Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 21 December 2020

Case Number: T 2246/17 - 3.5.05

Application Number: 11808754.3

Publication Number: 2656503

IPC: H03M3/02, H04B1/04, H04L27/36

Language of the proceedings: EN

Title of invention:
WIRELESS AUDIO EQUIPMENT USING A QUADRATURE MODULATION SYSTEM

Applicant:
Shure Acquisition Holdings, Inc.

Headword:
WIRELESS AUDIO EQUIPMENT USING A QUADRATURE MODULATION SYSTEM, SIGMA-DELTA MODULATOR / Shure

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no) - obvious combination of known features - technical prejudice in the art (no)

Decisions cited:
T 0870/96

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2246/17 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 21 December 2020

Appellant: (Applicant)	Shure Acquisition Holdings, Inc. 5800 West Touhy Avenue Niles, IL 60714 (US)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 3 April 2017 refusing European patent application No. 11808754.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	A. Ritzka
Members:	N. H. Uhlmann
	F. Blumer

Summary of Facts and Submissions

I. The appellant appealed against the decision of the examining division refusing European patent application No. 11808754.3.

II. The examining division made reference to the following documents:

D1 US 2007/160164
D2 US 2009/252206
D3 WO 2004/030221
D4 WO 98/20657
D5 US 2004/223553
D6 EP 2 037 585 A1
D7 GB 2 408 858 A
D8 US 6 956 513

and decided that the main request and the first to seventh auxiliary requests did not satisfy the requirements of Article 56 EPC.

III. In its statement setting out the grounds of appeal the appellant maintained and resubmitted the main request underlying the decision under appeal and submitted modified first to fourth auxiliary requests based, respectively, on the sixth, fifth, seventh and first auxiliary requests.

IV. The board summoned the parties to oral proceedings.

V. In a communication pursuant to Article 15(1) RPBA 2020, the board set out its provisional view of the case and introduced in the proceedings an excerpt of the textbook

S. R. Norsworthy, R. Schreier and G. C. Temes, "Delta-Sigma Data Converters: Theory, Design, and Simulations," IEEE Press, New York, 1997, ISBN 0-7803-1045-4

as document DA9.

VI. Final requests

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or on the basis of any one of the first to fourth auxiliary requests, all requests as filed with the statement setting out the grounds of appeal of 14 August 2017.

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

"An apparatus (101) comprising:

an in-phase/quadrature-phase, I/Q, converter (104) adapted to receive an input signal (151) and convert the input signal to a digital in-phase, I, signal and a digital quadrature, Q, signal;

at least one oversampling noise-shaping modulator (105a) comprising a first sigma-delta modulator (203, 301; 401) arranged to convert the digital I signal to a quantized I signal and a second sigma-delta modulator (206, 301; 401) arranged to convert the digital Q signal to a quantized Q signal, wherein the quantized I signal and the quantized Q signal are quantized with a desired number of quantized bits per sample;

at least one digital-analog converter, DAC (105b; 204, 207; 306), adapted to convert the quantized I signal and the quantized Q signal to an analog I signal and an analog Q signal, respectively;

at least one filter (106; 209, 210) adapted to reduce noise components of the analog I and Q signals by a predetermined level to form filtered I and Q signals; and

an analog quadrature modulator (107; 212) adapted to transform the filtered I and Q signals and a local oscillator signal to a transmitted output signal (257), wherein the transmitted output signal is transmitted to a wireless receiver."

VIII. Claim 1 of the first auxiliary request is based on claim 1 of the main request. The designation "An apparatus" has been replaced by "A wireless microphone".

IX. Claim 1 of the second auxiliary request is based on claim 1 of the first auxiliary request. The definition of the "at least one digital-analog converter" has been replaced by

"at least one digital-analog converter, DAC (105b), comprising a first DAC (204; 306) adapted to convert the quantized I signal to an analog I signal and a second DAC (207; 306) adapted to convert the quantized Q signal to an analog Q signal"

and the definition of the "at least one filter" has been replaced by

"at least one filter (106) comprising a first filter (209) adapted to reduce noise components of the analog I signal by a predetermined level to form a filtered I signal and a second filter (210) adapted to reduce noise components of the analog Q signal by a predetermined level to form a filtered Q signal".

X. Claim 1 of the third auxiliary request reads as follows:

"A wireless microphone (101) comprising:

an in-phase/quadrature-phase, I/Q, converter (104) adapted to receive an input signal (151) and convert the input signal to a digital in-phase, I, signal and a digital quadrature, Q, signal, each of the I signal and the Q signal having M bits per sample, where M > 1;

at least one oversampling noise-shaping modulator (105a) comprising a first sigma-delta modulator (203, 301; 401) arranged to convert the digital I signal to a quantized I signal and a second sigma-delta modulator (206, 301; 401) arranged to convert the digital Q signal to a quantized Q signal, wherein the quantized I signal and the quantized Q signal are quantized with one quantized bits per sample;

at least one digital-analog converter, DAC (105b), comprising a one-bit first DAC (204; 306) adapted to convert the quantized I signal to an analog I signal and a second one-bit DAC (207; 306) adapted to convert the quantized Q signal to an analog Q signal;

at least one filter (106) comprising a baseband first filter (209) adapted to reduce out-of-band quantization noise components of the analog I signal by a predetermined level to form a filtered I signal and a second baseband filter (210) adapted to reduce out-of-band quantization noise components of the analog Q signal by a predetermined level to form a filtered Q signal; and

an analog quadrature modulator (107; 212) adapted to transform the filtered I and Q signals and a local oscillator signal to a transmitted output signal (257),

wherein the transmitted output signal is transmitted to a wireless receiver."

XI. Claim 1 of the fourth auxiliary request is based on claim 1 of the first auxiliary request. The following features have been added at the end:

"wherein the first sigma-delta modulator comprises:

an I modulator filter (405) having a transfer function;

a first I signal combiner (402) adapted to sum the digital I signal and a filtered I signal from the I modulator filter to form a first summed I signal;

an N-bit I quantizer (403) adapted to quantize the first summed I signal to form the quantized I signal in accordance with N quantized bits;

a second I signal combiner (404) adapted to subtract the quantized I signal from the first summed I signal to form a second summed I signal; and

the I modulator filter adapted to filter the second summed I signal in accordance with the transfer function to reduce a noise level of the second summed I signal to obtain the filtered I signal; and

wherein the second sigma-delta modulator comprises:

a Q modulator filter (405) having a transfer function;

a first Q signal combiner (402) adapted to sum the digital Q signal and a filtered Q signal from the Q modulator filter to form a first summed Q signal;

an N-bit Q quantizer (403) adapted to quantize the first summed Q signal to form the quantized Q signal in accordance with N quantized bits;

a second Q signal combiner (404) adapted to subtract the quantized Q signal from the first summed Q signal to form a second summed Q signal; and

the Q modulator filter adapted to filter the second summed Q signal in accordance with the transfer function to reduce a noise level of the second summed Q signal to obtain the filtered Q signal."

Reasons for the Decision

1. The present application pertains to processing of data, in particular of a signal from a microphone, for transmission over a wireless channel. The input signal is converted to two digital signals: an in-phase signal and a quadrature signal. These two digital signals are quantized to a smaller number of bits per sample, via two oversampling noise-shaping modulators comprising sigma-delta modulators, converted to analog signals, filtered and transformed using an analog quadrature modulator.

2. Document D1 describes a wireless device in which digital signals are converted into an in-phase signal and a quadrature signal, converted to analog signals, filtered and transformed using an analog quadrature modulator.

Document D4 discloses a method for quadrature modulation and digital-to-analog conversion, comprising two oversampling sigma-delta modulators.

Main request

3. Patentability

3.1 The appellant agreed with the examining division that document D1 did not disclose the following features of claim 1:

"at least one oversampling noise-shaping modulator comprising a first sigma-delta modulator arranged to convert the digital I signal to a quantized I signal and a second sigma-delta modulator arranged to convert the digital Q signal to a quantized Q signal, wherein the quantized I signal and the quantized Q signal are quantized with a desired number of quantized bits per sample".

3.2 Additionally, the appellant argued that D1 failed to disclose that the DAC and filter in D1 process a quantized I and Q signal from respective (also not disclosed) sigma-delta modulators.

The board is not persuaded. The sigma-delta modulators, as claimed, reduce the number of bits per sample (due to the quantizing) of the I and Q signals and increase the sampling frequency, due to the oversampling. E.g. reducing of the number of bytes from 16 to 15 and doubling of the sampling frequency fall under the claim's wording. The board considers that a DAC which is able to deal with 16 bits per sample is able to cope with 15 bits per sample, too. Similarly, having in mind that the application in suit overall pertains to the transmission of audible audio signals, doubling of the sampling frequency does not impose a different DAC.

With regard to the filters, the noise to be filtered out is shifted to higher frequencies, due to the oversampling. Having in mind that as a rule following a DAC low-pass filters are used, a filter with a given

cut-off frequency would filter out noise shifted to higher frequency even better.

3.3 In the statement setting out the grounds of appeal, the appellant agreed with the examining division that the invention as claimed sought to solve the technical problem of "how to relax the implementation requirements at the back-end stage (e.g. the DAC)".

In its letter dated 23 November 2020 and at the oral proceedings the appellant argued that this problem formulation included a pointer to the solution by virtue of the wording in brackets "e.g. the DAC". They suggested that "the technical problem should be “how to relax the implementation requirements at the back-end stage”" because "it is not possible to add the claimed sigma-delta modulators without also changing the DAC in D1".

The board is not convinced. As explained in section 3.2 above, document D1 discloses a DAC and claim 1 does not impose a different DAC. In fact, the introduction of sigma-delta modulators relaxes the implementation requirements for the DAC, i.e. it makes it possible, but not compulsory, to use a simpler, or different, DAC.

At the oral proceedings the appellant suggested an even more general problem to be solved: "how to simplify D1's system".

The board does not agree with this problem formulation. The distinguishing features (section 3.1 above) rather make D1's system overall structurally more complex.

For these reasons, the board sticks to the formulation of the objective technical problem used in the decision under appeal.

3.4 The appellant agreed that the system disclosed in document D4 solved the same broad technical problem as the present invention and that D4 (page 5, line 32 to page 6, line 13) disclosed the distinguishing features set out in section 3.1 above.

3.5 The appellant argued that D4 did not use the sigma-delta modulators in the same way as presently claimed to solve the problem, i.e. the quantized I and Q signals were not immediately digital-to-analog converted and filtered, but first each of the two quantized signals was processed by a rate conversion device (the boxes "1/2 M" in Figure 1) and then a digital quadrature modulation took place (boxes "x" and the switch) resulting in one modulated signal. This (single) signal was then digital-to-analog converted and filtered.

3.6 The appellant submitted in the statement setting out the grounds of appeal, page 5, further that D4 "is not using sigma-delta modulation in order to simplify conversion of a multi-bit word digital signal into multi-level analog signals that are mixed in the analog domain".

3.7 The board agrees with the appellant that in document D4 the output signals of the sigma-delta modulators are not processed in the same way as claimed. However, claim 1 does not refer to multi-level analog signals.

3.8 The board notes that according to D4, page 2, lines 22 and 23, "it is an objective of the present invention to **simplify substantially** the equipment necessary to obtain a digital quadrature modulator and **digital-to-analog converter**" (emphasis added).

Additionally, D4, page 1, line 35 to page 2, line 2 discloses that "one of the conventional methods for carrying out digital-to-analog (and analog-to-digital)

conversion of a low-pass limited signal (e.g., an audio signal) is to use sigma-delta modulation of the signal so that it is represented by 1 bit per sample, at the same time as the introduced quantization noise is shaped spectrally so that most of this noise ends up outside the frequency band of interest. To achieve this noise shaping to a sufficient degree, oversampling is used; i.e., a higher sampling rate than is strictly necessary according to Nyquist. One of the **major advantages of this technique is that 1 bit sample values can be very easily and accurately converted from digital to analog form** (or vice versa)" (emphasis added).

3.9 Hence, D4 addresses the problem to be solved (section 3.3 above) and would thus be taken into consideration by the skilled person.

3.10 In view of D4's teaching in the passage bridging pages 1 and 2 and page 5, line 32 to page 6, line 13, the skilled person would be motivated to add two oversampling noise-shaping modulators comprising a sigma-delta modulator to D1's system. It is clear that these modulators have to be inserted in front of D1's two DACs, to be able to contribute to solving the objective technical problem.

3.11 Having in mind that document D1 is the starting point for inventive-step analysis, the person skilled in the art would not modify D1's system more than is needed to solve the problem posed. D4 clearly teaches that the use of sigma-delta noise-shaping modulators simplifies the conversion from digital to analog form. Furthermore, the reduction of number of bytes in D4 simplifies the digital-to-analog converter, even when it takes place after the quadrature modulation: "The quadrature modulated signal, which thus is still represented by a small number (usually 1) of bits per

sample, finally passes through a digital-to-analog converter" (D4, page 10, lines 35 and 36).

3.12 The board holds that the skilled person would not completely implement D4's system into the system of D1 because the objective technical problem refers specifically to relaxing the implementation requirements at the back-end stage (e.g. the DAC). Hence, the skilled person would not modify the analog quadrature modulator of D1.

Furthermore, D1 discloses modulation (Figure 1, item 130) after the DAC 122 and filter 124. Hence, the skilled person would not add second modulation before the DAC because there is no need for it and it does not help towards relaxing of the implementation requirements for DAC processing.

For these reasons, the person skilled in the art would not incorporate the entire modulation system of D4 into D1.

3.13 The board notes that the addition of D4's two oversampling noise-shaping modulators comprising a sigma-delta modulator to D1's system clearly solves the posed problem, because the digital-to-analog conversion of a digital signal with 1 bit per sample is much easier than of multi-bit samples.

Appellant's statement on page 2 of the letter dated 23 November 2020 "The appellant agrees that the skilled person reading D4 is taught that a sigma-delta modulator produces a 1-bit output, and that simplified DAC processing is possible because only 1-bit data needs to be converted" confirms that the problem is solved.

3.14 The further argument of the appellant in the same paragraph
"when read as a whole, the skilled person would understand that the simplification of the DAC processing in D4 has arisen because the IQ modulator is transmitting only 1-bit I and Q data, i.e. it is operating as a QPSK system instead of a QAM system"
is not convincing because according to page 10, lines 35 and 36 of D4, the quadrature modulated signal, which is "still represented by a small number (usually 1) of bits per sample" has the same small number of bits as the signal on the output of D4's sigma-delta modulator.

3.15 The appellant submitted "Thus, digital approaches which often involve complex modulation (see paragraph [04] of the present application), and hence experience significant drains on power, **are not desirous solutions for the wireless transmission of a signal**".

The board notes that document D1 discloses precisely wireless transmission of a signal including complex modulation.

3.16 Finally, it is self-evident that the skilled person may adapt the DACs and the subsequent filters to the output signal of the added oversampling noise-shaping modulators, using generally known components, in order to make use of the relaxed implementation requirements.

3.17 For these reasons the board confirms the outcome of the decision under appeal that the subject-matter of claim 1 does not involve an inventive step.

First auxiliary request

4. Patentability

4.1 Claim 1 of the first auxiliary request pertains specifically to a wireless microphone.

4.2 The appellant argued in the statement of grounds twofold:

(a) that the wireless microphone was a further distinguishing feature which provided a synergistic effect with the distinguishing features set out in section 3.1 above, i.e. to facilitate the use of quadrature modulation in a wireless microphone

(b) that neither D1 nor D4 related to the technological field of wireless microphones, thus the skilled person would not have started from these quadrature modulation systems

4.3 The appellant submitted in the statement of grounds, page 7 that "at the priority date, quadrature modulation systems were not considered viable for use in wireless microphones because of their high cost and poor battery life", pointing to paragraphs 3 and 4 of the application in suit.

The board observes that paragraph 3 does not relate to wireless microphones with digital transmission and does not refer to quadrature modulation. Paragraph 4 refers to "simultaneous amplitude and phase modulation", which largely corresponds to quadrature modulation, but compares this modulation with analog approaches only. Paragraph 23 confirms this understanding. Furthermore, these paragraphs state that wireless microphone technology using digital approaches were known: "wireless microphone technology is currently moving from analog approaches such a FM to digital approaches." Hence, the above statement of the appellant is not supported by these passages of the application in suit and thus not convincing.

4.4 The board observes that document D1 explicitly refers to a wireless device, see e.g. the title, paragraphs 3, 7 and 10 and Figure 1. Thus, the further feature

distinguishing the disclosure of D1 from the claimed subject-matter is that D1 does not explicitly disclose that its wireless device is a wireless microphone.

Since claim 1 does not specify any properties of the microphone, document D1 is a suitable starting point for inventive-step analysis.

4.5 The appellant argued further that "the skilled person, under real-world circumstances, would only realistically have started from an existing wireless microphone rather than an alternative, or generic, wireless device. This would represent a situation as close as possible to that encountered by the inventor, i.e. a “bridgehead” position, which the skilled person would have realistically taken under the “circumstances” of the claimed invention" and referred to the decision T0870/96.

The board is not persuaded. D1 is not a generically different document, but belongs to the same field of wireless devices. Furthermore, looking for further applications of a known technology is a very common development technique.

4.6 At the oral proceedings the appellant argued that in view of paragraph 64 of the application in suit document D1 belonged to a different field of technology.

This paragraph describes advantages of a discrete quadrature modulator over a traditional analog quadrature modulator. However, claim 1 does not refer to a discrete modulator and claim 9 does not refer to any modulation.

4.7 The appellant submitted that the skilled person was a wireless microphone designer and thus would take a

disclosure pertaining to wireless microphones as a starting point.

The board observes that a wireless microphone designer would certainly be aware of wireless modulation and transmission technologies, e.g. like described in document D1.

4.8 Finally, the appellant argued that a claim to a wireless microphone included implicit limitations regarding weight, form and size of the device.

The board notes that a wireless microphone is, in general, not necessarily smaller or lighter as D1's wireless device. D1 discloses that the digital transmitters may be used e.g. for the GSM900 frequency band (paragraph 84) and small and light GSM phones comprising a microphone were generally known.

4.9 The appellant submitted that

(a) document D5 represents the closest prior art to the present invention

(b) the skilled person would not have found it obvious to arrive at the claimed invention when starting from D5.

In its preliminary opinion, the board provisionally agreed with statement (b). However, as explained above, document D1 forms a suitable starting point for inventive-step assessment and the board holds that the subject-matter of claim 1 does not involve an inventive step over document D1 in view of document D4. The reasons are given in the following.

4.10 Document D4 does not explicitly refer to wireless aspects, however the output of the described method and system is intended for transmission using radio, or wireless, technology. Furthermore, D4 (page 1, lines 35

and 36) suggests that the techniques described in this document may be used for transmitting audio signals.

4.11 D1 already discloses the use of quadrature modulation in a wireless device, therefore the fact that the wireless device is a wireless microphone in claim 1 does not lead to the synergistic effect suggested by the appellant.

4.12 The further distinguishing feature leads to the effect that a further application of D1's wireless device is provided.

4.13 The objective technical problem to be solved is accordingly how to provide a further application of D1's wireless device.

4.14 In view of the teaching in document D4 relating to an audio signal the board holds that it was obvious for the skilled person to arrange D1's wireless device as wireless microphone. Additionally, according to paragraph 4 of the application in suit, wireless microphones using digital approaches were known.

4.15 With regard to a synergistic effect, the appellant argued that "there was a resistance to the use of such modulating techniques within wireless microphones at the priority date".

For the reasons given in section 4.3 the board is not convinced. Additionally, the passages of document D5 to which the appellant referred do not support its argument. Paragraph 5, lines 20-25 of the second column pertains only to analog FM microphone systems and paragraph 9 confirms that digital wireless microphones with multi-bit technique were known and does not set out any negative aspects of quadrature modulation.

Hence, general disadvantages of digital techniques (e.g. increased power consumption) were known, however no technical prejudice is apparent. Rather, these problems were subject of technical developments.

4.16 The appellant submitted that "the operating lifetime, size and cost of the wireless microphone is functionally interdependent with the provided digital-analog converter", (see letter of 23 November 2020, page 5).

The board is not persuaded because this statement is correct for a wireless microphone but similarly for other wireless devices, such as disclosed in D1.

4.17 The appellant argued in the letter of 23 November 2020, page 5,
"As discussed at page 1, lines 35-39 of D4, digital-to-analog conversion of a signal using sigma-delta modulation can only be employed in systems processing certain types of signal. Specifically, low-pass limited signals, such as audio signals. Such signals arise inherently within the context of a wireless microphone, as now claimed in the independent claims. However, the device of D1 contains no indication as to its technical application and could be used for any type of data signal, including signals that are not low-pass limited".

The board does not agree because practically all signals subjected to any kind of digital-to-analog conversion must be low-pass limited, due to the Nyquist theorem.

4.18 The argument of the appellant that the use of sigma-delta modulation for signals of a microphone is based on inventive trade-off between accurate conversion and power consumption is not convincing. As discussed, the use of sigma-delta modulation does not necessarily have

an impact on the accuracy of the conversion: it depends on implementation details which are not specified in claim 1.

4.19 For these reasons, the subject-matter of claim 1 does not involve an inventive step.

Second auxiliary request

5. Document D1 discloses two DACs and two filters, hence claim 1 does not add further distinguishing features in view of document D1. This was confirmed by the appellant in the statement of grounds. Consequently the subject-matter of claim 1 does not involve an inventive step for the reasons given in section 4. above.

Third auxiliary request

6. Patentability

6.1 Document D1 discloses that the Q and I signals have more than one bit per sample. However, D1 does not disclose that these signals are quantized with one bit per sample, one-bit DACs are used and the filters comprise baseband filters adapted to reduce out-of-band quantization noise.

6.2 These further distinguishing features, together with the distinguishing feature set out in section 3.1 above solve the same problem as given in section 3.3. The appellant did not argue differently.

6.3 Documents D4 discloses the further distinguishing features.

6.4 The appellant argued at the oral proceedings that according to D4 (Figure 1), sigma-delta modulation was followed by modulation and mixing and then by the DAC and filter BPF. This was substantially different than

the claimed device, in which the DAC followed immediately after the sigma-delta modulator.

The board agrees. However, as explained in sections 3.5 to 3.14, the skilled person would not completely implement D4's system into the system of D1.

6.5 The argument of the appellant that in D4 the DAC outputs two levels only is not persuasive. First, D4 does not include such teaching. Second, an output signal having two levels can hardly be the output of a digital-to-analog converter. The output signal is analog, which in general implies a large number of values.

6.6 Furthermore, the appellant argued that D4's DAC changed only the phase of the signal but not the amplitude.

The board is not convinced. Document D4 refers to the phase of a signal only in relation with the quadrature-phase and in-phase signals Q and I. Furthermore, claim 1 does not refer to a phase or amplitude of the signal output by the DAC.

6.7 Therefore, the subject-matter of claim 1 does not involve an inventive step for the reasons given in sections 3., 4. and 5. above.

Fourth auxiliary request

7. Patentability

7.1 Claim 1 of this request is based on claim 1 of the first auxiliary request and specifies the sigma-delta modulators in more details.

Document D4 discloses the same structure of the sigma-delta modulators, see Figure 3, page 4, lines 19 to 24 and page 5, lines 38 and 39. The differences in the algebraic signs for the two summing/combining components relate to minor implementation details.

For example, document D8 (Figure 1 and column 1, lines 27 to 53) describes as "conventional art" a sigma-delta modulator with precisely the same structure as claimed. Incidentally, the same passage states that such modulators "has been widely used in the low-power applications, such as digital voice and audio".

The textbook DA9 describes as well the same sigma-delta modulator, see Figure 1.8 in chapter 10.2.2. It represents common general knowledge.
Documents D7 and D8 refer to this textbook.

7.2 With regard to the related technical effect, the appellant argued that "the advantage of the presently claimed sigma-delta modulator structure as compared with other sigma-delta modulator structures is that it facilitates implementation without the use of discrete electrical components (e.g., resistors and capacitors). Discrete electrical components typically have variances that give poor performance when operating in the discrete time domain (corresponding to processing before DAC)".

The board notes that the description of the application in suit does not refer to such effect. It is also not apparent why the claimed modulator structure specifically would facilitate an implementation without the use of discrete electrical components. Therefore, the board considers that this effect is not achieved.

7.3 Hence, the subject-matter of claim 1 does not involve an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

A. Chavinier-Tomsic A. Ritzka

Decision electronically authenticated