruction to examine the application in accordance with section F IV 9.4.2 of the Guidelines for Examination.

New claim 1 was drafted so as to define, specifically, the embodiment of Figure 10. Hence, it described in detail how the various components were located relative to one another.

IV. In the appellant's view, many of the clarity objections raised by the Examining Division were contrary to the generally-accepted principle that a claim's wording is to be interpreted in an attempt to make technical sense.

Moreover, none of the available prior art documents disclosed the claimed arrangement with a first and a second transformer for mutual decoupling of the transmit and receive coil strips. The claimed arrangement was also not obvious, starting from document D3 as closest prior art.

- V. The Board arranged oral proceedings, and set out its provisional view in a communication under Article 15(1) RPBA.

While acknowledging that many of the objections raised under Article 84 EPC no longer applied, the wording of the claim was nevertheless considered ambiguous. This applied, specifically, to the arrangement of the two transformers with regard to the other components of the claimed array.

Insofar as claim 1 could be construed, in the appellant's favour, as describing the embodiment of Figure 10, the appellant's submissions regarding novelty were considered persuasive. Doubts were however expressed as to the existence of an inventive step, in view of document D3 (alternatively, of D1). The provision of transformers seemed to define a mere alternative to the inductors of D3 for decoupling the transmit and receive coils.

- VI. In its reply to the communication of the Board, the appellant filed a new main and a new auxiliary request, both consisting of a single claim.

These constitute the final requests on which the Board had to adjudicate.

- VII. The appellant argued that the claim of both requests had been amended to address the misgivings of the Board with regard to clarity.

Further, the appellant saw the Board's preliminary assessment of inventive step as relying on hindsight,

since there was no hint or incentive in the prior art to replace an inductive decoupling by transformers in the way actually claimed. Particular emphasis was put on the fact that the claimed configuration was not limited to only decoupling the transmit and receive coils from the RF-shield, but extended to providing additional mutual decoupling between the transmit and receive coils.

VIII. Oral proceedings before the Board took place on 9 July 2019 in the presence of the appellant's representative.

IX. Claim 1 of the main request reads:

*A double layer transmit and receive (T/R) coil array (10) for a high-field magnetic resonance imaging (MRI) system including*

- a radio frequency (RF) shield (12),*
- a transmit coil strip (14) positioned adjacent the shield (12) at a first distance from the shield (12) and*
- a receive coil strip (16) positioned at a second distance from the shield (12), the second distance being larger than the first distance,*

- the transmit coil strip (14) being positioned between the shield (12) and the receive coil strip (16), and*
- the transmit coil strip (14) and the receive coil strip each (16) comprising several tuning capacitors (74),*

- a first transformer (70) and second transformer (72) that mutually decouple the transmit coil strip (14) and the receive coil strip (16) and decouple the transmit coil strip (14) as well as the receive coil strip (16) from the radio frequency shield (12), wherein

- the transmit coil strip (14) is coupled to a first side (70a) of the first transformer (70) on one extremity of the first side (70a) of the first transformer (70) and to a first side (72a) of the second transformer (72) on one extremity of the first side (72a) of the second transformer (72), the first side (70a) of the first transformer (70) and the first side (72a) of the second transformer (72) being coupled to the radiofrequency shield (12) by capacitors (18a, 18b) on their other extremities, respectively, and

- the receive coil strip (16) is coupled to a second side (70b) of the first transformer (70) on one extremity of the second side (70b) of the first transformer (70) and to a second side (72b) of the second transformer (72) on one extremity of the second side (72b) of the second transformer (72), the second side (70b) of the first transformer (70) and the second side (72b) of the second transformer (72) being coupled to the radiofrequency shield



*(12) by capacitors (18c, 18d) on their other extremities, respectively.*

- X. Claim 1 of the auxiliary request differs from that of the main request in that it specifies that the tuning capacitors 74 provide resonance.

### **Reasons for the Decision**

*Added subject-matter - Article 123(2) EPC*

1. Claim 1 of the main request comprises the feature of "a first transformer (70) and second transformer (72) that [...] decouple the transmit coil strip (14) as well as the receive coil strip (16) from the radio frequency shield (12)". The same wording is present in claim 1 of the auxiliary request.

As emphasised by the appellant, the term "decouple" is to be given, in the context of the claim, the meaning of an electrical decoupling. It thus relates to the intended effect of avoiding electrical interference between modes in various sections of the circuit.

2. The claimed feature has no literal support in the original application.

This finding alone does not suffice to establish the existence of added subject-matter. The question to be answered is, rather, whether the technical content resulting from the amendment derives directly and unambiguously from the original disclosure (cf. decision T 667/08).

3. Claim 1 has been amended so as to reflect the teaching of Figure 10 and the corresponding section of the description (page 7, line 29 - page 8, line 10).

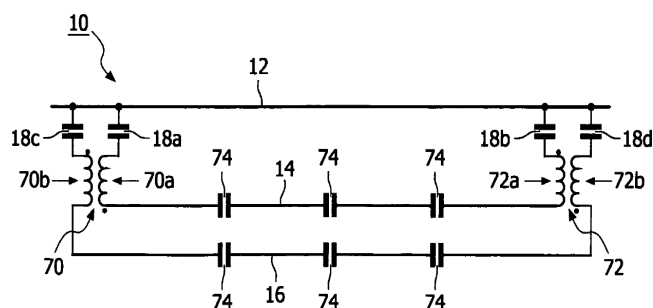


Figure 10

4. While describing with many details the arrangement of Figure 10, the corresponding passage of the description on page 7, line 28 to page 8, line 10, does not expound on the electrical phenomena taking place in the circuit, beyond the indication that the transmit and receive strips define resonators that are mutually decoupled using inductive transformers. Effects associated with the (physical) coupling of the first and second transformers to the shield are not mentioned.
5. The issue of added subject-matter hinges thus on what the skilled person would have been able to derive from its understanding of the circuit of Figure 10.

Concretely, the question to be answered is whether the skilled person would have recognised that the presence of the transformers permits (electrical) decoupling of the receive and transmit strips from the shield.

6. The Board is satisfied that the skilled person would not have recognised any such effect associated to the arrangement of Figure 10.

The embodiment of Figure 10 belongs to the category of embodiments referred to on page 4, lines 13 and 14, in which the shield is also used as a return path. The electrical circuits consisting of the resonating transmit and receive strips, respectively, are thus closed by means of the shield.

7. The resonating modes in the transmit and receive strips are defined by the capacitors they incorporate. In the absence of transformers, no electrical "coupling", in the sense of the resonating mode in a section of the circuit interfering with a mode in another section, can be recognised between the strips and the shield acting simply as the return path. In the absence of such coupling in the first place, and since the shield also acts as a return path in the embodiment of Figure 10, no decoupling can result from the presence of the first and second transformers.

8. It follows that claim 1 of the main and auxiliary requests defines subject-matter extending beyond the content of the application as originally filed contrary to Article 123(2) EPC.

*Novelty and inventive step - the appellant's proposed amendment*

9. During oral proceedings, the appellant suggested that it would be possible to delete the problematic feature (see paragraph 1, above) and replace it by a structural limitation in line with the passage of the description referring to Figure 10.
  
10. A corresponding request was not made, but the novelty and inventive step of Figure 10 were discussed and the Board announced its view that there would have been no inventive step. In the following, the Board sets out its reasons.

*Novelty - Article 54 EPC*

11. None of the documents presently available discloses a double layer transmit and receive coil array as recited in claim 1 of the main request.
  
12. Document D3 discloses a double layer transmit and receive coil array for a high-field magnetic resonance imaging system including a radio frequency (RF) shield and a transmit and a receive coil strip at, respectively, a first and a second distance from the shield (cf. page 1, lines 14-21, page 2, lines 4-17, page 7, lines 3-15, figures 1, 2).

According to one embodiment in D3, the double-layer transmit and receive coil array comprises inductors separating each pair of transmit and receive coils. The inductors are present at both extremities of each coil

loop and allow a decoupling of both coils (cf. page 7, line 29 - page 8, line 5, Figure 4a).

Moreover, document D3 explicitly refers to the use of stripline technology to make the rings, rungs or rods of the resonating coils disclosed therein (cf. page 9, lines 15-23).

There is however no mention in D3 of a first and second transformer with associated capacitors coupling the first and second sides of the first and second transformers to the radio-frequency shield.

13. Document D1 discloses an RF coil for use in NMR imaging. The RF coils define a multiplicity of current paths thus allowing improved control of the field intensity, amplitude and phase (cf. paragraphs [0007], [0033], [0046]). In the absence of any concrete indications regarding the specific arrangement of the transmitting and detection elements and their relative positions to the shield, D1 does not anticipate the claimed subject-matter. This is all the more true as the function and construction of the decoupling means referred to in D1 (paragraph [0065]) are not defined in a concrete manner.
  
14. Document D2 discloses a double layer transmit and receive coil array for a high-field magnetic resonance imaging system with a first set of coils at a first distance from the shield and a second set of coils at a second distance (cf. page 11, lines 4-11; Figures 10A, 10C, 11). According to an embodiment, the coil elements consist of microstrip conductors (cf. page 7, lines 1-8). The first and second sets of coil elements may

selectively be controlled for transmission or reception. It is further foreseen to couple the microstrip elements to the shield by means of capacitors (cf. page 7, lines 5-8).

The claimed subject-matter differs from the coil array of D2 by the presence of first and second transformers coupled between the capacitors and respective microstrips.

*Inventive step - Article 56 EPC*

15. The capacitors present in the system disclosed in D1 are provided in order to define the optimal tuning of the microstrips. They are not intended as means to optimise decoupling between both strips.
  
16. Document D3 discloses a double layer transmit and receive coil array. In comparison with document D2, the embodiments are much more detailed. The embodiment of Figure 4A in D3 appears particularly relevant to the claimed subject-matter since it reproduces most of the claimed features in combination. Moreover, D3 also addresses the problem resulting from the mutual coupling between transmit and receive coil elements.
  
17. For all these reasons, the Board concurs with the view of the Examining Division that D3 discloses the closest prior art.
  
18. The claimed array differs from the configuration disclosed in the embodiment of Figure 4A in D3 in that:

(i) the transmit and receive coil strips comprise several tuning capacitors that provide resonance, and in that

(ii) it comprises a first and a second transformer and associated capacitors as claimed in claim 1 (i.e. as illustrated in Figure 10), instead of the inductors provided in D3 between the transmit and receive coil elements.

19. It is well known that the resonance modes of a resonating structure are directly determined by its reactances (capacitors or inductors). No inventive step can thus be seen in distinguishing feature (i). The appellant did not dispute this.

This conclusion is supported by D3, which comprises other embodiments that explicitly incorporate capacitors in the resonating coil structures (cf. Figures 3A and 3B). A further confirmation can be found in D2, where the use of capacitors for a fine tuning of the resonance frequencies is explicitly acknowledged (cf. page 7, lines 5-9, Figure 4A).

20. Distinguishing feature (ii) contributes to a mutual decoupling of the receive and transmit strips.

21. Since the presence of the inductors in D3 serves, similarly, the need to decouple the transmit and receive coil elements, the objective problem solved by the claimed configuration is restricted to providing an alternative to said inductors.

22. As emphasised by the appellant, the claimed decoupling means associating transformers and capacitors between the receive and transmit strips, on one side, and the shield, on the other side, as illustrated in Figure 10 of the application, was not known from the prior art.

The appellant further argued that, in the present context, the claimed invention did not reside in the values of the components (capacitors, inductors) required for an optimal decoupling, but in the very design that had been selected that allowed such mutual decoupling.

23. This argument did not persuade the Board.

The mere selection of an alternative design in order to achieve the intended purpose cannot justify the existence of an inventive step. A different finding would be tantamount, under such circumstances, to acknowledge the existence of an inventive step once the condition of novelty is met. In the field of electric circuits, where an infinite number of alternative networks may provide the same impedance, any minor change to a known circuit configuration would then be sufficient to imply the existence of an inventive step.

As such, a new design, can thus not justify the existence of an inventive step if it is not associated with a technical effect. This appears all the more true, under the present circumstances, since D3 explicitly suggests other designs, i.e. alternative configurations to the disclosed inductors (cf. page 8, lines 1-4) in order to fulfil the same purpose of decoupling various sections of an electric circuit.



Beyond impedance networks, said passage of D3 explicitly envisages the use of transformers.

24. The skilled person would, therefore, have considered replacing the inductors in D3 by transformers. Guided by the intention of improving decoupling between the two strips, the skilled person would have excluded the possibility of introducing the transformers at both ends of said strips with their respective primary winding directly connected to the secondary winding thus defining a closed path incorporating the transmit and receive coil strip in one single loop. All other configurations, associating said transformers to inductors and/or capacitors selected to provide, for the selected resonating frequency, the required reactance, are equivalent.
25. In the absence of any technical effect resulting from the selected design, beyond the intended mutual decoupling of the transmit and receive strips, no inventive step can be recognised in the claimed configuration.
26. The subject-matter of claim 1 of the (suggested) main request derives in an obvious manner from the prior art. It is thus not inventive in the sense of Article 56 EPC.
27. The added feature in claim 1 of the auxiliary request according to which the tuning capacitors in the transmit and receive coil strips provide resonance is without bearing on the definition of the claimed

subject-matter. The feature, indeed, is redundant since the capacitors are tuning capacitors, i.e. electric components affecting the resonating modes (frequency) of the transmit and receive coil strips.

28. The subject-matter of claim 1 of the (suggested) auxiliary request is thus not inventive in the sense of Article 56 EPC, for the reasons set out above with regard to the main request.

## Order

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

The appeal is dismissed.

The Registrar:

The Chairman:



R. Schumacher

P. Scriven

Decision electronically authenticated