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Datasheet for the decision of 22 November 2013

Case Number: T 0345/11 - 3.5.03

Application Number: 06845864.5

Publication Number: 1969890

IPC: H04Q7/38

Language of the proceedings: EN

Title of invention:
Methods and apparatus for generating, communicating, and/or using information relating to self-noise

Applicant:
Qualcomm Incorporated

Headword:
Communicating self-noise information/QUALCOMM

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - no (all requests)"

Decisions cited:
T 0231/97

Catchword:

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Case Number: T 0345/11 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 22 November 2013

Appellant: (Applicant)
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Decision under appeal:
Decision of the Examining Division of the European Patent Office posted on 30 September 2010 refusing European patent application No. 06845864.5 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: F. van der Voort
Members: T. Snell
R. Moufang

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division refusing European patent application No. 06845864.5, with international publication number WO 2007/075736 A.

The refusal was based on the ground, *inter alia*, that the subject-matter of claim 1 of the main request and the auxiliary request respectively did not meet the requirement of inventive step pursuant to Article 52(1) EPC in combination with Article 56 EPC with respect to the disclosure of document D1:

D1: WO 2004/077685 A

II. The applicant filed a notice of appeal against the above decision. The appellant requested that the impugned decision be reversed and a patent be granted. In the statement of grounds of appeal, the appellant requested that a patent be granted on the basis of the claims of either the main request refused by the examining division or, alternatively, the claims of either Auxiliary Request I or II, both filed together with the statement of grounds of appeal.

Oral proceedings were conditionally requested.

III. In a communication accompanying a summons to oral proceedings, the board gave a preliminary opinion that the subject-matter of claim 1 of each request did not involve an inventive step.

IV. In reply, the appellant maintained the requests on file and additionally submitted claims of Auxiliary Request III.

In addition, the appellant submitted two documents in support of its arguments with respect to inventive step:

Exhibit E1: Wikipedia page entitled "Probability integral transform".

Exhibit E2: R. Hickling, "Noise Control and SI Units", Journal of the Acoustical Society of America, Vol. 106, Issue 6, December 1999, page 3048.

V. Oral proceedings were held on 22 November 2013. At the oral proceedings, the appellant withdrew Auxiliary Request III and submitted claims of Auxiliary Request IV.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed with the letter dated 2 September 2009 or, in the alternative, of Auxiliary Request I or II, both filed with the grounds of appeal, or of Auxiliary Request IV, submitted in the oral proceedings.

After due deliberation, the chairman announced the board's decision.

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

"A method (400) of operating a wireless terminal, the method comprising:
i) determining (404) a downlink signal to noise ratio saturation level; and
ii) transmitting (406) said determined signal to noise ratio saturation level; wherein said downlink signal to

noise ratio saturation level is a downlink signal to noise ratio that said wireless terminal would measure on a received signal that was transmitted by a base station at infinite power; and
wherein said downlink signal to noise ratio saturation level is a function of wireless terminal self-noise;
wherein the wireless terminal self-noise is a signal-dependent component to the noise."

Claim 1 of **Auxiliary Request I** reads as follows:

"A method (400) of operating a wireless terminal, the method comprising:
i) determining (404) a downlink signal to noise ratio saturation level; and
ii) transmitting (406) said determined signal to noise ratio saturation level as a quantized dB value to a base station using OFDM signals;
wherein said downlink signal to noise ratio saturation level is a downlink signal to noise ratio that said wireless terminal would measure on a received signal that was transmitted by a base station at infinite power; and
wherein said downlink signal to noise ratio saturation level is a function of wireless terminal self-noise;
wherein the wireless terminal self-noise is a signal-dependent component to the noise."

Claim 1 of **Auxiliary Request II** reads as follows:

"A method (400) of operating a wireless terminal, the method comprising:
i) determining (404) a downlink signal to noise ratio saturation level; and
ii) transmitting (406) said determined signal to noise ratio saturation level as a quantized dB value to a

base station using OFDM signals; wherein determining a downlink signal to noise ratio saturation level comprises
measuring the received power of multiple NULL tones to determine an interference power N;
measuring the received power of a pilot signal GP_0;
determining the signal to noise ratio of said received pilot signal SNR_0; and
calculating the downlink signal to noise ratio saturation level by the formula $(1/SNR_0 - N/(GP_0))^{-1}$."

Claim 1 of **Auxiliary Request IV** reads:

"A method (400) of operating a wireless terminal, the method comprising:
i) determining (404) a downlink signal to noise ratio saturation level; and
ii) transmitting (406) said determined signal to noise ratio saturation level as a quantized dB value to a base station using OFDM signals;
wherein said downlink signal to noise ratio saturation level is a downlink signal to noise ratio that said wireless terminal would measure on a received signal that was transmitted by a base station at infinite power; and
wherein said downlink signal to noise ratio saturation level is a function of wireless terminal self-noise;
wherein the wireless terminal self-noise is a signal-dependent component to the noise;
further comprising:
prior to performing said transmitting step, making a determination as to whether said downlink signal to noise ratio saturation level is to be transmitted in an uplink transmission unit dedicated to said wireless terminal in which said wireless terminal can select to

transmit said downlink signal to noise ratio saturation level or other information;
wherein determining a downlink signal to noise ratio saturation level includes:
measuring the received power of multiple tones corresponding to a NULL base station output to thereby determine an interference power N;
measuring the received power of a pilot signal GP_0;
determining the signal to noise ratio of said received pilot signal SNR_0; and
calculating the downlink signal to noise ratio saturation level by the formula:
downlink signal to noise ratio saturation level = $(1/SNR_0 - N/(GP_0))^{-1}$."

Reasons for the Decision

1. *Inventive step*

The subject-matter of claim 1 of each of the requests does not involve an inventive step (Articles 52(1) and 56 EPC) for the reasons set out below.

2. Claim 1 - main request

2.1 The present application concerns the determination and transmission of a value representing "a downlink signal to noise saturation level" by a wireless terminal. In accordance with claim 1, this value is "a downlink signal to noise ratio that said wireless terminal would measure on a received signal that was transmitted by a base station at infinite power" and is "a function of wireless terminal self-noise", ie "a signal-dependent component to the noise".

2.2 The closest prior art is represented by D1, cf. in particular the embodiment of Figure 5, described on page 21, line 4 to page 23, line 19 of D1. This embodiment relates to a wireless terminal having an omnidirectional antenna (cf. page 21, lines 27-30). According to this embodiment (see Fig. 5), the OFDM spectrum includes a single NULL pilot tone, ie a tone with zero transmission power. As stated on page 21, lines 30-31, "By looking at the received signal for the pilot, the WT [wireless terminal] ... is able to measure the SNR [signal to noise ratio]".

2.3 The appellant did not dispute the finding of the examining division that D1 discloses in connection with this embodiment the determination of a value SRR1 which is the <u>inverse</u> of a downlink signal signal to noise ratio saturation level falling within the scope of claim 1. In particular, SRR1 = γ/α (cf. D1, page 23, line 10), where γ is a proportionality factor representing the ratio between the signal-dependent noise ("self-noise") and the transmit power P (ie the signal-dependent noise = γP), and α represents the channel gain (cf. page 22, lines 20-22). The value SRR1 is reported by the wireless terminal to the base station (cf. page 23, lines 18-19). Hence the only distinguishing feature between the subject-matter of claim 1 and the disclosure of this embodiment of D1 is that the value 1/SRR1 is reported to the base station rather than SRR1.

2.4 However, the board notes that in D1 on page 24, lines 17-18, it is stated that "rather than sending SNRO(P) and SRR1, there are equivalent sets of reports that the WT 1300 can send to the BS 1200, which fall within the scope of the invention". In connection with the embodiment of Figure 5, the nature of possible equivalents is not indicated.

2.5 The problem to be solved can thus be seen as finding equivalent sets of values to SNRO(P) and SRR1 suitable for the embodiment of Figure 5. The board agrees with the appellant that the skilled person who would be faced with this problem is a telecommunications engineer.

2.6 In order to solve this problem, the skilled person would take account of Fig. 3 of D1 which is a graph including a line 305 showing the dependence of noise on transmitted signal power and "is used for explaining the present invention" (cf. page 8, lines 8-9). In connection with Fig. 3, it is stated that (cf. page 19, lines 15-19) "The WT 1300 can then also communicate the parameters of this line 305 (for example slope and intercept, or some other equivalent set of information)" (board's underlining). In Fig. 3, the X-axis represents the value of total noise, ie signal independent noise plus signal dependent noise. Using the terminology of page 22, lines 20-25, this noise is equal to $N + \gamma P$, where N denotes the signal-independent noise. The Y axis represents the received power, ie αP (cf. page 22, lines 20-21). It follows that the gradient (ie the slope) of the line 305 is equal to $\alpha P / \gamma P$, or α / γ, or 1/SRR1 (cf. point 2.3). In other words, the skilled person is taught here to transmit the value 1/SRR1 rather than SRR1. In the board's view, the skilled person would regard Fig. 3 and the corresponding description as a general explanation of the invention of D1 which is applicable to the later embodiments, including that of Fig. 5. The skilled person starting out from the embodiment of Fig. 5 would therefore conclude that alternatively, the value 1/SRR1 may equivalently be transmitted.

2.7 The appellant argued that Fig. 3 and Fig. 5 concerned different embodiments and would not be considered in combination, since the description concerned with Fig. 3 mentions NULL pilot signal<u>s</u> (cf. page 19, lines 7-14) whereas Fig. 5 shows clearly only a single NULL pilot. The board however finds this argument unconvincing since Fig. 3 is mentioned in the detailed description of Fig. 5 (cf. page 23, line 12). Moreover, the skilled person would readily appreciate that the number of NULL pilots makes no difference to the technical analysis set out in connection with Fig. 3 on page 19 and Fig. 5 on pages 22 and 23.

2.8 The board concludes that the subject-matter of claim 1 of the main request does not involve an inventive step (Articles 52(1) and 56 EPC).

3. Claim 1 - Auxiliary Request I

3.1 Claim 1 of Auxiliary Request I differs from claim 1 of the main request in that it is further specified that the downlink signal to noise ratio saturation level is transmitted "as a quantized dB value to a base station using OFDM signals".

3.2 Since D1 also makes use of OFDM signals, the only difference is the conversion of the value 1/SRR1 to a quantized dB value. In fact, D1 makes no mention in what form either SRR1 or 1/SRR1 is sent.

3.3 In the board's view the use of decibel values for representing signal to noise ratios belonged to the skilled person's common knowledge (cf. eg Exhibit E2, cited by the appellant, first sentence, according to which the practice was "deeply entrenched" in noise control).

In the statement of grounds (cf. point 8) the appellant argues that "the use of a logarithmic (dB) scale ... may only be considered by a skilled person as a matter of routine if those parameter values have a wide dynamic range, in order to compress this range to a smaller range. However, document D1 discloses that SRR1 takes values in the small interval [0, 1]".

The board agrees that the use of logarithmic values is obvious when the dynamic range is wide. The board also notes that small values within the interval [0, 1] may have a large dynamic range (eg 0.001 to 0.1 are values within the quoted range varying by a factor of 100). In the present case the values determined experimentally in the system of D1 will apparently be small values having a large dynamic range (cf. point 11 of the statement of grounds and Figure 6 of the present application when considering a value 1/SRR1 determined from the logarithmic inverse of the "saturation level of DL SNR"). The board concludes that the use of a decibel representation for 1/SRR1 was obvious at the priority date.

3.4 The appellant argued that in D1 the [quantised] value SRR1 could take only three values, namely 0, 0.5 or 1 (cf. D1, Fig. 6 and page 23, lines 21-27 of the description). Hence it would not be obvious to use a logarithmic representation, especially considering that the value 0 cannot be represented logarithmically. However, the board considers that Fig. 6 of D1 merely depicts curves for certain theoretical values of SRR1, two of which correspond to no signal-dependent noise at all and signal-dependent noise being equal to the signal itself respectively, which values clearly would never be measured in a practical system. Further, in the board's view there is no suggestion in D1 that the value SRR1 should be quantised to take one of these three values only. In fact this would make no technical sense since the value of SRR1 in practice is always close to zero (cf. the statement of grounds, point 11).

3.5 The appellant also argued that the skilled person has the more obvious option of using a 32 or 64-bit floating point binary representation. However, the appellant comments himself that since bandwidth is a scarce resource in wireless communication, such a solution is clearly undesirable (cf. the statement of grounds, point 13). All the more reason then to conclude that the use of decibels, commonly used for the reporting of signal to noise ratios, would be the obvious choice.

3.6 The appellant also argued (cf. point 15 of the statement of grounds) that "It is the merit of the inventors ... to have realized that by transforming the values of SRR1 in the interval of interest using the function *f1(SRR1) = log(1/SRR1)*, the resulting probability distribution of *f1(SRR1)* becomes approximately constant".

In point 16, it is stated "If this interval is uniformly quantized, the probability distribution of the transformed values *f1(SRR1)* falling in any of the equal-sized bins, i.e. being mapped on any one of the available 4-bit patterns, is the same. Accordingly, in this case the choice of uniform quantization is optimal ...".

However, in the board's view this alleged optimisation with regard to 4-bit quantisation would be achieved as an inherent consequence of using decibels. As explained above, the skilled person would find the use of decibels obvious whether or not he was aware of this further alleged advantage. According to established case law, an unexpected bonus effect does not confer inventiveness on an obvious solution (cf. eg T 231/97, point 5.7.5.2). Moreover, the board notes that the description includes no reference to this alleged optimal property of decibels.

3.7 The appellant cited document "Exhibit E2" as evidence of an alleged technical prejudice against using decibel values. The board notes that this article sets out a point of view in a rather polemic style criticising the "deeply entrenched" use of decibels. Exhibit E2 is apparently an isolated article and hence in the board's view does not represent common knowledge. On the contrary, Exhibit E2 if anything demonstrates that there was a technical prejudice in favour of using decibel values for representing noise values.

3.8 The appellant further cited document "Exhibit E1" in support of an argument that the skilled person, were he a mathematician, would not choose a decibel representation of the value SRR1, but a "probability integral transform". However, since the board agrees with the appellant that the skilled person is a communications engineer rather than a mathematician, this argument is considered not relevant.

The appellant's arguments are therefore not convincing.

3.9 For the above reasons and those set out in point 2 concerning claim 1 of the main request, the board concludes that the subject-matter of claim 1 of Auxiliary Request I does not involve an inventive step either.

4. Claim 1 - Auxiliary Request II

4.1 Claim 1 of Auxiliary Request II includes a formula for calculating the downlink signal to noise ratio saturation level, namely $(1/SNR_0 - N/(GP_0))^{-1}$. The appellant did not dispute that this was the same formula as used in D1, albeit using different terminology.

4.2 The essential distinguishing feature as compared to claim 1 of the previous requests is that the received power of multiple NULL tones is measured instead of a single NULL tone.

4.3 Firstly, the board adopts the appellant's interpretation of this feature as meaning multiple NULL tones within the same symbol period.

4.4 As regards inventive step, the appellant argued that this feature enabled an improved measurement of the noise. There was no suggestion in D1 for the skilled person to modify the OFDM spectrum used in Fig. 5 to have more than one NULL tone. Moreover, the waste of bandwidth that that would entail taught against such a step.

4.5 However, the board notes that D1 explicitly suggests in connection with an embodiment using an omnidirectional antenna deployment that "the WT .. measures the noise using the cell null pilot tone(s)" (cf. D1, page 6, lines 18-21). Consequently, the skilled person would not require inventive skill to modify the spectrum of

Fig. 5 by including further NULL tones. The fact that this would be at the expense of bandwidth does not teach against the inclusion of further NULL tones since this is a readily foreseeable disadvantage which the skilled person would accept according to circumstances, eg where the accuracy of the noise measurement based on a single tone proved to be unsatisfactory in practice.

4.6 The appellant argued that the passage on page 6 of D1 was not an explicit reference to several tones during one symbol interval, but referred to the fact that the single NULL tone occurred in each symbol interval. The board however finds this interpretation of the term "tone(s)", which is understood to mean "tone or tones", rather implausible in the present OFDM context, and certainly not the one that would most likely occur to the skilled reader.

For these reasons and those set out at points 2 and 3, the board concludes that the subject-matter of claim 1 of Auxiliary Request II does not involve an inventive step either.

5. *Claim 1 - Auxiliary Request IV*

5.1 The appellant submitted this request at the beginning of the oral proceedings as an amended version of Auxiliary Request III, which was withdrawn.

5.2 Although this request was apparently aimed only at overcoming potential objections related to Article 123(2) EPC (cf. the letter dated 22 October 2013, section V, first paragraph), the board notes that claim 1 includes the following additional features with respect to claim 1 of Auxiliary Request II:

(a) "prior to performing said transmitting step, making a determination as to whether said downlink signal to noise ratio saturation level is to be transmitted in an uplink transmission unit dedicated to said wireless terminal in which said wireless terminal can select to transmit said downlink signal to noise ratio saturation level or other information"; and

(b) measuring the received power of the multiple tones corresponding to a NULL base station output.

5.3 Insofar as feature (a) can be understood, it appears to comprise two aspects: (i) there is a dedicated uplink transmission unit (eg control channel segment, cf. paragraph [0053] of the description of the published application) which is available to the wireless terminal for transmitting said downlink signal to noise ratio saturation level or other information, and (ii) it is determined whether said downlink signal to noise ratio saturation level is to be transmitted.

5.4 Re (i): A dedicated channel (eg a control channel) used for transmitting more than one type of information was a standard feature of the air interface of mobile communications systems at the priority date.

Re (ii): This measure would be obvious to the skilled person, eg in order to send updated information only when necessary or when the dedicated channel is free.

Hence in the board's view neither of these aspects contribute to inventive step.

5.5 Feature (b) does not add anything as it was assumed in connection with claim 1 of Auxiliary Request II that the multiple tones corresponded to a (ie one) NULL base station output.

5.6 The appellant did not present any arguments in support of inventive step except to refer to those already given in respect of Auxiliary Request II (cf. the letter dated 22 October 2013, section V, final paragraph).

5.7 Consequently, for these reasons and those set out at points 2, 3 and 4, the board concludes that the subject-matter of claim 1 of Auxiliary Request IV does not involve an inventive step either.

6. Conclusion

As there is no allowable request, it follows that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Rauh F. van der Voort

Decision electronically authenticated