

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ROKU, INC.,
Petitioner

v.

DOLBY INTERNATIONAL AB,
Patent Owner

Case IPR2024-01354
U.S. Patent No. 6,339,757

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 6,339,757**

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Patent Trial and Appeal Board
U.S. Patent & Trademark Office
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PETITIONER’S EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 6,339,757 (“’757 patent”)
1002	Prosecution History of U.S. Patent No. 6,339,757 (“’757 Prosecution History”)
1003	Declaration of Dr. Tim A. Williams in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 6,339,757
1004	<i>Curriculum Vitae</i> of Dr. Tim A. Williams
1005	U.S. Patent No. 5,185,800 to Mahieux (“Mahieux”)
1006	U.S. Patent No. 5,109,417 to Fielder et al. (“Fielder”)
1007	U.S. Patent No. 5,241,603 to Akagiri et al. (“Akagiri”)
1008	U.S. Patent No. 4,896,362 to Veldhuis et al. (“Veldhuis”)
1009	U.S. Patent No. 4,677,671 to Galand et al. (“Galand”)
1010	U.S. Patent No. 5,579,431 to Reaves (“Reaves”)
1011	U.S. Patent No. 5,105,463 to Veldhuis et al. (“Veldhuis’463”)
1012	European Patent Publication No. 0145788A1 to Akagiri (“Akagiri’788”)
1013	European Patent Publication No. 0525809A2 to Akagiri (“Akagiri’809”)
1014	U.S. Patent No. 4680797 to Benke (“Benke”)
1015	U.S. Patent No. 4,949,383 to Koh et al. (“Koh”)
1016	International Publication No. WO 92/12607 to Davis et al. (“Davis”)
1017	U.S. Patent No. 4,538,234 to Honda et al. (“Honda”)
1018	U.S. Patent No. 4,790,015 to Callens et al. (“Callens”)
1019	U.S. Patent No. 4,964,166 to Wilson (“Wilson”)
1020	U.S. Patent No. 5,235,671 to Mazor (“Mazor”)

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Exhibit No.	Description
1021	U.S. Patent No. 5,263,088 to Hazu (“Hazu”)
1022	International Publication No. WO 89/003140 to Vössing et al. (“Vössing”)
1023	International Publication No. WO 89/09965 to McLaughlin et al. (“McLaughlin”)
1024	A 128 kb/s Hi-Fi Audio CODEC Based on Adaptive Transform Coding with Adaptive Block Size MDCT (“Iwadare”)
1025	Transform coding of audio signals using correlation between successive transform blocks (“Mahieux NPL”)
1026	Predictive SVD-transform coding of speech with adaptive vector quantization (“Masgrau”)
1027	An optimal bit allocation algorithm for sub-band coding (“Westerink”)
1028	Efficient bit allocation for an arbitrary set of quantizers (“Shoham”)
1029	Quantization and bit allocation in speech processing (“Gray”)
1030	U.S. Patent No. 5,151,941 to Nishiguchi et al. (“Nishiguchi”)
1031	Low bit-rate coding of high-quality audio signals: an introduction to the MASCAM system (“Theile”)
1032	Subband coding of high-fidelity quality audio signals at 128 kbps (“Teh”)
1033	Excerpts from Jeffrey Hass, “Introduction to Computer Music. Chapter Five: Digital Audio. 6. Quantizing, Approximation Errors and Sample Size,” https://cmtext.indiana.edu/index.php , Chapter 5, Section 6 accessed at https://cmtext.indiana.edu/digital_audio/chapter5_quantize.php
1034	Complaint in <i>Dolby Licensing Corp. v. Roku, Inc.</i> , No. 5:24-cv-04660 (N.D. Cal.)

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Exhibit No.	Description
1035	Claim Chart for U.S. Pat. No. 6,339,757 and Dolby Digital (ATSC Doc. A/52:2018)
1036	U.S. Patent No. 4,216,354 to Esteban et al. (“Esteban”)
1037	ATSC Standard: Digital Audio Compression (AC-3, E-AC-3), Doc. A/52:2018 (Jan. 25, 2018)
1038	U.S. Patent No. 4,672,457 to Hyatt (“Hyatt”)
1039	United States District Courts – National Judicial Caseload Profile, 2019-2024, United States Courts, https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_disprofile0630.2024.pdf
1040	Excerpts from Jayant, N. S., Noll, P. “Digital Coding of Waveforms,” Chapters 1, 2, 4, 11, and 12, Prentice-Hall, Inc. (1984)
1041	Certified Translation of International Publication No. WO 89/003140 to Vössing et al. (“Vössing Translation”)
1042	U.S. Patent No. 5,381,145 to Allen et al. (“Allen”)

I. INTRODUCTION

The '757 patent is directed to encoding audio signals that have been converted from analog to digital, and decreasing the error in the encoding process by more efficiently allocating bits to the signal. EX1001, Abstract, 1:7-10; EX1003, ¶31. One bit-allocation method “adopted extensively” in the art was to assign bits based on “psychoacoustic” criteria—i.e., assigning more bits to frequencies within the original signal that are most perceptible to the human ear. EX1007, 1:32-40; EX1001, 1:57-67. The '757 patent simply implements this well-known technique using a two-step process: bits not allocated during the first step are iteratively allocated during the second step.

But two-step bit-allocation processes are not new, and such processes have long been used in conjunction with psychoacoustic criteria. The prior art cited here proves the point and renders claims 1-17 of the '757 patent obvious. EX1003, ¶¶99-303.

II. IDENTIFICATION OF UNPATENTABILITY GROUNDS

Ground	Prior Art	Basis	Claims Challenged
1	Mahieux, Fielder	§ 103	1-3, 6-7, 10-11, 14, 16
2	Mahieux, Fielder, Akagiri	§ 103	1-17
3	Veldhuis, Galand	§ 103	1-3, 6-7, 10-11, 14, 16
4	Veldhuis, Galand, Reaves	§ 103	1-17

The alleged priority date of the '757 patent is February 19, 1993. The references qualify as prior art:

- Mahieux is prior art under pre-AIA §§ 102(a) and 102(e) because it issued on February 9, 1993, and claims priority to an application filed on October 9, 1990, both before the '757 patent's earliest priority date.
- Fielder is prior art under §§ 102(a) and 102(e) because it issued on April 28, 1992, and claims priority to an application filed on November 20, 1989, both before the earliest priority date.
- Akagiri is prior art under § 102(e) because it was filed on May 21, 1991, before the earliest priority date, and issued into a patent.
- Veldhuis is prior art under § 102(b) because it issued on January 23, 1990, more than one year before the earliest priority date.
- Galand is prior art under § 102(b) because it issued on June 30, 1987, more than one year before the earliest priority date.
- Reaves is prior art under § 102(e) because it was filed on October 5, 1992, before the earliest priority date, and issued into a patent.

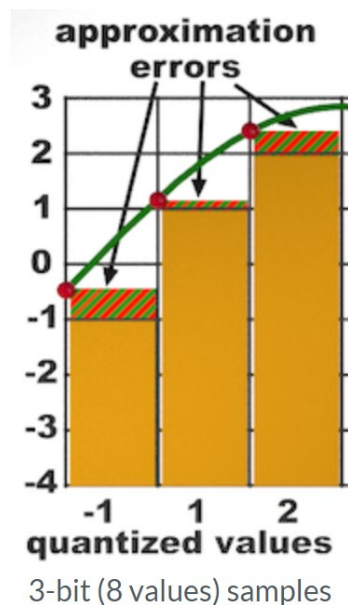
III. LEVEL OF ORDINARY SKILL IN THE ART

A POSA at the time the '757 patent was filed would have had a Bachelor of Science (BS) degree in Computer Science, Computer Engineering, Electrical Engineering, or an equivalent field, as well as at least 2-3 years of academic or industry experience in the fields of audio encoding, analog-to-digital signal conversion, or digital signal processing. EX1003, ¶¶19-24.

IV. OVERVIEW OF THE '757 PATENT

A. Technology Background

Analog audio signals are typically represented by a continuous waveform of amplitude values as a function of time. When a signal is converted to digital form, the amplitudes must be mapped onto their corresponding digital values, represented by groups of binary digits called “bits”:



EX1033, 26.

EX1003, ¶¶32-35. As shown above, each amplitude at a sampled time is rounded to the nearest available digital value in a process known as “quantization.”

EX1001, 1:43-45. The larger the numerical distance between an amplitude and its quantized value, the greater the error in the encoded signal. EX1006, 1:33-39;

EX1003, ¶36.

One way to reduce this error is to increase the number of values that a digital

integer can assume. That, in turn, requires allocating more bits to the integer. The more bits that are allocated, the greater number of values an integer may have and thus the lower the quantization error. EX1006, 1:33-39; EX1008, 2:7-11; EX1009, 1:39-41. The total number of bits used, however, is limited by the bit rate of the communication channel. Thus, the challenge is reducing quantization error for low bit-rate channels. EX1006, 1:17-25; EX1009, 1:47-55; EX1003, ¶¶37-39.

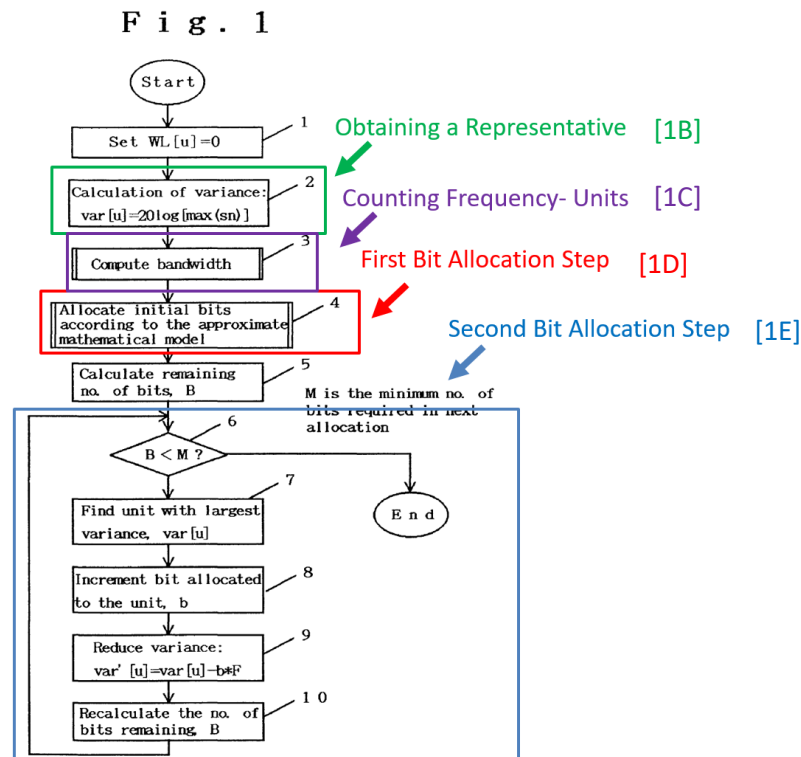
The '757 patent acknowledges that various “dynamic bit allocation” methods were known for addressing this challenge. EX1001, 1:46-47. One such method, which was “adopted extensively” in the art, was to allocate bits based on “psychoacoustic” criteria—i.e., “how an individual perceives a sound.” EX1002, 194; EX1007, 1:32-40; EX1001, 1:57-67. Using this method, audio signals are transformed into the frequency domain and divided into multiple “bands,” each containing “spectral lines” whose amplitudes represent the strength of the frequencies making up the original signal. EX1031, 159; EX1032, II-198; EX1007, 1:9-31; EX1003, ¶¶40-41. Then, rather than allocating bits evenly across each band, bits are allocated based on how perceptible the frequencies are to the human ear. EX1031, 159; EX1005, 1:60-68. That way, the most perceptible bands are quantized with the greatest precision (allocated more bits), while the least perceptible bands—i.e., those that are rendered inaudible or “masked” by more dominant bands—are quantized with lower precision (allocated fewer bits) or not

at all. EX1001, 3:14-26, FIG. 5; EX1031, 167; EX1003, ¶¶42-44.

The '757 patent implements this well-known technique using a two-step bit-allocation method: in the first step, bits are allocated using a mathematical model; in the second step, the remaining bits are allocated based on psychoacoustic criteria. EX1001, 2:60-67; EX1003, ¶¶45-74, 86-87.

B. The '757 Patent

Figure 1 is shown below (mapped onto corresponding claim limitations):

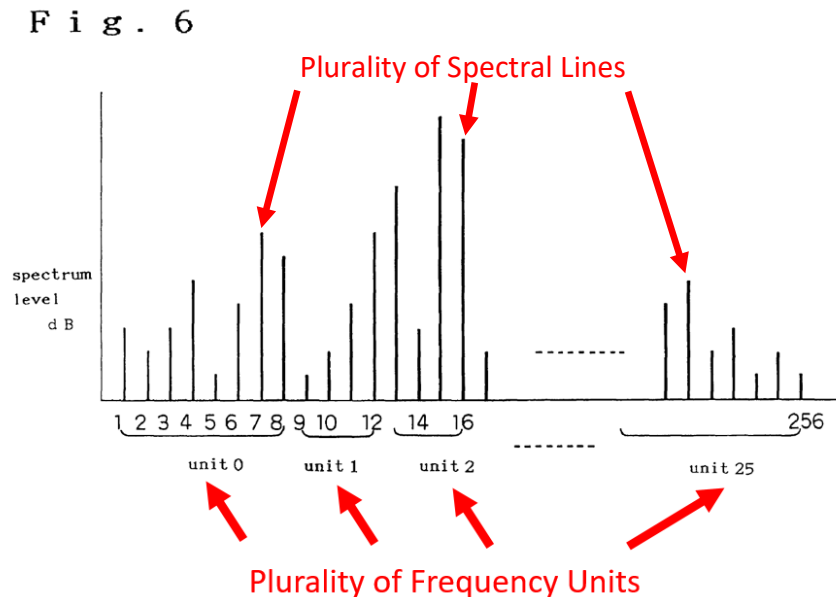


EX1001, FIG. 1 (annotated).

The bit-allocation steps are shown in red and blue, along with several preliminary steps. EX1003, ¶75.

First, a frequency-domain representation of the audio signal is divided into

frequency bands or “units” (not shown in Figure 1). EX1001, 1:37-40, 4:21-24; EX1003, ¶76. For example, Figure 6 depicts a signal divided into twenty-five units, each including spectral lines:



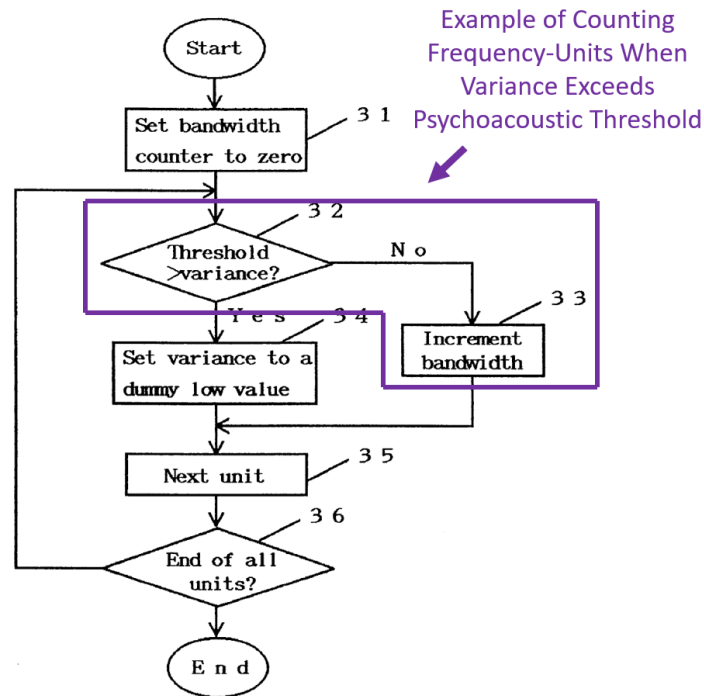
EX1001, FIG. 6 (annotated).

EX1001, 4:21-28; *see also* EX1001, FIG. 7. The goal of the patent is to determine how many bits (represented by “WL[u]”) to allocate to each unit. EX1003, ¶77-79.

Second, for each unit, a “representative”—i.e., a “characteristic representative of the signal”—is calculated. EX1001, 2:46-57, 3:1-5; EX1002, 254. The disclosed embodiments use a so-called “variance” as the representative. EX1001, 3:50-52, FIG. 1. The variance can be calculated from the maximum amplitude, or the average of the amplitudes, within each unit. EX1001, 3:50-59; *see also* EX1001, FIG. 1 (step 2); EX1003, ¶80.

Third, the “bandwidth of transmission is computed” (shown in step 3 of Figure 1). EX1001, 3:59-60. Figure 2 depicts an example of this step:

F i g . 2



EX1001, FIG. 2 (annotated).

Each unit’s variance is compared against a specified “human hearing threshold.” EX1001, 4:29-57. If a variance exceeds the threshold, “the bandwidth counter is incremented,” and the unit will have bits allocated to it. EX1001, 4:41-42. This process is repeated for all units, which “eliminate[s] units that are irrelevant according to psychoacoustic criteria.” EX1001, 4:45-48; EX1003, ¶¶81-82.

Fourth, the first bit-allocation step is performed (shown in step 4 of Figure 1). In this step, an “initial number of bits are allocated according to [an]

approximate mathematical model.” EX1001, 3:60-62. For example, bits can be allocated based on an equation that accounts for the relative magnitude of each unit’s variance. EX1001, 4:49-5:18, FIG. 3. The first bit-allocation step recited in claims 1-17, however, is not limited to such an equation. EX1003, ¶¶83-84.

Finally, the second bit-allocation step is performed (shown in steps 6-10 of Figure 1). In this step, “[t]he remaining bits, B are iteratively allocated to the units” until “the number of bits remaining is less than the minimum number of bits required in the next allocation.” EX1001, 3:62-4:18; EX1003, ¶85.

C. The Prosecution History

During prosecution, the ’757 patent claims were rejected in view of U.S. Patent No. 5,105,463 to Veldhuis et al. (“Veldhuis’463,” EX1011)¹ and U.S. Patent No. 5,151,941 to Nishiguchi et al. (EX1030). EX1002, 140-41, 163-68. The Applicant appealed these rejections. EX1002, 198-200.

The BPAI reversed, agreeing with the Applicant that Veldhuis’463 does not disclose “a step for counting a number of available frequency-units by using the representative, based on psychoacoustic criteria.” EX1002, 256 (underline in original). Although the BPAI recognized that Veldhuis’463 discloses a “count of available frequency units,” it found that Veldhuis’463 does not disclose actively

¹ Veldhuis’463 is a divisional of the Veldhuis reference asserted in Grounds 3-4.

“counting” the units. EX1002, 256. The BPAI also found that Veldhuis’463 does not disclose certain aspects of the first and second bit-allocation steps. EX1002, 257-258.

But neither the Examiner nor the BPAI addressed the Veldhuis reference at issue here. And even if the BPAI’s findings were applicable to Veldhuis, the BPAI did not have the benefit of Dr. Williams’s testimony, which establishes that Veldhuis and Galand (which was also not before the BPAI) render the challenged claims obvious. *See* Sections VIII-IX; EX1003, ¶¶88-95.

V. CLAIM CONSTRUCTION

In IPRs, claims are “construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b).” 37 C.F.R. § 42.100(b). Claims must be given their ordinary-and-customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the specification and the prosecution history. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1313 (Fed. Cir. 2005) (en banc).

Although limitations recited in claim 1 of the ’757 patent include the phrase “step for,” neither the Applicant nor the BPAI treated them as step-plus-function limitations during prosecution. To the extent the Board determines that the

limitations are written in step-plus-function format, Petitioner identifies the following claimed functions and disclosed acts²:

Claim Term	Function	Corresponding Acts
“a step for dividing at least one frequency interval into a plurality of frequency-units”	Dividing at least one frequency interval into a plurality of frequency-units.	Grouping transformed spectral samples into units, and equivalents thereof. EX1001, 1:37-40, 4:21-24, FIG. 6.
“a step for obtaining a representative of each frequency-unit obtained”	Obtaining a representative of each frequency-unit obtained.	Calculating a variance from the maximum spectral sample amplitude or from an average of the spectral components within the unit, or determining the maximum

² Petitioner does not concede that the '757 patent specification adequately discloses corresponding acts for each claim term. While Petitioner attempts to identify corresponding acts, several terms are not sufficiently defined or supported by the patent specification (e.g., “representative,” “variance,” “counting,” “mathematical model,” etc.). EX1003, ¶97.

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Claim Term	Function	Corresponding Acts
		spectral amplitude, and equivalents thereof. EX1001, 3:50-59, FIG. 1 (numeral 2).
“a step for counting a number of available frequency-units by using the representative, based on psychoacoustic criteria”	Counting a number of available frequency-units by using the representative, based on psychoacoustic criteria.	Incrementing a bandwidth counter if a variance is above a human hearing threshold, and equivalents thereof. EX1001, 4:29-48, 4:51-53, FIG. 1 (numeral 3), FIG. 2 (numerals 32-33), FIG. 3 (numeral 41).
“a first bit allocation step for determining an initial bit allocation for each of said available frequency-units by using an approximate mathematical model	Determining an initial bit allocation for each of said available frequency-units by using an approximate mathematical model using said counted	Allocating bits based on Equation 1 of the '757 patent, and equivalents thereof. EX1001, 4:49-5:11, FIG. 1 (numeral 4), FIG. 3 (element 43).

Claim Term	Function	Corresponding Acts
using said counted number of available frequency-units”	number of available frequency-units.	
“a second bit allocation step for determining further bit allocation for each of said available frequency-units based on psychoacoustic criteria”	Determining further bit allocation for each of said available frequency-units based on psychoacoustic criteria.	Iteratively allocating bits as described at 3:63-4:18 and FIG. 1 (numerals 6-10), and equivalents thereof.

Nevertheless, whether the terms are step-plus-function is immaterial because the cited art renders the claims obvious under both the step-plus-function constructions and the terms’ plain-and-ordinary meanings. All other claim terms should receive their ordinary-and-customary meaning in view of the specification. EX1003, ¶¶96-98.

VI. GROUND 1: CLAIMS 1-3, 6-7, 10-11, 14, AND 16 ARE OBVIOUS OVER MAHIEUX-FIELDER.

A. Overview of Mahieux

Mahieux describes “compressing a digital audio signal” by “allocating a specific number of bits for the expression of the coefficients of each frequency

band of a transformed digital audio signal.” EX1005, Abstract. Like the ’757 patent, Mahieux’s bit allocation “takes account of psychoauditive criteria” to quantize only the most dominant frequencies. EX1005, 3:1-3;

Mahieux’s method is depicted in Figure 1:

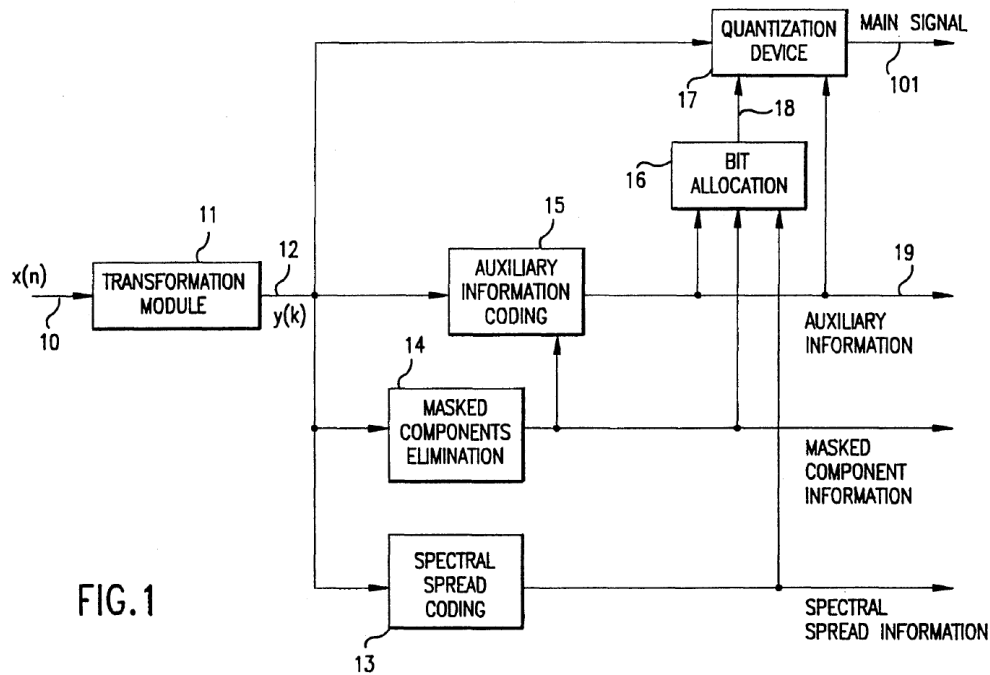


FIG.1

EX1005, FIG. 1.

First, an input signal is decomposed into temporal blocks and transformed to a frequency-domain representation. EX1005, 1:46-53, 2:13-34, 3:17-32, 5:14-36, 5:63-66. The frequency spectrum is then divided into “bands,” each having one or more “spectral components”:

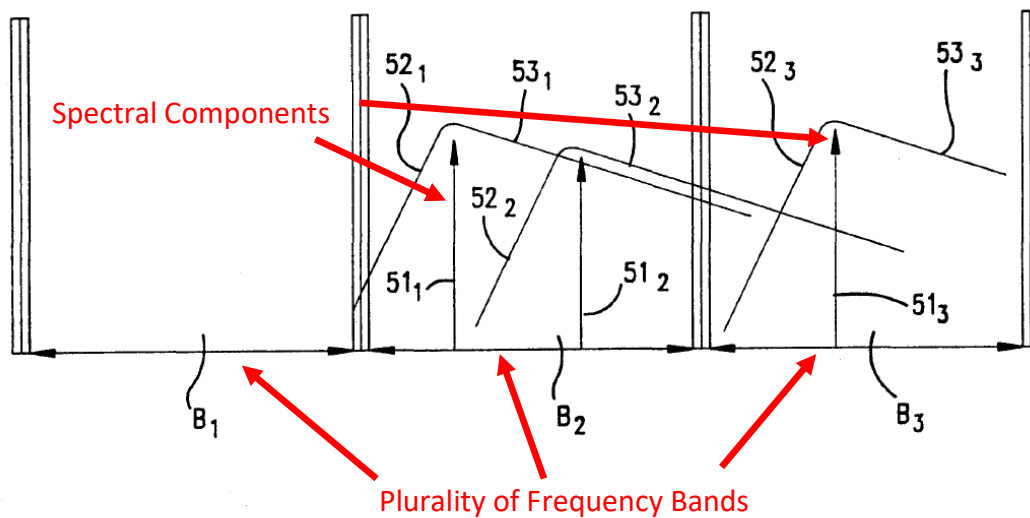


FIG. 5

EX1005, FIG. 5 (annotated).

EX1005, 3:17-32; EX1003, ¶¶100-103.

Second, for each band, “transform coefficients” $y(k)$ are calculated. EX1005, 1:20-37. The coefficients represent the magnitudes of the frequency bands and, thus, the spectral energy of the signal at various frequencies. EX1005, 1:54-56, 5:38-44. The square of the coefficients represents the power of the bands. EX1003, ¶104.

Third, Mahieux considers spectral components “as a function of a psychoauditive criterion.” EX1005, 1:46-68, 2:9-12, 3:1-3, 3:17-52; *see also* EX1005, 3:33-49, 5:66-68, 9:48-59. “If a frequency band is entirely masked”—i.e., rendered inaudible by adjacent bands—“it is not necessary” to allocate bits to the band. EX1005, 10:45-49; *see also* EX1005, 4:35-42, 5:66-6:6, 6:63-65, 7:45-8:6,

12:57-63. Such bands are not considered or counted during bit allocation. *See* EX1005, 6:30-33; EX1003, ¶105.

Fourth, Mahieux assigns bits to the counted bands according to a particular mathematical model. EX1005, 3:43-49, 6:30-46, 7:3-8:9, 11:33-12:64, 11:33-38, 11:44-64, 12:3-11, 12:22-29. The signal is then quantized to produce a digitally encoded signal. *See* EX1005, 6:49-58; EX1003, ¶¶106-108.

B. Overview of Fielder

Fielder likewise describes “high-quality low bit-rate digital signal processing of audio signals[.]” EX1006, 1:14-16, 2:5-7, 5:61-68, 6:17-41. Fielder’s bit-allocation method is applied to frequency bands (which Fielder calls “subbands”) and relies on “psychoacoustic masking” principles. EX1006, 1:40-2:60, 5:61-6:14, 8:24-56, 18:62-19:13, 19:60-20:64, 23:31-24:13, 25:14-27:33, 27:36-54; EX1003, ¶¶109-111. Similar to the ’757 patent, Fielder’s method employs two steps: a first, “fixed” step and a second, “adaptive” step. EX1006, 8:24-56, 9:27-10:2, 21:3-28, 22:19-23:5, 28:30-51.

In the first step, a “fixed number of bits are assigned to each subband based on empirical observations regarding psychoacoustic-masking effects of a single-tone signal in the subband under consideration.” EX1006, 8:31-35, 9:46-56. Then, in the second step, “bits are added to reduce the audible noise to acceptable levels in the problem regions.” EX1006, 9:46-56. The second step is carried out in

several phases:

Phase one assigns bits, up to a maximum of four per transform coefficient, to the coefficients within the same critical band of those frequency components with the greatest spectral energy. If all allocable bits are assigned during phase one, the allocation process stops. If not, phase two allocates additional bits to the transform coefficients which were allocated bits during phase one such that the total adaptively allocated bits for each coefficient is four. If all allocable bits are assigned during phase two, the allocation process stops. If any bits remain, phase three allocates bits to those coefficients which are adjacent to coefficients that were allocated bits during phase one and two.

EX1006, 23:13-27; EX1003, ¶¶112-113.

C. A POSA Would Have Been Motivated to Improve Mahieux's Bit-Allocation Method Using Fielder's Second Bit-Allocation Step.

A POSA would have recognized that Mahieux's bit-allocation method, while effective for identifying perceptually important frequency bands, may not fully optimize bit distribution within those bands. EX1003, ¶117. Two-step bit allocation methods such as Fielder's were well understood in the art to address this problem by providing a more granular allocation of bits. EX1003, ¶¶114, 117. The first step in Fielder's method, similar to Mahieux's approach, allocates bits to perceptually significant bands. EX1003, ¶117. Fielder's second step offers a

refinement mechanism that can more precisely distribute bits among bands already deemed important. This two-step process allows for a more nuanced allocation that can better adapt to the specific characteristics of the audio signal being encoded.

EX1003, ¶¶116-118.

Indeed, Fielder recognizes that more granularity can be achieved using two steps. Fielder explains that its two-step method accurately accounts for frequency bands having the “greatest spectral energy”—i.e., those that are most perceptible to the human ear—while taking into account “coding accuracy and total bit rate” constraints. EX1006, 6:17-27, 23:7, 23:13-29; *see also* EX1006, 9:46-56. Fielder’s second step “reduce[s] the audible noise to acceptable levels in ... problem regions” of the signal. EX1006, 9:49-56; EX1003, ¶119. Accordingly, by allocating any excess bits not already allocated by Mahieux’s method using Fielder’s second step, Mahieux’s method would result in an even higher quality, lower bit-rate signal, and would permit Mahieux to better handle a wider range of audio signals.³ EX1005, 3:43-49, 6:30-46, 7:3-8:9, 11:33-12:64; EX1006, 9:46-56,

³ Given that bits can only be distributed as integers, there are likely to be bits leftover after Mahieux’s allocation step. But even if Mahieux allocates all of its bits, Fielder teaches reserving some bits for the second step. *See* EX1006, 9:46-49 (explaining that, after the first step, the system “remov[es] one or more bits from

23:13-30; EX1003, ¶120.

Combining Mahieux and Fielder would have been nothing more than applying a known technique (Fielder's second bit-allocation step) to a known method ready for improvement (Mahieux's bit-allocation process) to yield predictable results (a system that maintains Mahieux's psychoacoustic-based allocation while gaining the ability to more finely distribute bits among perceptually important coefficients). Stated differently, combining Mahieux and Fielder would have involving using a known technique (Fielder's second bit-allocation step) to improve a similar method (Mahieux's bit-allocation process) in the same way. EX1003, ¶121.

Further, both references share the same goal of reducing the bit-rate representation of a digital audio signal while preserving the quality of the original signal. *Compare* EX1005, 2:60-68, *with* EX1006, 1:14-16. EX1003, ¶¶115-116. And, to achieve that goal, both references allocate bits to certain frequencies based on psychoacoustic criteria. *Compare* EX1005, 3:1-3, *with* EX1006, 6:39-41. In view of these common goals and techniques, a POSA would have been motivated,

each transform coefficient across the spectrum"). A POSA would have used this same technique with Mahieux for all the reasons explained above—i.e., to achieve a high-quality, low bit-rate signal. EX1003, ¶120 n.4.

and known how, to combine the references. EX1003, ¶¶115-116, 122.

Indeed, to effectuate the combination, a POSA would have simply used the conventional hardware described in the references (e.g., conventional audio-processing encoders, algorithms, and quantizers to allocate bits for digital audio signals). EX1005, 2:13-56, 3:43-49, 6:49-58, 11:29-12:29; EX1006, 12:41-14:58. And Fielder describes a “basic hardware architecture” for audio encoding, including an analog-to-digital converter (ADC), digital-signal processor (DSP), RAM, and EEPROM. *See* EX1006, 12:41-42, 12:64-68, 13:2-19; EX1003, ¶123.

A POSA would have understood that the “quantizers” described in Mahieux and Fielder would have been implemented using such hardware and programming. EX1005, 2:13-56, 3:43-49, 6:49-58. This programming would have amounted to a simple implementation of a combined software algorithm that would have controlled the processing performed by the DSP to allocate bits. EX1005, 12:47-63, 13:2-19. Thus, a POSA would have had a reasonable expectation of success that the combination would continue to operate as desired. EX1003, ¶124.

D. The Mahieux-Fielder Combination Renders Claim 1 Obvious.

- 1. [1P] “A method of determining a bit allocation for a quantization of digital audio signals having spectral and temporal structure wherein the digital audio signals are obtained by buffering audio signals in frames and decomposing the digital signals into spectral components, which comprises the steps of”**

To the extent the preamble is limiting, Mahieux discloses it and/or renders it

obvious. Mahieux describes a “**bit allocation** device enabling an adaptive **quantization** of a digital audio signal” after the signal has been “transformed into the frequency domain and **cut up into frequency bands**.”⁴ EX1005, 1:17-22; *see also* EX1005, Title, Abstract, 1:61-68, 3:17-32. Mahieux decomposes an audio signal having spectral and temporal structure by “cut[ting] up” the signal (buffering it)⁵ “into **temporal blocks**” (the claimed “frames”), and then subjects the signal “to a time/frequency transformation.” EX1005, 1:18-22, 1:46-48, 5:45-46; *see also* EX1005, 2:13-34, 4:47-50, 5:20-37, 16:7-10, FIG. 1. The resulting signal is “constituted by a plurality of **spectral components**” distributed “among a plurality of adjacent critical bands.” EX1005, 13:34-42; *see also* EX1005,

⁴ Emphasis added unless otherwise noted.

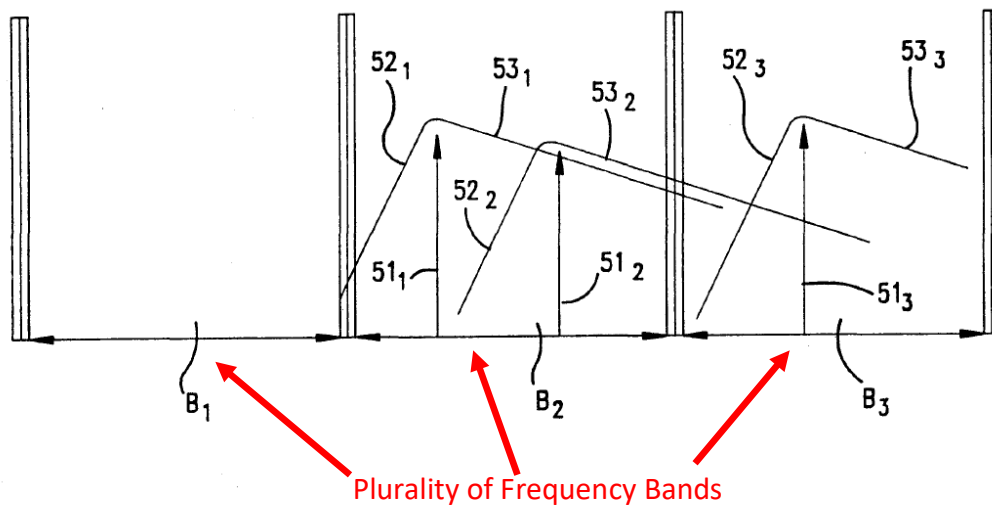
⁵ The BPAI determined that buffering—which is described by the ’757 patent only in its Abstract—is “either inherent or obvious to one of ordinary skill in the art[.]” EX1002, 253. A POSA would have understood that by dividing an audio signal into temporal blocks, Mahieux “buffers” the signal. Fielder itself makes this clear. *See* EX1006, 13:5-10 (describing analog-to-digital converter that “receives and **buffers** [a] serial stream of digitized samples[.]” and “groups the samples into blocks”); *see also* EX1006, FIG. 1a (element 102 showing a “buffer”); EX1003, ¶126 n.5.

Abstract, 3:17-32, 6:17-27.

The spectral components are ultimately fed into “**bit allocation module 16**,” which determines “the number of bits R available for the expression of each of the coefficients $y(k)$ of the transformed signal.” EX1005, 6:30-37; *see also* EX1005, 11:65-12:11, 12:43-56, FIGS. 1, 7. Finally, the output is fed into “**quantizer 17**,” which quantizes the signal to reduce the bit rate “while at the same time preserving the quality of the starting signal to the maximum extent.” EX1005, Abstract, 6:30-33; *see also* EX1005, 1:18-22, 6:49-51; EX1003, ¶¶125-128.

2. [1A] “a step for dividing at least one frequency interval into a plurality of frequency-units”

Mahieux discloses [1A]. Mahieux decomposes an audio signal into spectral components by subjecting the signal “to a time/frequency transformation.” *See* Section VI.D.1. The resulting output is a frequency “**spectrum**” (claimed “frequency interval”) that is “cut up” or “divided” “into **frequency bands**” (claimed “frequency-units”). EX1005, 1:17-21, 3:17-32, 7:13-15; *see also* EX1005, 3:43-49, 5:38-44, 6:40-46, 9:31-59, 12:47-56, 13:1-9, 13:34-42. These bands are depicted as B_1 , B_2 , and B_3 in Figure 5:



EX1005, FIG. 5 (annotated).

EX1003, ¶¶129-130.

Even to the extent the limitation is step-plus-function, Mahieux's disclosure is identical to the corresponding acts disclosed in the '757 patent. EX1001, 1:37-40, 4:21-24, FIG. 6; EX1005, 1:17-21, 3:17-32, 3:43-49, 5:38-44, 6:40-46, 7:13-15, 9:31-59, 12:47-56, 13:1-9, 13:34-42; EX1003, ¶131.

3. [1B] “a step for obtaining a representative of each frequency-unit obtained”

Mahieux discloses and/or renders obvious [1B]. Mahieux calculates “*transform coefficients*” representing the magnitudes of the frequencies within each band, which “are very close to the true spectrum.” EX1005, Abstract, 3:17-32, 3:43-49, 5:20-44, 6:30-58, 7:3-8:9, 10:45-49, 11:33-12:64. These coefficients $y(m, k)$ are defined by the equation below, where N is the size of the transform

block, $h(n)$ is the block weighting window, and m is the block transform number:

$$y(m,k) = \sum_{n=0}^{N-1} x_m(n) \cdot h(N-1-n) \cdot \cos(2\pi(k + \frac{1}{2})(n + n_0)/N)$$

$$k = 0, \dots, N-1.$$

EX1005, 5:20-44.

Mahieux explains that “application of mathematical transformation achieves a concentration of the energy of the source signal on the biggest coefficients.”

EX1005, 1:46-68. Accordingly, a POSA would have understood that Mahieux’s coefficients represent the energy of the frequency bands and are “representative” of the bands. *See* EX1002, 254; EX1003, ¶¶132-133. Additionally, the squares of the coefficients represent the power of the frequency bands and are likewise “representative” of the bands. EX1003, ¶133. And, by calculating the coefficients and power, Mahieux “obtains” them, just as the ’757 patent calculates its variance. *See* EX1001, 3:50-59, FIG. 1; EX1003, ¶134.

For all the same reasons, even to the extent the limitation is step-plus-function, Mahieux’s calculation of its coefficients renders obvious the corresponding acts disclosed in the ’757 patent. EX1001, 3:50-59, FIG. 1 (numeral 2); EX1005, Abstract, 1:46-68, 3:17-32, 3:43-59, 5:20-44, 6:30-58, 7:3-8:9, 10:45-49, 11:33-12:64. EX1003, ¶135.

4. [1C] “a step for counting a number of available frequency-units by using the representative, based on psychoacoustic criteria”

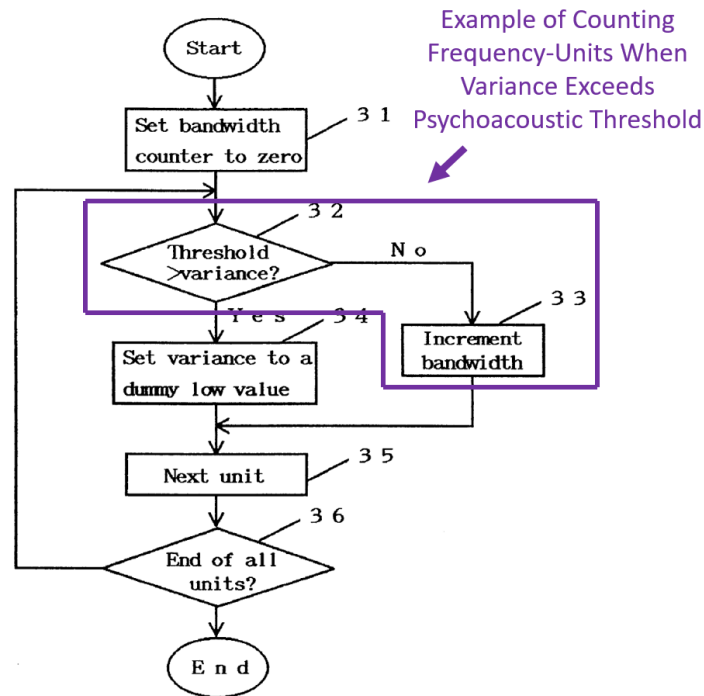
Mahieux discloses and/or renders obvious [1C]. Mahieux’s goal is “to provide a bit allocation device ... wherein the principle of operation takes account of *psychoauditive criteria*.” EX1005, 3:1-3; *see also* EX1005, 1:54-68, 2:9-12.

In Mahieux, when a frequency band is “entirely masked” (e.g., rendered “inaudible” by more prominent frequencies within the signal), “it is not necessary” to allocate bits to that band. EX1005, 10:45-49. Accordingly, Mahieux ignores bands below a “masking threshold corresponding to the human auditory system” and “eliminat[es]” them from consideration while “preserving” bands above the threshold. EX1005, 1:54-68, 3:17-49, 10:45-49, 11:29-38, 12:22-29, 13:13-17. To make that determination, Mahieux compares its power (proportional to the square of the transform coefficients) against a “masking threshold corresponding to the human auditory system.” EX1005, 8:6-9, 13:13-17. Thus, Mahieux uses its coefficients and power values (claimed “representatives”) to determine which bands are audible and, thus, which bands are available for bit allocation. *See* EX1005, 6:63-65; EX1003, ¶¶136-139.

Regarding “counting,” the ’757 patent provides an example in which a “bandwidth counter” is used to count each frequency-unit whose variance exceeds a “human hearing threshold.” EX1001, 4:29-35. If a unit exceeds the threshold, the

counter “is incremented,” as shown in step 33 of Figure 2:

F i g . 2



EX1001, FIG. 2 (annotated).

See also EX1001, 4:39-42. This step “eliminates units that are irrelevant according to psychoacoustic criteria.” EX1001, 4:46-48.

While Mahieux does not expressly disclose “counting” in this fashion, it accounts for frequency bands that exceed a masking threshold and are thus available for bit allocation. Mahieux therefore “counts” those bands so as to eliminate all bands below the threshold, just as the plain claim language requires. That disclosure is sufficient because, as the Applicant acknowledged during prosecution, “there is no mention of a bandwidth counter” in the claims. See

EX1002, 225-26; EX1003, ¶¶140-141.

Nevertheless, to the extent that the Board determines that affirmatively counting—for example, by incrementing a counter—is required, a POSA would have found it obvious to do so in Mahieux’s system. EX1003, ¶142. First, there are only a finite number of ways to keep track of perceptibly significant frequency bands, and a prominent one known in the art was to use a counter. EX1003, ¶142. And so, using a counter in Mahieux’s system would have at least been obvious to try given how easy it is to implement.

Further, PO itself has taken a broad view of what affirmatively counting encompasses in the parallel district-court litigation. There, PO mapped the “counting” step to the following excerpt of pseudocode in a digital audio compression standard:

Pseudo Code

```
bndstrt = masktab[start] ;
bndend = masktab[end - 1] + 1 ;
if (bndstrt == 0) /* For flw and lfe channels */
{ /* Note: Do not call calc_lowcomp() for the last band of the lfe channel, (bin = 6) */
    lowcomp = calc_lowcomp(lowcomp, bndpsd[0], bndpsd[1], 0) ;
    excite[0] = bndpsd[0] - fgain - lowcomp ;
    lowcomp = calc_lowcomp(lowcomp, bndpsd[1], bndpsd[2], 1) ;
    excite[1] = bndpsd[1] - fgain - lowcomp ;
    begin = 7 ;
    for (bin = 2; bin < 7; bin++)
    {
        if ((bndend != 7) || (bin != 6)) /* skip for last bin of lfe channels */
        {
            lowcomp = calc_lowcomp(lowcomp, bndpsd[bin], bndpsd[bin+1], bin) ;
        }
        fastleak = bndpsd[bin] - fgain ;
        slowleak = bndpsd[bin] - sgain ;
        excite[bin] = fastleak - lowcomp ;
        if ((bndend != 7) || (bin != 6)) /* skip for last bin of lfe channel */
        {
            if (bndpsd[bin] <= bndpsd[bin+1])
            {
                begin = bin + 1 ;
            }
        }
    }
}
```

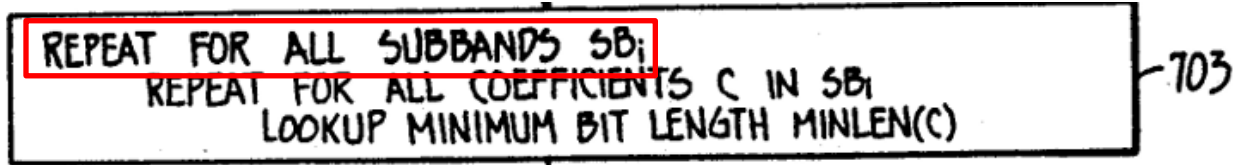
EX1037, 49 (excerpted and annotated).

The pseudocode does not appear to perform any counting. EX1003, ¶¶143-144.

Nevertheless, PO points to the pseudocode’s iteration through the available frequency-units (“bins”) in a “for” loop as an example of “counting.” EX1035, 3.

To the extent the limitation encompasses such counting, that is how a POSA would have implemented Mahieux’s bit-allocation process.⁶ Indeed, Fielder expressly discloses iterating through all frequency sub-bands to determine transform coefficients:

⁶ Petitioner does not agree with PO’s infringement allegations and cites them only as evidence of how PO interprets its claims.



EX1006, FIG. 7 (annotated).

Using a similar iterative process in Mahieux would have been the most straightforward way to implement Mahieux, as the software would need a way to account for and loop through all frequency bands that exceed Mahieux's masking threshold. Such counting would not have changed any aspect of the system. Accordingly, utilizing a counter to actively count available frequency bands represents a mere design choice that would have yielded predictable results.

EX1003, ¶¶145-146.

And, for all the same reasons, even to the extent the limitation is step-plus-function, it would have been obvious to implement Mahieux to count frequency-units by incrementing a counter, as disclosed in the '757 patent. EX1001, 4:29-48, 4:51-53, FIG. 1 (numeral 3), FIG. 2 (numerals 32-33), FIG. 3 (numeral 41); EX1005, 1:54-68, 2:9-12, 3:1-3, 3:17-49, 6:63-65, 8:6-9, 10:45-49, 11:29-38, 12:22-29, 13:13-17; EX1003, ¶147.

5. [1D] "a first bit allocation step for determining an initial bit allocation for each of said available frequency-units by using an approximate mathematical model using said counted number of available frequency-units"

Mahieux discloses and/or renders obvious [1D]. As explained above,

Mahieux counts—or at least renders obvious counting—non-masked bands that include perceptible frequencies and, therefore, that are available for bit allocation. See Section VI.D.4. Mahieux then allocates bits to those bands using an approximate mathematical model.

An example of such a model is shown in module 72 of Figure 7 below:

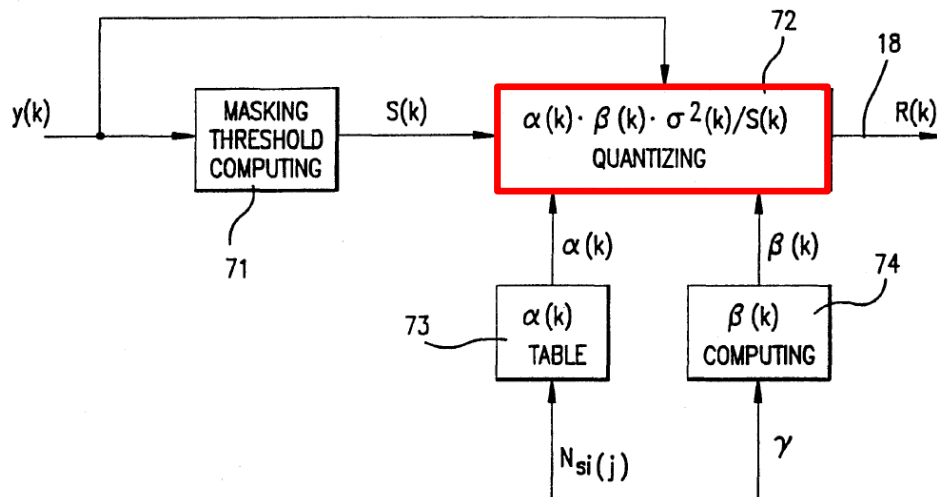


FIG.7

EX1005, FIG. 7 (annotated).

The model is based on the following ratio: $\alpha(k) \cdot \beta(k) \cdot \sigma^2(k)/S(k)$. EX1005, 12:3-11.

The function $\alpha(k)$ accounts for “*the number of non-zero coefficients.*” EX1005,

12:25-26; *see also* EX1005, 12:47-56 (explaining that $\beta(k)$ ensures that bits are

allocated to “*zones of the spectrum that contain peaks*” (that have non-zero

coefficients)). And, because Mahieux does not allocate bits to bands that are

entirely masked, EX1005, 10:45-49, it would have been obvious to a POSA that

the mathematical model accounts for the frequency bands that have been counted as described above, *see* Section VI.D.4; EX1003, ¶¶148-154.

Even to the extent the limitation is step-plus-function, Mahieux's bit allocation using a mathematical model is equivalent to the corresponding acts disclosed in the '757 patent. EX1001, 4:49-5:11, FIG. 1 (numeral 4), FIG. 3 (element 43); EX1005, 10:45-49, 12:3-11, 12:25-26, 12:47-56; EX1003, ¶155.

6. [1E] “a second bit allocation step for determining further bit allocation for each of said available frequency-units based on psychoacoustic criteria”

Mahieux-Fielder discloses and/or renders obvious [1E]. As explained above, Mahieux describes a single-step bit-allocation process using a mathematical model. As also explained above, a POSA would have been motivated to use Fielder's two-step method to achieve greater granularity in allocating bits. *See* Section VI.C; EX1003, ¶156. And, to implement Fielder's method in Mahieux, a POSA would have simply added Fielder's second bit-allocation step.

Fielder's second step is performed in an iterative fashion:

- First, bits are assigned “to the coefficients within the same critical band of those frequency components with the greatest spectral energy.” EX1006, 23:13-30. “If all allocable bits are assigned during phase one, the allocation process stops.” EX1006, 23:13-30.
- Second, additional bits are allocated to “the transform coefficients which were allocated bits during phase one such that the total adaptively

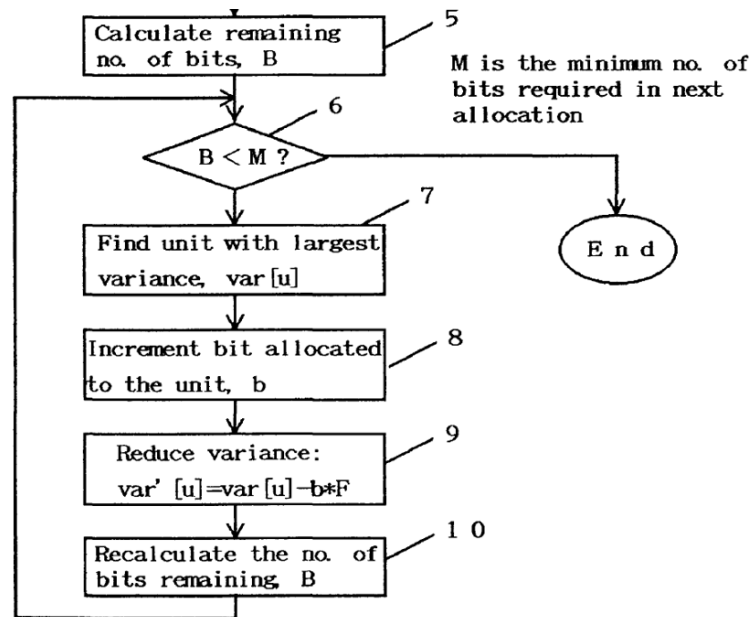
allocated bits for each coefficient is four.” EX1006, 23:13-30. “If all allocable bits are assigned during phase two, the allocation process stops.” EX1006, 23:13-30.

- Third, if any bits remain, they are allocated “to those coefficients which are adjacent to coefficients that were allocated bits during phase one and two.” EX1006, 23:13-30.

Fielder explains that this method accounts for “*psychoacoustic masking*” such that “fewer bits are allocated to signal components whose quantizing errors are masked (rendered inaudible) by other signal components.” EX1006, 6:7-10; EX1003, ¶157.

Indeed, a POSA would have understood that Fielder’s frequency components having “the greatest spectral energy” are the audible components that are most perceptible to the human ear. *See* EX1006, 5:61-6:14. That is the point of Fielder’s adaptive bit-allocation step—i.e., to allocate bits only to the most audible frequencies in order to reduce quantization error. *See* EX1006, 9:46-56 (explaining that bits are “added to *reduce the audible noise* to acceptable levels in [any] problem regions”), 5:61-6:14; EX1003, ¶158.

In fact, Fielder’s iterative process mirrors the ’757 patent’s method:



EX1001, FIG. 1 (excerpted).

Just as the '757 patent requires bits to be allocated to frequency-units having the largest variance (step 7 in Figure 1 above), Fielder requires bits to be allocated to bands having “the greatest spectral energy.” EX1006, 23:13-29. Both methods allocate bits based on psychoacoustic criteria. EX1003, ¶159.

And, as this comparison demonstrates, even to the extent the limitation is step-plus-function, Fielder’s adaptive allocation step is equivalent to the corresponding acts disclosed in the '757 patent. EX1001, 3:63-4:18, FIG. 1 (numerals 6-10); EX1006, 5:61-6:14, 9:46-56, 23:13-30; EX1003, ¶160.

Finally, a POSA would have been motivated to employ Fielder’s second bit-allocation step in Mahieux, as doing so would achieve greater quantization precision and accuracy. *See* Section VI.C; EX1003, ¶161. In the combination,

Fielder's method would be used to allocate bits to the available frequency bands that Mahieux counts. *See* Section VI.D.4; EX1003, ¶161.

E. Claim 2: “mathematical model is derived from an in-band masking effect such that an error spectrum will follow more closely to the original signal spectrum”

Mahieux-Fielder renders this claim obvious. As explained above, Mahieux discloses allocating bits to bands using an approximate mathematical model. *See* Section VI.D.5. The allocation process accounts for the “masking of inaudible spectral components” and “eliminate[s]” from consideration “the masked lines” corresponding to “inaudible frequencies.” EX1005, 1:54-68, 4:67-68, 6:1-5; Sections VI.D.4-5; EX1003, ¶¶162-163.

Mahieux also accounts for masked lines from within a *single* band (“in-band”). Mahieux describes “*intra-band masking*”:

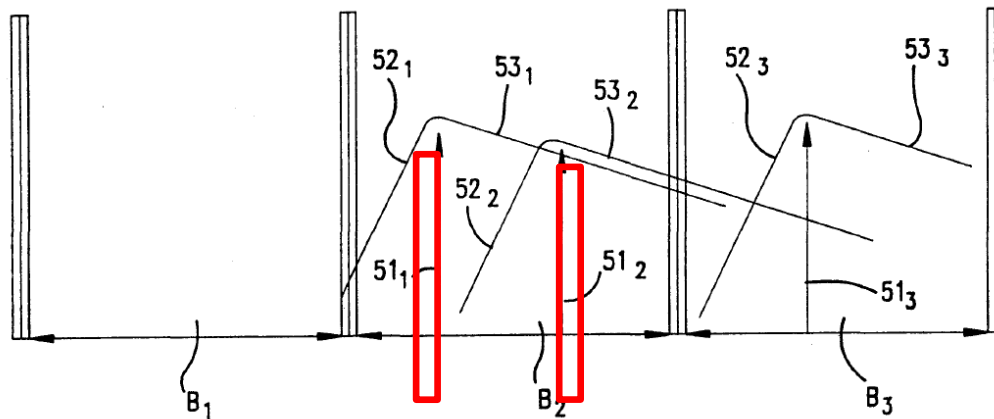


FIG.5

EX1005, FIG. 5 (annotated).

EX1005, 7:16-32. Intra-band masking “corresponds to the total masking effect of all the lines $51_1, 51_2$ *within one and the same band B_2 .*” EX1005, 7:19-23. And, “[i]f a frequency band is entirely masked,” it is “not necessary” to allocate bits for the band. EX1005, 10:45-49; EX1003, ¶164.

Mahieux’s mathematical model accounts for these masked lines and is therefore “derived from” an in-band masking effect. Indeed, the “*masking threshold*” $S(k)$ expressly appears in Mahieux’s mathematical model:

$\alpha(k) \cdot \beta(k) \cdot \sigma^2(k) / S(k)$. EX1005, 12:3-11. Likewise, $\alpha(k)$ is a function of $N_{si}(j)$, which is “the number of *non-masked coefficients* in the band j .” EX1005, 9:58-59; EX1003, ¶165.

Because the model accounts for in-band masking effects, it leads to an error spectrum that follows more closely to the original signal spectrum. Mahieux explains that its model and bit-allocation method are “designed to accomplish the *spectral shaping of the quantization noise according to perceptual criteria*” by “*minimiz[ing] the noise to masking threshold ratio.*” EX1005, 11:65-68; *see also* EX1005, 6:38-39. Mahieux’s method thus codes “pure sounds contained in the signal ... with higher precision” such that the masking threshold “is lower than in the case of a noise spectrum.” EX1005, 12:51-56. This results in a signal having coefficients that are “*very close to the true spectrum.*” EX1005, 5:38-44, 12:57-63; *see also* EX1005, 2:61-68; EX1003, ¶166.

By accounting for in-band masking effects, Mahieux minimizes noise for frequencies that are most perceptible, thereby yielding an error spectrum that follows more closely to the original signal spectrum for those frequencies. Lowering the error spectrum in this manner mirrors the '757 patent's disclosure. *See* EX1001, 5:24-26 (“[I]n the higher frequency end, the error spectrum ... is lower and this accounts for the improvement in the noise control at high frequency.”); EX1003, ¶¶167-168.

F. Claims 3, 7, 11, and 14: “each frequency-unit is represented by a single spectral component”

Mahieux-Fielder renders these claims obvious. As explained above, Mahieux divides a signal's frequency spectrum into various bands and obtains transform coefficients and corresponding power values (claimed “representatives”) for each band. *See* Sections VI.D.2-3. Further, Mahieux depicts an example in which one of those bands (B_3) includes a *single spectral component* (51₃):

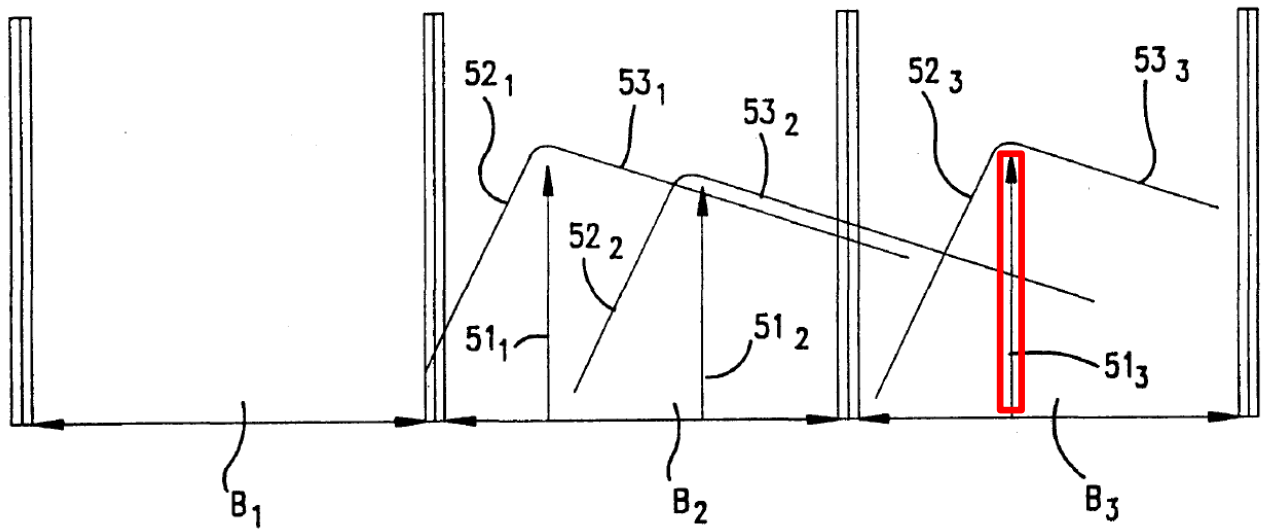


FIG.5

EX1005, FIG. 5 (annotated).

The unit's representative is the transform coefficient or power value for the single spectral component 51_3 . EX1003, ¶¶169-170.

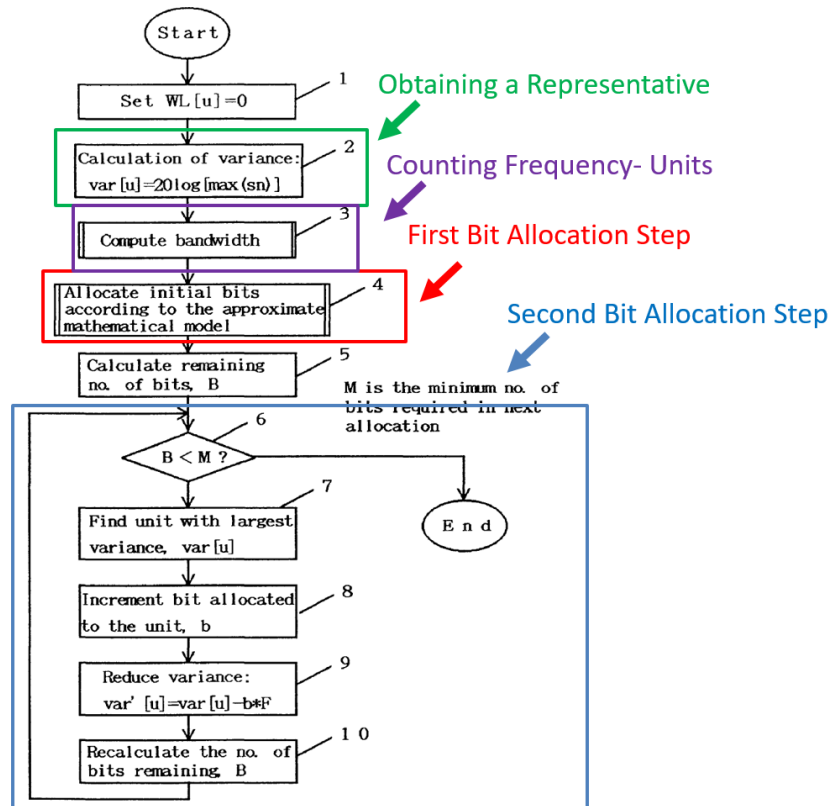
Further, the spectrum can be divided into several bands of “*equal width.*” EX1005, 9:13-17, 12:43-46. Since Mahieux discloses at least one band having a width accommodating a single spectral component, and since Mahieux explains that *all* bands can have the same width, a POSA would have understood that Mahieux discloses each frequency band being represented by a single spectral component. EX1005, 7:13-15, FIG. 5; EX1003, ¶¶171-172.

G. Claim 6: “second bit allocation step is to determine the bit allocation through a psychoacoustically weighted inverse relationship with the said representative of each of said frequency-units”

Mahieux-Fielder renders this claim obvious. The '757 patent does not meaningfully discuss a “psychoacoustically weighted inverse relationship” with the representative of each frequency-unit. Rather, the Abstract states in passing that the claimed method “iteratively increas[es] the quantization of each of the frequency intervals through a psychoacoustically weighted inverse relationship with the [*sic*] variance of each of the frequency intervals.” EX1001, Abstract.

The only disclosure in the '757 patent bearing on the second bit-allocation step is the description of steps 6-10 in Figure 1:

F i g . 1



EX1001, FIG. 1 (annotated).

EX1001, 3:62-4:18. As steps 7-8 show, frequency-units having the “largest variance” are allocated the most bits. Accordingly, as the variance of a frequency-unit increases, the quantization for the unit increases and the corresponding error decreases. Variance and quantization error are thus inversely related. *Cf.* EX1006, 1:33-39 (explaining that quantization error is “inversely proportional to the number of bits available to represent the signal sample quantization”); EX1003, ¶¶173-175.

Stated differently, adverse psychoacoustic effects are reduced through the iterative bit-allocation process shown in Figure 1. And, so, in a broad sense, the bit

allocation is determined based on a psychoacoustically weighted inverse relationship with the variance of each frequency-unit. EX1003, ¶176.

As explained above, that is what Fielder discloses. *See* Section VI.D.6. Fielder’s second bit-allocation step considers “psychoacoustic masking” so that “fewer bits are allocated to signal components whose quantizing errors are masked (rendered inaudible) by other signal components,” and “more bits are allocated to transform coefficients” (the claimed “representatives”) having “the greatest amplitude or energy.” EX1006, 5:61-6:14. This method “*reduce[s] the audible noise* to acceptable levels in the problem regions.” EX1006, 9:46-56. And, like the ’757 patent, Fielder iteratively assigns bits in this manner “until all allocable bits are assigned.” EX1006, 25:1-13; EX1003, ¶¶177-178.

H. Claim 10: “counted number of available frequency-units is a number of the frequency-units which have the representative exceeding a human hearing threshold”

Mahieux-Fielder renders this claim obvious. As explained above, Mahieux obtains transform coefficients and power values to determine whether a particular frequency band includes spectral components that meet psychoacoustic criteria. *See* Sections VI.D.3-4; EX1003, ¶¶179-180.

If a band is “inaudible” or “entirely masked,” it is not necessary to allocate bits to the band. EX1005, 10:45-49; *see also* EX1005, 4:35-42, 5:66-6:6, 6:63-65, 12:57-63. Mahieux therefore compares its power values (proportional to the square

of the transform coefficients) against a “*masking threshold corresponding to the human auditory system*” (claimed “human hearing threshold”)—i.e., it ignores bands that are “below [the] threshold” and “preserv[es]” bands that are above the threshold. EX1005, 8:6-9, 13:13-17. The preserved bands are thus “*representative of the sensibility of the human ear.*” EX1005, 13:1-9; EX1003, ¶181.

By accounting for bands that are above the masking threshold, Mahieux counts—or at least renders obvious counting—bands that exceed a human hearing threshold, similar to the ’757 patent. *See* Section VI.D.4, EX1001, 4:46-48; EX1003, ¶¶182-183.

I. Claim 16: “frequency-unit is obtained by dividing said spectral and temporal structure with at least one frequency interval”

Mahieux-Fielder renders this claim obvious. As explained, Mahieux allocates bits to a digitally converted audio signal having spectral and temporal structure. *See* Sections VI.D.1-2. Mahieux divides the signal’s frequency spectrum (claimed “frequency interval”) into “blocks of samples” (thus exploiting the signal’s temporal structure) and performs a “time/frequency transformation and a predictive and adaptive coding of the most significant coefficients of each block” (thus exploiting the signal’s spectral structure). EX1005, 2:13-23; EX1003, ¶¶184-185.

Mahieux then divides the frequency spectrum into a plurality of frequency

“bands” (claimed frequency-units). *See* Section VI.D.2. By dividing the “totality of the spectrum” into “a set of adjacent bands,” EX1005, 3:17-32, Mahieux obtains the frequency-units. EX1003, ¶¶186-187.

VII. GROUND 2: CLAIMS 1-17 ARE OBVIOUS OVER MAHIEUX, FIELDER, AND AKAGIRI.

As explained above, Mahieux-Fielder renders obvious claims 1-3, 6-7, 10-11, 14, and 16. Further, as explained below, Akagiri discloses a representative comprising a “variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit,” as recited in claims 4, 8, 12, and 15, and a “variance which is calculated from an average of a spectral component of each frequency-unit,” as recited in claims 5, 9, 13, and 17. *See* Sections VII.C-D.

Accordingly, because Akagiri discloses the “representatives” recited in those dependent claims, it also discloses the “representative” recited in independent claim 1 and its other dependent claims. Mahieux-Fielder-Akagiri thus also renders claims 1-17 obvious. *See* Section VII.E; EX1003, ¶188.

A. Overview of Akagiri

Akagiri describes “an apparatus for encoding an input digital signal.” EX1007, 2:21-26. Akagiri’s device transforms an audio signal into a frequency-domain representation and divides the signal “into a number of frequency bands.” EX1007, Abstract, 2:32-50, 4:14-67. Akagiri then determines “the energies or spectral intensities of each band” by summing either the “peak value” or “mean

value” of spectral components. EX1007, 4:58-68; EX1003, ¶189.

Ultimately, bits are allocated to bands having the largest energies, thus accommodating for “masking characteristics of the human auditory sense.”

EX1007, 1:32-35, 4:42-57; EX1003, ¶190.

B. A POSA Would Have Combined Akagiri with Mahieux and Fielder.

In the proposed combination, Akagiri is used to calculate Mahieux’s transform coefficients and power values (claimed “representatives”) from spectral components’ peak values (claims 4, 8, 12, and 15) and average values (claims 5, 9, 13, and 17) within each of Mahieux’s frequency bands. A POSA would have been motivated to use Akagiri in Mahieux-Fielder.

Both Mahieux and Fielder obtain representatives for frequency bands and use them to allocate bits. *See* Sections VI.D.3-6; EX1003, ¶¶191-192. Mahieux and Fielder consider the “biggest coefficients” and “greatest amplitude or energy” in a frequency band to allocate bits. EX1005, 1:54-60; EX1006, 6:4-6. A POSA, when assigning bits considering the “greatest amplitude or energy” in a frequency band as taught in Mahieux-Fielder, would have implemented the method using Akagiri’s “peak values.” Such values indisputably represent the “greatest amplitude or energy” values. Thus, calculating representatives by determining peak amplitude values for each band is nothing more than a simple substitution of one known

element (using coefficients and power values) for another (using peak values) to obtain predictable results. EX1003, ¶192.

Additionally, a POSA would have recognized that another way to represent a frequency band is to consider an average or mean value of the amplitudes within the band. EX1007, 4:58-68; EX1003, ¶193. Doing so would capture a broader spectrum of frequencies in each band. And, by using that approach in Mahieux-Fielder, a POSA would achieve a number of advantages, including greater flexibility and computational efficiency, and more accurate and improved bit allocation that would align more closely to the original spectrum. EX1003, ¶¶193-198. At the very least, using the average or mean value of the amplitudes within a band would be obvious to try given that there are only a finite number of ways to represent a frequency band (e.g., peak value, mean value, median, etc.). EX1003, ¶199.

Finally, a POSA would have known how to combine Akagiri with Mahieux-Fielder with a reasonable expectation of success. A POSA would have implemented Akagiri's teachings using the DSP and programming described in Fielder. *See* Section VI.C; EX1003, ¶200. This combination would have led to predictable results and would have worked as intended because Mahieux, Fielder, and Akagiri use conventional audio-processing encoders and algorithms for encoding digital audio signals. *See* Section VI.C; EX1007, 3:44-4:41. Thus, a

POSA would have had an expectation of success that the combination would continue to operate as desired. EX1003, ¶200.

C. Claims 4, 8, 12, and 15: “representative is a variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit”

Mahieux, Fielder, and Akagiri render these claims obvious. While the term “variance” has a well-defined statistical meaning (e.g., the spread between numbers in a data set), the patent appears to adopt a broader meaning. It states that the variance can be “calculated from the maximum spectral sample amplitude in [each] unit,” and the only example provided (in step 2 of Figure 1) shows that the variance is calculated as follows: $\text{var}[u]=20\log[\max(\text{sn})]$. EX1001, 3:50-52, FIG. 1. And the Applicant stated during prosecution that the term “variance” is used “to define a change [in] each frequency unit,” without specifying how the change is determined. EX1002, 179; EX1003, ¶¶201-202.

In view of this disclosure and statement, Mahieux-Fielder-Akagiri renders the limitation obvious. Mahieux discloses representatives in the form of transform coefficients and power values representing amplitudes of spectral components in each frequency band. *See* Section VI.D.3; EX1003, ¶203. And Akagiri uses a peak amplitude value to represent a frequency band.

Akagiri determines the “energies or spectral intensities of each band” by considering the “*peak value*” of the “*amplitude values Am for the critical bands.*”

EX1007, 4:58-68. Specifically, Akagiri determines the “energies or spectral intensities of each band” by taking the sum of the peak values. EX1007, 4:58-68. The peak value is the claimed “amplitude of a maximum spectral component of each frequency-unit.” And, by summing the peak values so as to obtain “energies or spectral intensities,” Akagiri calculates the variance “from” the amplitude of a maximum spectral component. EX1003, ¶203.

Finally, as discussed above, a POSA would have been motivated to employ Akagiri’s method of determining peak amplitude values for each band in Mahieux-Fielder, as doing so would be a simple substitution of one known element (using coefficients) for another (using peak values) to obtain predictable results. *See* Section VII.B; EX1003, ¶204.

D. Claims 5, 9, 13, and 17: “representative is a variance which is calculated from an average of a spectral component of each frequency-unit”

Mahieux-Fielder-Akagiri renders these claims obvious. Akagiri states that “the *mean value* of the amplitude values” may be summed to obtain “the energies or spectral intensities of each band,” which are ultimately used to allocate bits. EX1007, 4:58-68. The mean value of the band amplitudes is the claimed “average of a spectral component of each frequency-unit.” And, by summing the mean values to obtain “energies or spectral intensities,” Akagiri calculates the variance “from” the average of a spectral component of each frequency-unit. EX1003,

¶¶205-207.

Finally, as explained above, a POSA would have been motivated to employ Akagiri's method of determining an average value of the spectral components for each band in Mahieux-Fielder, as doing so would capture a wider spectrum of frequencies in each of the bands. *See* Section VII.B; EX1003, ¶208.

E. Claims 1-3, 6-7, 10-11, 14, and 16

Given that Akagiri discloses the representative in claims 4 and 5, it also discloses the representative in independent claim 1. At the very least, Akagiri discloses determining the sum of peak and mean amplitude values within each band, which indisputably would qualify as a “representative”—i.e., “a characteristic representative of the signal.” EX1002, 254 (cleaned up).

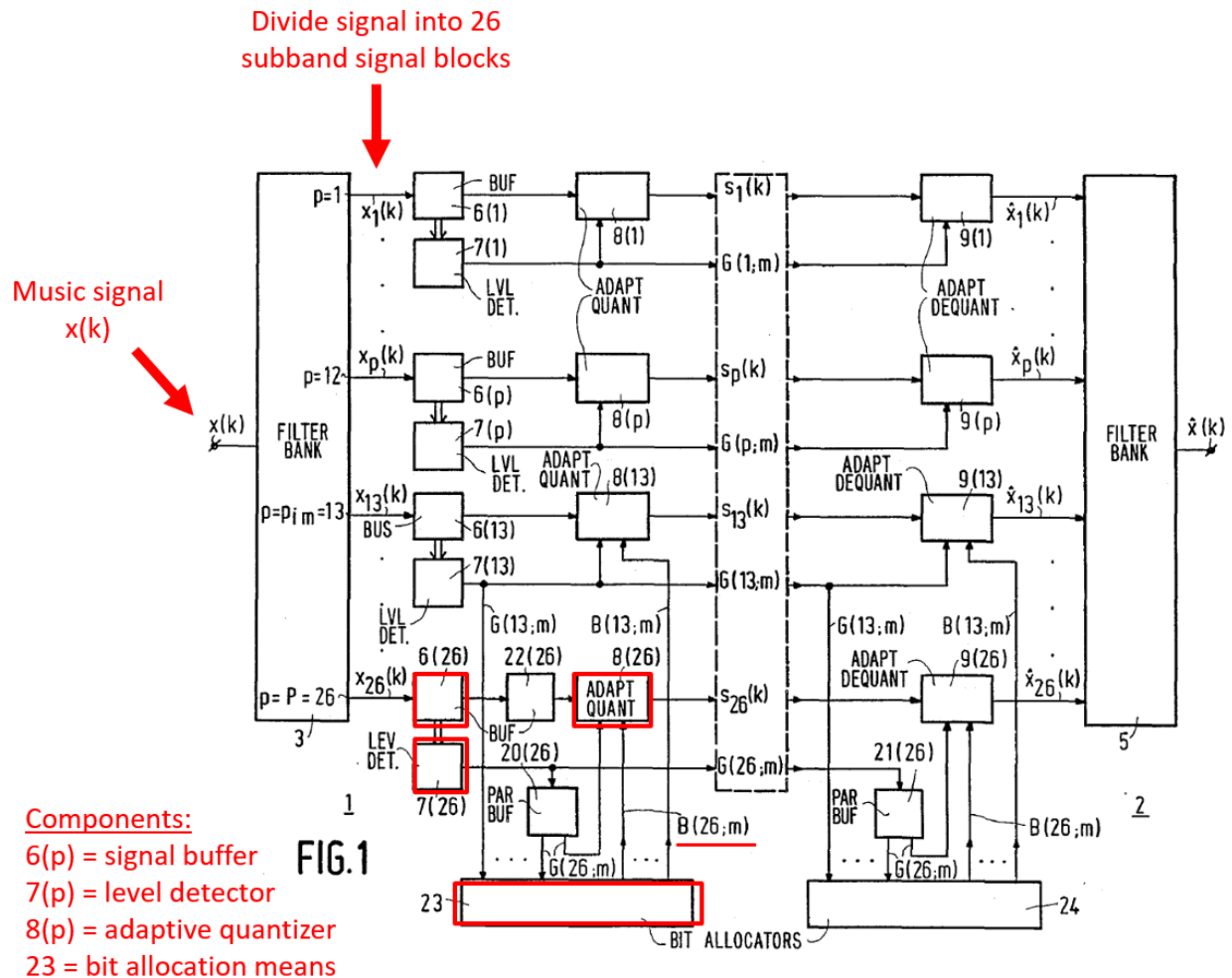
Thus, Mahieux-Fielder-Akagiri also renders claims 1-3, 6-7, 10-11, 14, and 16 obvious as well. EX1003, ¶¶209-210.

VIII. GROUND 3: CLAIMS 1-3, 6-7, 10-11, 14, AND 16 ARE OBVIOUS OVER VELDHUIS-GALAND.

A. Overview of Veldhuis

Veldhuis describes “subband coding of a digital audio signal.” EX1008, Abstract, 1:6-40. Like the '757 patent, Veldhuis allocates bits based on “characteristic parameters representing the signal energy” to “exploit the psychoacoustic effect of temporal masking.” EX1008, 3:49-4:52.

Veldhuis's method is shown in Figure 1:



EX1008, FIG. 1 (annotated).

EX1003, ¶¶212-213. First, an input signal having a frequency band between 0 and 22.05 kHz is applied to filter bank 3 and divided into 26 subbands having “band numbers $p(1 \leq p \leq P=26)$ ”:

p	f _{co} [H z]		W(p) [H z]	L(p)	B(p)
1	0	86	86	25	4.64
2	86	172	86	25	4.64
3	172	258	86	25	4.64
4	258	345	86	25	4.64
5	345	517	172	25	4.64
6	517	689	172	25	4.64
7	689	861	172	25	4.64
8	861	1034	172	25	4.64
9	1034	1206	172	25	4.64
10	1206	1378	172	25	4.64
11	1378	1550	172	25	4.64
12	1550	1723	172	25	4.64
13	1723	2067	345	25	4.64
14	2067	2412	345	19	4.25
15	2412	2756	345	13	3.70
16	2756	3101	345	9	3.17
17	3101	3445	345	7	2.81
18	3445	4134	689	7	2.81
19	4134	4823	689	7	2.81
20	4823	5513	689	7	2.81
21	5513	6891	1378	7	2.81
22	6891	8269	1378	5	2.32
23	8269	11025	2756	3	1.58
24	11025	13781	2756	3	1.58
25	13781	16538	2756	3	1.58
26	16538	22050	5513	3	1.58

EX1008, FIG. 3.

EX1008, 5:53-59. For each subband $p(13 \leq p \leq 26)$ —i.e., the subbands having frequencies between 1,723 Hz and 22.05 kHz—a signal $x_p(k)$ is generated, and the signals “are quantized blockwise” using “known block-adaptive PCM methods.”⁷

EX1008, 5:64-68, 6:10-21; EX1003, ¶214.

⁷ Subbands having band numbers $p(1 \leq p \leq 12)$ receive “a fixed number of B(p) bits per signal sample.” EX1008, 10:60-66. Those bands are irrelevant to the patentability challenge presented here. *See* EX1002, 255; EX1003, ¶214.

Second, for each block “(p;m),”⁸ “a characteristic parameter $G(p;m)$ ” is determined, which represents “the signal level in th[e] block.” EX1008, 6:14-18. “As is well known, the signal level can be represented by the average value of the amplitude or the power of the signal samples of a block, but also by the peak value of the amplitude of the signal[] samples in a block.” EX1008, 6:24-28; EX1003, ¶215.

Third, the parameter $G(p;m)$ is compared to a threshold $T(p)$ “of the human auditory system for just perceiving single tones in the respective frequency ranges” so as to generate a binary comparator signal $C(p;m)$. EX1008, 11:23-36. If $G(p;m)$ is greater than or equal to the threshold, $C(p;m)$ is set to 1; otherwise, $C(p;m)$ is set to 0. EX1008, 11:23-28. This comparison allows the blocks to be categorized into two groups: (a) blocks “containing perceptually significant signal energy” indicated by $C(p;m)=1$, and (b) blocks “containing no perceptually significant signal energy” indicated by $C(p;m)=0$. EX1008, 11:37-49. For blocks that cannot be heard, a “sum S of the saved number of quantizing bits” is determined by “increment[ing]” the number of bits that would have otherwise been assigned to the blocks. EX1008, 11:37-49, 12:11-24, 13:51-14:23, FIG. 8; EX1003, ¶216.

⁸ In block (p;m), “p” represents the subband and “m” represents the block. EX1008, 5:53-68.

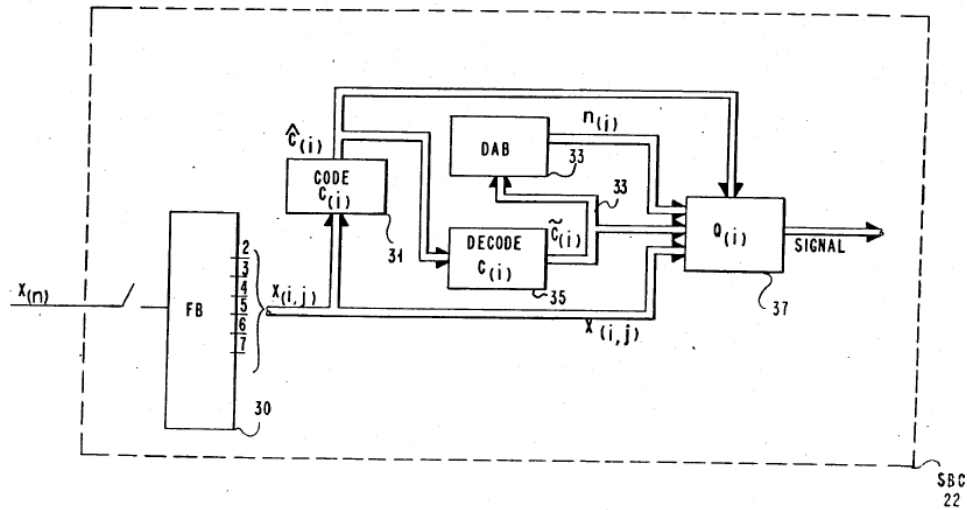
Fourth, Veldhuis assigns bits to the audible subbands having $C(p;m)=1$ according to a bit-allocation pattern $\{B(p)\}$. EX1008, 11:44-12:14; *see also* EX1008, 13:51-14:23, FIG. 8. In one example, as shown above in Figure 3, bits are allocated based on $L(p)$, which represents the “number of quantizing levels” and is “related to th[e] noise masking curve in a manner such that in each subband the signal-to-noise ratio is sufficiently high for not perceiving the quantizing noise.” EX1008, 7:48-8:14; EX1003, ¶217.

Fifth, Veldhuis assigns additional bits to the audible subbands having $C(p;m)=1$ according to an iterative process based on which subband has the greatest “need of bits.” EX1008, 14:53-15:16, FIG. 9. Bits available for allocation in this step are those “saved” from the blocks having $C(p;m)=0$. EX1008, 11:44-49, 12:24-36. By reallocating the saved bits, Veldhuis’s system results “in an effective reduction of the audibility of quantizing noise during music passages presenting single tones.” EX1008, 13:4-6; EX1003, ¶218.

B. Overview of Galand

Galand discloses a “voice signal coding method,” which splits residual signals “over several sub-bands” and codes them. EX1009, Abstract. Galand’s Figure 2 demonstrates this process:

FIG. 2



EX1009, FIG. 2.

A sub-band coder 22 is “provided with filter set (FB) 30 which receives samples $X_{(n)}$ ” and “divides the pass band of the residual base-band signal into eight adjacent sub-bands 1-8.” EX1009, 4:33-37; EX1003, ¶219.

Relevant here, Galand teaches that bits are allocated based on several parameters, including the number of “useful sub-bands”—i.e., those that are available for bit allocation. EX1009, 4:64-5:7, 6:33-42. All other bands are not counted and thus do not have bits allocated to them. EX1003, ¶220.

Galand’s dynamic bit allocating device (DAB) 33 allocates bits using a mathematical model:

$$n(i) = \frac{1}{p} \left[M - \sum_{j=2}^7 \log_2 \tilde{C}_{(j)} \right] + \log_2 \tilde{C}_{(i)}$$

The model includes the “[n]umber of useful sub-bands” (“p”) and requires summing over all “useful sub-bands” (e.g., $2 \leq j \leq 7$ in the equation above). EX1009, 4:61-5:9, 6:33-42; EX1003, ¶221.

C. A POSA would have been motivated to use Galand’s mathematical model in determining Veldhuis’s initial bit allocation.

A POSA would have been motivated to combine Veldhuis and Galand, and in particular, use Galand’s mathematical model to allocate bits in Veldhuis’s first bit-allocation step. Both references describe methods for subband coding of audio signals. EX1008, Abstract, 1:6-40, 2:14-20, 11:44-11:49, 11:67-12:4; EX1009, Abstract, 2:23-45, 3:11-31, 5:37-41, 6:33-42. Both references recognize, moreover, the importance of efficiently allocating bits to the encoded signal, with a focus on reducing quantizing noise. EX1008, 2:14-20; EX1009, 1:27-51. And, like Veldhuis, Galand discloses a method for allocating bits only to “useful sub-bands.” EX1009, 6:33-42; EX1003, ¶222.

Veldhuis’s method includes a first bit-allocation step, in which bits are allocated only to those blocks that can be heard. EX1008, 11:37-12:14. Veldhuis’s bit allocation pattern $\{B(p)\}$ is “related to the noise-masking curve of the human auditory system” and, in one embodiment, is calculated from “ $L(p)$,” which is the number of quantizing levels and is “related to th[e] noise-masking curve in a manner such that in each subband the signal-to-noise ratio is sufficiently high for

not perceiving the quantizing noise.” EX1008, 7:48-52, 11:49-58. But Veldhuis does not disclose specifically how the bits are determined. EX1003, ¶223.

Thus, a POSA would have been motivated to look for these implementation details elsewhere. Galand provides such implementation details, including a mathematical model for allocating bits:

$$n_{(i)} = \frac{1}{p} \left[M - \sum_{j=2}^7 \log_2 \tilde{C}_{(j)} \right] + \log_2 \tilde{C}_{(i)}$$

EX1009, 5:1-5.

A POSA would have been motivated to incorporate Galand’s mathematical model for bit allocation into Veldhuis in order to determine the bit allocation for the available blocks. *See* Section VIII.D.5. Similar to Veldhuis, Galand’s bit allocation is premised on assigning bits to only the “useful sub-bands.” EX1009, 4:61-5:9, 6:33-42. And Galand’s equation provides a way to conveniently allocate bits in Veldhuis’s system based on the number of “useful” bands that can be heard (i.e., that have a $C(p;m)$ value of 1). Still further, implementing Galand’s equation in Veldhuis would not change Veldhuis’s second bit-allocation step in any way. *See* Section X.D.6; EX1003, ¶¶224-225.

A POSA would have easily combined Veldhuis and Galand because both use conventional audio-processing hardware to implement their methods. *See, e.g.,*

EX1008, 1:41-46, 5:35-52, 6:10-11; EX1009, 3:4-10, 6:30-32, FIG. 1. Combining the references would have merely been a simple substitution of one known element (Galand's mathematical model) for another (Veldhuis's undisclosed implementation details for allocating bits) to obtain predictable results (allocating bits only to the blocks that can be heard, to improve the effect of noise). EX1003, ¶226. A POSA therefore would have had a reasonable expectation of success in making the combination. EX1003, ¶226.

D. The Veldhuis-Galand combination renders Claim 1 obvious.

1. [1P]

Veldhuis discloses, or at least renders obvious, the preamble. Veldhuis describes a method for “*allocat[ing]* ... the numbers of *quantizing bits* $B(p;m)$ ” for a “*digital audio signal*.” EX1008, 2:22-24, 10:15-31. The quantization is performed “blockwise,” meaning that the signal is divided into 26 subbands ($1 \leq p \leq 26$), which, in turn, are divided into “blocks” (denoted by $(p;m)$). EX1008, 2:67-3:2, 5:53-68, FIG. 5. Each block has a “block length” or “duration” (a temporal component) as well as “*spectral components*.” EX1008, 2:40-41, 3:32-49, 9:33-43; EX1003, ¶¶227-228.

Further, Veldhuis's coder 1 has a *buffer* $6(p)$ to record the digital audio signals. EX1008, 6:12-18; *see also* EX1008, 10:65-68 (describing signal buffers 22). A POSA would have understood that Veldhuis's decomposing and buffering,

occurring at filter bank 3 and buffer 6, respectively, results in the claimed “digital audio signals[that] are obtained by buffering audio signals in frames and decomposing the digital signals into spectral components.” EX1003, ¶229; *see also* EX1002, 253 (BPAI indicating this “limitation is considered either inherent or obvious to one of ordinary skill in the art”).

Finally, “bit allocation means” 23 performs “[t]he **allocation** of the numbers of **quantizing bits** $B(p;m)$ per signal sample from the predetermined total number of B bits for an allocation window.” EX1008, 11:1-13. The complete allocation pattern $\{B(p;m)\}$ is then transferred to **quantizers** 8(p). EX1008, 12:60-62; EX1003, ¶¶230-231.

2. [1A]

Veldhuis discloses [1A]. As explained above, Veldhuis’s coder “**divides** the ... **signal band of 0-22.05 kHz**” “**into a number of $P=26$ subbands.**” EX1008, 5:53-59, FIG. 3. Veldhuis further samples each subband in “a time interval corresponding with one block of $M=32$.” EX1008, 9:67-10:13; *see also* EX1008, 10:26-31, FIG. 5. Each of these blocks $(p;m)$ represents the claimed “frequency-unit.” EX1003, ¶232.

Only the blocks associated with subbands having numbers $(13 \leq p \leq 26)$ are allocated bits using Veldhuis’s method. These bands correspond to a frequency range of between 1,723 Hz and 22.05 kHz:

p	f _{co} [H z]		W(p) [H z]	L(p)	B(p)
1	0	86	86	25	4.64
2	86	172	86	25	4.64
3	172	258	86	25	4.64
4	258	345	86	25	4.64
5	345	517	172	25	4.64
6	517	689	172	25	4.64
7	689	861	172	25	4.64
8	861	1034	172	25	4.64
9	1034	1206	172	25	4.64
10	1206	1378	172	25	4.64
11	1378	1550	172	25	4.64
12	1550	1723	172	25	4.64
13	1723	2067	345	25	4.64
14	2067	2412	345	19	4.25
15	2412	2756	345	13	3.70
16	2756	3101	345	9	3.17
17	3101	3445	345	7	2.81
18	3445	4134	689	7	2.81
19	4134	4823	689	7	2.81
20	4823	5513	689	7	2.81
21	5513	6891	1378	7	2.81
22	6891	8269	1378	5	2.32
23	8269	11025	2756	3	1.58
24	11025	13781	2756	3	1.58
25	13781	16538	2756	3	1.58
26	16538	22050	5513	3	1.58

Frequency
Interval
(1,723 Hz –
22.05 kHz)
Divided into
Plurality of
Frequency-
Units
(13 ≤ p ≤ 26)

EX1008, FIG. 3 (annotated).

That range represents the claimed “frequency interval.” And Veldhuis divides the interval into a plurality of frequency-units (blocks). EX1008, 5:53-68, 7:23-31; EX1003, ¶¶233-234. Accordingly, Veldhuis satisfies this limitation. *See also* EX1002, 253 (BPAI finding that Veldhuis’s divisional satisfies this limitation).

Even to the extent the limitation is step-plus-function, Veldhuis’s disclosure is identical to the corresponding acts disclosed in the ’757 patent. EX1001, 1:37-40, 4:21-24, FIG. 6; EX1008, 5:53-68, 7:23-31, 9:67-10:13, 10:26-31, FIG. 3, FIG. 5; EX1003, ¶235.

3. [1B]

Veldhuis discloses [1B]. Veldhuis's level detector determines "a *characteristic parameter $G(p;m)$ representative* of the signal level in *th[e] block*." EX1008, 6:14-18. "This characteristic parameter $G(p;m)$ is used for an optimal adjustment of an adaptive quantizer $8(p)$ for quantizing the signal block stored having block number m ." EX1008, 6:18-21. Accordingly, the parameter $G(p;m)$ is the claimed "representative." EX1003, ¶236.

Indeed, Veldhuis explains that "the signal level can be *represented*" by $G(p;m)$ in the form of the average value or peak value of the amplitudes within a block. EX1008, 6:24-28. And, by determining the parameter $G(p;m)$, Veldhuis "obtains" it. *See also* EX1002, 254; EX1003, ¶237.

Even to the extent the limitation is step-plus-function, Veldhuis's disclosure is identical to the corresponding acts disclosed in the '757 patent. EX1001, 3:55-59; EX1008, 6:14-28; EX1003, ¶238.

4. [1C]

Veldhuis, alone or in combination with Galand, renders obvious [1C]. Veldhuis categorizes the blocks within subbands $13 \leq p \leq 26$ into two groups: (a) blocks that *can* be heard, and (b) blocks that *cannot*. EX1008, 11:23-49. Veldhuis uses that information to determine the sum of saved bits S for allocating bits to the blocks that can be heard. EX1008, 14:7-23. This process satisfies

claim 1's "counting" step. EX1003, ¶¶239-240.

In particular, Veldhuis categorizes the blocks by comparing the characteristic parameter $G(p;m)$ (claimed "representative") for each block to a threshold $T(p)$ that is "related to *the thresholds of the human auditory system* for just perceiving single tones in the respective frequency ranges" (claimed "psychoacoustic criteria"). EX1008, 11:28-36; *see also* EX1002, 255 (BPAI finding that Veldhuis'463's thresholds are "based on psychoacoustic criteria"). The result of that comparison, $C(p;m)$, determines which blocks are available for bit allocation. EX1003, ¶241.

For example, blocks "containing perceptually significant signal energy" (above the human auditory threshold), have their $C(p;m)$ values set to 1. EX1008, 2:49-59, 11:23-36. By contrast, blocks "containing no perceptually significant signal energy" (below the threshold) have their $C(p;m)$ values set to 0. EX1008, 2:49-59, 11:23-44. By determining which signal blocks can be heard and thus are available for bit allocation (those having $C(p;m)$ values equal to 1), Veldhuis "counts" such blocks. Indeed, the '757 patent describes its counting step similarly. EX1001, 4:46-48 (explaining that using a "hearing threshold will eliminate units that are irrelevant according to psychoacoustic criteria" such that they will not be counted). EX1003, ¶242.

As explained above, the BPAI found that Veldhuis'463 does not disclose

actively “counting” the “available frequency-units,” and instead discloses tracking “the count” of such units. *See* Section IV.C; EX1002, 256. However, that is a distinction without a difference because nothing in the claims requires actively counting by, for example, incrementing a counter. *See* EX1002, 225-26; EX1003, ¶243.

In any event, even if the BPAI’s finding were applicable to Veldhuis, the BPAI failed to consider Veldhuis’s entire disclosure. Veldhuis discloses that, when a block has a $C(p;m)$ value equal to 0, the number of available bits S for subsequent allocation is “increment[ed]” by the number of bits that would have otherwise been assigned to the block. EX1008, 13:51-14:23, FIG. 8. By incrementing S in that fashion, Veldhuis “counts” the bits associated with the unavailable blocks. Veldhuis’s express disclosure of counting bits for unavailable frequency bands would have motivated a POSA to employ a similar technique with respect to the available frequency bands. Doing so would have been nothing more than a mere design choice. EX1003, ¶244.

Further, a POSA would have found it obvious to actively count available frequency bands in light of Veldhuis incrementing a bit count associated with *unavailable* frequency bands (and subsequently made available to allocate to the available frequency bands). EX1003, ¶245. There are only two options for $C(p;m)$ (1 and 0). Given this limited choice, it would have been obvious to count the 1s

(available blocks) instead of the 0s (unavailable blocks). EX1003, ¶245.

At the very least, affirmatively counting available frequency bands in Veldhuis would have been obvious to try. In Veldhuis, the total number of bits B available for allocation is known. *See, e.g.*, EX1008, 10:31-41. Further, there is only a limited number of choices as to how to determine the number of “saved” bits S: based on the blocks that can be heard or the blocks that cannot be heard. EX1008, 3:61-66, 9:67-10:10. In view of that limited choice, a POSA would have been motivated to try determining S by counting the number of blocks that can be heard. EX1003, ¶246.

A POSA would have likewise been motivated to affirmatively count available frequency bands in Veldhuis based on Galand, which teaches using the “number of useful sub-bands” as a parameter in the mathematical model for determining the bit allocation for a sub-band.⁹ EX1009, 4:61-5:9, 6:33-42. A POSA would have understood that, to determine the number of sub-bands that are “useful,” Galand counts them. Galand thus confirms what Veldhuis already teaches—i.e., that counting the units that exceed a threshold (i.e., those that can be heard, or those that are “useful”) was a desirable way to allocate bits. EX1003,

⁹ In the combination, Galand’s mathematical model is used for determining the initial bit allocation. *See* Sections VIII.C, VIII.D.5.

¶247.

To the extent the limitation requires incrementing a counter, a POSA would have found it obvious to do so in Veldhuis-Galand. EX1003, ¶248. Incrementing a counter was well known and commonly used in programming at the time of the '757 patent, and it would have been a straightforward and preferred way to implement the Veldhuis-Galand combination's counting in software. EX1003, ¶248; Section VI.D.4.

Finally, for all the same reasons, even to the extent the limitation is step-plus-function, it would have been obvious to implement Veldhuis-Galand to count frequency-units by incrementing a counter, as disclosed in the '757 patent. EX1001, 4:29-48, 4:51-53, FIG. 1 (numeral 3), FIG. 2 (numerals 32-33), FIG. 3 (numeral 41); EX1008, 2:49-59, 3:61-66, 9:67-10:10, 10:31-41, 11:23-49, 13:51-14:23, FIG. 8; EX1009, 4:61-5:9, 6:33-42; EX1003, ¶249.

5. [1D]

Veldhuis-Galand renders obvious [1D]. Veldhuis teaches a first bit-allocation step in which bits $B(p)$ are allocated to blocks that can be heard (those having $C(p;m)=1$), while no bits are allocated to blocks that cannot be heard (those having $C(p;m)=0$). EX1008, 11:44-55; EX1003, ¶250. Veldhuis further teaches that the “numbers $B(p)$ [of bit allocation pattern $\{B(p)\}$] are related to the noise-masking curve of the human auditory system” and, in one embodiment, are

calculated by the equation $B(p)=\log_2[L(p)]$. EX1008, 11:49-58. “ $L(p)$ ” is the number of quantizing levels, which is “related to th[e] noise-masking curve in a manner such that in each subband the signal-to-noise ratio is sufficiently high for not perceiving the quantizing noise.” EX1008, 7:48-52. Although $L(p)$ may be predetermined for each subband (*see, e.g.*, EX1008, FIG. 3),¹⁰ during Veldhuis’s first bit-allocation step, bits are allocated only to those blocks that can be heard (i.e., those that are “counted”). EX1008, 11:37-12:14; EX1003, ¶250.

Veldhuis does not expressly disclose how the $L(p)$ values (and thus the $B(p)$ values) are determined. As discussed above, a POSA would have been motivated to look for these implementation details elsewhere. Galand provides such details, including a mathematical model for allocating bits:

$$n_{(i)} = \frac{1}{p} \left[M - \sum_{j=2}^7 \log_2 \tilde{C}_{(j)} \right] + \log_2 \tilde{C}_{(i)}$$

¹⁰ The values shown in Figure 3 constitute one example for a particular audio signal. A POSA would have understood that, for different audio signals, a different initial bit allocation would result. EX1003, ¶250 n.7. In any event, in Veldhuis-Galand, bit allocation is not predetermined, but rather determined using Galand’s mathematical model.

EX1009, 5:1-5.

This model includes the “[n]umber of useful sub-bands” (“p”) and requires summing over all “useful sub-bands” (e.g., $2 \leq j \leq 7$ in the equation above). EX1009, 4:61-5:9, 6:33-42; EX1003, ¶251.

In combination with Veldhuis’s teachings to only allocate bits to the available blocks (i.e., corresponding to Galand’s “useful sub-bands”), using Galand’s bit-allocation model would result in summing over the blocks for which $C(p;m)=1$ (i.e., the available blocks). The mathematical model of the Veldhuis-Galand combination mirrors Equation 1 of the ’757 patent, which likewise sums over “N,” the “Number of valid units.” A POSA would have thus understood that in Veldhuis-Galand, the initial bit allocation is determined “using an approximate mathematical model using the counted number of available frequency-units.” EX1003, ¶252.

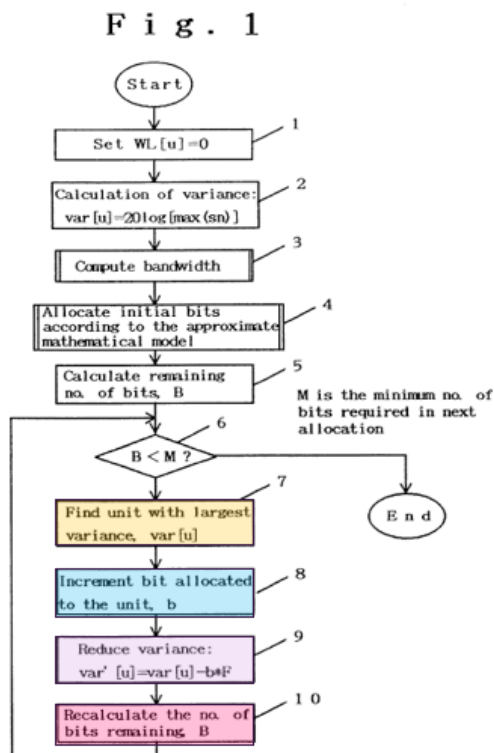
Even to the extent the limitation is step-plus-function, Veldhuis-Galand’s bit allocation using a mathematical model is equivalent to the corresponding acts disclosed in the ’757 patent. EX1001, 4:49-5:11, FIG. 1 (numeral 4), FIG. 3 (element 43); EX1008, 7:48-52, 11:37-12:14; EX1009, 4:61-5:9, 6:33-42; EX1003, ¶253.

6. [1E]

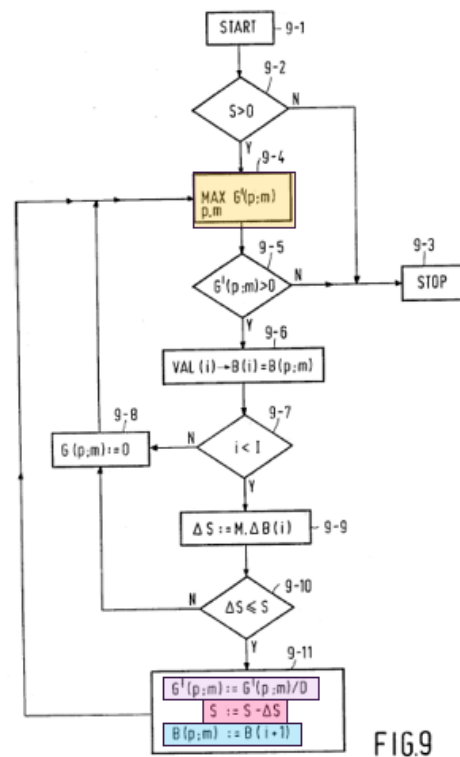
Veldhuis discloses and/or renders obvious [1E]. Veldhuis discloses a second

bit-allocation step in which the “sum S of saved numbers of bits” is allocated “to the blocks (p;m) within the allocation window having $C(p;m)=1$,” resulting in more bits being allocated to those blocks than initially allocated in the first allocation step. EX1008, 11:44-49, 12:24-30. It thus satisfies the claim limitation because, in this second bit-allocation step, additional bits are only assigned to blocks that can be heard. EX1003, ¶254.

Further, Veldhuis’s second bit allocation is implemented in the same way as described in the ’757 patent:



EX1001, FIG. 1 (annotated).



EX1008, FIG. 9 (annotated).

First, the “allocation commences at the block (p;m) having the largest value of parameter $G(p;m)$ ” (orange).¹¹ EX1008, 12:30-36; *see also* EX1008, 14:63-64, FIG. 9 (step 9-4). This corresponds to the ’757 patent’s step 7 of finding the unit having the largest representative (variance in FIG. 1). EX1003, ¶¶255-256.

Second, if a sufficient number of saved bits are available and other criteria are met (steps 9-5 to 9-10), the additional bits are allocated to the block (blue). EX1008, 12:30-36; *see also* EX1008, 15:14-16, FIG. 9 (step 9-11 (“ $B(p;m):=B(i+1)$ ”). This corresponds to the ’757 patent’s step 8 of incrementing bits allocated to the unit. EX1003, ¶257.

Third, Veldhuis’s sum S is reduced by the number of bits allocated to the block, thus indicating the number of saved bits remaining (pink). EX1008, 12:36-39; *see also* EX1008, 15:12-13, FIG. 9 (step 9-11 (“ $S:=S-\Delta S$ ”). This corresponds to the ’757 patent’s step 10 of recalculating the number of bits remaining. EX1003, ¶258.

Fourth, the parameter $G'(p;m)$ is reduced for the block so as “to evenly distribute the sum S of the saved numbers of bits over the blocks (p;m) having

¹¹ $G'(p;m)$ refers to the “need of bits.” EX1008, 14:62-64. The initial value of $G'(p;m)$ is set as $G(p;m)$ for blocks having $C(p;m)=1$ and is set to 0 for blocks having $C(p;m)=0$. EX1008, 13:51-66.

$C(p;m)='1'$ (purple). EX1008, 12:39-44; *see also* EX1008, 15:10-11 (step 9-11 (“ $G'(p;m):=G'(p;m)/D$ ”). This corresponds to the '757 patent's step 9 of reducing the variance.¹² EX1003, ¶259.

Veldhuis explains that this iterative process “exploit[s] the *psychoacoustic effect* of temporal masking, which means the property of the human auditory system that its threshold for perceiving signals shortly before and shortly after the occurrence of another signal which has a relatively high signal energy appears to be temporarily higher than in the absence of the latter signal.” EX1008, 4:34-40. The effect is captured by Veldhuis's coefficient “D” (shown in step 9-11 of Figure 9). Although the BPAI found that the D value disclosed in Veldhuis'463 is not based on psychoacoustic criteria, EX1002, 258, the BPAI did not appreciate the similarity between how Veldhuis describes its D value and how the '757 patent describes its “psychoacoustic weighting factor F.” EX1003, ¶261.

In the '757 patent, once bits are allocated to a unit in the second bit-allocation step, the variance for that unit is reduced by a factor of F so that

¹² A POSA would have understood that the order in which the '757 patent's steps 8-10 are performed would not affect the result because they are simply adjusting various values before repeating the step of choosing the unit with the largest variance and continuing the process. EX1003, ¶260.

remaining bits are not disproportionately allocated to the same unit in the next pass, as shown in step 9 of Figure 1. EX1001, 4:11-13. The patent explains that F is simply a coefficient that is adjusted to whatever value will result in an error spectrum that most closely follows the original signal. EX1001, 5:12-24. Similarly, in Veldhuis, the D value is used to “reduce[]” the value of $G(p;m)$ “so as to evenly distribute the number of quantizing bits” in subsequent passes. EX1008, 15:54-60; *see also* EX1008, 14:57-15:16. And, like the ’757 patent, Veldhuis explains that the D value “can be determined such that the improvement in the signal-to-noise ratio due to the increment of the number of quantizing bits per signal sample with an amount [that] is approximately reflected in the reduction of the need of bits $G'(p;m)$.” EX1008, 15:60-65. Veldhuis also suggests that D can be a function of the bands, which the BPAI did not appear to consider. EX1008, 15:65-16:6. In any event, both F and D have the effect of decreasing the representative value for each subsequent iteration to ensure an even distribution of bits in the second bit-allocation step. EX1003, ¶¶262-263.

Accordingly, a POSA would have understood that Veldhuis’s D value reflects psychoacoustic criteria. And, indeed, the BPAI itself noted that the phrase “based on psychoacoustic criteria” can be “interpreted broadly as very indirectly based on some psychoacoustic criterion.” EX1002, 257. At the very least, Veldhuis discloses such an indirect relationship. EX1003, ¶264.

And, as this comparison demonstrates, even to the extent the limitation is step-plus-function, Veldhuis's iterative second bit-allocation step is equivalent to the corresponding acts disclosed in the '757 patent. EX1001, 3:63-4:18, FIG. 1 (numerals 6-10); EX1008, 4:34-40, 11:44-49, 12:24-44, 13:51-66, 14:57-15:16, 15:54-16:6, FIG. 9; EX1003, ¶265.

E. Claim 2

Veldhuis-Galand renders this claim obvious. As explained above, Veldhuis-Galand allocates bits ($B(p)$) to blocks ($p;m$) using an approximate mathematical model. *See* Section VIII.D.5. Moreover, it would have been obvious to derive that model from an in-band masking effect. EX1003, ¶¶266-267.

Veldhuis, for example, teaches that bit allocation $B(p)$ is “related to the thresholds for *masking noise in the critical bands* of the human auditory system by single tones in the centre of the respective critical bands.” EX1008, 2:60-66, 7:48-52, 11:53-56. Veldhuis further explains that “quantizing noise will be optimally *masked by the signals within [a] subband* when the quantizing takes account of the noise-masking curve of the human auditory system (this curve indicates the threshold for masking the noise in a critical band by a single tone in the centre of the critical band).” EX1008, 1:52-61. EX1003, ¶268.

Veldhuis recognizes that “[t]he refined quantization [of the invention] during music passages presenting single tones ... results in *an effective reduction of the*

audibility of quantizing noise without the need of increasing the average number of quantizing bits per output signal sample of the coder.” EX1008, 3:66-4:2; *see also* EX1008, 13:4-39. Galand also recognizes the importance of reducing quantizing noise. EX1009, 1:27-35. A POSA would have understood that a reduction in the audibility of quantizing noise, as taught both by Veldhuis and Galand, results when “an error spectrum ... follow[s] more closely to the original signal spectrum,” as claimed. EX1003, ¶¶269-271.

F. Claims 3, 7, 11, and 14: “each frequency-unit is represented by a single spectral component”

Veldhuis-Galand renders these claims obvious. As explained above, Veldhuis teaches “a characteristic parameter $G(p;m)$ ” or “the signal level in th[e] block” as a “representative value” of claim 1. EX1008, 6:12-34. Veldhuis teaches, moreover, that “the signal level can be *represented ... by the peak value of the amplitude ... of the signal samples in a block.*” EX1008, 6:12-34. The peak value, in turn, is simply the amplitude of the spectral component within the block having the largest magnitude. EX1003, ¶¶272-723.

Alternatively, Veldhuis recognizes that “the quantizing noise is especially audible in music passages presenting single tones” and that “*only a single spectral component having significant signal energy occurs in each of the few remaining subbands.*” EX1008, 8:66-9:7. In this instance, Veldhuis teaches that each

frequency-unit is represented by a single spectral component. EX1003, ¶¶274-275.

G. Claim 6

Veldhuis-Galand renders this claim obvious. Veldhuis's second bit-allocation step assigns more bits to blocks "having the largest value of parameter $G(p;m)$ " (claimed "representatives") and no bits to blocks that cannot be heard as determined based on a threshold $T(p)$ "related to the thresholds of the human auditory system for just perceiving single tones in the respective frequency ranges" (claimed "psychoacoustic criteria"). See EX1008, 11:28-36, 13:51-16:17; EX1003, ¶¶276-278.

This method reduces "the audibility of quantizing noise in the replica of the audio signals ... in an effective manner without increasing the average number of bits per sample of the quantized output signals of the coder." EX1008, 2:15-21; see EX1008, 4:33-52, 13:4-6. And, like the '757 patent, Veldhuis iteratively assigns bits until no bits remain. EX1008, 14:53-16:18, FIG. 9; EX1003, ¶¶278-279.

H. Claim 10

Veldhuis-Galand renders this claim obvious. As explained above, Veldhuis determines which blocks $(p;m)$ should receive bits based on whether the blocks can be heard. See Sections VIII.D.3-4. This determination is based on a threshold $T(p)$ "related to the *thresholds of the human auditory system for just perceiving single tones* in the respective frequency ranges." EX1008, 11:28-36; EX1003, ¶¶280-281.

By accounting for blocks above the threshold, Veldhuis counts—or, in view of Galand’s disclosure of using the “[n]umber of useful sub-bands,” at least renders obvious counting—blocks that exceed a human hearing threshold. *See* Section VIII.D.4. Once again, Veldhuis’s disclosure is nearly identical to the ’757 patent’s. *See* EX1001, 4:46-48 (explaining that using a “hearing threshold will eliminate units that are irrelevant according to psychoacoustic criteria”); EX1003, ¶¶282-283.

I. Claim 16

Veldhuis-Galand renders this claim obvious. As explained above, Veldhuis discloses bit allocation for an audio signal having spectral and temporal structure. *See* Sections VIII.D.1-2. Veldhuis divides the signal having a frequency range between 1,723 Hz and 22.05 kHz (claimed “frequency interval”) into blocks (p;m) (thus exploiting the signal’s temporal structure). EX1008, 4:53-68; EX1003, ¶¶284-285.

In block (p;m), “p” represents the subband and “m” represents the block. EX1008, 5:53-68. The subbands are frequency bands, as shown in Figure 3:

p	f _{co} [Hz]		W(p) [Hz]	L(p)	B(p)
1	0	86	86	25	4.64
2	86	172	86	25	4.64
3	172	258	86	25	4.64
4	258	345	86	25	4.64
5	345	517	172	25	4.64
6	517	689	172	25	4.64
7	689	861	172	25	4.64
8	861	1034	172	25	4.64
9	1034	1206	172	25	4.64
10	1206	1378	172	25	4.64
11	1378	1550	172	25	4.64
12	1550	1723	172	25	4.64
13	1723	2067	345	25	4.64
14	2067	2412	345	19	4.25
15	2412	2756	345	13	3.70
16	2756	3101	345	9	3.17
17	3101	3445	345	7	2.81
18	3445	4134	689	7	2.81
19	4134	4823	689	7	2.81
20	4823	5513	689	7	2.81
21	5513	6891	1378	7	2.81
22	6891	8269	1378	5	2.32
23	8269	11025	2756	3	1.58
24	11025	13781	2756	3	1.58
25	13781	16538	2756	3	1.58
26	16538	22050	5513	3	1.58

Frequency
Interval
(1,723 Hz –
22.05 kHz)
Divided into
Plurality of
Frequency-
Units
(13 ≤ p ≤ 26)

EX1008, FIG. 3 (annotated).

EX1008, 1:52-61, 5:1-3, 6:35-47. By dividing the spectrum into subbands and then into blocks, Veldhuis obtains the frequency-units. EX1003, ¶¶286-287.

IX. GROUND 4: CLAIMS 1-17 ARE OBVIOUS OVER VELDHUIS, GALAND, AND REAVES.

As explained above, Veldhuis-Galand renders obvious claims 1-3, 6-7, 10-11, 14, and 16. And Reaves discloses, or at least renders obvious, a representative comprising a “variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit,” as recited in claims 4, 8, 12, and 15,

as well as a “variance which is calculated from an average of a spectral component of each frequency-unit,” as recited in claims 5, 9, 13, and 17. *See* Sections IX.C-D.

Accordingly, because Reaves discloses and/or renders obvious the “representatives” recited in those dependent claims, it also discloses and/or renders obvious the “representative” recited in independent claim 1 and the rest of its dependent claims. Veldhuis-Galand-Reaves thus renders claims 1-17 obvious. *See* Section IX.E; EX1003, ¶288.

A. Overview of Reaves

Reaves discloses a speech-recognition device for detecting “the start and end of a segment containing speech within an input audio signal which contains both speech segments and nonspeech noise or background segments.” EX1010, 1:9-12. Reaves’s device uses energy values in particular frequency bands to calculate “the beginning and the ending points of speech.” EX1010, 5:66-6:3; EX1003, ¶289.

In particular, “[t]he variance of the frequency band limited energy” is calculated. EX1010, 4:42-43. This “variance V” is compared with a “threshold,” and when the variance is above the threshold, Reaves determines that the “beginning of speech” has occurred. EX1010, 5:21-6:7, FIG. 5; EX1003, ¶290.

B. A POSA Would Have Combined Reaves with Veldhuis and Galand.

In the combination proposed here, Reaves is used to determine a variance of a spectral component as a representative in place of the parameter $G(p;m)$ taught

by Veldhuis. A POSA would have been motivated to use Reaves in Veldhuis-Galand. EX1003, ¶291.

As explained above, Veldhuis uses characteristic parameters $G(p;m)$ as a representative of blocks $(p;m)$, comparing $G(p;m)$ to threshold $T(p)$ to determine whether each block $(p;m)$ contains “perceptually significant signal energy.” See Section VIII.D.3; EX1008, 10:35-11:44; EX1003, ¶292. Reaves teaches that its speech-recognition device compares the variance of the frequency band-limited energy of the signal in a single frequency band to a threshold to determine whether the input signal contains a “beginning of speech.” EX1010, 4:17-28, 5:25-30. A POSA would have understood that detecting whether there is speech also is related to the perceptibility of the signal, i.e., as compared to the background noise. EX1010, 1:33-37, 5:23-24, FIG. 5; EX1003, ¶292.

In other words, Veldhuis and Reaves are similar in that they use a given representative value—parameter $G(p;m)$ in Veldhuis and “variance” in Reaves—to detect perceptually significant signal energy. Reaves’s “variance” is of the “frequency band limited energy,” which is described as “[a]ny quantity that varies generally monotonically with the energy of the frequency band limited signal,” and may be, for example, “the peak of the value ... of the frequency band limited signal.” EX1010, 4:17-63. Similarly, Veldhuis teaches the signal level can be represented by the peak value of the amplitude of the signal samples. EX1008,

6:24-28; EX1003, ¶293.

Reaves teaches benefits to using a variance in detecting perceptually significant signal energy. Specifically, “[t]he use of the variance allows detection which is relatively independent of an absolute signal-to-noise ratio with the signal, and allows accurate detection within a wide variety of backgrounds such as music, motor noise, and background noise, such as other speakers.” EX1010, Abstract. In other words, using a variance allows for more effective detection of the desired sounds “above a ‘noise floor’ of relatively low fluctuation.” EX1010, 1:51-53, 2:3-14. Based on these teachings, a POSA would have been motivated to use a variance, as taught in Reaves, in place of the parameter $G(p;m)$ taught in Veldhuis. EX1003, ¶294.

A POSA would have known how to combine Reaves with Veldhuis-Galand and would have had an expectation of success. Specifically, as noted, the combination would use a variance, as taught by Reaves, instead of parameter $G(p;m)$ (the “average value of the amplitude ... of the signal samples” or the “peak value of the amplitude of the signal[] samples”), as taught by Veldhuis. EX1008, 6:24-28, 10:35-11:44; EX1010, 4:42-43; EX1003, ¶295. Like Veldhuis and Galand, Reaves also uses conventional audio processing hardware to implement the methods thereof. EX1010, Abstract (“The device can be easily implemented using off-the-shelf hardware ...”). A POSA would have easily incorporated

Reaves's algorithm for calculating variance into Veldhuis-Galand in view of the conventional components described in the references. EX1003, ¶295.

C. Claims 4, 8, 12, and 15

Veldhuis-Galand-Reaves renders these claims obvious. As explained above, Veldhuis teaches that “characteristic parameter $G(p;m)$ ” represents “the signal level in this block” (claimed “representative value” of claim 1). *See* Section VIII.D.3. Veldhuis further teaches that “the signal level can be *represented ... by the peak value of the amplitude of the signal[] samples in a block.*” EX1008, 6:24-28; EX1003, ¶¶296-297.

As discussed above, the '757 patent takes a broad view of “variance.” Section VII.C. In any event, Reaves expressly teaches using a *variance* of a signal energy level to determine the perceptibility of the sound. In the combination with Reaves, instead of using the peak value of the amplitude as taught in Veldhuis, the claimed “representative value” is determined as a *variance* thereof. *See* Section IX.B. Reaves expressly recognizes that its “frequency band limited energy,” from which the variance is determined, can be the “peak of the value” of the signal. EX1010, 4:17-28. Thus, the *variance is calculated from* peak values of the amplitude or, as a POSA would recognize is the same, an amplitude of a maximum spectral component. EX1003, ¶298.

D. Claims 5, 9, 13, and 17

Veldhuis-Galand-Reaves renders these claims obvious. As explained above, Veldhuis teaches that “characteristic parameter $G(p;m)$ ” represents “the signal level in this block” (claimed “representative value”). *See* Section VIII.D.3. Veldhuis further teaches that “the signal level can be *represented by the average value of the amplitude or the power of the signal samples of a block.*” EX1008, 6:24-28; EX1003, ¶¶299-300.

Reaves teaches using a *variance* of a signal energy level to determine the perceptibility of the sound. In the combination, instead of using the average value of the amplitude as taught in Veldhuis, the “representative value” is determined as a *variance* thereof. *See* Section IX.B. Based on Reaves’ teaching of determining a variance based on the “peak of the value” and on Veldhuis’s teachings of using either the “peak” or “average” in its method, it would have been obvious to determine the variance of the average value of the amplitude. Thus, the *variance is calculated from* the average value of the amplitude or, as a POSA would recognize is the same, an average value of a spectral component. EX1003, ¶301.

E. Claims 1-3, 6-7, 10-11, 14, and 16

Finally, given that Reaves discloses the representative in claims 4-5, it also discloses the representative in independent claim 1. At the very least, Reaves discloses determining the peak and mean amplitude values within each band,

which indisputably would qualify as a “representative”—i.e., “a characteristic representative of the signal.” EX1002, 254 (cleaned up).

Thus, Veldhuis-Galand-Reaves renders obvious claims 1-3, 6-7, 10-11, 14, and 16 obvious as well. EX1003, ¶¶302-303.

X. PETITIONER IS UNAWARE OF ANY SECONDARY CONSIDERATIONS OF NONOBVIOUSNESS.

Petitioner is unaware of any evidence of secondary considerations or that PO has made non-conclusory assertions of such.

XI. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION TO DENY THIS PETITION UNDER 35 U.S.C. §§ 314(A) OR 325(D).

A. *Fintiv* Strongly Favors Institution.

On August 5, 2024, PO served a patent-infringement complaint in the Northern District of California. *Dolby Labs. Licensing Corp. v. Roku, Inc.*, No. 5:24-cv-04660 (N.D. Cal.). Given the early stage of that litigation, the *Fintiv* factors strongly favor institution. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020).

Factor 1 is neutral or favors institution. No motion for a stay has been filed, and the court has not indicated whether it would grant any such motion.

Factor 2 strongly favors institution because the district-court case is in the very early stages. No trial date is set, and the median time to trial for civil actions in NDCAL is more than four years (48.9 months). EX1039, 66.

Factor 3 favors institution because, by the time of institution, neither the parties nor the district court will have invested significant resources in the parallel litigation. Currently, the court has not made any substantive rulings, and Petitioner's diligence in filing this Petition nearly a year before the statutory deadline confirms that Factor 3 favors institution.

Factor 4 favors institution. The Petition challenges claims 1-17 of the '757 patent, whereas only claims 1-3 are mentioned in PO's complaint. Petitioner's challenge to additional claims significantly mitigates the concerns for duplication of efforts.

Factor 6 favors institution. The strength of the merits weighs in favor of institution as fully laid out above.

B. Denial Under § 325(d) Is Not Appropriate.

The two-part framework set forth in *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (P.T.A.B. Feb. 13, 2020), demonstrates that denial under § 325(d) is inappropriate.

As to part one, Mahieux, Fielder, Akagiri, Galand, and Reaves are not cited on the face of the '757 patent and were not applied during prosecution. And, while Veldhuis's divisional (Veldhuis'463) was applied, Veldhuis itself was not and, in any event, is presented here in combination with Galand and Reaves, which are new combinations not considered during prosecution. The Office thus has not

previously considered the same art and arguments as presented in the Petition.¹³

Even considering part two of *Advanced Bionics*, the Board should institute review because the Office materially erred in overlooking the applicability of Veldhuis'463's disclosure to the '757 patent claims. The BPAI found that, while Veldhuis'463 teaches a "count" of available frequency-units, it does not disclose "counting" the units. EX1002, 256. But, as explained above, and as confirmed by Dr. Williams, Veldhuis renders obvious counting available frequency-units and, in any event, such counting would have been obvious in view of Veldhuis and Galand, which was not considered during prosecution. *See* Section VIII.D.4. The BPAI also found that Veldhuis'463 does not disclose a mathematical model and that its coefficient D does not reflect "psychoacoustic criteria." EX1002, 257-58. But, as explained above, and as again confirmed by Dr. Williams, the Veldhuis-Galand combination renders obvious using a mathematical model for allocating bits, and a POSA would have understood that Veldhuis's coefficient D functions in

¹³ Fielder and Akagiri appear in the Examiner's prior-art searches. *See* EX1002, 14, 19. But the Examiner did not apply those references. Additionally, different references naming Fielder and Akagiri as inventors were "made of record" during prosecution. EX1002, 168-169. But those references are not at issue here and were "not relied upon" by the Examiner. EX1002, 168.

the same manner as the '757 patent's "psychoacoustic weighting factor" F. See Sections VIII.D.5-6. Thus, part two of *Advanced Bionics* also weighs in favor of institution.

Should PO analogize any previously considered art or arguments to those presented here, Petitioner reserves the right to respond.

XII. MANDATORY NOTICES (37 C.F.R. § 42.8(a)(1))

A. Real Party In Interest (37 C.F.R. § 42.8(b)(1))

The real party-in-interest is Petitioner Roku, Inc.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

The '757 patent is at issue in *Dolby Laboratories Licensing Corp. v. Roku, Inc.*, No. 5:24-cv-04660 (N.D. Cal.), which is currently pending.

C. Lead and Back-up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioner appoints **Lestin L. Kenton** (Reg. No. 72,314) as lead counsel and **Richard A. Crudo** (Reg. No. 65,245), **Jennifer Meyer Chagnon** (Reg. No. 55,440), and **Masayuki Iino** (Reg. No. 80,729) as back-up counsel at the address: Sterne, Kessler, Goldstein & Fox P.L.L.C., 1101 K Street, N.W., 10th Floor, Washington, D.C., 20005, phone number (202) 371-2600, and facsimile (202) 371-2540.

D. Service Information (37 C.F.R. § 42.8(b)(4))

Petitioner consents to electronic service by email at: **lkenton-PTAB@sternekessler.com**, **rcrudo-PTAB@sternekessler.com**, **jchagnon-**

PTAB@sternekessler.com, miino-PTAB@sternekessler.com, and

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XIII. STANDING (37 C.F.R. § 42.104(A))

Petitioner certifies that the '757 patent is available for IPR, and that Petitioner is not barred or estopped from requesting IPR. The assignee of the '757 patent served a complaint asserting the '757 patent on August 5, 2024, less than one year from the filing date of this Petition.

XIV. CONCLUSION

The Board should institute IPR and hold claims 1-17 of the '757 patent unpatentable.

Respectfully submitted,
STERNE, KESSLER, GOLDSTEIN & FOX
P.L.L.C.

/Lestin Kenton /

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Attorney for Petitioner Roku, Inc.

Date: September 9, 2024

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APPENDIX A: LISTING OF CHALLENGED CLAIMS

1. [1P] A method of determining a bit allocation for a quantization of digital audio signals having spectral and temporal structure wherein the digital audio signals are obtained by buffering audio signals in frames and decomposing the digital signals into spectral components, which comprises the steps of:

[1A] a step for dividing at least one frequency interval into a plurality of frequency-units;

[1B] a step for obtaining a representative of each frequency-unit obtained;

[1C] a step for counting a number of available frequency-units by using the representative, based on psychoacoustic criteria;

[1D] a first bit allocation step for determining an initial bit allocation for each of said available frequency-units by using an approximate mathematical model using said counted number of available frequency-units; and

[1E] a second bit allocation step for determining further bit allocation for each of said available frequency-units based on psychoacoustic criteria.

2. Method according to claim 1, wherein said mathematical model is derived from an in-band masking effect such that an error spectrum will follow more closely to the original signal spectrum.

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3. Method according to claim 2, wherein each frequency-unit is represented by a single spectral component.
4. Method according to claim 2, wherein said representative is a variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit.
5. Method according to claim 2, wherein said representative is a variance which is calculated from an average of a spectral component of each frequency-unit.
6. A method according to claim 1, wherein said second bit allocation step is to determine the bit allocation through a psychoacoustically weighted inverse relationship with the said representative of each of said frequency-units.
7. Method according to claim 6, wherein each frequency-unit is represented by a single spectral component.
8. Method according to claim 6, wherein said representative is a variance which is calculated from an amplitude of a maximum spectral component of each

frequency-unit.

9. Method according to claim 6, wherein said representative is a variance which is calculated from an average of a spectral component of each frequency-unit.

10. A method according to claim 1, wherein said counted number of available frequency-units is a number of the frequency-units which have the representative exceeding a human hearing threshold.

11. Method according to claim 10, wherein each frequency-unit is represented by a single spectral component.

12. Method according to claim 10, wherein said representative is a variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit.

13. Method according to claim 10, wherein said representative is a variance which is calculated from an average of a spectral component of each frequency-unit.

14. Method according to claim 1, wherein each frequency-unit is represented by a single spectral component.
15. Method according to claim 1, wherein said representative is a variance which is calculated from an amplitude of a maximum spectral component of each frequency-unit.
16. Method according to claim 1, wherein each frequency-unit is obtained by dividing said spectral and temporal structure with at least one frequency interval.
17. Method according to claim 1, wherein said representative is a variance which is calculated from an average of a spectral component of each frequency-unit.

**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION,
TYPEFACE REQUIREMENTS, AND TYPE STYLE REQUIREMENTS**

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,969 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

STERNE, KESSLER, GOLDSTEIN & FOX
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CERTIFICATION OF SERVICE (37 C.F.R. §§ 42.6(e), 42.105(a))

The undersigned hereby certifies that on September 9, 2024, true and correct copies of the foregoing **PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 6,339,757**, Petitioner's Power of Attorney, and all associated exhibits were served in their entireties on the following parties via FedEx Express® or Express Mail:

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