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**Datasheet for the decision  
of 19 March 2024**

**Case Number:** T 1228/22 - 3.5.05

**Application Number:** 14825013.7

**Publication Number:** 3080686

**IPC:** G06F3/043, G06K9/00

**Language of the proceedings:** EN

**Title of invention:**

Micromechanical ultrasonic transducers and display

**Applicant:**

Qualcomm Incorporated

**Headword:**

Micromechanical transducer/QUALCOMM

**Relevant legal provisions:**

EPC Art. 56

RPBA 2020 Art. 12(4), 12(6)

**Keyword:**

Inventive step - main request, 1st and 2nd auxiliary requests (no): obvious combination of known features  
Admittance of claim requests not admitted by the examining division - 3rd and 4th auxiliary requests (no): no erroneous exercise of discretion  
Admittance of claim requests with the appeal - 5th and 6th auxiliary requests (no): no reasons provided + not suitable to address the relevant issues

**Decisions cited:**

T 1520/14



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Case Number: T 1228/22 - 3.5.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.05**  
**of 19 March 2024**

**Appellant:** Qualcomm Incorporated  
(Applicant) 5775 Morehouse Drive  
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**Representative:** Emde, Eric  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 11 January 2022  
refusing European patent application No.  
14825013.7 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chair** K. Bengi-Akyürek  
**Members:** N. H. Uhlmann  
R. Romandini

## Summary of Facts and Submissions

- I. The appellant (applicant) appealed against the examining division's decision to refuse the European patent application in suit.
- II. The following prior-art documents are referred to in the decision under appeal:  
  

**D1:** US 2013/0201134 A1  
**D3:** US 2010/0237992 A1  
**D7:** US 2010/0148627 A1.
- III. The board summoned the appellant to oral proceedings and set out its provisional opinion in a communication under Article 15(1) RPBA.
- IV. On 29 February 2024, the appellant informed the board that it will not be attending the scheduled oral proceedings and asked for a written decision.
- V. The oral proceedings were thus cancelled (cf. Article 12(8) RPBA).
- VI. The appellant requested that the decision under appeal be set aside and that a patent be granted based on the claims of a **main request** or one of **first to sixth auxiliary requests**, all as filed with the statement of grounds of appeal.

VII. Claim 1 of the **main request** reads as follows:

"A display device (40), comprising:  
a display (30);  
a piezoelectric micromechanical ultrasonic transducer,  
PMUT, array (105) proximate the display; and  
a control system (110), wherein the control system is  
capable of:

making a determination whether to operate at least  
a portion of the PMUT array in at least one of a  
low-frequency mode or a high-frequency mode; and

controlling at least a portion of the PMUT array to  
operate in at least one of the low-frequency mode or  
the high-frequency mode, according to the  
determination, wherein the low-frequency mode  
corresponds to a frequency range of approximately 50  
kHz to 200 kHz and wherein the high-frequency mode  
corresponds to a frequency range of approximately 1 MHz  
to 25 MHz."

VIII. Claim 1 of the **first auxiliary request** differs from  
claim 1 of the main request in that the following  
clause has been added to claim 1:

"the PMUT array comprising first PMUT elements  
operable in the low-frequency mode and second PMUT  
elements operable in the high-frequency mode".

IX. Claim 1 of the **second auxiliary request** differs from  
claim 1 of the first auxiliary request in that the  
following clause has been added to claim 1 at the end:

"wherein the control system is capable of  
controlling a portion of the PMUT array that is  
disposed in the peripheral area of the display for

at least one of fingerprint sensor functionality, signature pad functionality, stylus detection functionality, gesture detection functionality or button functionality".

- X. Claim 1 of the **third auxiliary request** differs from claim 1 of the main request in that the following clauses have been added to claim 1:

"a housing (41);"

"multiple microphones (46) on the front and/or back of the housing for enhanced audio clarity and noise cancellation;"

"wherein the low-frequency mode corresponds to a gesture detection mode, wherein free-space gestures near the display are detected;"

"using at least some of the multiple microphones for receiving ultrasonic waves generated by the PMUT elements to further aid in gesture detection".

- XI. Claim 1 of the **fourth auxiliary request** differs from claim 1 of the third auxiliary request in that the following clauses have been added to claim 1:

"a substrate (160);"

"wherein at least a portion of the PMUT array is disposed on the substrate;"

"a plurality of thin-film transistors, TFTs, wherein at least a first array of TFTs is disposed on the substrate and includes circuitry for controlling the display, and at least a second

array of TFTs is disposed on the substrate and includes circuitry for controlling at least a portion of the PMUT array;"

XII. Claim 1 of the **fifth auxiliary request** differs from claim 1 of the third auxiliary request in that the clauses enlisted in points VIII. and IX. above have been added to claim 1.

XIII. Claim 1 of the **sixth auxiliary request** differs from claim 1 of the fourth auxiliary request in that the clauses enlisted in points VIII. and IX. above have been added to claim 1.

### **Reasons for the Decision**

1. The present application relates to a display device and a "piezoelectric micromechanical ultrasonic transducer (PMUT) array" which is positioned in the proximity of the display. The elements of the array may be operated in a low-frequency or a high-frequency mode.

#### **2. Main request - claim 1 - inventive step**

2.1 This request is the same as the main request underlying the contested decision. Claim 1 includes the following limiting features (board's labelling and emphasis):

- (a) a display device, comprising:
- (b) a display;
- (c) a PMUT array proximate the display; and
- (d) a control system, wherein the control system is capable of:

- (e) making a determination whether to operate at least a portion of the PMUT array in at least one of a low-frequency mode or a high-frequency mode;
- (f) controlling at least a portion of the PMUT array to operate in at least one of the low-frequency mode or the high-frequency mode, according to the determination,
- (g) wherein the low-frequency mode corresponds to a frequency range of approximately 50 kHz to 200 kHz and
- (h) wherein the high-frequency mode corresponds to a frequency range of approximately 1 MHz to 25 MHz.

## 2.2 Claim interpretation

2.2.1 The "PMUT array" referred to in **feature (c)** is a set of PMUT elements. The number of the elements and their position relative to each other are not defined in claim 1. For instance, the elements

- could be positioned along a line or
- could form a two-dimensional matrix in a plane or
- a three-dimensional matrix.

2.2.2 The wording "proximate the display" used in **feature (c)** is very broad and specifies merely that the "array" is positioned near, i.e. not far from, the display.

2.2.3 As to feature (e), the "control system" is capable of determining "whether to operate at least a portion of the PMUT array in at least one of a low-frequency mode or a high-frequency mode". For example, the "control system" may determine that a first "portion", which is tailored to the "low-frequency mode", is to be operated in this mode. Similarly, the "control system" may



determine that a second "portion", which is tailored to the "high-frequency mode", is to be operated in this mode (cf. also "first PMUT elements" and "second PMUT elements" in present claim 5). Though, feature (e) does not require that one specific "portion" of the "array" must be able to deal with both types of frequencies. The same observations apply to **feature (f)**.

### 2.3 Distinguishing features

Document **D1** discloses a PMUT array and its use for detecting fingerprints and the location of a pointing object (e.g. finger or a pen). More specifically, it discloses a device comprising a display and an ultrasonic device able to emit ultrasonic waves, using a plurality of piezoelectric transmitters, and to detect reflected ultrasonic waves, using a plurality of piezoelectric detectors. Further, the ultrasonic device may be attached to a "display monitor layer" (see paragraphs [0005] to [0007] and [0029]). The ultrasonic device is able to detect **both**

- a location of a "pointing object", e.g. a finger (paragraph [0029]) and
- a "fingerprint" of a finger (paragraphs [0030] and [0033]).

The ultrasonic device includes further an "electronic control system" (paragraph [0035]). Consequently, document D1 discloses features (a) to (d) and fails to disclose **features (e) to (h)**. Furthermore, D1 discloses that the ultrasonic device is able to detect the two

aspects of an object pointing to the display referred to above.

#### 2.4 Technical effect of the distinguishing features

Document D1 refers to "timing signals" provided to the transmitters of the ultrasonic device (see paragraph [0035]), but does not disclose any details in this regard. The distinguishing **features (e) to (h)** provide implementation details of the control of the "PMUT array", hence they lead to a completed implementation. The board notes that the application as filed does not appear to set out any particular technical effect caused by those distinguishing features. Furthermore, it is not apparent how these features could contribute towards the effect relied on by the appellant, i.e. "saving of energy".

2.5 The objective technical problem to be solved is rather seen as *how to implement in detail the "timing signals" provided to the transmitters of the ultrasonic device of D1 such that a location of a pointing object and a fingerprint of a finger can be properly detected, i.e. such that those functions, which are already disclosed in document D1, can be properly implemented.*

#### 2.6 Inventive step

Considering that the objective technical problem refers to two functions already disclosed in D1, the skilled person would have consulted both documents **D3** (i.e. disclosing the use of a relatively high frequency of around 20 MHz for a piezoelectric transmitter for *detecting a fingerprint*, see paragraphs [0071] and [0096]) and **D7** (i.e. disclosing that a relatively low

frequency of 100 kHz is typically used for the *detection of the location* of a pointing device and/or fingerprint, see paragraph [0073]). It is also a generally known physical property of ultrasound signals that *lower* frequencies can be used to detect objects over longer distances, like the distance between the ultrasonic device 50 and a finger or input pen (see Figure 1 and paragraph [0045] of D7). In view of these observations, the skilled person would have been motivated to implement a control circuit which is actually able to control a *part* of the ultrasonic device, or the *complete* device to operate at 20 MHz and another *part*, or the *complete* device, to operate at 100 kHz. This implementation falls well within the terms of claim 1. Thus, the subject-matter of claim 1 does not involve an inventive step.

For the sake of completeness, the board notes that, according to the appellant (last paragraph on page 5 of the statement of grounds of appeal), "the skilled person would built a fingerprint PMUT array and a touch PMUT array each tailored for the specific purpose and put them in adjacent areas". However, as explained in point 2.2.3 above, two tailored PMUT arrays, which are both positioned adjacent to each other and to the display, fall well within the scope of present claim 1.

2.7 For these reasons, the board confirms the finding in the decision under appeal that the subject-matter of claim 1 of the main request does not involve an inventive step (Article 56 EPC).

**3. First auxiliary request - claim 1 - inventive step**

3.1 This request is the same as the first auxiliary request underlying the contested decision. Claim 1 differs from claim 1 of the main request in that it further specifies that

(i) the PMUT array comprises first PMUT elements operable in the low-frequency mode and second PMUT elements operable in the high-frequency mode.

3.2 The claim interpretation set out in point 2.2 above applies also to claim 1 of the first auxiliary request.

3.3 Consequently, the subject-matter does not involve an inventive step for the reasons given in point 2 above for the main request (Article 56 EPC).

**4. Second auxiliary request - claim 1 - inventive step**

4.1 This request is the same as the second auxiliary request underlying the contested decision. Claim 1 differs from claim 1 of the first auxiliary request in that it further specifies that

(j) the control system is capable of controlling a portion of the PMUT array that is disposed in the peripheral area of the display for at least one of fingerprint sensor functionality, signature pad functionality, stylus detection functionality, gesture detection functionality or button functionality.

4.2 Document D1 discloses a fingerprint sensor and a gesture detection functionality but fails to disclose that "a portion of the PMUT array that is disposed in the peripheral area of the display" is controlled accordingly within the meaning of added feature (j). The appellant argued that this feature led to "energy savings" and thus solved the objective problem of "how to save energy when using the PMUT array".

4.3 In view of this problem, the skilled person would have considered that, as a rule, detecting a "fingerprint" does not require the entire area of the PMUT array in the system of D1 and thus have foreseen that only a *part* of the PMUT array is used, e.g. by reading out the signals only from a subset of the piezoelectric detectors. Positioning of the subset in the peripheral area of the display in D1, however, amounts to an obvious selection of well-known and equally likely implementation measures which does not lead to any synergistic technical effect. Hence, the skilled person would have indeed come up with such a modification of the system of D1 and would have arrived at the solution defined in claim 1 of the second auxiliary request. Furthermore, the distinguishing features referred to in points 2.3 and 4.2 above do not lead to any synergistic effect either.

4.4 For these reasons, the subject-matter of claim 1 likewise does not involve an inventive step (Article 56 EPC).

## **5. Third and fourth auxiliary requests - admittance**

5.1 These requests are the same as the third and fourth auxiliary requests underlying the contested decision. Claim 1 further specifies, *inter alia*, that

- (k) multiple microphones on the front and/or back of the housing are used for enhanced audio clarity and noise cancellation
- (l) at least some of the multiple microphones are used for receiving ultrasonic waves generated by the PMUT elements to further aid in gesture detection.

5.2 These two auxiliary requests were filed during the oral proceedings before the examining division. They were not admitted into the proceedings, because the features added from the description were not searched and it could not be legitimately expected that they were in fact searched. According to the examining division, non-searched features could however not be examined.

5.3 Under Article 12(6), first sentence, RPBA, the board shall not admit requests which were not admitted in the proceedings leading to the decision under appeal, unless the decision not to admit them suffered from an error in the use of discretion or unless the circumstances of the appeal case justify their admittance.

5.4 The examining division has exercised its discretion in accordance with the right principles and in a reasonable way. It is correct to apply the criterion of "clear allowability" for requests filed during the oral proceedings, i.e. after the date set under Rule 116(2) EPC. It is also reasonable to come to the conclusion that a claim request is not clearly allowable if the allowability hinges on features which were not searched. Finally, the board does not find fault with the finding that the features (k) and (l) were not subject to a complete search.

The appellant's arguments are not persuasive. The alleged "core of the invention" is not apparent from the application documents, which do not relate to minimising the power consumption at all. Furthermore, according to feature (k), additional components ("microphones") are added to the claimed "display device". These microphones are used "for enhanced audio clarity and noise cancellation", i.e. for purposes which are unrelated to the subject-matter of the claims as originally filed. It is mentioned only in paragraph [0096] of the description as filed that the microphones could also be used "to further aid in gesture detection" and no objective reason is apparent why a claim amendment might be directed to microphones, in particular taking into consideration that current claim 1 and claim 5 as originally filed refer to a detection of "free-space gestures near the display" and not to any unspecific "gesture detection". In this regard, the board agrees with the finding of decision **T 1520/14**, Reasons 5.7.5, that there is no obligation on a search division to extend the search to a feature mentioned in the description where there is no objective reason to expect that future amendments might be directed to precisely this feature.

- 5.5 The board is also not aware of any circumstances of the appeal case which would justify the admittance of the third and fourth auxiliary requests into the appeal proceedings.
- 5.6 In view of these observations, the board has not admitted the third and fourth auxiliary requests into the appeal proceedings (Article 12(6), first sentence, RPBA).

**6. Fifth and sixth auxiliary requests - admittance**

- 6.1 The claims of these requests are a combination of the claims of the second and third auxiliary requests and second and fourth auxiliary requests, respectively.
- 6.2 These auxiliary requests were filed for the first time with the statement of grounds of appeal. Accordingly, they are to be regarded as an "amendment" of the appellant's case within the meaning of Article 12(4) RPBA.
- 6.3 The appellant did not provide any reasons for submitting these amendments in the appeal proceedings, and the board is not aware of any such reasons. Furthermore, it is apparent that these auxiliary requests do not overcome the objections raised in the decision under appeal which effectively led to the non-admittance of the third and fourth auxiliary request (cf. Article 12(4), fifth sentence, RPBA).
- 6.4 For these reasons, the board has not admitted the fifth and sixth auxiliary requests into the appeal proceedings (Article 12(4) RPBA).



**Order**

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

The appeal is dismissed.

The Registrar:

The Chair:



B. Brückner

K. Bengi-Akyürek

Decision electronically authenticated