

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QSC AUDIO PRODUCTS, LLC

Petitioner

v.

Crest Audio, Inc.

Patent Owner

CASE: Unassigned

Patent No. 5,652,544

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 5,652,544**

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I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(b)

A. Real Party In Interest

QSC Audio Products, LLC (“QSC”), located at 1675 MacArthur Blvd. Costa Mesa, CA 92626, is the real party in interest for this Petition. No other entity is a real party of interest or a privy of QSC for this Petition.

B. Related Matters

U.S. Patent No. 5,652,544 (“the ’544 patent”) is being asserted against Petitioner in a patent infringement lawsuit brought by Patent Owner in *Crest Audio, Inc. v. QSC Audio Products, LLC*, 3:13CV610 DPJ-FKB filed in the United States District Court for the Southern District of Mississippi, Jackson Division on Sept. 27, 2013 and served on Petitioner on October 4, 2013.

U.S. Patent No. 5,652,542 and U.S. Patent No. 6,023,153 are being asserted against Petitioner in an on-going patent infringement lawsuit brought by Patent Owner in *Crest Audio, Inc. v. QSC Audio Products, LLC*, 3:12-CV755 CWR-FKB filed in the United States District Court for the Southern District of Mississippi, Jackson Division on Nov. 7, 2013.

In the above litigation involving the ’544 patent, Petitioner is asserting, *inter alia*, that claims 1-15, 18-21 and 23-26 of the ’544 patent are disclosed by the prior art and are invalid. Rejection and cancelation of claims 1-15, 18-21 and 23-26 of the ’544 patent will prevent the Patent Owner from claiming technologies that are in the public domain as its own and from asserting invalid claims against others.

In addition to the current Petition, Petitioner is pursuing *inter partes* review of U.S. Patent Nos. 6,023,153 and 5,652,542 that are also being asserted in the above-mentioned litigations.

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

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D. Service Information (§ 42.8(b)(4))

Service may be made by mail or hand delivery to Perkins Coie LLP, 1201 Third Ave, Suite 4900, Seattle, WA 98101. Phone 206-359-8000 and fax 206-359-9000.

E. Power of Attorney (§ 42.10(b))

Pursuant to 37 C.F.R. § 42.10(b), this Petition is being filed with a Power of Attorney executed by Petitioner appointing the above designated counsel.

F. Proof of Service (§§ 42.6(e) and 42.105(a))

Proof of service of this Petition is provided in **Attachment A**.

II. COMPLIANCE WITH REQUIREMENTS FOR *INTER PARTES* REVIEW PETITION

A. Grounds For Standing (§ 42.104(a))

Pursuant to 37 C.F.R. 42.104(a), Petitioner hereby certifies that the '544 patent is available for *inter partes* review and that the Petitioner is not barred or

estopped from requesting *inter partes* review challenging claims 1-15, 18-21 and 23-26 of the '544 patent on the grounds identified herein.

Neither Petitioner, nor any party in privity with Petitioner: (i) has filed a civil action challenging the validity of claims 1-15, 18-21 and 23-26 of the '544 patent; or (ii) has been served with a complaint alleging infringement of the '544 patent, more than a year prior to the date of filing of this Petition. Also, claims 1-15, 18-21 and 23-26 of the '544 patent have not been the subject of a finally concluded district court litigation involving the Petitioner.

B. Fee For *Inter Partes* Review (§ 42.15(a))

The director is authorized to charge the fees specified by 37 C.F.R. §42.15(a), and any other fee required from Petitioner in connection with this petition, to Deposit Account No. 50-0665.

III. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)-(2), Petitioner challenges claims 1-15, 18-21 and 23-26 of the '544 patent (Ex. 1001).

A. Prior Art Patents and Printed Publications

Petitioner relies on the following patents and printed publications, which were not considered during the examination of the '544 patent (with the exception of the Admitted Prior Art):

1. U.S. Patent No. 5,822,775 to Sudo et al. (“Sudo” (Ex. 1005)) issued on Oct. 13, 1998 from an application filed on Dec. 18, 1992 and is prior art to the ’544 patent under at least §102(a) or §102(e).
2. U.S. Patent No. 5,450,634 to Porambo et al. (“Porambo” (Ex. 1006)) issued on Sept. 12, 1995 from an application filed on Jan. 7, 1993 and is prior art to the ’544 patent under at least §102(a) or §102(e).
3. PCT Application No. PCT/NO90/00178 by Krokstad et al. (“Krokstad”)(Ex. 1007)), which was published in English on June 13, 1991 and is prior art to the ’544 patent under at least §102(b).
4. TMS320 Second Generation Digital Signal Processors Data Sheet (“TMS320 Data Sheet” (Ex. 1008) ©1991 Texas Instruments is prior art to the ’544 patent under at least §102(b).
5. The Patent Owner’s Admitted Prior Art (“APA”) disclosed in the ’544 patent.

B. Identification of Challenge (37 C.F.R. § 42.104(b)(1-2) and Relief Requested (37 C.F.R. § 42.22(a)(1))

Petitioner challenges claims 1-15, 18-21 and 23-26 of the ’544 patent as unpatentable under 35 U.S.C. §103 and requests cancellation of those claims.

This Petition, supported by a declaration of Daniel Ellis, PhD (Ex. 1003) filed herewith, demonstrates that there is a reasonable likelihood that Petitioner will prevail with respect to at least one of the challenged claims and that the

challenged claims are unpatentable for at least the reasons cited in this Petition.

See 35 U.S.C. §314(a).

IV. SUMMARY OF THE '544 PATENT AND THE PROSECUTION HISTORY

A. Introduction

The '544 patent describes and claims an audio amplifier that includes a digital signal processor ("DSP") that modifies a signal to be amplified according to a digital signal processing function. The claimed amplifier is required to have a programming signal input port to which an external programmer can be removably connected in order to modify the digital signal processing functions and digital signal processing parameters defined in the digital signal processor.

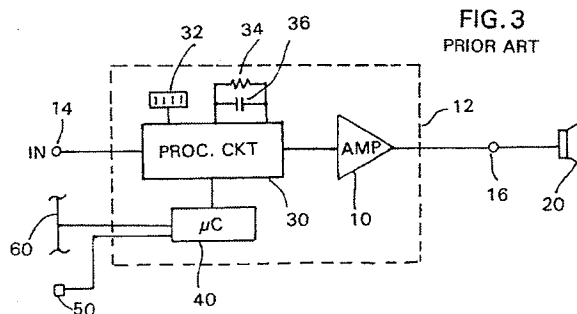
As will be shown by the evidence submitted with this Petition, audio amplifiers that include programmable DSP circuits that perform digital signal processing functions on signals to be amplified were well known in the art before the earliest filing date of the '544 patent. In addition, it was well known in the art to include a programming signal input port in an amplifier for removably connecting an external programmer for use in modifying the signal processing functions and signal processing function parameters of a DSP.

As discussed in the accompanying declaration from Daniel Ellis, PhD, a professor of Electrical Engineering at Columbia University, the subject matter recited in claims 1-15, 18-21 and 23-26 of the '544 patent are merely combinations

of well-known features employed in amplifier designs that would have been obvious to a person of ordinary skill in the art to combine.

B. Summary of the '544 patent

The Description of the Prior Art section of the '544 patent (Ex. 1001 1:20-67) and Figure 3 shown below, admit that amplifiers having built in signal processors were well known in the art. These signal processors operate to modify and amplify input signals and transmit the modified signals to a load. The signal processing circuit 30 includes resistive and capacitive elements along with switching elements, operational amplifiers and other devices to modify an input signal in a desired manner. *Id.* at 1:22-30.



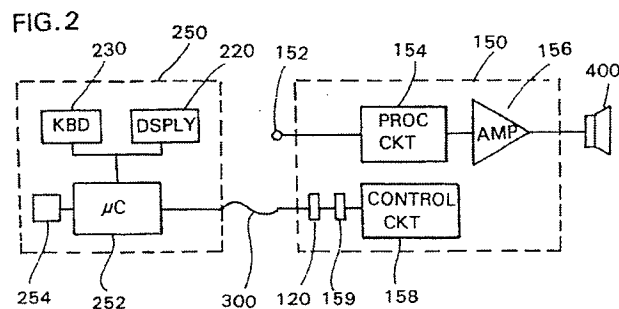
According to the '544 patent, the problem with these types of signal processing circuits is that the signal processing function and parameters of the amplifier can only be modified by setting the switches 32 and removing and/or replacing one or more of the resistors 34 and capacitors 36, which requires opening the amplifier housing. In addition, the modification, removal and/or replacement

of the various circuit elements to modify the parameters is time consuming and difficult because the signal processing control circuit elements are plug-in or solderable components. *Id.* at 1:62-67 and 2:13-17.

The '544 patent also admits that it was well known to include a controller 40 in the amplifier 10 that is connected to controllable knobs 50 or a network 60 to receive input command signals for modifying the signal processing parameters. If the controller 40 is connected to a network 60, a computer or similar input device must be provided to input control signals through the network 60. *Id.* at 2:23-45.

According to the '544 patent, the solution to these problems is to use a digital signal processor in the amplifier and provide an amplifier programmer that is removably connected to the amplifier to allow the signal processing functions and/or parameters to be changed or modified without modifying the signal processing circuit elements.

Figure 2 of the '544 patent shows an embodiment of the amplifier.



As described at 6:41-47, programming information is input from the portable programmer 200 [250] through the connector 300 and the programming port 120 to

a control circuit 158. This programming information may comprise signal processing function programs and program data for defining function parameters, parameter modification requests, new parameters and other suitable control information. The control circuit 158 may comprise a programmable microprocessor that serves as an interface between the portable programmer and the signal processing circuit 154. Alternately, the control circuit and signal processing circuit of the amplifier may be formed by a digital signal processor. If a digital signal processor is provided in the amplifier 100, both signal processing functions and function parameters can be changed by inputting control information from the portable programmer 200 to the amplifier 100. *Id.* at 6:48-54.

C. Summary of the Prosecution History

The application that became the '544 patent was filed on Nov. 16, 1995 as a file wrapper continuation of U.S. Patent Application Serial No. 08/337,157 ("the '157 application") that was filed on Nov. 9, 1994.

When the '157 application was filed, the independent claims were directed to an amplifier having a signal processing circuit and "a programming signal input device for receiving at least one programming signal from an external programmer removably connected to the programming signal input device" as well as to an amplifier programmer and a method of programming an amplifier. Ex. 1002 at 46-49.

In the first Office Action of May 17, 1995 claims 1-20 were rejected as being anticipated or obvious in view of a number of references. No response was made to the first Office Action. Instead, a file wrapper continuation application was filed on Nov. 16, 1995 without amending the claims or submitting comments about the previous rejections.

A first Office Action in the continuation application was mailed on Feb. 14, 1996 again rejecting claims 1-20 as being anticipated by U.S. Patent No. 4,223,272 to Feistel (“Feistel”) or U.S. Patent No. 5,015,969 to Barclay (“Barclay”). In a response filed on Jul. 15, 1996, claim 1 was amended, as shown below, to emphasize that the signal processing circuit is a digital signal processor capable of receiving both a signal processing function and signal processing function parameters, as well as to emphasize that the external programmer is removably connected to the programming signal input port.

1. (Amended) An amplifier comprising:
an input port for receiving an input signal;
a signal; processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal processing function parameter, wherein the signal processing circuit receives [for receiving] the input signal from the input port and [modifying] modifies the input signal;

a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting [a modified] an amplified signal to an output device;

an external programmer; and

a programming signal input [device] port for receiving at least one programming signal from [an] the external programmer, the external programmer being removably [connected] connectable to the programming signal input [device] port for modifying at least one of a signal processing and a signal processing function parameter defined in said signal processing circuit. *Id.* at 80-81.

In distinguishing the amended claims from the cited references, the prosecuting attorney repeatedly emphasized the fact that the cited prior art only taught systems for receiving signals that change the signal processing parameters but not systems that change the signal processing functions.

For example, the attorney stated:

The Feistel reference and the Barclay reference disclose amplifiers comprising microprocessor controlled signal processing circuits where the parameters of the signal processing circuits are modified by the output data of the microprocessor.

Specifically, the Feistel reference shows that an audio signal may be modified by a digital filter where “the various parameters defining the transfer function...can be chosen on the basis of either frequency or response time.” (emphasis added, Col. 2, lines 23-26). The parameters are adjusted by turning knobs or wheels (Col. 5, lines 32, 43 and 64); by physically replacing electrical components (Col. 6,

lines 4-8); or by keyboard entry into a microprocessor (Col. 6, lines 19-29).

However, the Feistel reference does not disclose:

a signal processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal processing function parameter, wherein the signal processing circuit receives the input signal from the input port and modifies the input signal;

an external programmer; and

a programming signal input port for receiving at least one programming signal from the external programmer, the external programmer being removably connected to the programming signal input port as recited in amended claim 1 of the instant application.

Indeed, the Feistel reference discloses a filter circuit in which only the filter function parameters can be modified as opposed to a digital signal processor capable of modifying the signal processing function of an amplifier as recited in Applicant's amended claims, 1, 10 and 16.

Further, the Feistel reference does not disclose an external programmer which is removably connect to the amplifier via a programming signal input port as recited in amended claim 1. *Id.* at pages 87-88.

Similar arguments were made with regard to the other cited references.

A final Office Action was mailed on Sept. 17, 1996, in which claims 1-8 were indicated as allowable and claims 10-38 were again rejected. In response to the final Office Action, claims 10-15 and 25-30 directed to the external

programmer were amended to depend from claim 1. Method claims 16-20 were cancelled.

Had the Patent Office been aware of the full scope of the art, the '542 claims would have never been allowed. The prior art submitted with this Petition shows that it was well known in the art to program both digital signal processing functions and digital signal processing parameters into a DSP with a portable programmer that is removably connected to an amplifier.

V. CLAIM CONSTRUCTION

A claim term in an unexpired patent subject to *inter partes* review shall be “its broadest reasonable construction in light of the specification of the patent in which it appears” to one of ordinary skill in the art. 37 C.F.R. §§ 42.100(b) and 42.104(b)(3).

Claim 1 requires that the amplifier have “**a programming signal input port,**” which is described in the '544 patent as something that is to receive a connector coupled to a portable programmer. Ex. 1001 at 5:56-57. Therefore, the broadest reasonable interpretation of a programming signal input port would be “an electrical interface capable of being operably coupled to a connector.”

Claims 1, 2, 3, 18, 20, 23, 24, 25 and 26 require that the digital signal processor be capable of receiving “**at least one of a signal processing function**

and a signal processing function parameter.” The ’544 patent specification states that “Once all of the signal processing function programs **and/or** function parameter values have been input to the programmer 200 and the microprocessor 252 has converted the input control information to control signals, the user can actuate a send key on the keyboard 230 to transmit the new signal processing function **and/or** parameter information to the input port 120 of the amplifier.” Ex. 1001 7:48-54 (Emphasis added). From the “and/or” description in the specification and the use of the qualifier “at least one of,” in the claims it is clear that the broadest reasonable interpretation of this phrase is “a digital signal processor that is capable of receiving either a signal processing function or a signal processing function parameter, or both.”

Claim 2 depends from claim 1, which specifies that the amplifier is to have a programming signal input port for receiving at least one programming signal. Claim 2 further requires “**a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit.**” There is no description in the ’544 patent of a control circuit that converts an input programming signal that is received on the programming signal input port to a control signal that is sent to the signal processor.

A control circuit in the amplifier is described in the '544 patent at 6:48-50 (“The control circuit 158 preferably comprises a programmable microprocessor...”). The '544 patent also states that “the control circuit and the signal processing circuit may be formed by a digital signal processor...” *Id.* at 6:52-55. However, a word search of the '544 patent for “convert” or “converting” only shows the term used with converting input signals from a user into control signals that are sent from the external programmer to the amplifier. See Ex. 1001 3:56-61; 3:62-64 and 7:44-50.

Nothing in the specification of the '544 patent indicates that the control circuit 158 in the amplifier does any conversion of a programming signal that is received on the programming signal input port. Indeed the term “input programming signal” only appears in the claims and is not used in the specification. Therefore, the broadest reasonable interpretation of the term “a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit” would appear to mean “a circuit that supplies a received programming signal to a signal processor.”

Claim 8 includes a limitation of a “**non-volatile storage means for storing a set [sic] performance characteristics.**” This clause should be interpreted as a means plus function limitation under 35 U.S.C. §112¶(6) or 112(f). Pursuant to

rule 42.104(b)(3), it appears that this term refers to a memory or storage device in the DSP for storing a set parameter value. Ex. 1001 3:21-25.

The remaining terms in the claims are to be given their broadest reasonable interpretation in light of the specification as commonly understood by those of ordinary skill in the art.

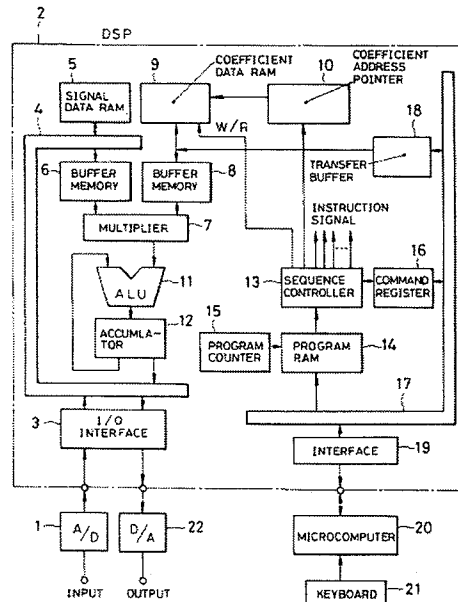
The above proposed claim constructions are offered only to comply with 37 C.F.R. §§ 42.100(b) and 42.104(b)(3) and for the sole purpose of this Petition. Petitioner and its privies specifically reserve the right to argue different claim constructions for use in the concurrent litigations and other proceedings where a different claim construction standard applies.

VI. THE PRIOR ART THAT RENDERS THE CHALLENGED CLAIMS UNPATENTABLE

A. U.S. Patent No. 5,822,775 to Sudo et al

The Sudo patent is submitted with the Petition as evidence that it was well known in the art to use a computer to program a DSP with both a desired signal processing function and signal processing parameters in order to process audio signals. Figure 1 from the Sudo patent is shown below.

FIG. 1



The Sudo patent discloses an improvement to a digital signal processor (DSP) that is programmed to add reverberation and presence to an input audio signal in order to create an acoustic space similar to a concert hall or theater. Sudo indicates that it was well known to provide:

A program for an arithmetic operating process which is used in the DSP is stored in a rewriteable RAM in the DSP. Each time the desired sound field mode or the like is switched, the corresponding processing program and coefficient data are transferred from a microcomputer and written to the rewritable program RAM, so that the desired acoustic space sound can be produced.” (Emphasis added) *See* Ex. 1005 at 1: 35-42.

Sudo describes a microcomputer 20 that is connected to the main bus 17 [of the DSP 2] through an interface 19 (“The microcomputer 20 is connected to the main bus 17 through an interface 19.”) Sudo explains:

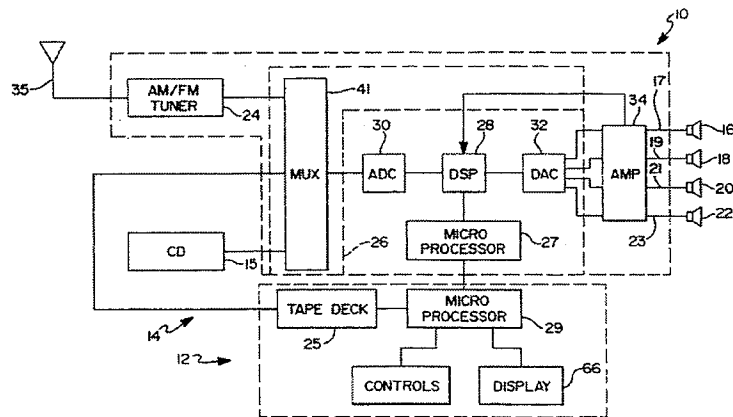
When any key on the keyboard 21 is selected, the microcomputer 20 reads out the processing program corresponding to the selected key from the ROM (not shown), transfers the program through the interface 19 and main bus 17 and stores it program RAM 14. A group of coefficient data ... which are used in the processing program, are read out from the ROM and transferred and stored in the coefficient data RAM 9 through the interface 19, main bus 17 and transfer buffer 18. (Emphasis added) *Id.* at 4:8-12.

As can be seen from the above, the interface 19 of Sudo is operating as a programming signal input port through which programming signals for a digital signal processing function and digital signal processing function parameters are received and programmed into the memories of the DSP.

Sudo does not explicitly disclose that the DSP is connected to an amplifier. However, Sudo discloses an improvement to DSP of the type that can produce an acoustic space similar to a concert hall or theater in a room or a vehicle. *Id.* at 1:15-23. Therefore, a person of ordinary skill in the art would have found it obvious to connect the analog audio signals produced at the output of the digital to analog converter I/O interface 22 in Sudo to an amplifier and speakers in order to produce the modified audio signals in a room or vehicle.

B. U.S. Patent No. 5,450,624 to Porambo et al.

The Porambo patent (Ex 1006) discloses an amplifier design for use in automobiles that incorporates a general purpose, programmable digital signal processor that provides audio signals to a power amplifier. As can be seen in Figure 1 of Porambo reproduced below, the output signals of the DSP 28 are fed to a digital to analog converter 32 that in turn supplies the signals to a power amplifier 34. See Ex. 1006 4:1-32 and 5:3-6.

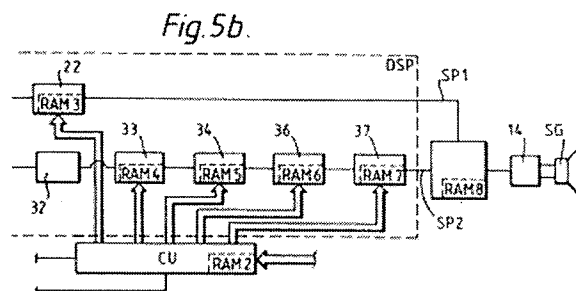
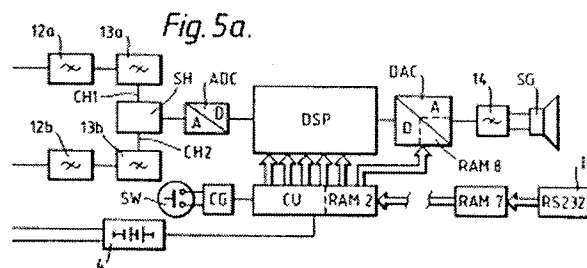


C. PCT Application No. PCT/NO90/00178 to Krokstad et al.

Krokstad describes an audio amplifier for use in a hearing aid. In Krokstad, a digital signal processor is used to provide signal processing functions, such as compression and equalization, filtering, etc. The user can touch a control keypad on the outside of the device in order to cause a new set of parameters for a specific response function to be moved into the memories of the DSP. See Ex. 1007 page 20-top of page 21.

Krokstad also explicitly describes a programming signal input port for the amplifier that is used to program the DSP with functions that are selected for a particular user. *See* Ex. 1007 at page 20, lines 28-29 (“Normally the user will be offered a menu of several response functions with a corresponding number of stored parameter sets.”) and page 21, lines 7-9 (“A typical menu of response functions can include, e.g. five such functions. Each of the response functions is adapted to the user’s hearing...”).

Figure 5a shown below and the text on page 21, lines 18-25 of the Krokstad application, explain how a control unit (CU), which interfaces with the DSP, is connected to a RS232 port to allow the DSP to be programmed by a personal computer (not shown).



In Krokstad, the D/A converter operates as the power amplifier. However if additional power is required, Krokstad mentions that an additional power amplifier could be used as shown in Fig. 4d. *Id.* at page 18, lines 17-22 and page 6, last line.

The Krokstad reference is therefore submitted as further evidence, *inter alia*, that DSP-controlled amplifiers having a programming signal input port for receiving DSP functions and digital signal function parameters were well known in the art prior to the earliest filing date of the '544 patent.

D. Texas Instrument TMS320 Second Generation Digital Signal Processors Data Sheet.

The TMS320 Data Sheet was published in 1991 and discloses information about general purpose digital signal processors that were available prior to the earliest filing date of the '544 patent. In particular, the TMS320 data sheet is submitted as evidence, *inter alia*, that it was well known to include non-volatile memory in a DSP.

E. Patent Owner's Admitted Prior Art

The '544 patent admits, *inter alia*, that amplifiers having a plurality of control knobs for controlling gain, volume, an equalizer circuit, a level threshold etc. on a control panel of the amplifier were "conventional" or well known in the art. See Ex. 1001, 5:46-55.

VII. DETAILED EXPLANATION OF THE GROUNDS FOR UNPATENTABILITY OF CLAIMS 1-15, 18-21 and 23-26 OF THE '544 PATENT.

A. Claim 1 is Unpatentable as Obvious 35 U.S.C. §103(a) over Sudo in view of Porambo.

Sudo discloses each element of claim 1 with the exception of a power amplifier. The device disclosed by Sudo is a digital signal processor that receives an input signal on a input port and performs a digital signal process on the input signal according to a programmed digital signal processing function and associated parameters in order to modify the input signal to provide a desired sound field. Ex. 1005 3:35-4:5. A microcomputer 20 that operates as an external programmer for the DSP is removably connected to the DSP 2 through the interface 19. *See* 1003 Declaration of Professor Ellis at page 5, ¶13.

If a user selects a key representing a different sound field on the keyboard, the microcomputer 20 reads out the processing program corresponding to the selected sound field control key and the corresponding coefficients and transfers this data to the DSP through the interface 19. Ex. 1005. at 3:61-4:24.

Sudo does not disclose a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting an amplified signal to an output device. However, a person of ordinary skill in the art would have considered the idea of connecting a power amplifier and an output device (e.g. speakers) to the output of the digital to analog converter 22 to have been obvious.

The outputs of the D/A converter 22 are described in the Sudo patent as being analog audio signals. *Id.* at 4:48-50. In addition, Sudo indicates that “the audio signal data, after it has been arithmetically operated on by the DSP 2 is supplied to a D/A converter 22, through the data bus 4...then, the analog signal is supplied to a circuit or apparatus at the post stage.” A person of ordinary skill in the art of audio amplifiers would recognize that the circuit or apparatus at the post stage mentioned by Sudo would refer to some sort of power amplifier and output device such as speakers and thus connecting output from the DSP in Sudo to a power amplifier and an output device would have been obvious. *See* Ex. 1003, Declaration of Professor Ellis at pages 5-6, ¶14-15.

In addition, the Porambo patent discussed above shows that it was well known to connect the outputs of a DSP in a DSP-controlled audio system to a power amplifier 34 and speaker load (speakers 16, 18, 20, 22). *See* Ex. 1006 Fig. 1.

Therefore, a person of ordinary skill in the art would have considered connecting the output of the DSP in Sudo to a power amplifier and speakers as shown by Porambo, to have been an obvious way to hear the modified input audio signals. *See* Ex. 1003 Declaration of Professor Ellis at page 12, ¶33-34.

The following claim chart compares each element of claim 1 with the corresponding disclosure in the Sudo and Porambo patents. Because the

differences between what is disclosed in Sudo and claim 1 would have been obvious to a person of ordinary skill in the art, claim 1 is unpatentable.

| Claim 1 of '544 | Prior Art |
|--|--|
| An amplifier comprising: | Sudo discloses a DSP sound processor that would be used with an amplifier. |
| an input port for receiving an input signal; | The Sudo device has an input port I/O interface 3 that is connected to the A/D converter 1 that receives an input signal. Ex. 1005, Fig. 1. |
| a signal processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal processing function parameter, wherein the signal processing circuit receives the input signal from the input port and modifies the input signal; | <p>The DSP 2 is capable of receiving both a signal processing function and signal processing function parameters. <i>Id.</i> at 4:8-16.</p> <p>The DSP is programmed to receive and modify the input signal. <i>Id.</i> at 4:1-5</p> |
| a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting an amplified signal to an output device; | <p>The use of a power amplifier for amplifying the modified signal from the signal processing circuit and outputting the amplified signal to an output device would have been obvious to a person of ordinary skill in the art. See Ex. 1003, Declaration of Prof. Ellis at page 11 ¶33-34.</p> <p>Porambo shows that it is well known to include a power amplifier 34 that amplifies modified input signal received from a DSP and output the amplified signal to output devices 16-22 (e.g. speakers). Ex. 1006, Fig. 1.</p> |
| an external programmer; and | Sudo discloses a microcomputer 20 that operates as an external programmer for the DSP. Ex. 1005, |

| | |
|---|---|
| | Fig. 1 and 3:61-67. |
| a programming signal input port for receiving at least one programming signal from the external programmer, the external programmer being removably connectable to the programming signal input port for modifying at least one of a signal processing function and a signal processing function parameter defined in said signal processing circuit. | <p>Sudo discloses a programming signal input port (interface 19) that receives programming signals and signal processing function parameters from the external programmer (microcomputer 20) and that the external programmer is removably connectable to the programming signal input port. (Could disconnect the microcomputer 20 from the interface 19). Ex. 1003, page 5, ¶13.</p> <p>The signals received from the microcomputer modify the signal processing function (e.g. create a sound field of hall 1 or hall 2) and the signal processing function parameters (groups of coefficient data used by the processing program.) <i>Id.</i> at 3:61-4:17.</p> |

B. Claim 1 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 1 is also unpatentable over Sudo in view of Krokstad. Amplifiers having a DSP that is programmable with a removably connected, external programmer were well known in the art prior to the earliest filing date of the '544 patent. For example, Krokstad discloses a DSP-controlled amplifier for use in a hearing aid. Krokstad further discloses that the DSP can provide signals to a power amplifier if needed. Ex. 1007 at 18, lines 17-22 and Fig. 4d. In Krokstad, a personal computer is used to program the DSP with different functions and parameters that are optimized for each particular user. The computer is removably

connectable to the amplifier and DSP via an RS232 port. *See* Ex. 1007, Fig. 5a and page 21, lines 7-22.

Both Sudo and Krokstad are in the field of DSP-controlled audio devices and both use programmable DSPs to alter an incoming audio signal in a desired manner. A person of ordinary skill in the art would have been motivated to program the DSP of Sudo with a programmer that is connected via a removable connection such as the RS232 port shown in Krokstad, in order to allow the programmer to be easily connected to or disconnected from the DSP or to allow a general purpose computer that could be used for other tasks to be used in programming the DSP. *See* Ex. 1003 Declaration of Professor Ellis at page 12 ¶38.

The claim chart below compares the elements of claim 1 with the corresponding disclosure in the Sudo and Krokstad patents. Because each element of claim 1 is found in the combined teachings of Sudo and Krokstad and a person of ordinary skill in the art would have been motivated to combine the teachings for at least the reasons set forth above, claim 1 is unpatentable.

| Claim 1 of '544 | Prior Art |
|--|--|
| An amplifier comprising: | Sudo discloses a DSP sound processor that would be used with an amplifier. |
| an input port for receiving an input signal; | The DSP 2 has an input port connected to the A/D converter 1. Ex. 1005, Fig. 1. |
| a signal processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal | The Sudo device is capable of receiving both a signal processing function and signal processing function parameters. <i>Id.</i> at 4:8-16. |

| | |
|---|---|
| processing function parameter, wherein the signal processing circuit receives the input signal from the input port and modifies the input signal; | The DSP of Sudo receives an input signal and modifies it. <i>Id.</i> at 4:1-5. |
| a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting an amplified signal to an output device; | <p>The use of a power amplifier for amplifying the modified signal from the signal processing circuit and outputting the amplified signal to an output device would have been obvious to a person of ordinary skill in the art. See Ex. 1003, Declaration of Prof. Ellis at page 11 ¶33-34.</p> <p>Krokstad discloses that the amplifier can include a power amplifier. Ex. 1007, page 18, lines 17-22.</p> |
| an external programmer; and | Sudo discloses a microcomputer 20 that operates as an external programmer. Ex. 1005, Fig. 1 and 3:61-67. |
| a programming signal input port for receiving at least one programming signal from the external programmer, the external programmer being removably connectable to the programming signal input port for modifying at least one of a signal processing function and a signal processing function parameter defined in said signal processing circuit. | <p>Sudo discloses a programming signal input port (interface 19) that receives programming signals from an external programmer (microcomputer 20) that is removably connectable to a programming signal input port. Ex. 1005, Fig. 1 and 3:50-52 and Ex. 1003, page 5, ¶13.</p> <p>The signals received from the microcomputer modify the signal processing function (e.g. create a sound field of hall 1 or hall 2) and the signal processing function parameters (groups of coefficient data used by the processing program). <i>Id.</i> at 3:61-4:17.</p> <p>Krokstad discloses a DSP-controlled</p> |

| | |
|--|---|
| | amplifier that is programmed with a signal processing function and parameters using a personal computer that is removably connected to a programming signal input port by an RS232 connection. Ex. 1007, page 21. |
|--|---|

C1. Claim 2 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 2 requires a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and the signal processing function parameter defined in said signal processing circuit. For the reasons discussed above, this feature is not described in the '544 patent.

Assuming the broadest reasonable interpretation of the term is “a circuit that supplies a programming signal to a signal processor,” this feature is also disclosed in both Sudo and Porambo. Sudo inherently includes an interface circuit 19 that supplies a programming signal to the signal processor. Ex. 1005, Fig. 1 and 3:63-67.

In addition, Porambo inherently discloses an amplifier with a control circuit (microprocessor) that receives programming signals (knob or button settings) and converts them into signal processing function parameters and sends to the signal processing circuit. Porambo discloses a car radio with an microprocessor 29 that interfaces with a number of controls 42-62. Ex. 1006 4:33-44. A person of

ordinary skill in the art would understand that the microprocessor 29 would be programmed to read the values or settings of these controls (i.e. programming signals) and generate control signals that are passed to the DSP to adjust the volume, bass, treble, etc. See Ex. 1003, Declaration of Professor Ellis at page 6 ¶17.

A person of ordinary skill in the art would have found it obvious to use a control circuit for receiving a programming signal and converting the programming signal to a control signal and converting it into the proper format that can program the DSP. See Ex. 1003 Declaration of Professor Ellis at page 14, ¶44. Therefore, claim 2 is unpatentable.

| Claim 2 | Prior Art |
|--|---|
| The amplifier of claim 1, further comprising a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and the signal processing function parameter defined in said signal processing circuit. | <p>Porambo discloses a microprocessor 29 that would be programmed to read the value of programming signals input via the radio control buttons and generate control signals that are sent to the DSP. Ex. 1003 page 6, ¶17.</p> <p>Sudo discloses an interface circuit 17 that receives input programming signals and send them to the DSP. Ex. 1005.</p> |

C2. Claim 2 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 2 requires a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and the signal processing function parameter defined in said signal processing circuit. For the reasons discussed above, this feature is not described in the '544 patent.

Assuming the broadest reasonable interpretation of the term is “a circuit that supplies a programming signal to a signal processor” it is also disclosed in both Sudo and Krokstad. Sudo inherently includes an interface circuit 19 that supplies a programming signal to the signal processor. Ex. 1005, Fig. 1 and 3:52-5. Krokstad explicitly discloses a control unit (CU) in Figure 5a that serves as an interface between the DSP and the personal computer that is used to re-program the DSP. *See* Ex. 1007 page 21, lines 18-23. The control unit of Krokstad inherently converts the electrical programming signals received from the personal computer via the RS232 port into the corresponding digital data that is used to reprogram the DSP with the desired functions and coefficients.

A person of ordinary skill in the art would find it obvious in view of Krokstad to use a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and

the signal processing function parameter defined in said signal processing circuit as a way to supply the programming signals to interface the DSP with an external programmer. See Ex. 1003 Declaration of Professor Ellis at page 14, ¶44. Therefore, claim 2 is unpatentable.

| Claim 2 | Prior Art |
|--|---|
| The amplifier of claim 1, further comprising a control circuit for receiving the programming signal and converting the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and the signal processing function parameter defined in said signal processing circuit. | Krokstad shows a control circuit (control unit (CU)) that converts a programming signal received from a personal computer into control signals that modify the signal processing functions and parameters defined in the signal processing circuit. Ex. 1007, page 21, lines 18-23. |

D1. Claim 3 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 3 depends from claim 2 and requires that the digital signal processor include a storage device for storing at least one of the signal processing function and the signal processing function parameter produced by the control circuit. The DSP disclosed in Sudo has memories for storing a programming function (program RAM 14) and signal processing function parameters (coefficient data RAM 9).

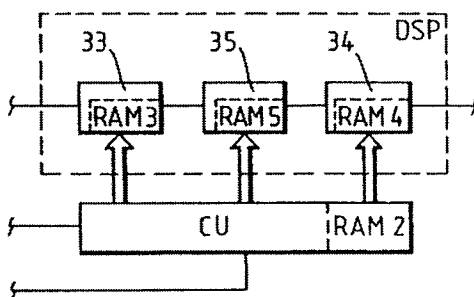
A person of ordinary skill in the art would have considered the use of memories for storing programming functions and parameters to have been obvious in view of Sudo as a way to store the data and programs in the DSP. See

Declaration of Professor Ellis at page 14, ¶48. Therefore, claim 3 is also unpatentable.

| Claim 3 | Prior Art |
|---|--|
| The amplifier of claim 2, wherein the signal processing circuit comprises a storage device for storing at least one of the signal processing function and the signal processing function parameter produced by the control circuit. | Sudo discloses that the DSP 2 has a storage device (Programming RAM 14) and Coefficient Data RAM 9) See Ex. 1005 Fig. 1. |

D2. Claim 3 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 3 depends from claim 2 and requires that the digital signal processor include a storage device for storing at least one of the signal processing function and the signal processing function parameter produced by the control circuit. As discussed above, the DSP disclosed in Sudo has memories for storing a programming function (program RAM 14) and signal processing function parameters (coefficient data RAM 9). Krokstad similarly discloses that the DSP has storage devices (RAM, RAM4, RAM5) for storing signal processing functions and signal processing function parameters produced by the control circuit as shown in FIG 4C below and described at Ex. 1007, page 20, lines 9-16 (“separate filter coefficients for each filter which is part of the filter coefficient set stored in the random-access memories RAM3-RAM6”).

Fig. 4c.

A person of ordinary skill in the art would have considered the use of memories for storing programming functions and parameters to have been obvious over Sudo and/or Krokstad as a way to store the data and programs in the DSP. See Declaration of Professor Ellis at page 14, ¶48. Therefore, claim 3 is also unpatentable.

| Claim 3 | Prior Art |
|---|--|
| The amplifier of claim 2, wherein the signal processing circuit comprises a storage device for storing at least one of the signal processing function and the signal processing function parameter produced by the control circuit. | <p>Sudo discloses that the DSP 2 has a storage device (Programming RAM 14) and Coefficient Data RAM 9). See Ex. 1005 Fig. 1.</p> <p>Krokstad discloses RAMs in the DSP. Ex. 1007 Fig 4a.</p> |

E1. Claim 4 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 4 depends from claim 2 and requires that the control circuit comprise a programmable microprocessor. As discussed above, the use of a programmable

microprocessor to receive programming signals and convert them to control signals for the DSP is inherently by Porambo which shows a microprocessor 29 interfacing with the DSP 28. A person of ordinary skill in the art would have recognized that the microprocessor 29 in a car radio would be programmed to read the values (programming signals) of button/switches 42-46 on the control panel of a radio and convert the readings into digital signal processing parameters for the DSP. See Ex. 1003, Declaration of Professor Ellis at page 6, ¶17.

A person of ordinary skill in the art would have considered the use of a programmable microprocessor to receive programming signals and convert them to control signals for sending to a signal processing circuit to be obvious in view of Porambo as a convenient way to interface to the DSP. *Id.* at page 15, ¶50. Therefore, claim 4 is unpatentable.

E2. Claim 4 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 4 depends from claim 2 and requires that the control circuit comprise a programmable microprocessor. Krokstad shows the use of a control unit (CU) that receives the programming signals and transmits them to the memories of the DSP to change the function and parameters of the DSP. Ex. 1007, page 21, lines 1-5. A person of ordinary skill in the art would have recognized that the control unit of Krokstad would be implemented as a programmable microprocessor. See Ex. 1003, Declaration of Professor Ellis at page 8, ¶21.

A person of ordinary skill in the art would have considered the use of a programmable microprocessor to receive programming signals and convert them to control signals having the proper format for programming a function or parameters of the DSP, as done in Krokstad, to be an obvious way to interface with the DSP. *Id.* at page 15, ¶50. Therefore, claim 4 is unpatentable.

F1. Claim 5 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 5 depends from claim 1 and adds a storage device for storing at least one programming signal. Sudo discloses a program RAM 14 that stores the programming signals. Ex. 1005 4:10-13 (“the microprocessor 20 reads out the processing program corresponding to the selected key from the ROM (not shown), transfers the program through the interface 19 and the main bus 17, and stores it in program RAM 14”). A person of ordinary skill in the art would have considered the use of a storage device for storing programming signals to have been obvious in view of Sudo as a convenient way to store the programming signals in the DSP. See Ex. 1003 Declaration of Professor Ellis at page 15, ¶53. Therefore, claim 5 is also unpatentable.

F2. Claim 5 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 5 depends from claim 1 and adds a storage device for storing at least one programming signal. Krokstad discloses a DSP having a number of storage

devices (RAM3-RAM6) for storing programming signals. See Ex. 1007, page 20, lines 9-16 and Fig. 5a. A person of ordinary skill in the art would have considered the use of a storage device for storing programming signals to have been obvious in view of Sudo as a convenient way to store the programming signals in the DSP. See Ex. 1003 Declaration of Professor Ellis at page 15, ¶53. Therefore, claim 5 is also unpatentable.

**G1. Claim 6 is Unpatentable as Obvious under 35 U.S.C. §103(a)
Over Sudo in view of Porambo.**

Claim 6 depends from claim 1 and adds the limitation of an amplifier housing where the signal processing circuit and power amplifier are located in the amplifier housing. Porambo discloses an amplifier where the DSP and power amplifier are in the same housing. See Ex. 1006 Fig. 1 4:1-5 (Control box indicated by dashed lines 14 includes the DSP 28 and power amplifiers 34).

Because Porambo shows a DSP and a power amplifier in the same housing, a person of ordinary skill in the art would have considered it obvious to combine the DSP of Sudo in an amplifier housing that includes a power amplifier for any number of reasons such as to shorten the length of the signal leads that would be needed to connect the components of the amplifier together. See Ex. 1003 Declaration of Professor Ellis at page 16, ¶56. Therefore, claim 6 is unpatentable.

| Claim 6 | Prior Art |
|---|--|
| The amplifier of claim 1, further comprising an amplifier housing, the signal processing circuit and power amplifier being located in said amplifier housing. | Porambo discloses putting a DSP in a control box 14 that includes a power amplifier. Ex. 1006 at 4:1-12 and Fig 1. |

**G2. Claim 6 is Unpatentable as Obvious under 35 U.S.C. §103(a)
Over Sudo in view of Krokstad.**

Claim 6 depends from claim 1 and adds the limitation of an amplifier housing where the signal processing circuit and power amplifier are located in the amplifier housing. Krokstad discloses a DSP-controlled amplifier where the components are located in an amplifier housing. *See* Ex. 1006 page 8, ll. 7-8. (“the electronics components which form part of the hearing aid are provided in a first secondary section 2a [See Fig. 2]”) In Krokstad, the digital to analog converter is a high output converter to avoid need for a power amplifier. However, Krokstad indicates that if a power amplifier is required, one could be used in the output stage and connected to the output of the digital to analog converter as shown in Figure 4d. *Id.* at 18, ll. 17-22.

Because Krokstad suggests that a DSP and a power amplifier can be placed the same housing, a person of ordinary skill in the art would have considered it obvious to combine the DSP of Sudo in an amplifier housing that includes a power

amplifier for any number of reasons such as to shorten the length of the signal leads that would be needed to connect the components of the amplifier together. See Ex. 1003 Declaration of Professor Ellis at page 16, ¶56. Therefore, claim 6 is unpatentable.

| Claim 6 | Prior Art |
|---|---|
| The amplifier of claim 1, further comprising an amplifier housing, the signal processing circuit and power amplifier being located in said amplifier housing. | Krokstad discloses putting all the electronic components (DSP and power amplifier) of an amplifier into an amplifier housing. Ex. 1006 at page 8, ll. 17-22 and Fig. 2. |

H1. Claim 7 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 7 depends from claim 1 and adds the additional limitation of a control panel, wherein said programming signal input port is provided on the control panel.

The Patent Owner's APA admits that it was well known in the art to include controls for modifying an amplifier on a control panel. See Ex. 1001 5:50-54 ("Also, a plurality of control knobs 116 for controlling the gain, volume, an equalizer circuit, a level threshold etc. are provided on the control panel 112 as is conventional."). Sudo discloses an amplifier with a programming signal input port 19. The APA shows an amplifier with knobs, etc., on a control panel. A person of ordinary skill in the art would have considered the placement of a programming signal input port on a control panel that included other knobs, etc., for the amplifier

to be an obvious way to conveniently group the inputs to the amplifier. See Ex. 1003 Declaration of Professor Ellis at page 17, ¶58. Therefore, claim 7 is also unpatentable.

| Claim 7 | Prior Art |
|--|---|
| The amplifier of claim 1, further comprising a control panel, wherein said programming signal input port is provided on the control panel. | Patent Owner's APA admits that it was known to include controls for an amplifier on a control panel. Ex. 1001 at 5:51-55. |

H2. Claim 7 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 7 depends from claim 1 and adds the additional limitation of a control panel, wherein said programming signal input port is provided on the control panel.

As discussed above in H1, the Patent Owner's APA admits that it was well known in the art to include controls for modifying an amplifier on a control panel. See Ex. 1001 5:50-54.

Krokstad discloses the use of a programming signal input port (RS232 port) to program the DSP. A person of ordinary skill in the art would have considered the placement of a programming signal input port of the type shown by Krokstad on a control panel that included other knobs etc. for the amplifier as known from the APA to be an obvious way to conveniently group the inputs to the amplifier.

See Ex. 1003 Declaration of Professor Ellis at page 17, ¶58. Therefore, claim 7 is also unpatentable.

II. Claim 8 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of the Texas Instrument TMS320 Data Sheet.

Claim 8 depends from claim 1 and adds the further limitations that the signal processing circuit further comprises a plurality of electronic components and adds “a non-volatile storage means for storing a set [sic] performance characteristics.”

The DSP in Sudo clearly has a plurality of electronic components. See Ex. 1005, Fig 1. (program counter 15, command register 16, buffer memories 6, 8, etc.).

The use of non-volatile memories in a DSP was well known in the art as evidenced by the Texas Instrument TMS320 data sheet. This data sheet for digital signal processors that were available in 1991 shows that it was well known to include non-volatile memories (ROM and EPROM) in a DSP. See Ex. 1008, page 6.

A person of ordinary skill in the art would have considered the use of a non-volatile storage means (memory) in a DSP to have been obvious in light of the TMS320 Data Sheet as a convenient way to allow the DSP to retain stored performance characteristics in the event that power was removed from the device.

See Ex. 1003, Declaration of Professor Ellis at page 17, ¶61. Therefore, claim 8 is also unpatentable.

| Claim 8 | Prior Art |
|--|--|
| The amplifier of claim 1, wherein the signal processing circuit further comprises a plurality of electronic components and a non-volatile storage means for storing a set [sic] performance characteristics. | <p>Sudo discloses a DSP with a plurality of electronic components (program counter, buffer memories, etc.). Ex. 1005 Fig. 1.</p> <p>Well known to include non-volatile memory storage in a DSP as shown by Texas Instrument TMS320 datasheet. Ex. 1007 at 8.</p> |

I2. Claim 8 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad, in further view of the Texas Instrument TMS320 Data Sheet.

Claim 8 depends from claim 1 and adds the further limitations that the signal processing circuit further comprises a plurality of electronic components and adds “a non-volatile storage means for storing a set [sic] performance characteristics.”

The DSP in Sudo clearly has a plurality of electronic components. See Ex. 1005, Fig 1. (program counter 15, command register 16, buffer memories 6, 8 etc.).

As discussed above in I1, use of non-volatile memories in a DSP was well known in the art as evidenced by the Texas Instrument TMS320 data sheet.

A person of ordinary skill in the art would have considered the use of a non-volatile memory in a DSP to have been obvious in light of the TMS320 Data Sheet as a convenient way to allow the DSP to retain stored performance characteristics

in the event that power was removed from the device. See Ex. 1003, Declaration of Professor Ellis at page 17, ¶61. Therefore, claim 8 is also unpatentable.

| Claim 8 | Prior Art |
|--|--|
| The amplifier of claim 1, wherein the signal processing circuit further comprises a plurality of electronic components and a non-volatile storage means for storing a set [sic] performance characteristics. | <p>Sudo discloses a DSP with a plurality of electronic components (program counter, buffer memories, etc.). Ex. 1005 Fig. 1.</p> <p>Well known to include non-volatile memory storage in a DSP as shown by Texas Instrument TMS320 datasheet. Ex. 1007 at 8.</p> |

J1. Claim 9 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 9 depends from claim 1 and requires that the external programmer include an input/output port, data input device and a controller. As shown in the claim chart below, Sudo discloses that the DSP is programmed by a microcomputer that inherently has each element recited in claim 9. Therefore, it would have been obvious to a person of ordinary skill in the art to include all the elements of claim 9 in an external programmer as a way to program the DSP. See Ex. 1003 Declaration of Professor Ellis at page 18, ¶63. Therefore, claim 9 is unpatentable.

| Claim 9 | Prior Art |
|--|---|
| The amplifier of claim 1, wherein the external programmer comprises: | Sudo discloses an external programmer that is a microcomputer. Ex. 1005 3:54- |

| | |
|--|---|
| <p>an input/output port for sending and receiving control information;</p> <p>a data input device for allowing input of programming information to the programmer; and</p> <p>a controller for receiving the input programming information,</p> <p>generating programming signals from the input programming information and transmitting the programming signals through the input/output port to the amplifier for modifying at least one of a signal processing function and a signal processing function parameter of the amplifier.</p> | <p>60.</p> <p>Microcomputer has an input/output port (input port connected to keyboard 21) 3:61 and output port (connection between microcomputer and DSP interface 19). Keyboard receives control information and output port sends control information.</p> <p>Keyboard 21. <i>Id.</i> at Fig. 1.</p> <p>CPU that receives input programming information (microprocessor reads out the processing program corresponding to the selected key from the ROM...). <i>Id.</i> at 4:9-17.</p> <p>CPU generates programming signals based on key selected and transmits programming signals through input/output port to the DSP to change the concert hall function. <i>Id.</i></p> |
|--|---|

J2. Claim 9 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 9 depends from claim 1 and requires that the external programmer include an input/output port, data input device and a controller. As shown in the table set forth in J1 above, each element of claim 9 is disclosed in the external programmer of Sudo. Therefore the use of an external programmer having these elements would have been obvious to a person of ordinary skill in the art as a way

to program the DSP. See Ex. 1003 Declaration of Professor Ellis at page 18, ¶63.

Therefore, claim 9 is unpatentable.

K1. Claim 10 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 10 depends from claim 9 and requires that the external programmer include a display screen for displaying input programming information and information read by the controller. Sudo discloses that the external programmer is a microcomputer. It was well known that microcomputers include display screens that could display input programming information and information read by the microcomputer. Therefore, a person of ordinary skill in the art would have considered the use of a display screen to have been obvious. See Ex. 1003, Declaration of Professor Ellis at page 18, ¶65. Therefore, claim 10 is also unpatentable.

| Claim 10 | Prior Art |
|---|--|
| The amplifier of claim 9, wherein the external programmer further comprises a display screen for displaying input programming information and information read by the controller. | Well known that personal computers include a display screen for displaying input information and information read by a controller. |

K2. Claim 10 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 10 depends from claim 9 and requires that the external programmer include a display screen for displaying input programming information and

information read by the controller. Krokstad discloses a DSP controlled amplifier that is programmed with a personal computer and it was well known that personal computers include display screens that could display input programming information and information read by the personal computer. Therefore, a person of ordinary skill in the art would have considered the use of a display screen to have been obvious. See Ex. 1003, Declaration of Professor Ellis at page 18, ¶65.

Therefore, claim 10 is also unpatentable.

L1. Claim 11 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 11 depends from claim 9 and adds the additional limitation that the external programmer include a storage device for storing the input programming information and previously selected control signals. Sudo discloses that the microcomputer 20 includes a ROM that stores the programs and coefficients used for programming the DSP. See Ex. 1005 3:63-67 (“The microcomputer 20 reads out the processing program corresponding to the operated sound field key, the coefficient data group used in a particular program, and the like from the ROM and transfers this data to the DSP 2”). In addition, Sudo mentions that it was well known to update the DSP settings when a desired sound field is switched. See Ex. 1005 1:37-40 (“Each time the sound field mode or the like is switched, the corresponding program and coefficient data are transferred from a microcomputer and are written to the rewriteable RAM...”). A person of ordinary skill in the art

would have considered it obvious in light of Sudo to store previously entered control signals in the storage memories in order to determine when the user has made a switch in a desired sound field and it was time to download a new program to the DSP. *See* Ex. 1003, Declaration of Professor Ellis at page 19, ¶67.

Therefore, claim 11 is unpatentable.

| Claim 11 | Prior Art |
|---|---|
| The amplifier of claim 9, wherein the external programmer further comprises a storage device for storing the input programming information and previously selected control signals. | Sudo discloses RAM and ROM memories in the external programmer that stores programming information. storing the previously selected control signals would have been obvious. Ex. 1003, page 19, ¶67. |

L2. Claim 11 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 11 depends from claim 9 and adds the additional limitation that the external programmer include a storage device for storing the input programming information and previously selected control signals. As discussed above in L1, a person of ordinary skill in the art would have considered it obvious in light of Sudo to store previously entered control signals in the storage memories in order to determine when the user has made a switch in a desired sound field and it was time to download a new program to the DSP. *See* Ex. 1003, Declaration of Professor Ellis at page 19, ¶67. Therefore, claim 11 is unpatentable.

M1. Claim 12 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 12 requires that the data input device has a plurality of keys. Sudo discloses that the data input device microcomputer 20 has a keyboard with a plurality of keys. See Ex. 1005, 3:61-63 (“A keyboard 21 is connected to the microcomputer 20”). A person of ordinary skill in the art would have considered the use of a data input device with a plurality of keys to have been obvious in view of Sudo as a convenient method of allowing data to be entered into the external programmer. Ex. 1003 Declaration of Professor Ellis at page 20, ¶71. Therefore, claim 12 is also unpatentable.

M2. Claim 12 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 12 requires that the data input device has a plurality of keys. Krokstad describes that the DSP is programmed with a personal computer (Ex. 1007, page 21, lines 18-23) and it is well known that personal computers inherently include keyboards having a plurality of keys. Therefore, a person of ordinary skill in the art would have considered the use of a data input device with a plurality of keys as disclosed by Krokstad to have been an obvious way of entering data into the external programmer. Ex. 1003 Declaration of Professor Ellis at page 20, ¶71. Therefore, claim 12 is also unpatentable.

N1. Claim 13 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 13 depends from claim 9 and requires that the controller of the external programmer comprise a microprocessor that receives programming information from at least one of an input device and a control circuit of the amplifier. Sudo discloses that the microcomputer 20 used to program the DSP has a CPU (e.g. a microprocessor) that receives programming information from an input device (from keys pressed on the keyboard). Ex. 1005 3:54-65.

A person of ordinary skill in the art would have considered it obvious in light of Sudo to use a microprocessor in an external programmer that receives programming information from an input device as a way to supply desired programming information to the external programmer. See Ex. 1003 Declaration of Prof. Ellis at page 20, ¶75. Therefore, claim 13 is unpatentable.

| Claim 13 | Prior Art |
|---|---|
| The amplifier of claim 9, wherein the controller comprises a microprocessor for receiving programming information from at least one of the input device and a control circuit of the amplifier. | Sudo discloses an external programmer with a CPU that receives programming information from an input device (keys on a keyboard). Ex. 1005 3:54-65. |

N2. Claim 13 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 13 depends from claim 9 and requires that the controller of the external programmer comprise a microprocessor that receives programming

information from at least one of an input device and a control circuit of the amplifier. For the same reasons set forth in N1 above, a person of ordinary skill in the art would have considered it obvious in light of Sudo to use a microprocessor in an external programmer that receives programming information from an input device (keyboard 21) as a way to determine how the DSP should be programmed. See Ex. 1003 Declaration of Prof. Ellis at page 20, ¶75. Therefore, claim 13 is unpatentable.

O. Claim 14 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo and Krokstad.

Claim 14 depends from claim 9 and adds the limitation that the controller of the external programmer include a connector for removably connecting the programmer to the amplifier. Sudo discloses a DSP that is programmed with an external programmer that is removably connected to interface 19. This would necessarily imply that there is a connector on the external programmer for removably connecting to the interface 19. Fig. 1 and Ex. 1003 page 5 ¶13.

On the other hand, Krokstad explicitly discloses a DSP that is programmed with a personal computer via an RS232 port. A person of ordinary skill in the art would have understood that the personal computer would include a connector that removably connects with the RS232 port. Ex. 1003, Declaration of Professor Ellis at page 21, ¶79.

A person of ordinary skill in the art would have considered it obvious to include a connector for removably connecting the programmer to the amplifier in light of Sudo or Krokstad as a way to easily connect and disconnect the programmer from the DSP. *Id.* at page 21, ¶80. Therefore, claim 14 is also unpatentable.

P1. Claim 15 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 15 depends from claim 9 and adds the limitation that the programmer is a standard computer. Sudo discloses that the external programmer is a microcomputer which is a “standard computer.” Ex. 1005 3:54-55. A person of ordinary skill in the art would have therefore considered the use of a standard computer to program a DSP to have been obvious in light of Sudo, for example, as a way to avoid having to design and build a special purpose computer to use as an external programmer. *See* Ex. 1003 Declaration of Professor Ellis at page 22, ¶ 84. Therefore, claim 15 is unpatentable.

P2. Claim 15 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 15 depends from claim 9 and adds the limitation that the programmer is a standard computer. Krokstad discloses using a personal computer to program the DSP. Ex. 1007, page 21, lines 23. A personal computer is a “standard computer.” A person of ordinary skill in the art would have therefore considered

the use of a standard computer to program a DSP to have been obvious in light of Krokstad, for example, as a way to avoid having to design and build a special purpose computer to use as an external programmer. *See* Ex. 1003 Declaration of Professor Ellis at page 22, ¶ 84. Therefore, claim 15 is unpatentable.

Q. Claim 18 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Krokstad.

Claim 18 depends from claim 1 and adds the additional limitation that the amplifier executes operation according to said at least one of a signal processing function and a signal processing function parameter after said external programmer is disconnected from said amplifier.

Sudo discloses a DSP that is programmed to provide a selected concert hall effect with an external programmer. Sudo describes that the DSP operates to process incoming audio data in the manner programmed until a change command is entered into the keyboard. Ex. 1005 4:8-60. There is nothing in Sudo that would suggest the DSP would halt operation if the external programmer were disconnected from the DSP.

On the other hand, Krokstad discloses an amplifier with a DSP that is programmed with a personal computer that is removably connected to the amplifier via an RS232 port. The amplifier clearly is designed to operate after the programming computer is removed from the RS232 port because a hearing aid

would not be very useful if the wearer had to carry around the personal computer used to program it.

A person of ordinary skill in the art would have found it obvious to have an amplifier that continues to operate according to at least one of a signal processing function and a signal processing function parameter after the external programmer is disconnected, as disclosed in Krokstad, for example, as a way to allow a single external programmer to be able to program more than one amplifier at a time. See Ex. 1003 Declaration of Professor Ellis at 22, ¶88. Therefore, claim 18 is unpatentable.

R1. Claim 19 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo.

Claim 19 depends from claim 1 and adds the limitation that the external programmer is a standard computer. For the same reasons set forth above in P1 regarding dependent claim 15, a person of ordinary skill in the art would have considered it obvious in view of Sudo to use a standard computer to program a DSP in an amplifier to avoid having to design and build a special purpose programmer. Therefore, claim 19 is unpatentable.

R2. Claim 19 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 19 depends from claim 1 and adds the limitation that the external programmer is a standard computer. For the same reasons set forth above in P2

regarding dependent claim 15, a person of ordinary skill in the art would have considered it obvious in view of Krokstad to use a standard computer to program a DSP in an amplifier to avoid having to design and build a special purpose programmer. Therefore claim 19 is unpatentable.

S. Claim 20 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 20 depends from claim 1 and adds the limitation that the signal processor receive and store a processing function and signal processing parameters for a crossover function.

Sudo discloses a DSP that is programmed to provide a selected concert hall effect. Ex. 1005, 3:61-62. Porambo discloses that the use of a DSP to provide concert hall emulations was known. Ex. 1006, 1:68-2:2. The Patent Owner's APA discloses that it was well known to provide a crossover function in an amplifier via a signal processing circuit. *See* Ex. 1001 1:31-33 ("The various elements of the signal processing circuit define a plurality of sound processing parameters such as a frequency and amplitude of a cross-over function...").

It was well known that DSPs can operate to provide functions that were formally performed with hardware. Therefore, a person of ordinary skill in the art would have found it obvious in view of the Patent Owner's APA to program a DSP to perform a well-known cross-over function as a way to provide the function

without having to add additional circuitry to the amplifier. *See* Ex. 1003

Declaration of Professor Ellis at page 23, ¶94. Therefore, claim 20 is also unpatentable.

T1. Claim 21 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 21 depends from claim 1 and adds the limitation that the DSP receives and stores a combination of at least two signal processing functions. As discussed above, the Patent Owner's APA discloses that many different signal processing functions were provided with signal processors (mixing, compression, equalizing cross-over, etc.). Ex. 1001 1:30-36. In addition, it was well known that a DSP can be programmed to provide signal processing functions formally performed with hardware.

A person of ordinary skill in the art would have considered programming a DSP in an amplifier to perform at least two signal processing functions to have been obvious in view of the APA as a way to achieve more than one desired audio effect with a single digital signal processor without having to provide additional circuitry. *See* Ex. 1003, Declaration of Professor Ellis at page 24, ¶99. Therefore, claim 21 is unpatentable.

T2. Claim 21 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 21 depends from claim 1 and adds the limitation that the DSP receives and stores a combination of at least two signal processing functions. Krokstad discloses a DSP in an amplifier that is programmed to provide at least three signal processing functions including compression, equalization and pre-compensation. Ex. 1007 page 20, lines 1-2.

A person of ordinary skill in the art would have considered programming a DSP in an amplifier to perform at least two signal processing functions to have been obvious in view of Krokstad as a way to achieve more than one desired audio effect with a single digital signal processor without having to provide additional circuitry. *See* Ex. 1003, Declaration of Professor Ellis at 24, ¶99. Therefore, claim 21 is unpatentable.

U. Claim 23 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 23 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a volume control function.

The Patent Owner's APA describes the fact that it was conventional (e.g. well known) for amplifiers to include controls for adjusting the volume of the amplifier. *See* Ex. 1001 5:51-55 ("Also a plurality of control knobs 116 for

controlling gain, volume, an equalizer, a level threshold, etc., are provided on the control panel 112 as is conventional.") (Emphasis added).

As indicated above, it was well known that DSPs could be used to provide functions that were formally provided with special purpose signal processors. Therefore, a person of ordinary skill in the art would have considered the idea of programming a DSP to provide a previously known signal processing function, such as volume, to have been an obvious way to implement the function in the amplifier without requiring additional circuitry. *See* Ex. 1003 Declaration of Professor Ellis at page 25, ¶102-103. Claim 23 is therefore unpatentable.

V1. Claim 24 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 24 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for an equalizing function.

The Patent Owner's APA indicates that this function was known to be provided in an amplifier. Ex. 1001 5:52. ("Also a plurality of control knobs 116 for controlling gain, volume, an equalizer, a level threshold, etc., are provided on the control panel 112 as is conventional.") (emphasis added). In addition, it was well known that a DSP could be used to implement a function formally performed with a special purpose signal processor. Therefore, a person of ordinary skill in the

art would have considered the idea of programming a DSP to implement a previously well-known signal processing function, such as equalization, to have been an obvious way to provide the function in an amplifier without requiring additional circuitry. *See* Ex. 1003, Declaration of Professor Ellis at page 26, ¶108. Therefore, claim 24 is unpatentable.

V2. Claim 24 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 24 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for an equalizing function. Krokstad discloses a DSP in an amplifier that is programmed to receive and store an equalizing function and parameters. Ex. 1007, page 20, lines 1-16. In addition, the Patent Owner's APA indicates that this function was known as discussed above in V1.

A person of ordinary skill in the art would have considered the idea of programming a DSP to receive and store an equalizing function and parameters in order to implement a previously known signal processing function as obvious in view of Krokstad (that discloses a DSP that implemented that very thing). In addition, a person of ordinary skill would have been motivated to program the DSP to perform this well-known function in order to provide the function without having to provide additional special circuitry in the amplifier. *See* Ex. 1003,

Declaration of Professor Ellis at page 26, ¶108. Therefore, claim 24 is unpatentable.

W1. Claim 25 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's APA.

Claim 25 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a compression function.

The Patent Owner admits that compression was a well-known signal processing function in amplifiers. Ex. 1001 1:36.

A person of ordinary skill in the art would have considered the idea of using a DSP to receive and store a compression function and parameters to have been obvious in view of the APA as a way to provide the well-known function in an amplifier without requiring separate special purpose circuitry to be provided. See Ex. 1003, Declaration of Professor Ellis at page 26, ¶113. Therefore, claim 25 is unpatentable.

W2. Claim 25 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad.

Claim 25 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a compression function.

Krokstad discloses a DSP in an amplifier that is programmed to receive and store a compression function and parameters. Ex. 1007, page 20, lines 1-16.

A person of ordinary skill in the art would have considered the idea of using a DSP to receive and store a compression function and parameters to have been obvious in view of Krokstad as a way to provide the function in an amplifier without requiring separate special purpose circuitry to be provided. *See* Ex. 1003, Declaration of Professor Ellis at page 26, ¶113. Therefore, claim 25 is unpatentable.

X1. Claim 26 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Porambo, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 26 depends from claim 1 and adds the limitation that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a level threshold function. The Patent Owner's APA admits that this function was known. Ex. 1001 5:52 ("control knobs 116 for controlling gain, volume, an equalizer circuit, a level threshold, etc., are provided on the control panel 112 as is conventional") (emphasis added).

Because it was well known that DSPs can be used to implement signal processing functions formally performed with specialized circuits, a person of ordinary skill in the art would have considered it obvious to use a DSP to receive and store a level threshold function and parameters to implement the well-known

function without having to provide additional circuitry in the amplifier. *See* Ex. 1003, Declaration of Professor Ellis at page 27, ¶116-117. Therefore, Claim 26 is unpatentable.

X2. Claim 26 is Unpatentable as Obvious under 35 U.S.C. §103(a) over Sudo in view of Krokstad, in further view of Patent Owner's Admitted Prior Art (APA).

Claim 26 depends from claim 1 and adds the limitation that the DSP receives and stores a level threshold function and parameters. The Patent Owner's APA admits that this function was known. Ex. 1001 5:52. Because it was well known that DSP can be used to implement signal processing functions formally performed with specialized circuits, a person of ordinary skill in the art would have considered it obvious to use a DSP to receive and store a level threshold function and parameters as a way to provide the well-known function without having to provide additional circuitry in the amplifier. *See* Ex. 1003, Declaration of Professor Ellis at page 27, ¶116-117. Therefore, Claim 26 is unpatentable.

VIII. CONCLUSION

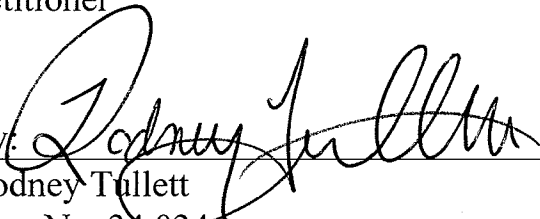
In summary, Petitioner has met the threshold specified by 35 U.S.C. §314(a) (i.e. a reasonable likelihood that the Petitioner would prevail with respect to at least one claim challenged). Therefore this Petition should be granted.

It is respectfully requested that a trial for *Inter Partes* Review of the '544 Patent be instituted and claims 1-15, 18-21 and 23-26 be rejected and canceled.

Rejection and cancellation of claims 1-15, 18-21 and 23-26 would prevent Patent Owner from asserting the '544 Patent for technologies that were already known in the prior art.

Dated: November 7, 2013

Respectfully submitted,
QSC Audio Products, LLC
Petitioner

By: 
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ATTACHMENT A
CERTIFICATE OF SERVICE

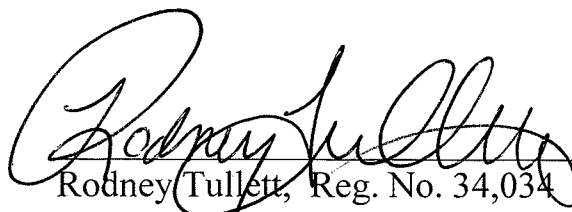
The undersigned hereby certifies that a true copy of the foregoing
PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 5,652,544
and supporting materials (Exhibits 1001-1007 and Power of Attorney) have been
served in its entirety this 7 of November, 2013, by EXPRESS MAIL® on
Patent Owner at the correspondence address for the attorney of record for the '544
Patent shown in USPTO PAIR and the attorneys of record for Plaintiff in the
concurrent litigation matter:

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ATTACHMENT B

EXHIBIT LIST

| Exhibit # | Description |
|-----------|---|
| 1001 | U.S. Patent No. 5,652,544 |
| 1002 | File History of U.S. Patent No. 5,652,544 |
| 1003 | Declaration of Daniel Ellis, Ph.D. |
| 1004 | Curriculum Vitae of Daniel Ellis, Ph.D. |
| 1005 | U.S. Patent No. 5,822,775 to Sudo et al., (“Sudo”) |
| 1006 | U.S. Patent No. 5,450,624 to Porambo et al., (“Porambo”) |
| 1007 | PCT/NO90/00178 Krokstad et al., (“Krokstad”) |
| 1008 | Texas Instrument TMS Second Generation Signal Processors Data Sheet |