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Case Number: T 0558/09 - 3.4.01

Application Number: 05019114.7

Publication Number: 1633018

IPC: H01Q 9/14, H01Q 21/30, H01Q 5/00

Language of the proceedings: EN

Title of invention:
Antenna apparatus of mobile communications terminal and operation method thereof

Applicant:
LG Electronics Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (no: all requests)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0558/09 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 10 May 2011

Appellant: LG Electronics Inc.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 20 November 2008 refusing European patent application No. 05019114.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: B. Schachenmann
Members: H. Wolfrum
F. Neumann

Summary of Facts and Submissions

I. European patent application 05 019 114.7 (publication No. EP-A-1 633 018) was refused by a decision of the examining division dispatched on 20 November 2008, for the reason of lack of inventive step (Articles 52(1) and 56 EPC 1973) of the subject-matter of the requests then on file.

II. The applicant lodged an appeal against the decision and paid the prescribed fee on 8 January 2009. On 13 February 2009 a statement of grounds of appeal was filed. The appellant requested the grant of a patent on the basis of amended sets of claims according to a main request and an auxiliary request. Furthermore, an auxiliary request for oral proceedings was made.

III. On 9 February 2011 the appellant was summoned to oral proceedings.

In a communication annexed to the summons, the Board gave a preliminary opinion *inter alia* on the issue of inventive step based on documents :
D1: WO 01/31732 A1, and
D2: US 2004/0164905 A1.

IV. In response, the appellant filed by letter of 25 March 2011 a new set of claims 1 to 5 as a main request, and a new set of claims 1 to 4 as an auxiliary request.

V. Oral proceedings were held on 10 May 2011.

As a result of the discussion, the appellant requested that the decision under appeal be set aside and a patent be granted, by way of a main request, with

claims 1 to 5, as filed with letter dated 25 March 2011;

description pages 1, 4, 7, 8 and 10 as originally filed,
pages 2, 2a, 2b, 5, 6, 9 and 11 as filed on 29 December 2006,
and page 3 as filed on 18 September 2008;

drawings Figures 1 to 7 as originally filed.

Alternatively, grant of a patent was requested on the basis of claims 1 to 4 filed as auxiliary request with the letter of 25 March 2011 and the remainder of the documents as for the main request.

VI. Claim 1 of the appellant's **main request** reads as follows :

"*1. An antenna apparatus of a mobile communications terminal comprising:*
- a first antenna (201);
- an antenna length adjustor (202) connected to the first antenna (201) for varying the length of the first antenna (201) according to a signal transmission/reception quality of the mobile communications terminal, wherein the antenna length adjustor (202) comprises:
a plurality of second antennas each of which having a different length and being shorter than the first antenna;
one first switch for selectively connecting the first antenna (201) and one of the second antennas; and

a first controller (202a, 202b) adapted to repeatedly connect none or one of the plurality of second antennas with the first antenna by the one first switch in response to the signal transmission/reception quality of the mobile communications terminal determined at predetermined time intervals,
wherein the antenna apparatus further comprises:
- at least one or more third antennas which are different from the first antenna;
- a second switch (SW) for connecting one of the first antenna (201) and the one or more third antennas (302) to a matching circuit; and
- a second controller (203a) for changing the operation frequency band of the mobile communications terminal by controlling the second switch (SW)."

Claims 2 to 5 are dependent claims.

Claim 1 of the **auxiliary request** differs from claim 1 of the main request in that the definition of the first controller is replaced by the definition
"*a first controller (202b) adapted to compare a transmission/reception quality of the first antenna (201) with a transmission/reception quality measured by sequentially connecting the first antenna to each second antenna, and to change the length of the first antenna (201) according to an antenna combination having an optimal transmission/reception quality by connecting none or one of the second antennas to the first antenna (201) using the one first switch, wherein the first controller (202b) is further adapted to repeatedly measure at predetermined time intervals the reception/transmission quality and, if the signal transmission/reception quality falls under a threshold*

value, to re-detect the antenna combination having the optimal reception/transmission quality;".

Claims 2 to 4 are dependent claims.

Reasons for the Decision

1. In the following reference is made to the provisions of the EPC 2000, which entered into force as of 13 December 2007, unless the former provisions of the EPC 1973 still apply to pending applications.

2. The appeal complies with the requirements of Articles 106 to 108 EPC and Rule 99 EPC and is, therefore, admissible.

3. Main request - inventive step (Article 52(1) EPC and Article 56 EPC 1973)

3.1 Interpretation of claim 1

As a result of the discussion in the oral proceedings, there was consent between the appellant and the Board that the feature "*one first switch for connecting the first antenna (201) and one of the second antennas*" is intended to define an arrangement as shown in Figure 4 of the application according to which the antenna length is varied by selectively connecting to the first antenna just one of the plurality of second antennas so that in each resulting antenna configuration only one respective (first) switch needs to be activated. The claimed arrangement for varying the antenna length is thus to be understood as a parallel arrangement of

second antennas, each of which give rise to the possible length configurations, from which the optimal configuration is selected. This is in distinction to an arrangement such as the one shown in Figure 3 of the application, according to which the variation of the antenna length would be effected by means of a stepwise increasing series connection of second antennas and a corresponding number of activated first switches from the shortest to the longest possible antenna length.

Furthermore, for the purpose of the present decision, there was agreement that claim 1 is intended to define the first controller as being adapted to sequentially connect none or one of the second antennas to the first antenna and to determine the resulting respective signal transmission/reception quality of the mobile communications terminal.

3.2 Document D1 (see Figures 1, 2, 5 and 6 with the corresponding description), shows an antenna apparatus of a mobile communications terminal which comprises a (receiving) antenna structure 13 that is switchable between a plurality of antenna configuration states by means of a switching device 14 which is preferably of the microelectromechanical switch (MEMS) type and operated under the control of a control device 22. The control device is configured to dynamically adapt the antenna to changes in the operation environment *inter alia* by sequentially varying the antenna length and to determine the respective signal reception quality of the mobile communications so as to establish the antenna length having an optimal reception quality (D1: page 9, line 28 to page 10, line 5). Signal quality is monitored repeatedly during use, by sampling

at regular time intervals or continuously (D1: page 9, lines 26 to 27). Figure 2 of D1 illustrates an arrangement for variations of the antenna length in the form of a series connection of antenna elements and switches (see also page 12, line 26 to page 13, line 26). Depending on the activation state of the switches, part of the antenna structure sketched in Figure 2 of D1 can be perceived as constituting a "first antenna" (*eg* 50, 51, 52) and the remainder of connectable antenna elements (53, 54 …) as a "plurality of second antennas shorter than the first antenna" within the meaning of claim 1 under consideration. Apart from the illustration of Figure 2, no details are given in document D1 as to the practical implementation of the antenna elements and MEMS-type switches in a concrete antenna apparatus.

Document D1 further refers to the requirement of multi-band operation for a mobile communication terminal and the associated need for band switching and, in the context of discussing the option of changing the radiation pattern, mentions the possibility of switching to a different antenna type (D1: page 1, lines 17 to 18; page 13, lines 7 to 12; page 14, lines 9 to 21; page 16, lines 10 to 25).

3.3 In the light of the interpretation indicated in paragraph 3.1 above, the subject-matter of claim 1 of the main request differs from the antenna apparatus known from document D1 mainly in two aspects: firstly, in that each of the second antennas has a different length and in that the variation of the antenna length takes place by the activation of a

respective single switch which connects a selected one of the second antennas to the first antenna; and secondly, in the express presence of at least one or more third antennas, different from the first antenna, and, associated therewith, of a second switch and a second controller for connecting either the first antenna or the at least one or more third antennas to a matching circuit so as to change the operation frequency band of the mobile communications terminal by controlling the second switch.

3.4 The consequence of the first aspect is the circumstance that for any of the possible antenna length configurations resulting from a connection of the first antenna to a second antenna only one switch is activated (closed).

The second aspect adds the functionality of multi-band operation to the mobile communications terminal.

In view of the fact that there is no functional relationship and thus no synergistic interaction between the first and the second aspect, the merits for inventive step of the two aspects can be assessed separately. Indeed, in its formulation of the objective problem, the appellant even disregards the second aspect.

3.5 In the appellant's view, the need for only one switch to be closed in order to establish a certain combined antenna length from the first antenna and one of the plurality of second antennas simplified the demands on the functionality of the first controller for determining the configuration with the optimal signal

transmission/reception quality. In comparison to a series connection of antenna elements as taught by document D1, in which the provision of increasing antenna lengths and the final change to the optimal configuration required a simultaneous activation of several switches, the respective controller of the claimed antenna apparatus could operate with a simpler control logic so that the process of determining and establishing the optimal antenna length by sequentially switching through all possible configurations became easier and faster. The objective problem underlying the claimed invention was thus to be seen in the desire to simplify the first controller and its mode of operation in establishing the optimal antenna length.

3.6 These alleged advantages and the objective technical problem derived from them find no support in the teaching of the application documents as filed. Rather, the appellant's assessment is speculative and thus does not convince the Board.

Figure 3 of the application illustrates a series arrangement of second antenna elements of equal length which are to be connected to the first antenna by means of a corresponding series of activated switches. Figure 4 illustrates a parallel arrangement of second antenna elements of different lengths which are to be selectively connected to the first antenna by means of one respectively activated switch. These two variations are presented as equivalent solutions to the problem of adapting the antenna length to changes in the operation environment. There is no indication in the application as filed that the arrangement according to Figure 4 would possess any advantage over the arrangement

according to Figure 3, which basically corresponds to what is shown in Figure 2 of document D1.

In fact, in terms of the required number of second antennas, the number of individually addressable switches and their associated control lines, as well as the number of antenna configurations to be established and evaluated for determining the optimal antenna length, no difference exists between a series arrangement and a parallel arrangement of second antenna elements and switches. Thus there is no structural or functional difference apparent between these two alternative arrangements as regards the complexity of the control logic for establishing the respective antenna configurations and for measuring and evaluating the associated signal quality. Likewise, given the fact that the state of the switches is controlled and maintained by DC signals, no substantial difference in energy consumption exists between antenna length configurations requiring one activated switch or a plurality of simultaneously activated switches. In terms of space consumption, the parallel arrangement of a number of second antennas, each having a different length, appears even to be disadvantageous with respect to a functionally equivalent series arrangement of the same number of second antennas, each having a length which would correspond to the shortest one of the second antennas of the parallel arrangement.

3.7 Consequently, instead of being confronted with a problem as conceived by the appellant, the skilled person, when setting out from the teaching of document D1, is rather faced for instance with the mundane task of how to practically implement the known antenna

apparatus with an antenna length adjustor and a MEMS-type switching device.

Guidance in this respect is offered for instance by document D2. This document relates to an antenna apparatus of a mobile communications terminal and shows a variety of examples of how antenna elements can be integrated with MEMS-type switches for achieving antenna configurations of selectable electrical lengths (D2 : claims 20 and 31; paragraphs [0015], [0016], [0039], [0042], [0049], [0050] and [0057]; Figures 3, 7 and 11). In particular, the embodiment of Figure 3 of document D2 illustrates how a series connection of antenna elements, each being of equal length, and of respective switches resembling the arrangement illustrated in Figure 2 of document D1 can be practically implemented on a circuit board. At the same time, the skilled person learns from document D2 about equivalent arrangements which offer alternative geometries but nevertheless allow the same goals to be achieved. For instance, Figure 7 of document D2 shows a parallel arrangement of antenna elements 112a, 112b, 112c, each of different length, in which the longest element 112a can be selectively connected to one of the plurality of shorter elements 112b or 112c by an individually controlled MEMS 106 so as to change the antenna length. A further example of selectively establishing three antenna lengths from antenna elements of differing lengths 112b, 112c, 112d arranged in parallel is shown by Figure 11 of document D2.

3.8 As a practical application of the antenna length adjustor, document D2 mentions only the change of the operation frequency band of the mobile communications

terminal (D2 : paragraphs [0005] and [0043]). Nevertheless, it is apparent from document D2 that the principle of implementing antenna elements and switches of the MEMS-type does not depend on the extent by which the length of two antenna configurations differs and thus is generally applicable to antenna length adjustors serving other purposes as well.

Applying the teaching provided by document D2 to an antenna apparatus as known from document D1, the most straightforward option for the skilled person would certainly be to adopt the example of the series arrangement of Figure 3 of document D2 in order to practically implement the antenna length adjustor for adapting the antenna length to changes in the operation environment as sketched in Figure 2 of document D1.

At the same time however, no exercise of inventive skill is required for the skilled person to recognize that a functionally equivalent antenna length adjustor would be achieved by adopting the alternative parallel arrangement according to the example of Figure 7 of document D2. Merging the teachings of documents D1 and D2, it would thus be obvious for the skilled person to alternatively devise an antenna apparatus with an antenna length adjustor for which each of the second antennas has a different length and the variation of the antenna length takes place by the activation of a respective single switch which connects a selected one of the second antennas to the first antenna, according to the first aspect indicated in paragraph 3.3 above.

3.9 The second aspect by which the claimed subject-matter differs from the antenna apparatus as known from

document D1 concerns commonly-known measures (*ie* the provision of a second switch and a second controller) which are indispensable for realizing the functionality of a multi-band operation as it is already addressed in document D1 (page 1, lines 17 to 18; page 13, lines 7 to 12; page 14, lines 9 to 21) in a mobile communications terminal and specifies in this context a straightforward design option (*ie* the provision of a third antenna different from the first antenna).

Therefore, the said second aspect does not support the presence of an inventive step, either.

3.10 In addition to alleging certain advantages of the claimed antenna structure (cf paragraphs 3.5 and 3.6 above), the appellant argued in support of inventive step that the antenna structure known from document D1 would not function with a single switch and that the skilled person had no incentive to adapt or modify the strict teaching of the document. On the other hand, it was doubtful whether the skilled person would consult document D2, since it did not address a variation of the antenna length according to a signal transmission/reception quality and thus did not disclose a repeated or sequential changing of the antenna length for the purpose of fine tuning the resonance frequency. Moreover, even if the skilled person did consult document D2, it would not be apparent to him why and how exactly the antenna structure shown by Figure 2 of document D1 could or would have to be modified so as to arrive at the claimed arrangement, which corresponded to the arrangement shown by Figure 4 of the present application. Thus, in order to arrive at the claimed

antenna apparatus, the skilled person would have to selectively pick suitable pieces of information from document D2 and to purposefully reassemble them in the antenna apparatus of document D1. Such a task could not be achieved without the benefit of hindsight.

These arguments cannot convince the Board because they are based on the unproven presumption that the skilled person would only consider modifying the antenna structure of Figure 2 of document D1 for the purpose of devising an antenna apparatus the optimal antenna length of which was easier to determine and to establish. As explained in paragraph 3.7 above, the Board considers that the skilled person would routinely consult documents, such as document D2, which offer advice and instruction as to the practical implementation of antenna elements and MEMS-type switches and would adopt such teaching in order to build an antenna of adjustable length for the antenna apparatus of a mobile communications terminal as known from document D1. In this context, it can be expected from the notional skilled person to take note of the complete teaching of document D2, which offers by the embodiment of Figure 7 a functionally equivalent alternative (*ie* a parallel arrangement of antenna elements and switches) to the series arrangement of Figure 3. By the simple choice of the other one of two functionally identical alternatives, the skilled person arrives at the claimed structure and arrangement of the first and second antennas.

3.11 For the above reasons, the Board has arrived at the conclusion that the subject-matter of claim 1 of the appellant's main request is rendered obvious by the teachings of documents D1 and D2.

Consequently, the appellant's main request does not meet the requirement of Articles 52(1) and 56 EPC 1973 having regard to inventive step and is therefore not allowable.

4. Auxiliary request - inventive step (Article 52(1) EPC and Article 56 EPC 1973)

The amendments made to claim 1 of the auxiliary request add some detail to the operation of the first controller for repeatedly establishing, setting and, if necessary, re-detecting the combination of a first and a second antenna which has the optimal signal reception/transmission quality.

Since the controller of the antenna length adjustor of the antenna apparatus known from document D1 possesses all of the additionally-claimed functionalities (D1: page 9, line 9 to page 10, line 12; page 18, lines 5 to 13), the subject-matter of claim 1 of the auxiliary request lacks inventive step for the same reasons as are set out above for the subject-matter of claim 1 of the main request.

In fact, the appellant did not submit any specific argument in support of inventiveness of the auxiliary request.

In consequence, the appellant's auxiliary request does not meet the requirement of Articles 52(1) and 56 EPC 1973 having regard to inventive step and is therefore not allowable, either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar | The Chairman

R. Schumacher | B. Schachenmann