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Datasheet for the decision of 9 November 2020

Case Number: T 0610/15 - 3.4.01

Application Number: 07851633.3

Publication Number: 2105020

IPC: G10L21/02, G10L19/14

Language of the proceedings: EN

Title of invention:
METHOD, APPARATUS, AND MEDIUM FOR BANDWIDTH EXTENSION ENCODING AND DECODING

Applicant:
Samsung Electronics Co., Ltd.

Headword:
Combined dual-mode and bandwidth extension decoding / SAMSUNG

Relevant legal provisions:
EPC Art. 83, 123(2), 56
RPBA 2020 Art. 13(1)

Keyword:
Sufficiency of disclosure - (no)
Amendments - added subject-matter in auxiliary request (yes)
Inventive step - choice of closest prior art - (no)
Admission of new requests - (no)

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Case Number: T 0610/15 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 9 November 2020

Appellant: (Applicant)	Samsung Electronics Co., Ltd. 129, Samsung-ro Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 (KR)
Representative:	Grootscholten, Johannes A.M. Arnold & Siedsma Bezuidenhoutseweg 57 2594 AC The Hague (NL)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 16 October 2014 refusing European patent application No. 07851633.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	P. Scriven
Members:	T. Petelski
	R. Winkelhofer

Summary of Facts and Submissions

I. The applicant lodged an appeal against the Examining Division's decision to refuse the European patent application 07 851 633 for lack of inventive step (Article 56 EPC).

II. The Examining Division held that the subject-matter of claims 1 - 3 would have been obvious in view of the combination of documents

D2: KR 100 647 336 B1 and
D6: WO 2005/043511 A1,

and using documents

D1: EP 1 657 710 A1 and
D3: M. Bosi at el: *"ISO/IEC MPEG-2 Advanced Audio Coding"*, Journal of the Audio Engineering Society, Vol. 45, No. 10, October 1997

for technical background. The English-language application

D2': US 2007/0106502 A1

corresponding to D2 was used, although published after the priority date.

III. The appellant requested that the decision be set aside and that a patent be granted on the basis of sets of claims filed with the statement of grounds of appeal, namely a new main request, a new first auxiliary request, or a second auxiliary request that is

identical to the sole request underlying the impugned decision.

IV. In a communication sent with a summons to oral proceedings, the appellant was informed of the Board's preliminary opinion, according to which the main request contained added subject-matter, the main and first auxiliary requests failed for insufficient disclosure, and the main and second auxiliary requests lacked inventive step in view of a combination of document D2 with document D6, basically following the Examining Division's line of argument.

V. In response, the appellant filed new main and first auxiliary requests, and arguments on inventive step. The previous requests were renumbered as second to fourth auxiliary requests.

VI. Oral proceedings were held by video link on 9th of November 2020.

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

A method of bandwidth extension decoding, comprising:

checking (1003) whether a signal is encoded in a frequency domain or a time domain;

lossless [sic] decoding (1005) the signal, de-quantizing (1010) the losslessly decoded signal, controlling (1015) noise of the do-quantized signal by performing temporal noise shaping (TNS), and inverse-transforming (1020) the noise controlled signal to the time domain, if the checking

result shows that the signal is encoded in the frequency domain;

decoding (1025) using CELP (code excited linear prediction) if the checking result shows that the signal is encoded in the time domain;

wherein the method further comprises:

transforming (1030) the signal inverse-transformed to the time domain or the signal decoded using CELP, using a quadrature mirror filterbank (QMF);

reconstructing (1035) a high frequency band signal in a QMF domain using the transformed signal;

generating (1050) a stereo signal in the time domain from the high frequency band signal and the transformed signal, using an inverse QMF.

VIII. Claim 1 of the first auxiliary request differs from the above claim in that the last feature reads:

...
generating (1050) a stereo signal in the time domain from the high frequency band signal and the transformed signal by performing an inverse QMF with respect to the high frequency band signal.

IX. Claim 1 of the second auxiliary request differs from claim 1 of the main request, apart from several

editorial amendments and different reference signs (from figure 14), in substance in the last two features and reads:

A method of bandwidth extension decoding, comprising:

checking (1403) whether a signal is encoded in a frequency domain or a time domain;

performing (1405) lossless decoding and de-quantization (1410), controlling (1415) noise, and inverse-transforming (1425) the de-quantized signal to the time domain if the checking result shows that the signal is encoded in the frequency domain;

performing decoding (1420) using CELP (code excited linear prediction) if the checking result shows that the signal is encoded in the time domain;

wherein the method further comprises:

transforming (1430) the signal inverse-transformed to the time domain or the signal decoded using CELP, using a quadrature mirror filterbank (QMF);

reconstructing (1435) a high frequency band signal in a QMF domain using the transformed signal;

generating (1450) a stereo signal from the high frequency band signal and the transformed signal, in the QMF domain; and

inverse-transforming (1455) the stereo signal using an inverse QMF.

X. Independent method claim 1 of the third auxiliary request reads as follows, the differences to claim 1 of the second auxiliary request lying in steps 1400, 1403, 1405 and 1425:

A method of bandwidth extension decoding, comprising:

demultiplexing (1400) an encoded bitstream;

checking (1403) for each sub-band signal of the demultiplexed bitstream whether the sub-band signal is encoded in a frequency domain or a time domain;

performing (1405) lossless decoding and de-quantization (1410) and controlling (1415) noise if the checking result shows that the sub-band signal is encoded in the frequency domain; and

performing decoding (1420) using CELP (code excited linear prediction) if the checking result shows that the sub-band signal is encoded in the time domain;

wherein the method further comprises:

synthesizing (1425) the sub-band signals and subsequently inverse-transforming the synthesized signal to the time-domain;

transforming (1430) the signal inverse-transformed to the time domain using a quadrature mirror filterbank (QMF);

reconstructing (1435) a high frequency band signal in a QMF domain using the transformed signal;

generating (1450) a stereo signal from the high frequency band signal and the transformed signal, in the QMF domain; and

inverse-transforming (1455) the stereo signal using an inverse QMF.

XI. The fourth auxiliary request, in contrast to all other requests, has an independent apparatus claim 1 that corresponds to method claim 2. The latter differs from claim 1 of the main request, apart from editorial amendments, in the last two steps and reads as follows:

A method of bandwidth extension decoding, comprising:

checking (1003) whether a signal has been encoded in a frequency domain or a time domain;

performing (1005) lossless decoding and de-quantization (1010), controlling (1015) noise, and inverse-transforming (1020) the signal to the time domain if the checking result shows that the signal has been encoded in the frequency domain;

performing decoding (1025) using CELP (code

excited linear prediction) if the checking result shows that the signal has been encoded in the time domain;

wherein the method further comprises:

transforming (1030) the signal inverse-transformed to the time domain or the signal decoded using CELP, using a QMF (quadrature mirror filterbank);

reconstructing (1035) a high frequency band signal using the transformed signal;

inverse-transforming the decoded high frequency band signal using an inverse QMF;

synthesizing the signal inverse-transformed to the time domain or the signal decoded using CELP and the inverse transformed high frequency band signal.

XII. The appellant's arguments, in so far as relevant, are set out in the Reasons, below.

Reasons for the Decision

Admission of the main request and the first auxiliary request

1. The appellant argues that the submission of the main and first auxiliary requests was a legitimate reaction to the Board's objection of added subject matter

(Article 123(2) EPC) in the current second auxiliary request, which the appellant heard about only in the Board's communication.

2. This might, under certain circumstances, qualify as a cogent reason to consider the requests, as required by Article 13(2) RPBA 2020.

3. Nevertheless, they are not admitted under Article 13(1) RPBA 2020.

4. Neither request is prima facie suitable for resolving the inventive-step objections, because they do not add any feature that would set those requests apart from the previous requests. It does not help that the appellant did not address the Board's inventive step argumentation.

5. In addition, these requests also give rise to new questions of clarity and added subject-matter. It does not seem understandable, from the last feature of the respective versions of claim 1, how and at which point during the performance of the method, the synthesis between the low and the high frequency bands takes place; or how and at which point the inverse transform to the time domain happens with respect to the generation of the stereo signal. It also seems that there is no basis in the original application for the respective steps of *generating ... a stereo signal ....* Hence, the admission of the requests would be detrimental to procedural efficiency.

6. The appellant argues that paragraphs [153] - [165] and figure 10 of the application provided a basis for the two versions of the step of generating a stereo signal

and that an inverse QMF transform and a synthesis were implicitly applied before it.

7. This, however, is not persuasive, because the formulation *generating a stereo signal ... using (by performing) an inverse QMF* does not say more than that an inverse QMF is used in some way for the generation of the stereo signal. There is nothing that could imply what is described in the cited paragraphs, namely that, in a first step 1040, the inverse QMF is used for inverse-transforming the high-frequency signal to the time domain, where it is synthesized with the low frequency signal in a second step 1045, and that the stereo signal is then generated from the synthesized signal in a third step step 1050.

Second auxiliary request - Added subject matter

8. Claim 1 defines a combination of features taken from the two different embodiments shown in Figures 10 and 14. In particular, it defines the sequence of steps 1003 - 1035 of Figure 10 (despite using the reference numbers 1403 - 1435 of Figure 14) combined with the sequence of steps 1435 - 1455 of Figure 14. However, such a combination was not originally disclosed (Article 123(2) EPC).

9. According to the appellant, the amendments to claim 1 were based on claim 2 in the form underlying the contested decision, which, in turn, was based on original claim 19, and on the embodiment relating to Figure 14 and the corresponding paragraphs [205] - [215]. The appellant argued further that it was clear from the application that the embodiment relating to Figure 14 could be combined with the embodiment

relating to Figure 10, even without a particular pointer.

10. This view cannot be shared. Original claim 19 and the corresponding embodiment of Figure 10 do not comprise stereo signal generation in the QMF domain. Instead, that embodiment teaches stereo decoding only after the synthesis of both sub-band signals in the time domain.

11. The embodiment relating to Figure 14, on the other hand, does not comprise inverse-transforming the de-quantized signal to the time domain immediately following the noise control and before any synthesis. Instead, according to Figure 14 and paragraph 212, the de-quantized and noise-controlled signal is first synthesized and only then inverse-transformed to the time domain.

12. Hence, neither of the two embodiments alone can serve as a basis for the subject-matter of claim 1, and consequently also not for the subject-matter of claim 2. In addition, the two embodiments are described as distinct and there is no hint as to whether and how they could be combined, and they cannot simply be combined without some adaptation of one or the other.

Second auxiliary request - Inventive step

13. The following analysis on inventive step does not depend on the exact sequence of steps and is, therefore, independent of the above objection of added subject-matter.

14. Claims 1 and 2 can be roughly compared to claims 2 and 3 of the claims on which the refusal was based, with

some differences regarding the processing sequence. The Examining Division argued that the subject-matter of those claims would have been obvious in view of a combination of documents D2 and D6. The Examining Division further referred to D1 and D3 for technical background.

15. This general line of reasoning also applies to present claims 1 and 2 and the Board agrees with the Examining Division's finding.

16. The application is concerned with encoding and decoding audio signals. It is always desirable to achieve a high compression (a small data volume) while maintaining a good quality of the reconstructed signal.

17. At the priority date of the application, it was known that time domain encoding works better for speech signals, while frequency domain encoding works better for other audio signals, like music, as described in the "Background" section of D2. *Dual-mode encoding/ decoding* separates the speech parts of the signal from the other audio parts, so each part can be treated in the domain to which it is better suited.

18. It was further known that there is a correlation between high and low frequency bands. This correlation can be used to reconstruct a highly compressed high-band signal by using information from the low band signal, with minimal loss in quality. This technique is known as *bandwidth extension* and is described, for example, in document D6.

19. The invention involves a decoding method that combines dual-mode decoding with bandwidth extension.

20. The appellant argues that, due to the wording of the claim, which begins *A method of bandwidth extension decoding*, document D6 rather than D2 should be regarded as the closest prior art. This was because D6 was directed to *bandwidth extension*, whereas D2 was directed to *dual-mode* decoding. The wrong choice of the closest prior art lead the Examining Division to reasoning contaminated by hindsight.

21. The appellant's argument seems to be based on two assumptions: first, that the purpose or technical field of the starting point must be the same as that of the invention; and second, that the purpose or technical field is whatever the beginning of the claim says it is, in this case *a method of bandwidth extension decoding*.

22. Regarding the first assumption, all documents that allow a realistic objection to inventive step to be raised can be a valid starting point (see Case Law, 9th Edition, I.D.3.4). Hence, D2 could not be excluded a priori, even if it were from a different technical field.

23. As to the second assumption, D2 lies in the field of audio encoding and decoding and attempts to solve the problem of achieving a small data volume whilst keeping a good signal quality by using dual-mode time and frequency domain encoding and decoding. The method of claim 1 does the same, and the claim would make just as much sense if it began *A method of dual-mode decoding*. Thus, D2 is as much in the field of the claim as D6 is, irrespective of the introductory wording.

24. The Examining Division was correct in that the advanced audio coding (AAC) used in D2, in the embodiment of

paragraph [0040], implies de-quantization and noise control. This is supported by technical background in document D3, section 0 "Introduction" and section 1 "Overview".

25. In line with the Examining Division's findings, which were not contested by the appellant, it follows from those implications and from the disclosure of the dual-mode decoding method in D2 that the subject-matter of claim 1 differs from the disclosure of D2 in the features relating to the bandwidth extension and the stereo signal generation, namely

(a) inverse-transforming the de-quantized frequency-domain signal to the time domain;
(b) transforming the signal inverse-transformed to the time domain or the signal decoded using CELP using a quadrature mirror filterbank (QMF);
(c) reconstructing a high frequency band signal in the QMF domain using the transformed signal;
(d) generating a stereo signal from the high frequency band signal and the transformed signal in the QMF domain; and
(e) applying the transformation to the time domain on the stereo signal using an inverse QMF transformation.

26. Encoding and decoding stereo signals has long been standard for music, at least, and the Board can see no inventive step in the stereo aspect of the invention. The appellant did also not suggest otherwise.

27. The technical effect of the remaining differences lies in a high quality decoding of a signal that has been further compressed.

28. Hence, the technical problem can be seen as allowing a further reduction in the amount of information transmitted, with minimal degradation of signal quality. This is only a slight reformulation of the problem identified by the Examining Division, which the appellant has not disputed.

29. The Examining Division held that it would have been obvious for the skilled person to employ the generic bandwidth extension processing as in D6, right after the dual-mode decoding process of D2.

30. This analysis is correct. Document D2 is occupied with the idea of finding an encoding and decoding method with a high compression efficiency (D2 paragraph [0003]) and offers the dual-mode compression as a solution. Improving compression efficiency as much as possible is an intrinsic motivation for the person skilled in that field.

31. Document D6 lies in the same field of efficient compression of audio signals as D2, and the solution offered lies in bandwidth extension encoding and decoding, which uses low-frequency information to reconstruct high-frequency information in the QMF domain (D6 paragraph [0008] and figure 3 together with paragraph [0029] and figure 5, and claim 15). D6 also explicitly mentions the generation of stereo signals and therefore discloses features (b) - (e).

32. Confronted with the problem of allowing a further increase in compression, the skilled person would have considered combining this technique with the dual-mode decoding of D2. She would have recognized that the additional steps of bandwidth extension can be added to the method in D2 at a place where the initial decoding

is performed and where all sub-band signals can be provided in the time domain. It would therefore have been obvious to transform the frequency-decoded sub-band(s) of D2, after being output from unit 810 in Figure 8, to the time-domain for synthesis with the time-domain decoded sub-bands, before performing the additional steps of QMF transformation, bandwidth extension, stereo signal generation and final inverse transformation into a completely extracted time domain stereo signal according to the teaching of D6. The skilled person would, in this way, have arrived at the subject-matter of claim 1.

33. The appellant argues that the signals in D2 were not in the proper format for a QMF transform, and that D2 applied encoding to the entire frequency spectrum, i.e. to all sub-bands. This was an alternative solution to, and could not be combined with, the method of D6.

34. This view is not shared. Dual-mode encoding and decoding applies different treatment to frequency ranges that contain speech and to ranges that do not. Bandwidth extension, on the other hand, applies a different treatment to low- and high-frequency ranges, independently of whether they contain speech or not. Therefore, the two methods are not alternatives but can be used in combination to realize the combined compression advantages. In other words, the bandwidth extension steps of D6 can be added after the dual-mode decoding steps of D2. Providing the sub-band signals in the proper format is a routine task, which the skilled person would have achieved by well known transformations and combinations of the sub-band signals. The number of sub-bands is of no relevance.

35. It follows that the skilled person would have arrived at the subject-matter of claim 1 by obvious steps. There is a lack of inventive step (Article 56 EPC) and the request cannot be allowed.

Third auxiliary request - Sufficiency of disclosure

36. Claim 1 of the third auxiliary request is based on claim 1 of the second. The additional amendments align the claim more closely to the embodiment providing a basis for the claims, which is described in paragraphs [205] - [215] and Figure 14.

37. According to step 1425 in claim 1, the (low-frequency) time-domain signal from the decoding operation 1420 is synthesized with the (high-frequency) frequency-domain signal, without transformation of the latter to the time-domain. A synthesis of signals in different domains does not make technical sense.

38. Further, according to the same step 1425, the synthesized signal is subsequently inverse-transformed to the time-domain. However, the signal from the decoding operation 1420 already is in the time-domain and cannot be transformed to it again.

39. The skilled person, therefore, cannot understand the steps that need to be carried out.

40. The corresponding embodiment in the description shows the same problem, in paragraph [212] and Figure 14. Again, signals in different domains are synthesized and inverse-transformed to the time-domain, in step 1425, although one of the signals already is in the time domain.

41. The same problem also applies to paragraph [115] of the embodiment described in paragraphs [109] - [119] and Figure 6.

42. The appellant did not comment on the point of sufficiency.

43. It follows that the request cannot be allowed for lack of disclosure (Article 83 EPC).

Fourth auxiliary request - Inventive step

44. The claims of the fourth auxiliary request differ from those of the second mainly in that the synthesis is performed on the final time-domain sub-band signals, after bandwidth extension.

45. It is irrelevant to the question of inventive step, where exactly, during the decoding of the sub-band signals, synthesis takes place. The synthesis of high- and low-frequency signals has to happen somewhere, and it has to happen in the time domain. It is one of only a few obvious options to place the synthesis after the bandwidth extension, where all signals are available in the time domain.

46. As a consequence, the subject-matters of claims 1 and 2 of the fourth auxiliary request do not involve an inventive step for similar reasons as the subject-matter of claim 1 of the second auxiliary request (Article 56 EPC). Therefore, this request can also not be allowed.

Summary of conclusions

47. The main request and first auxiliary request cannot be admitted. The second to fourth auxiliary requests cannot be allowed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Meyfarth P. Scriven

Decision electronically authenticated