

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

ALIVECOR, INC.,
Patent Owner.

IPR2022-01186
Patent 9,649,042 B2

Before JEFFREY N. FREDMAN, ERIC C. JESCHKE, and
DAVID COTTA, *Administrative Patent Judges*.

FREDMAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Apple, Inc. (“Petitioner”), on July 15, 2022, filed a Petition to institute *inter partes* review of claims 1–14 of U.S. Patent No. 9,649,042 B2 (Ex. 1001, “the ’042 patent”). Paper 1 (“Pet.” or “Petition”). AliveCor, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 8. On November 10, 2022, the Board instituted an *inter partes* review of all claims of the ’042 patent. Subsequently, Patent Owner filed a Patent Owner Response (Paper 18, “PO Resp.”), Petitioner filed a Reply to the Patent Owner Response (Paper 23, “PO Reply”), and Patent Owner filed a Sur-Reply (Paper 28, “PO Sur-Reply”). An oral hearing was held on August 28, 2023. A transcript of the hearing has been entered into the record. Paper 31.

For the reasons that follow, on the full trial record, we conclude that Petitioner has proven by a preponderance of the evidence that claims 1–14 of the ’042 patent are unpatentable.

II. REAL PARTIES-IN-INTEREST

Petitioner identifies Apple, Inc. as the real party-in-interest. Pet. 83. Patent Owner identifies AliveCor, Inc. as the real party-in-interest. Paper 5.

III. RELATED MATTERS

The Petition states the “Petitioner is not aware of any litigation, disclaimers, reexamination certificates or petitions for *inter partes* review for the ’042 patent.” Pet. 83.

IV. THE ’042 PATENT

The ’042 patent issued August 13, 2013, from an application filed June 8, 2010. Ex. 1001, codes (45), (22). The ’042 patent claims priority as

a divisional application from U.S. patent application 12/796,188, now U.S. Patent No. 8,509,882. *Id.* at code (62).

As background, the '042 patent explains that “[t]he prior art includes numerous systems wherein ECG data or the like is monitored and/or transmitted from a patient to a particular doctor’s office or health service center.” Ex. 1001, 1:37–39. The '042 patent references prior art that teaches “a handheld device that converts a patient’s ECG signal into a frequency modulated audio signal that may then be analyzed by audio inputting via a telephone system to a selected handheld computer device or to a designated doctor’s office.” *Id.* at 1:40–44. The '042 patent teaches:

Limitations of the prior art utilizing acoustic signals include a signal to noise ratio that is diminished by talking or any other noisy activity in the vicinity, thus potentially jeopardizing the integrity of the heart monitoring data signals. Additionally, the audible signals can be heard by anyone in the vicinity of the computer and heart monitor, which can be bothersome to the user as well as to others in the vicinity. Other applications fail to provide a reliable, inexpensive personal monitoring device that is readily compatible with existing computing devices such as smartphones.

Id. at 1:61–2:4.

The '042 patent teaches a “personal monitoring device having a sensor assembly configured to sense physiological signals upon contact with a user’s skin. The sensor assembly produces electrical signals representing the sensed physiological signals.” Ex. 1001, 2:11–15. The '042 patent further teaches that a “converter assembly, integrated with, and electrically connected to the sensor assembly, converts the electrical signals generated by the sensor assembly to a frequency modulated physiological audio signal.” *Id.* at 2:15–18. The '042 patent teaches an embodiment where “the

frequency modulated physiological audio signal has a carrier frequency in the range of from about 6 kHz to about 20 kHz.” *Id.* at 2:19–21.

V. ILLUSTRATIVE CLAIM

Claims 1–14 of the ’042 patent were challenged. Claim 1 is the sole independent claim and is reproduced below with bracketing added to identify each claim element:

1. [1.0] An ECG device comprising:
 - [1.1] a computing device comprising a display;
 - [1.2] an electrode assembly configured to sense heart-related signals upon contact with a user’s skin, and to convert the sensed heart-related signals to an ECG signal; and
 - [1.3] a converter assembly integrated with, and electrically connected to the electrode assembly, the converter assembly configured to convert the ECG signal generated by the electrode assembly to a frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz;
 - [1.4] a transmitter configured to transmit the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz to the computing device;
 - [1.5] a housing containing the electrode assembly, the converter assembly, and the transmitter, and configured to couple the electrode assembly, the converter assembly, and the transmitter to a surface of the computing device; and
 - [1.6] wherein the computing device is configured to receive the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz and display an ECG signal on the display.

Ex. 1001, 10:8–32.

VI. ASSERTED GROUNDS

Petitioner asserts the claims are unpatentable based on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–9, 13, 14	103 ¹	Albert, ² Vyshedskiy, ³ Platt ⁴
7, 8, 10–12	103	Albert, Vyshedskiy, Platt, Annavaram ⁵
1–9, 13, 14	103	Batkin, ⁶ Vyshedskiy
7, 8, 10–12	103	Batkin, Vyshedskiy, Annavaram
8	103	Albert, Vyshedskiy, Platt, Batkin
5	103	Albert, Vyshedskiy, Platt, Boschetti ⁷
5	103	Batkin, Vyshedskiy, Boschetti

Petitioner also relies on the declaration of Dr. Majid Sarrafzadeh, Ph.D., in support of the asserted grounds. Ex. 1003. Patent Owner relies upon the declaration of Dr. Roozbeh Jafari, Ph.D. Ex. 2003. Based on the statements of qualifications and curricula vitae, we find Petitioner’s declarant Dr. Sarrafzadeh qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See*

¹ Because the patent was filed before March 16, 2003, pre-AIA § 103(a) is applicable.

² Albert et al., US 5,735,285, issued Apr. 7, 1998. Ex. 1022.

³ Vyshedskiy et al., US 2004/0220488 A1, published Nov. 4, 2004. Ex. 1005.

⁴ Platt et al., US 6,485,416, issued Nov. 26, 2002. Ex. 1006.

⁵ Annavaram et al., *Multimodal Sensing for Pediatric Obesity Applications*, Proceedings of the International Workshop on Urban, Community, and Social Applications of Networked Sensing Systems (UrbanSense) 1–5 (Nov. 2008). Ex. 1007.

⁶ Batkin et al., US 2005/0239493 A1, published Oct. 27, 2005. Ex. 1008.

⁷ Sacco Boschetti, US 7,394,899 B2, issued July 1, 2008. Ex. 1021.

Ex. 1003 ¶¶ 4–14. Also based on the statements of qualifications and curricula vitae, we find Patent Owner’s declarant Dr. Jafari qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See* Ex. 2003 ¶¶ 1–9.

VII. LEVEL OF ORDINARY SKILL IN THE ART

The Petition states that a person of ordinary skill in the art (“POSA” or “POSITA”) at the time of the invention:

would have had either (1) at least a bachelor of science in electrical engineering, mechanical engineering, or biomedical engineering, or a related discipline, with at least two years of relevant multidisciplinary work experience designing wearable devices and/or sensors for measuring physiological signals or parameters of mammals, or (2) a medical degree and at least five years of relevant work experience designing wearable devices and/or sensors for measuring physiological signals or parameters of mammals.

Pet. 5; Ex. 1003 ¶ 15. Patent Owner “applies the level of skill provided in the petition.” PO Resp. 9; Ex. 2003 ¶ 25.

The level of ordinary skill in the art usually is evidenced by the prior art references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). For this decision, we apply Petitioner’s stated level of ordinary skill in the art, which is consistent with the level of skill reflected in the ’042 patent and the prior art of record.

VIII. CLAIM CONSTRUCTION

We interpret claim terms 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) (2021). Thus, claim terms “are generally given their ordinary and customary meaning” as understood by a person of

ordinary skill in the art at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Here, we construe only those claim terms that require analysis to determine the patentability of the challenged claims. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))); *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (“[C]laim terms need only be construed ‘to the extent necessary to resolve the controversy.’”).

Petitioner asserts “no formal claim constructions are necessary in this proceeding.” Pet. 5–6. Patent Owner asserts “no claim term needs to be expressly construed to find that Petitioner has not met its burden in establishing the unpatentability of the claims by a preponderance of the evidence. EX2003, ¶¶26-27.” PO Resp. 9. We agree that no terms require claim construction.

IX. ANALYSIS

A. Introduction

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics,*

Inc., 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

The obviousness inquiry also typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)). A petitioner cannot prove obviousness with “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Rather, a petitioner must articulate a sufficient reason why a person of ordinary skill in the art would have combined the prior art references. *In re NuVasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016).

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met its burden to establish, by a preponderance of the evidence, that the challenged claims are unpatentable over the cited prior art.

B. Overview of the Asserted Prior Art

1. *Albert (Ex. 1022)*

Albert is a U.S. patent that teaches “an improved method and apparatus for monitoring a patient’s electrocardiogram (ECG) data using a

hand-held computer in association with a wireline or wireless telephone system.” Ex. 1022, 1:13–16. Figure 1 of Albert teaches the apparatus as shown below:

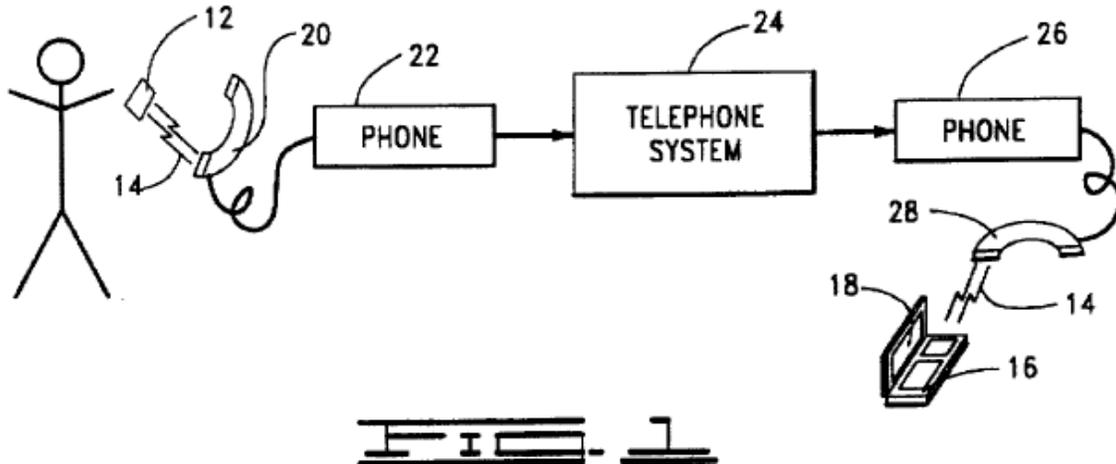
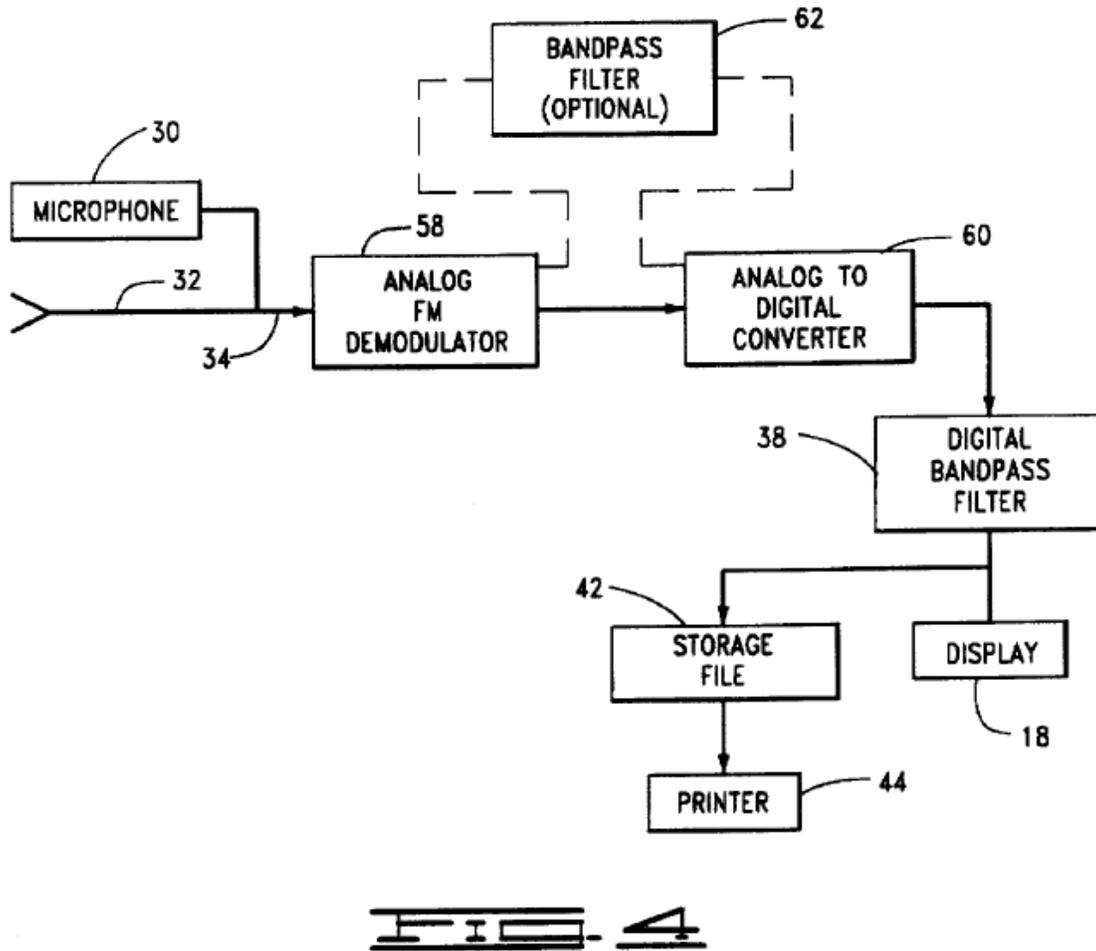


Figure 1 depicts “a patient monitoring system 10 consist[ing] of a Heart Card 12 disposed on the patient and capable of detecting and recording the electrocardiogram signal (ECG) for a predetermined time and then actuable to transmit the ECG as a frequency modulated audio band signal 14.” *Id.* at 3:10–15. Albert teaches that

The frequency modulated audio signal 14 may then be transmitted via telephone, either wireline or wireless; or, the frequency modulated audio signal 14 may be played directly into the audio microphone of a palmtop computer 16 which includes resident software that processes the biomedical data contained in the frequency modulated audio signal and displays the data on the computer screen 18.

Id. at 3:25–31.

Figure 4 of Albert depicts an alternative design of Albert’s invention 20 that utilizes a palmtop computer of the type having a PCMCIA (Personal Computer Memory Card International Association) interface slot for signal processing and display as shown below:



As shown in Figure 4:

A received frequency modulated audio signal is fed either via microphone 30 or connector 32 to input lead 34 to the analog FM demodulator 58. The FM demodulator 58 may be such as a IC phase locked loop, Exar type 215. The analog FM demodulator 58 then applies output to an analog to digital converter 60 which provides digital output via the palmtop PCMCIA interface to the palmtop's CPU for digital filtering (40), storage and display.

Ex. 1022, 4:21-29.

Figure 10 of Albert is reproduced below:

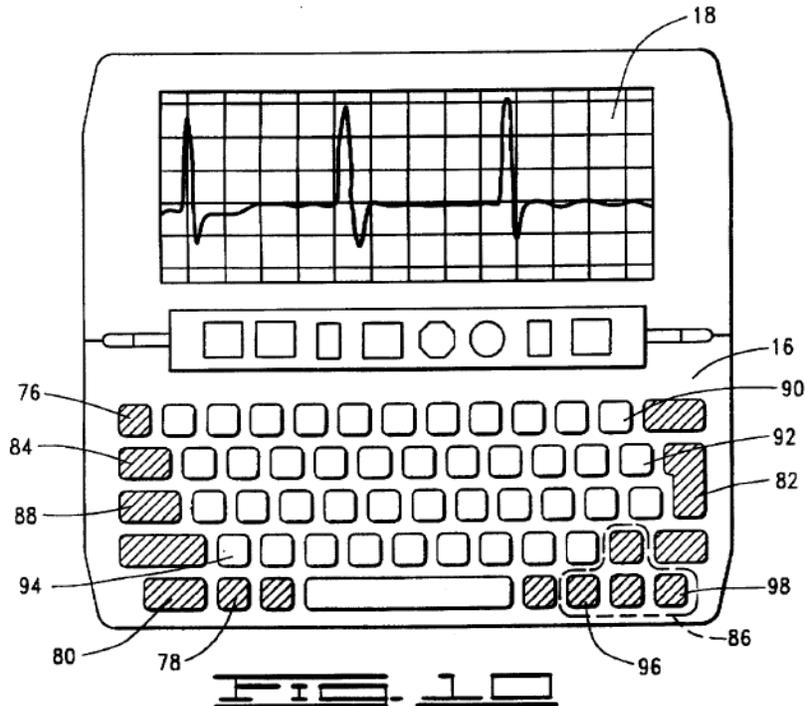


Figure 10 depicts the ECG signal on a smartphone where the “initial display represents a 12.5 mm/second scale that is divided into 200 ms graduations. Up to three 9.6 second periods of ECG totalling 28.8 seconds of ECG rhythm, may be displayed. Expanded scales of 25 and 50 mm per second are available.” Ex. 1022, 7:41–45.

2. *Vyshedskiy (Ex. 1005)*

Vyshedskiy is a U.S. patent publication that teaches “to simultaneously transmit the audio signal from an electronic stethoscope and the corresponding electrical EKG signal into a computing device via the microphone port of the computing device.” Ex. 1005 ¶ 11. *Vyshedskiy* teaches the “recording/visualization device could be a personal computer, a PDA, a mobile phone, a land line phone or a voice recorder.” *Id.* Figure 2, reproduced below, shows signal collection and microphone input.

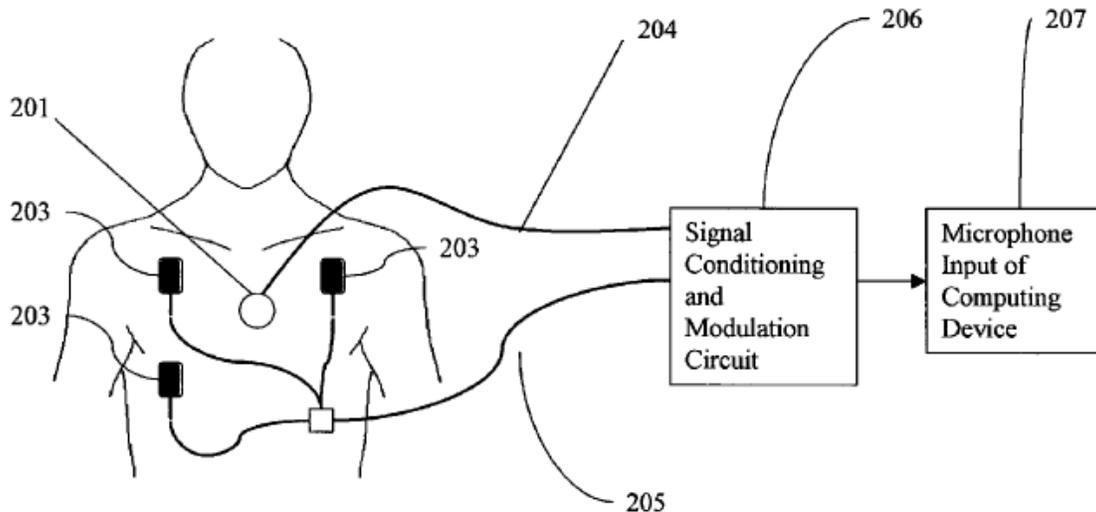


Figure 2 shows:

The chest piece 201 picks up an acoustic signal from the body, converts the acoustic energy into an electrical signal and then transmits the signal via wire or wirelessly 204 into a Signal Conditioning and Modulation Box 206. Further the electrocardiographic signal from the patient's skin is picked up by EKG electrodes 203 and transmitted via wire or wirelessly 205 into a Signal Conditioning and Modulation Box 206. The composite signal from the Signal Conditioning and Modulation Box 206 is transmitted to the Microphone Port of the computing device 207.

Ex. 1005 ¶ 33.

Vyshedskiy teaches that “[i]nside the computing device the composite signal is demodulated. As long as intervals occupied by modulated signals in the frequency domain are separated, it is possible to recover original signals with no loss. . . . The composite signal 121 is digitized by the computing device sound card.” Ex. 1005 ¶ 30.

Vyshedskiy teaches that the

system uses the fact that neither the EKG nor the audio signal requires the full bandwidth of the microphone port (which is 20 Hz to 44,100 Hz). Normally the EKG signal is between 0.5 Hz and 300 Hz, and body sounds are between 20 Hz and 2000 Hz.

Therefore, there is sufficient bandwidth to transmit both EKG and sound into the microphone port of the computing device.

Ex. 1005 ¶ 16. Vyshedskiy teaches “an 8 channel data acquisition system transmitting data into a standard computer sound card with sampling rate of 44,100 Hz.” *Id.* ¶ 28. Vyshedskiy teaches: “Eight carrier frequencies can be chosen as follows: $f_1=2,500$ Hz, $f_2=5,000$ Hz, $f_3=7.500$ Hz, $f_4=10,000$ Hz, $f_5=12,500$ Hz, $f_6=15,000$ Hz, $f_7=17,500$ Hz, $f_8=20,000$ Hz.” *Id.*

Vyshedskiy also teaches that

each channel is digitally multiplied by the corresponding carrier frequency. The output of the digital bandpass filter 1 is multiplied by the carrier frequency 1 equal to 2,500 Hz; the output of the digital bandpass filter 2 is multiplied by the carrier frequency 2 equal to 5,000 Hz, . . . ; the output of the digital bandpass filter 8 is multiplied by the carrier frequency 8 equal to 20,000 Hz.

Id. ¶ 32.

3. *Platt (Ex. 1006)*

Platt is a U.S. patent that teaches “monitoring physiological parameters and, in particular, a cardiac patient’s electrical cardiac activity at a central location by means of an apparatus associated with a cellular mobile phone handset and transmitting the information over the cellular phone/telephone network.” Ex. 1006, 1:4–9. Figure 1 of Platt is reproduced below:

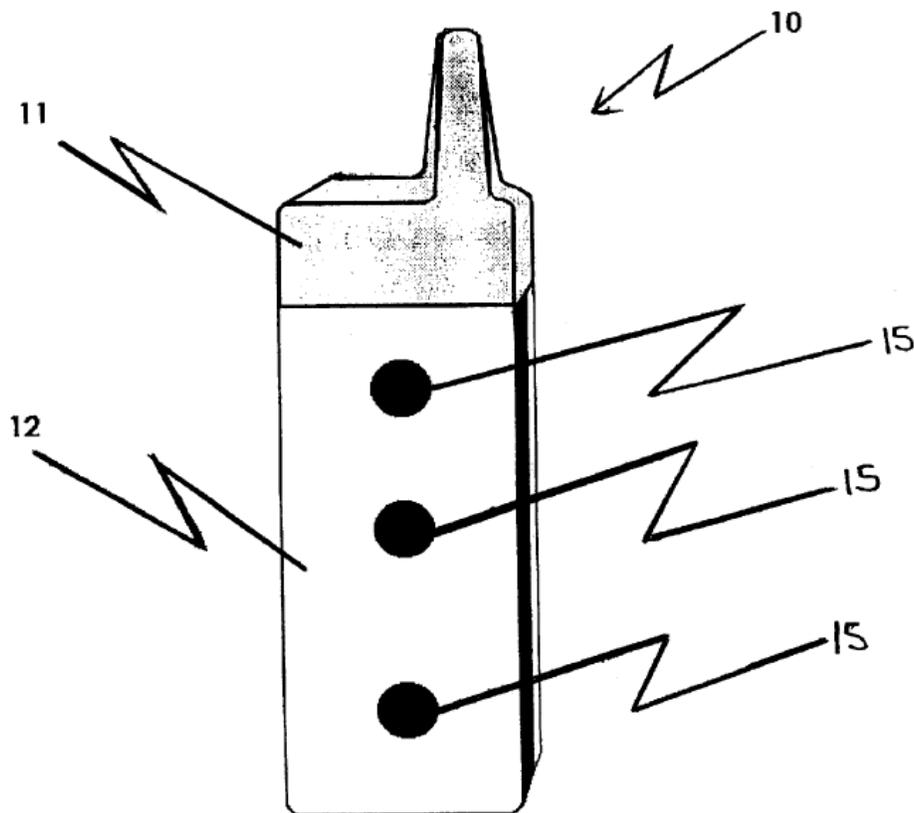


FIG. 1

Figure 1 shows a “cellular phone handset 10 incorporating the apparatus of the preferred embodiment . . . ha[ving] a casing 11 including a removable modified battery power pack container 12 removably attached.” *Id.* at 3:51–55. Figure 1 further shows “an ECG monitoring device which formulates the results of electrical cardiac activity detected by a bio sensor 15 which are preferably electrodes which are fixedly attached to the container 12.” *Id.* at 3:58–61.

Platt teaches:

ECG monitoring device 14 produces tone signals corresponding to the Signals detected by the electrodes 15 and is acoustically coupled via the Speaker output 18 to the microphone of the cellular phone handset 10 which is able to transmit these tone

signals over a cellular phone network to a central location which collects and collates these signals as data which is then interpreted by medical [practitioners].

In one preferred form, the ECG monitoring device 14 and cellular phone handset 10 are activated by the receipt of electrical cardiac Signals received from the electrodes 15 when the patient places the electrodes against his or her chest in the appropriate manner. The ECG is recorded and Simultaneously transmitted to a [S]ervice centre for diagnostic evaluation after it is received down the “phone line”.

Ex. 1006, 4:7–20.

4. *Annavaram (Ex. 1007)*

Annavaram is a scientific publication that teaches “a wireless body area network comprised of heterogeneous sensors is developed for wearable health monitoring applications.” Ex. 1007, 1 (Abstract). Figure 2 of Annavaram is reproduced below:



Figure 2 depicts an “(a) ECG monitor, (b) pulse oximeter, (c) Nokia Smartphone (GPS and accelerometer).” *Id.* at 3. Annavaram teaches that:

The current study employs an Alive Technologies[1] electrocardiograph (ECG). The ECG is a single channel device with 8 bit resolution and a peak sampling rate of 300 samples/second. The pulse-oximeter, also from Alive, provides non-invasive monitoring of oxygen saturation (SpO₂) and pulse rate. The oximeter is a Bluetooth slave device that supports the Bluetooth Serial Port Profile (SPP). We also have BodyMedia WMS sensors [2] to measure Galvanic Skin Response (GSR) and

motion estimation using accelerometers. We use feature rich Nokia N95 as the mobile phone platform.

Id. Annavaram teaches:

Many aspects of human behavior are inherently multimodal or require multimodal processing. For example, measuring and understanding energy expenditure and its etiology requires processing not only activity from accelerometers but other data such as pulse rate, ECG . . . Hence, to model human behavior and task-specific activity, both in terms of what people do, how they do it, and why they do it, it is critical to understand and capture the interplay between such multimodal streams. Multi-modal coverage of our approach enables cross-channel comparison and verification.

Id. at 2 (emphasis omitted).

5. *Batkin (Ex. 1008)*

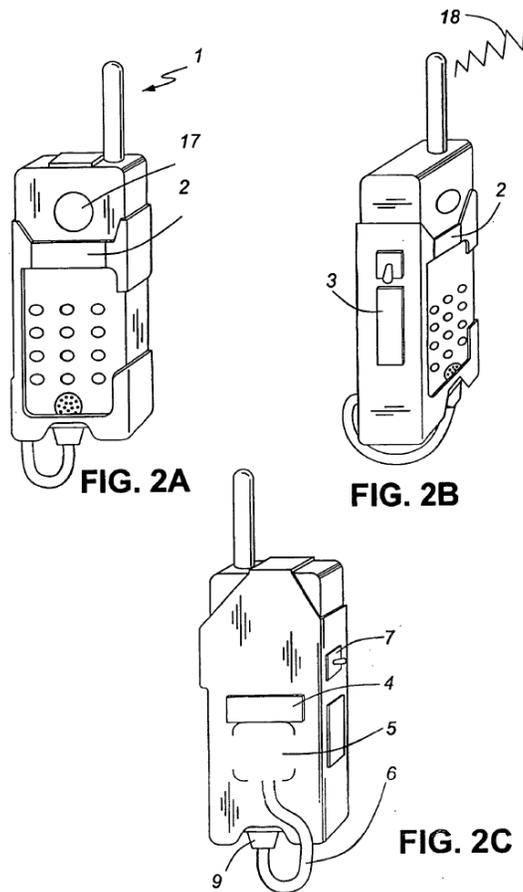
Batkin is a U.S. patent publication that teaches “a hand-held sensor system incorporating one of a variety of head-source bio-sensors, including sensors for blood oxygen, pulse, body-temperature, and ECG incorporated with or accompanying a telephone handset or cell phone.” Ex. 1008 ¶ 21.

Batkin teaches:

In the case of use of a cell phone for ECG, the first and second pickup electrodes, the reference electrode (preferentially all ohmic), and the electrical circuitry of the invention may readily be carried within a case or attachment, coupled to the cell phone by an internal or external connector which extends from the circuitry of the invention to the microphone or data port of the cell phone to permit inclusion of the bio-signal into the cell phone’s telephonic communications. A control switch may allow user control to toggle the telephonic communication between bio-signal and voice-only transmissions. Alternately, bio-signal and voice telephonic transmissions, including simultaneous transmissions, may be effected by any one of known means for combining voice and data communication.

Id. ¶ 34.

Figure 2 of Batkin is reproduced below:



Batkin teaches:

In FIG. 2 an already-existing cell phone 1 is provided with a harness incorporating a first, forward-facing sensor 2 positioned to contact the face or ear of the user; a second, side or rear-facing sensor 3 positioned to contact the left hand or thumb of the user; a reference electrode 4, preferably ohmic, positioned to contact either the face or hand of the user; and an electronic circuit 5 to condition and/or analyse the bio-signal and to digitise and/or modulate the bio-signal in preparation for transmission. A coupling connector 19 delivers the bio-signal to the cell phone input for telephonic transmission 18.

Ex. 1008 ¶ 46. Batkin teaches the “conditioned signal may be in acoustic or electronic form.” *Id.* ¶ 51.

6. *Boschetti (Ex. 1021)*

Boschetti is a U.S. patent that teaches “a device that transforms a digital signal into an acoustic signal, making use of a standard phase modulation, and having the purpose of transmitting data through a fix or mobile/cellular telephone line.” Ex. 1021, 1:9–12. Figure 2 of Boschetti is reproduced below:

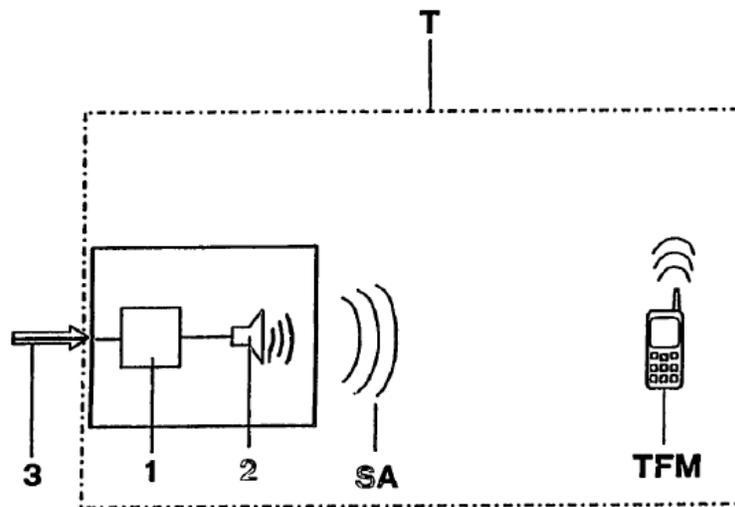


FIG.2

Figure 2 of Boschetti shows a “modem chip 1 with a phase modulation . . . an acoustic transducer 2 of the piezoelectric kind guided by said modem chip 1” and “a mobile telephone apparatus TFM which, through the repeater R, is connected by means of the telephone line LT to the receiving block BR.” *Id.* at 2:47–67. Boschetti teaches “the device allows a reliable data transmission” when “the transducer and the microphone are not aligned.” *Id.* at 3:16–23.

C. Ground 1: Obviousness over Albert, Vyshedskiy, and Platt

Petitioner contends that claims 1–9, 13, and 14 would have been obvious over the combination of Albert, Vyshedskiy, and Platt. Pet. 6–43. Petitioner provides a detailed analysis of independent claim 1 and then explains where dependent claim limitations of claims 2–9, 13, and 14 are found within the prior art. *Id.* at 33–43. Patent Owner responds and explains why the claims would not have been obvious over Albert, Vyshedskiy, and Platt. PO Resp. 9–37.

We begin with Petitioner’s position for claim 1, and then Patent Owner’s position, and then move to our analysis, which addresses the positions of both parties.

1. *Claims 1–3, 7–9, 13, and 14 - Petitioner’s position*

a) [1.0] An ECG device comprising:

Petitioner asserts that Albert discloses “Heart Card 12 monitors an ECG electric signal and converts the ECG electric signal into **a frequency modulated ECG sound signal 14**. APPLE-1022, 3:10-24; APPLE-1003, ¶45.” Pet. 6. Petitioner further asserts

in the Albert-Vyshedskiy-Platt combination, the combined ECG device includes both (1) a mobile device (e.g., cell phone or smart phone) with a display and (2) a container housing ECG electrodes (electrode assembly), a speaker output (transmitter), and Vyshedskiy’s heart sound monitor and converter assembly. APPLE-1005, Abstract, [0011], [0033], [0037], FIG. 2; APPLE-1006, Abstract, 3:56-61, 4:7-10, FIGS. 1-2; APPLE-1022, Abstract, 2:5-29, 3:10-31, FIG. 1.

Pet. 23.

b) [1.1] a computing device comprising a display

Petitioner asserts “Albert’s frequency modulated ECG sound signal 14 is transmitted via a speaker **to a microphone of a computing device 16**,

which ‘includes resident software that processes the biomedical data contained in the frequency modulated audio signal and **displays the data on the computer screen 18.**’ APPLE-1022, 3:25-31.” Pet. 24. Petitioner further asserts “Vyshedskiy discloses that the ‘**PDA can display the results of demodulation on its screen.**’ APPLE-1005, [0037].” *Id.* Petitioner also asserts “Platt further describes a cellular phone as the computing device in an ECG monitor. APPLE-1006, 3:51-66, Fig. 1.” Pet. 25.

c) [1.2] an electrode assembly configured to sense heart-related signals upon contact with a user’s skin, and to convert the sensed heart-related signals to an ECG signal

Petitioner asserts

Albert discloses “a **Heart Card 12 disposed on the patient** and capable of detecting and recording the electrocardiogram signal (ECG).” APPLE-1022, 3:10-14.

Vyshedskiy also discloses that “**the electrocardiographic signal from the patient’s skin is picked up by ECG electrodes 203** and transmitted via wire or wirelessly 205 into a Signal Conditioning and Modulation Box 206.” APPLE-1005, [0033].

Pet. 25–26. Petitioner further asserts “Vyshedskiy discloses an electrode assembly (ECG electrodes 203) that senses heart-related signals upon contact with a user’s skin, and converts the sensed heart-related signals to an ECG signal (EKG input 301, in the form of electrical voltage). APPLE-1003, ¶95.” Pet. 26. Petitioner also asserts Platt’s “handset 10 with electrodes 15 ‘built in’ provides a simple and convenient method of **detecting and transmitting data corresponding to electrical cardiac activity.**” APPLE-1006, 4:22-24.” *Id.* Petitioner asserts “a POSITA would have found it obvious that the ECG electrodes (ECG assembly) in the combined device pick up electrical signals from the user’s skin and convert the sensed heart-related signals to an ECG signal. APPLE-1003, ¶97;

APPLE-1005, [0033]-[0034]; APPLE-1006, 1:36-40, 4:14-20, 4:22-24, FIG. 1.” Pet. 26–27.

d) [1.3] a converter assembly integrated with, and electrically connected to the electrode assembly, the converter assembly configured to convert the ECG signal generated by the electrode assembly to a frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz

Petitioner asserts that Albert discloses a “Heart Card 12 monitors an ECG electric signal and converts the ECG electric signal into a **frequency modulated ECG sound signal 14**. APPLE-1022, 3:10-24; APPLE-1003, ¶45.3 This frequency modulated ECG sound signal 14 is transmitted via a speaker (and a telephone system) **to a microphone of a computing device.**”

Pet. 6. Petitioner further asserts

in Vyshedskiy, the ECG signal from the patient’s skin is picked up by ECG electrodes 203 and transmitted **via wire** or wirelessly 205 into a Signal Conditioning and Modulation Box 206. APPLE-1005, [0033]. A POSITA would have understood that the Signal Conditioning and Modulation Box 206 is a converter assembly that is integrated with, and electrically connected to the electrode assembly, and is configured to convert the ECG signal generated by the electrode assembly to a frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz. APPLE-1003, ¶102; APPLE-1005, Abstract, [0026]-[0028], [0032]-[0035], FIGS. 1-3.

Pet. 27–28. Petitioner asserts that Vyshedskiy’s modulated “signal 106 can have 8 channels (corresponding to Input 1, Input 2, to Input 8), and that the carrier frequencies of these 8 channels can be as follows: $f_1=2,500$ Hz, $f_2=5,000$ Hz, $f_3=7,500$ Hz, $f_4=10,000$ Hz, $f_5=12,500$ Hz, $f_6=15,000$ Hz, $f_7=17,500$ Hz, and $f_8=20,000$ Hz. APPLE-1005, [0028]; APPLE-1003, ¶51.” Pet. 10–11. Petitioner asserts that “Vyshedskiy discloses an example where body sound data (ranging from 20 Hz to 2000 Hz) is combined with

ECG data communicated over a carrier frequency of 3000 Hz. APPLE-1005, [0034]; APPLE-1003, ¶52.” Pet. 11.

Petitioner asserts

the combined device collects both body sound and ECG electric signals (APPLE-1022, 3:10-24; APPLE-1006, 3:20-28 and APPLE-1005, [0011]); converts, through frequency modulation, the ECG electric signals to frequency modulated ECG audio signals with a carrier frequency from about 6 kHz to about 20 kHz to generate a composite acoustic signal (APPLE-1022, 3:10-24; APPLE- 1005, [0028]).

Pet. 23.

e) [1.4] a transmitter configured to transmit the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz to the computing device

Petitioner asserts that Albert teaches a “frequency modulated ECG sound signal 14 is transmitted via a speaker (and a telephone system) **to a microphone of a computing device 16.**” Pet. 6 (citing Ex. 1022, 3:25–31). Appellant asserts “Platt’s ECG monitoring device 14 produces tone signals (ECG audio signals) **via the speaker output 18** to the microphone of the cellular phone handset 10. APPLE-1006, 4:7-10, FIG. 2.” Pet. 29.

Petitioner asserts Vyshedskiy also “discloses transmitting the composite audio signal into a microphone of a computing device. APPLE-1005, [0011], FIG. 2; APPLE-1003, ¶107.” *Id.* Petitioner asserts, as discussed immediately above, that these signals may use carrier frequencies “as follows: f1=2,500 Hz, f2=5,000 Hz, f3=7,500 Hz, f4=10,000 Hz, f5=12,500 Hz, f6=15,000 Hz, f7=17,500 Hz, and f8=20,000 Hz. APPLE-1005, [0028]; APPLE-1003, ¶51.” Pet. 10–11.

f) [1.5] a housing containing the electrode assembly, the converter assembly, and the transmitter, and configured to couple the electrode assembly, the converter assembly, and the transmitter to a surface of the computing device

Petitioner asserts

Platt's cell phone handset 10 includes (1) a cell phone (computing device) and (2) a battery pack container 12, which is attached to a surface of the cell phone, and includes three ECG electrodes 15, processing circuitry for sensing an ECG, and a speaker output 18. APPLE-1006, 3:56-61, 4:7-10, FIG. 1. Thus, the Albert-Vyshedskiy-Platt combination renders obvious a housing (battery pack container) that contains the electrode assembly (ECG electrodes), the converter assembly (Vyshedskiy's converter assembly), and the transmitter (speaker output 18), and that is configured to couple the electrode assembly, the converter assembly, and the transmitter to a surface of the computing device (the cell phone). APPLE-1003, ¶111.

Pet. 31.

g) [1.6] wherein the computing device is configured to receive the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz and display an ECG signal on the display

Petitioner asserts "Albert's computing device 16 'includes resident software that processes the biomedical data contained in the frequency modulated audio signal and **displays the data on the computer screen 18.**' APPLE-1022, 3:25-31." Pet. 33. Petitioner asserts "Vyshedskiy also discloses that the 'PDA can display the results of demodulation on its screen.' APPLE-1005, [0037], FIG. 6; APPLE-1003, ¶117." *Id.*

2. *Claims 1–3, 7–9, 13, and 14 - Patent Owner’s Position*

Patent Owner asserts “Petitioner’s combination of Albert, Vyshedskiy, and Platt purportedly results in a system configured to transmit a frequency-modulated ECG acoustic signal, but Petitioner’s obviousness analysis to reach this combination is legally flawed, unsupported by the prior art, and driven by hindsight.” PO Resp. 10 (emphasis omitted). Patent Owner asserts “Petitioner’s proposed combination is premised on the transmission of an acoustic signal, rather than other forms of transmission, such as electronic or wireless. *Id.*, ¶36.” *Id.* at 13 (emphasis omitted).

Patent Owner asserts

Petitioner’s proposed combination of Albert, Vyshedskiy, and Platt primarily rests on two rationales for the selection of a particular carrier frequency that would fall within the claimed range of about 6 kHz to about 20 kHz for Albert’s acoustic signal: (1) a POSA would have been motivated to use a carrier frequency in the range of about 6 kHz to about 20 kHz “to avoid interference from human voice” (Pet., 18); and (2) a POSA would have viewed the selection of carrier frequencies disclosed Vyshedskiy as “obvious to try” (Pet., 11-12); Paper 9 (“DI”), 34-35. Both rationales should be rejected as lacking evidentiary support and a grounding in the relevant case law.

PO Resp. 16.

Regarding the first rationale, Patent Owner asserts that “Petitioner’s claim of an alleged motivation to ‘avoid interference from human voice’ is conclusory and unsubstantiated.” PO Resp. 17. Patent Owner asserts “Petitioner cites only to its expert, who simply provides the same conclusory assertion with no additional explanation or corroborating evidence from the prior art.” *Id.* Patent Owner asserts “[u]nlike the prior art relied upon by Petitioner, the ’042 patent explicitly recognizes the drawbacks to personal monitoring systems that transmit ECG signals acoustically to a [microphone

of a] computing device, including Albert. EX1001, 1:37-2:1.” *Id.* Patent Owner asserts “Petitioner’s rationale rests solely on conclusory expert testimony to reach a solution that is disclosed *only* by the challenged patent. Such an approach is a classic example of hindsight reasoning and thus legally insufficient to support a determination of obviousness.” *Id.* at 18.

Regarding the second rationale, Patent Owner asserts that “Petitioner’s passing reference to ‘design choice’ and ‘obvious to try’ fail to establish even a *prima facie* case of obviousness. Petitioner makes no attempt to establish the prerequisites required to show that a purported modification would have been ‘obvious to try.’” PO Resp. 19. Patent Owner asserts that the “petition contains no discussion of design needs or market pressures and no identification of a particular problem to be solved, let alone analysis of known solutions to that problem.” *Id.* Patent Owner asserts

Petitioner and Dr. Sarrafzadeh fail to account for several teachings that are relevant to the POSA’s motivation to combine, including, for example, substantial differences in the types of signals being transmitted in Albert and Vyshedskiy and technical issues that would arise from attempting to combine their differing techniques. Thus, Petitioner’s expert confirmed that the grounds lack consideration of the full scope of the cited references, to the exclusion of considering what the references individually taught to those in the art.

Id. at 21–22.

Patent Owner further asserts “the petition glosses over the fact that while Albert’s system transmits ECG signals acoustically, Vyshedskiy’s does not.” PO Resp. 22–23. Patent Owner asserts “Dr. Jafari explains a POSA understood that acoustic systems involve design considerations and

problems that are distinct from those faced by electronic or wireless systems. EX2003, ¶31.” *Id.* at 23.

Patent Owner asserts that

the petition fails to explain why a POSA would have turned to systems utilizing different transmission methods (i.e., electronic or wireless) if seeking to modify Albert’s acoustic carrier frequency. Rather, Dr. Jafari explains a POSA understood that acoustic systems involve design considerations and problems that are distinct from those faced by electronic or wireless systems. EX2003, ¶31.

PO Resp. 23. Patent Owner asserts that “a POSA would have understood that Vyshedskiy utilizes electronic or wireless means for transmitting its signal data into a computing device because Vyshedskiy discloses inputting its signal data through a microphone *port*, not a microphone.” *Id.* at 24.

Patent Owner assert that a “microphone, on the other hand, operates in a different manner and in a different acoustic environment, which POSAs understood would implicate a number of different factors that would not have been present in Vyshedskiy’s system. EX2003, ¶46.” *Id.* at 25–26.

Patent Owner contends that “Petitioner’s assertions that the selection of carrier frequency would have been a ‘matter of design choice’ or ‘obvious to try’ are baseless and unsupported because Petitioner’s proposed combination relies on applying Vyshedskiy’s carrier frequencies to a new and distinct use. *See* EX2003, ¶50.” *Id.* at 27.

Patent Owner asserts that

even if a POSA would have sought to modify Albert’s system in view of Vyshedskiy, the POSA would not have been motivated to (1) transmit an ECG acoustic signal having a carrier frequency between 6 kHz and 20 kHz and (2) transmit the ECG acoustic signal as a composite signal with body sound data because . . . it would have been understood that the telephone-based system of Albert could not support[carrier] frequencies within this range or

composite signals of the type proposed by Petitioner. EX2003, ¶53.

PO Resp. 29. Patent Owner asserts that “Albert discloses using a ‘Heart Card 12,’ which ‘is a commercially available device’ that may be obtained from “Instromedix Inc.” EX1022, 3:10-24.” *Id.* at 34. Patent Owner notes that the “Heart Card was known to acoustically transmit ECG signal data at a carrier frequency of 1.9 kHz. See EX2014 (Heart Card brochure showing 1.9 kHz carrier frequency).” *Id.* Patent Owner asserts that therefore “Petitioner ignores Albert’s own teachings, which would have been understood to [describe]use [a] carrier [frequency] of about 1.9 kHz. EX2003, ¶60.” *Id.* at 33. Petitioner asserts this “Dr. Sarrafzadeh’s failure to consider Albert’s teachings as a whole undermines Petitioner’s assertions that a POSA would have even sought to modify Albert in the first place.” *Id.* at 35.

3. *Claim 1 - Analysis*

We begin our analysis by noting that both Petitioner’s expert Dr. Sarrafzadeh and Patent Owner’s expert Dr. Jafari agree that Albert teaches a device for “detecting and recording the electrocardiogram signal (ECG) for a predetermined time and then actuable to transmit the ECG as a frequency modulated audio band signal 14” where the “the frequency modulated audio signal 14 may be played directly into the audio microphone of a palmtop computer 16.” Ex. 1003 ¶ 45 (citing Ex. 1022, 3:10–31); Ex. 1027, 119:5–8 (Dr. Jafari’s deposition testimony agreeing that “Albert 1006 also discloses that the ECG signal from the Heart Card 12 is then transmitted to a palmtop computer 16 which includes software that processes the ECG data contained in the frequency modulated signal”); Ex. 2003 ¶ 55 (declaration of Dr. Jafari, stating that “the frequency modulated audio signal 14 ‘may be played

directly into the audio microphone of the computing device 16 (e.g., a palmtop computer)”)

Both experts further agree that Albert teaches to display on a display screen the real-time ECG signal represented by the demodulated digital ECG data. Ex. 1003 ¶ 46 (citing Ex. 1022, 4:19–36); Ex. 1027, 119:17–23. Dr. Jafari agreed that “the acoustic signal is being transmitted by the Heart Card to the palmtop computer over the telephone system . . . generally at around” 1.9 kHz.” Ex. 1027, 147:24–148:6.

Neither expert disputes that Vyshedskiy teaches “converting, through modulation, the electric ECG signals to audio signals with certain frequencies” and that the carrier frequencies may include “f1=2,500 Hz, f2=5,000 Hz, f3=7,500 Hz, f4=10,000 Hz, f5=12,500 Hz, f6=15,000 Hz, f7=17,500 Hz, and f8=20,000 Hz.” Ex. 1003 ¶¶ 51–52 (citing Ex. 1005 ¶¶ 27–28); Ex. 1027, 158:4–10, 161:1–7; Ex. 2003 ¶ 48 (“[A] composite signal such as the eight-channel composite signal or eleven-channel composite signal of Vyshedskiy (see EX1005 (Vyshedskiy), [0017], [0028]) would carry with it many different frequencies that could be heard by a user.”).

Dr. Jafari acknowledges that the claims to a computing device in the ’042 patent include a “personal digital assistant or PDA” as well as a smartphone, among other options. *See* Ex. 1027, 81:7–23. Dr. Sarrafzadeh states that “Albert discloses a ‘palmtop computer.’ APPLE-1022, 3:25-41. Platt discloses a ‘cellular telephone handset.’ APPLE-1006, Abstract. Vyshedskiy discloses ‘PCs, PDAs, cell phones, land line phones, and voice recorders.’ APPLE-1005, Abstract.” Ex. 1003 ¶ 80 (emphasis omitted). Dr. Sarrafzadeh states that an ordinary artisan

would have understood that palmtop computers, PDAs and cell phones have evolved from Albert's 1996 filing date, Platt's 1998 filing date, and Vyshedskiy's 2004 filing date to smartphones as of the '042 patent's 2010 filing date and would have found it obvious to implement the ECG monitoring using a smartphone.

Ex. 2003 ¶ 80 (citing Ex. 1009, 1). Dr Jafari answered "that is correct" in response to the question "Smartphones were known for years before June of 2010; correct?" Ex. 1027, 69:14–16. Dr. Jafari further acknowledged that "persons of ordinary skill in the art before June of 2010 would have recognized that smartphones, PDAs, tablet, personal computers, pocket personal computers, notebook computers, desktop computers and server computers were all different forms of computing devices." *Id.* at 82:6–13.

While Dr. Jafari and Dr. Sarrafzadeh are reasonably understood to agree that the separate elements of claim 1 of the '042 patent were disclosed in Albert, Vyshedskiy, and Platt, "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR*, 550 U.S. at 418.

We therefore review next whether a preponderance of the evidence supports an obviousness finding based on either of Petitioner's asserted reasons to select carrier frequencies from Vyshedskiy for use as a carrier frequency when combined with Albert and Platt as of the earliest priority date of the '042 patent.

Patent Owner asserts that Petitioner's reliance on avoidance of voice interference as a rationale is based on hindsight. *See* PO Resp. 17–19. Petitioner does not point to any specific disclosure in either Albert, Vyshedskiy, or Platt that suggests voice interference would have been an issue in the transmission of the ECG acoustic signals, instead relying on statements of Dr. Sarrafzadeh such as

[t]o avoid interference, a POSITA would have found it obvious to choose a carrier frequency from about 6 kHz to about 20 kHz (e.g., $f_3=7,500$ Hz, $f_4=10,000$ Hz, $f_5=12,500$ Hz, $f_6=15,000$ Hz, $f_7=17,500$ Hz, $f_8=20,000$ Hz) to avoid interference from human voice, which can reach the frequency of about 5 kHz.

Ex. 1003 ¶ 53 (cited in Pet. 12). Dr. Jafari acknowledges in deposition testimony that “the interference was a known fact. But in the context of how this invention is expected to operate, was novel at the time in my opinion.”

Ex. 1027, 65:23–65:1.

We agree with Dr. Jafari and Patent Owner that simply because interference of sound waves was a known phenomenon at the time of the invention does not demonstrate that the ordinary artisan would have had reason to select particular carrier frequencies for the ECG acoustic signals that avoided human voice frequencies in the absence of any disclosure that such frequencies were known to interfere. Rather, we agree with Patent Owner that this is hindsight reasoning because until the '042 patent pointed out this concern in the context of claim 1, there is no indication the prior art recognized that human voice interference was an issue.

Patent Owner asserts that Petitioner’s “obvious to try” rationale is also deficient. *See* PO Resp. 19–22. There is no dispute that Albert teaches that ECG acoustic signals are frequency modulated. *See* Ex. 1022, 3:14–15.

And Dr. Jafari acknowledges that the signals in Vyshedskiy “must be modulated in different frequencies, otherwise they collide with each other.”

Ex. 1027, 171:11–13.

Dr. Sarrafzadeh explains a “POSITA would have viewed the selection of the carrier frequency for the ECG signal as a matter of obvious design choice and would have considered any of the carrier frequencies disclosed by Vyshedskiy that are higher than 2000 Hz.” Ex. 1003 ¶ 53. Dr.

Sarrafzadeh states “Vyshedskiy clearly teaches using 10 kHz as an exemplary carrier frequency, and there is no need to modify its frequency range to meet the claims.” Ex. 1026 ¶ 5 (citing Ex. 1005 ¶ 28).

Dr. Sarrafzadeh provides a reason for frequency modulating the ECG signal as “visualizing a phonocardiogram simultaneously with an electrocardiogram is beneficial because auscultation of heart sounds is greatly facilitated by knowing the event of the heart cycle visualized on the EKG, and automatic heart sound analysis is facilitated by identification of events on the electrocardiogram.” Ex. 1026 ¶ 5 (citing Pet. 17); *cf.* Ex. 1005 ¶¶ 13–15. Patent Owner does not dispute this rationale.

As to the specific claimed frequency range, we agree with Petitioner that Vyshedskiy’s disclosure of a list of preferred carrier frequencies represents a permissible “obvious to try” situation. In *KSR*, the Supreme Court found that

a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

KSR, 550 U.S. at 421. And simply because the prior art “discloses a multitude of effective combinations does not render any particular formulation less obvious.” *Merck & Co. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989).

The record supports that, at the time of invention in 2010, it would have been obvious to try the known carrier frequencies of Vyshedskiy for modulation of the acoustic ECG signal of Albert in the claimed frequency range of 6 kHz to 20 kHz because these carrier frequencies would be

obvious alternatives to try and address Vyshedskiy's disclosed design need for simultaneous measurement of heart sound auscultation and ECG heart cycle. *See* Pet. 17 (citing Ex. 1005 ¶¶ 13–15.)

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

KSR, 550 US at 421.

We are not persuaded by Patent Owner's argument that "Petitioner fails to show that Vyshedskiy's 8-channel system, operated over an acoustically-isolated medium, would have been viewed as an identified, predictable solution applicable to Albert's acoustic system." PO Sur-Reply 3. Even Dr. Jafari acknowledges that, "in paragraph 11 of Vyshedskiy, that embodiment simultaneously transmits an acoustic signal and an EKG signal to the computing device." Ex. 1027, 181: 4–8. And Dr. Jafari states in response to a question asking about wireless transmission that, "in general, you know, you could replace some of these protocols." *Id.* at 174:6–19. Therefore, the evidence of record better supports the determination that substitution of different carrier frequencies was a known and predictable option to address concerns about simultaneous measurement of heard sound auscultation and ECG heart cycle.

We also find unpersuasive Patent Owner's argument relying on Albert's use of a telephone line as "incompatible with the combination advanced in the petition—namely, that telephone transmission was limited in bandwidth up to 3 kHz" (PO Sur-Reply 11) because this argument relies

on the bodily incorporation of Vyshedskiy into Albert but the “test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.” *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

Obviousness is assessed at the time of invention, here 2010, and at that time telephone transmissions were no longer necessarily transmitted over telephone lines, but rather also used mobile phones. Ex. 1005 ¶ 11. Indeed, Dr. Sarrafzadeh stated that as of “2010, smartphones were widely available and combined the functions of a landline and a PDA.” Ex. 1026 ¶ 15. Dr. Jafari also acknowledged that “[b]y June 2010, a built-in microphone of a smartphone, such as the Apple iPhone 3G, typically had a frequency response of about 20 [hertz] to about 20 [kilohertz].” Ex. 2003 ¶ 35.

Based on Dr. Jafari’s statement, it is evident that telephone transmission of frequencies in the ranges disclosed by Vyshedskiy would have been entirely compatible with the frequencies used by smartphones available as of the time of invention. Therefore, we agree that the balance of the evidence supports Dr. Sarrafzadeh’s statement that “it would have been obvious to replace Albert’s landline and PDA with a smartphone [Pet., 21-22; EX1007, FIG. 2; EX1027, 69:14-7:16 and 225:5-25 (smartphones were known for years and iPhone 3G was launched in 2008)].” Ex. 1026 ¶ 15. We find that Patent Owner has provided no persuasive support for the assertion that the frequencies disclosed by Vyshedskiy would have been incompatible with the use of such known smartphones.

We are not persuaded by Patent Owner’s argument that “Petitioner does not dispute that the Instromedix Heart Card was a device known to those in the art and that it transmitted an ECG acoustic signal having a 1.9 kHz carrier frequency. POR, 34.” PO Sur-Reply 13. Patent Owner further asserts “merely because Albert may not be strictly limited to the Instromedix Heart Card, Petitioner fails to show that POSAs knew of ‘other’ devices that operated at different frequencies.” *Id.* at 14.

“A person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 US at 421. Vyshedskiy provides direct evidence that multiple different frequencies may be used to transmit ECG signals with a sampling rate of about 44 kHz. Ex.1005 ¶ 28, 34. And Dr. Jafari acknowledges that Vyshedskiy teaches “you have multiple frequencies and you have multiple signals in the basebands. You modulate them in different frequency bands So these signals, they can be transmitted and communicated without any interference.” Ex. 1021, 184:2–14.

That the particular prior art Instromedix Heart Card in Albert used a particular carrier frequency does not support Patent Owner’s broad argument that any other carrier frequency would be unobvious. “Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. . . . [The reference] must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole.” *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). It is the combination of Albert and Vyshedskiy, as understood by experts such as Dr. Jafari and Dr. Sarrafzadeh, that renders claim 1 obvious. Accordingly, we agree with Dr. Sarrafzadeh that Patent Owner’s argument is “based on an overly-narrow read of the

references and do not accord with the level of skill, creativity of a POSITA, or the obviousness arguments advanced in the Petition.” Ex. 1026 ¶ 19.

Petitioner provides specific reasons, evidence, and arguments explaining why claims 2, 3, 7–9, 13, and 14 would have been obvious over Albert, Vyshedskiy, and Platt. Pet. 33–37, 39–43; Ex. 1003 ¶¶ 119–127, 145–166. Patent Owner does not provide separate arguments for these claims. *See, e.g.*, PO Resp. 35–37.

We find that Petitioner has shown, by a preponderance of the evidence, that claims 1–3, 7–9, 13, and 14 of the ’042 patent would have been obvious over Albert, Vyshedskiy, and Platt.⁸ *See In re NuVasive, Inc.*, 841 F.3d 966, 974 (Fed. Cir. 2016) (“The Board, having found the only disputed limitations together in one reference, was not required to address undisputed matters.”); *see also* Paper 8 at 9 (emphasizing that “any arguments not raised in the response may be deemed waived”).

4. *Analysis of contested dependent claims*

a) *Claims 4, 5, and 6*

Petitioner asserts

Albert’s “frequency modulated audio signal 14 may be played directly into the audio microphone of a computing device 16.” APPLE-1022, 3:25-31. Platt’s ECG audio signal is transmitted via a speaker output 18 to the microphone of the cell phone. APPLE-1006, 4:7-10. A POSITA would have been motivated to use a speaker because it avoids the need for wires or cables. APPLE-1003, ¶132; APPLE-1006, 2:28-34, 4:21-29.

Pet. 37 (emphasis omitted). Petitioner asserts specific to claim 5 that a “POSITA would have found it obvious to use a piezoelectric buzzer, which

⁸ We note that Patent Owner has not submitted evidence of objective indicia of non-obviousness.

is a simple speaker, as the transmitter, considering that a piezoelectric buzzer is inexpensive to manufacture (e.g., less expensive than a speaker) and only requires minimum space and electricity. APPLE-1003, ¶138; APPLE-1018, 7; APPLE-1021, claim 8, Abstract.” Pet. 38.

Patent Owner asserts “POAs understood that a speaker (claim 4) and a microphone (claim 6) were devices that were conventionally known to be configured to emit (in the case of a speaker) or receive (in the case of a microphone) sound waves traveling through the ambient environment. *Id.*, ¶¶34-36, 68.” PO Resp. 36. Patent Owner asserts “for claim 5, Petitioner effectively admits that neither Albert, Vyshedskiy, or Platt disclose a transmitter that is ‘a piezoelectric buzzer.’ Pet., 38. Nevertheless, Petitioner generally asserts that a POA ‘would have found it obvious to use a piezoelectric buzzer.’ *Id.* Patent Owner asserts “Petitioner, however, supports this assertion by citing to two exhibits: EX1018 and EX1021 EX1018 is a paper that indicates it was published in 2017, seven years after the relevant timeframe for the ’042 patent of June 8, 2010, and thus does not constitute prior art. See EX1018, 64.” *Id.* at 36–37. Patent Owner asserts, regarding Ex. 1021, that “Boschetti discloses the use of phase modulation, rather than frequency modulation, in connection with a piezoelectric transducer. EX2003, ¶70.” *Id.*

Claim 4 of the ’042 patent recites the “ECG device of claim 1, wherein the transmitter is a speaker” and claim 6 recites the “ECG device of claim 1, wherein the transmitter is configured to output the ECG signal to a microphone in the computing device.” Ex. 1001, 10:39–45.

Albert’s “frequency modulated audio signal 14 may be played directly into the audio microphone of a computing device 16.” Ex. 1022, 3:25–31. Similarly, Platt’s “ECG monitoring device 14 produces tone signals

corresponding to the Signals detected by the electrodes 15 and is acoustically coupled via the Speaker output 18 to the microphone.” Ex. 1006, 4:7–10. Moreover, Patent Owner’s expert, Dr. Jafari, acknowledges that in Albert “the acoustic signal is being transmitted by the Heart Card to the palmtop computer over the telephone system.” Ex. 1027, 147:24–148:1.

We find that the evidence supports Petitioner’s position as Albert and Platt teach and render obvious the use of speakers as transmitters for ECG devices and microphones for receivers in the computer device of claims 4 and 6 of the ’042 patent.

Claim 5 of the ’042 patent recites the “ECG device of claim 1, wherein the transmitter is a piezoelectric buzzer.” Ex. 1001, 10:41–42.

Dr. Sarrafzadeh states

A POSITA would have found it obvious to use a piezoelectric buzzer, which is a simple speaker, as the transmitter to transmit the frequency modulated ECG sound signal, especially considering that a piezoelectric buzzer is inexpensive to manufacture (e.g., less expensive than a speaker) and only requires minimum space and electricity. APPLE-1018, 7 (explaining that a piezo speaker does not need much space, does not need much electricity and is ridiculously cheap to manufacture); APPLE-1021, claim 8, Abstract (transmitting acoustic signals using a piezoelectric buzzer).

Ex. 1003 ¶ 138. Boschetti teaches “a device that transforms a digital signal into an acoustic signal, making use of a standard phase modulation . . . and an acoustic transducer (2) of the piezoelectric kind.” Ex. 1021, 1:9–12. Dr. Sarrafzadeh further states “Boschetti’s teachings are not limited to phase modulation and a POSITA would have found it obvious to use frequency modulation at least because it is the mostly used method.” Ex. 1026 ¶ 21.

Dr. Jafari states

with respect to claim 5, I note that Dr. Sarrafzadeh relies on Boschetti (EX1021) as disclosing the use of a piezoelectric buzzer to transmit an acoustic signal . . . , Boschetti does not disclose the use of a piezoelectric buzzer to transmit a frequency modulated acoustic signal as Dr. Sarrafzadeh proposes in the combination of Albert, Vyshedskiy, and Platt. Rather, Boschetti suggests the use of a phase modulation (PSK), instead of frequency modulation (FSK), of a digital signal in a modem to guide a piezoelectric transducer to emit an acoustic signal. See, e.g., EX1021 (Boschetti), 2:44-56. As such, Boschetti does not support the assertion that it would have been obvious “to use a piezoelectric buzzer . . . , as the transmitter to transmit the frequency modulated ECG sound signal.

Ex. 2003 ¶ 70.

We find the evidence supports Petitioner’s position as both experts acknowledge that piezoelectric devices function as speakers for transmission of acoustic signals and Dr. Sarrafzadeh provides a number of reasons for selecting piezoelectric speakers as the acoustic transmitters including reduced cost and space. *See* Ex. 1003 ¶ 138. Dr. Jafari asserts that Boschetti prefers phase modulation over frequency modulation, but does not assert that the piezoelectric buzzer of Boschetti would be incapable of frequency modulation, and Dr. Sarrafzadeh states a piezoelectric buzzer would be capable of frequency modulation. *See* Ex. 2003 ¶ 70; Ex. 1026 ¶ 21. A “given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Medichem, S.A. v. Rolabo S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). Here, Dr. Sarrafzadeh’s reasons to use a frequency modulated piezoelectric buzzer outweigh the evidence identified by Patent Owner supporting a preference for phase modulation.

Accordingly, we find that Petitioner has shown, by a preponderance of the evidence, that claims 4–6 of the '042 patent would have been obvious over Albert, Vyshedskiy, and Platt.

D. Ground 2: Obviousness over Albert, Vyshedskiy, Platt, and Annavaram

Petitioner asserts that claims 7, 8, and 10–12 are unpatentable as obvious over Albert, Vyshedskiy, Platt, and Annavaram. Pet. 44–51. For claims 7 and 8, Dr. Sarrafzadeh states “a POSITA would have found it obvious to use a smartphone (with a display) as the computing device, and to display the ECG signal on the smartphone’s display.” Ex. 1003 ¶ 147. For claims 10–12, Dr. Sarrafzadeh states “Annavaram discloses that ECG data can be combined with accelerometer data to accurately detect a user’s physical activity and energy expenditure. APPLE-1007, 2.” Ex. 1003 ¶ 170.

Beyond the arguments already discussed above with respect to Ground 1, Patent Owner does not otherwise argue these claims. *See generally* Pet. 37–38. Nor does Dr. Jafari address the particular limitations of claims 7, 8, and 10–12. *See* Ex. 2003 ¶ 72.

We determine that Petitioner has established, by a preponderance of the evidence, that claims 7, 8, and 10–12 would have been obvious over Albert, Vyshedskiy, Platt, and Annavaram.

E. Ground 3: Obviousness over Batkin and Vyshedskiy

Petitioner contends that claims 1–9, 13, and 14 would have been obvious over Batkin and Vyshedskiy. Pet. 51–71. Petitioner provides a detailed analysis of independent claim 1 and then explains where dependent claim limitations of claims 2–9, 13, and 14 are found within the prior art. *Id.* at 66–71. Patent Owner responds and explains why the claims would not have been obvious over Batkin and Vyshedskiy. PO Resp. 38–61.

We begin with Petitioner’s position for claim 1, and then Patent Owner’s position, and then move to our analysis, which addresses the positions of both parties.

1. *Claims 1–3, 7–9, 13, and 14 - Petitioner’s position*

a) *[1.0] An ECG device comprising:*

Petitioner asserts that “Batkin discloses an ECG device comprising (1) a cell phone (computing device) and (2) a cell phone case that detects an ECG signal through ECG electrodes and transmits the ECG signal to the cell phone. APPLE-1008, Abstract, [0001], [0021]-[0028], [0046], FIG. 2A-2C; APPLE-1003, ¶197.” Pet. 56. Petitioner asserts “in the Batkin-Vyshedskiy combination, the combined ECG device collects both body sound (including voice telephonic communication) and ECG electric signals (APPLE-1008, [0034]; APPLE-1005, [0011]). APPLE-1003, ¶198.” Pet. 56–57.

b) *[1.1] a computing device comprising a display*

Petitioner asserts “Batkin discloses a bio-monitor comprising (1) a cell phone (computing device) and (2) a cell phone case that detects an ECG signal through ECG electrodes and transmits the ECG signal to the cell phone. APPLE-1008, Abstract, [0001], [0021]-[0028], [0046] and FIG. 2A-2C; APPLE-1003, ¶201.” Pet. 57. Petitioner asserts “Vyshedskiy discloses transmitting the composite audio signal into a microphone port of a computing device (e.g., PDA or cell phone) (APPLE-1005, [0010]-[0011])” and “Vyshedskiy discloses that the ‘PDA can display the results of demodulation on its screen.’ APPLE-1005, [0037].” *Id.*

c) *[1.2] an electrode assembly configured to sense heart-related signals upon contact with a user’s skin, and to convert the sensed heart-related signals to an ECG signal*

Petitioner asserts “Batkin’s cell phone case contains three ECG electrodes. APPLE-1008, [0033]-[0034], [0046], FIG. 2. Batkin explains that the ECG electrodes pick up electrical signal inside the body for delivery to the conditioning circuit 5. APPLE-1003, ¶206; APPLE-1008, [0059].” Pet. 58. Petitioner also asserts “Vyshedskiy discloses an electrode assembly (ECG electrodes 203) that senses heart-related signals upon contact with a user’s skin, and converts the sensed heart-related signals to an ECG signal (EKG input 301, in the form of electrical voltage). APPLE-1003, ¶208.” *Id.*

d) [1.3] a converter assembly integrated with, and electrically connected to the electrode assembly, the converter assembly configured to convert the ECG signal generated by the electrode assembly to a frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz

Petitioner asserts

in Vyshedskiy, the ECG signal from the patient’s skin is picked up by ECG electrodes 203 and transmitted via wire or wirelessly 205 into a Signal Conditioning and Modulation Box 206. APPLE-1005, [0033]. A POSITA would have understood that Signal Conditioning and Modulation Box 206 is a converter assembly that is integrated with, and electrically connected to the electrode assembly, and is configured to convert the ECG signal generated by the electrode assembly to a frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz. APPLE-1003, ¶214; APPLE-1005, Abstract, [0026]-[0028], [0032]-[0035], FIGS. 1-3.

Pet. 59–60. Petitioner also asserts “[i]n the Batkin-Vyshedskiy combination, a POSITA would have been motivated to include this converter assembly in Batkin’s cell phone case, because this allows simultaneous transmission of the ECG and heart sound signals in one device. APPLE-1003, ¶215; APPLE-1008, [0022], [0024]; APPLE-1006, 4:21-29.” Pet. 60.

e) [1.4] a transmitter configured to transmit the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz to the computing device

Petitioner asserts “Vyshedskiy discloses transmitting the composite audio signal into a microphone input of a computing device. APPLE-1005, FIG. 2; APPLE-1003, ¶219.” Pet. 61. Petitioner asserts “Batkin also discloses that an ‘acoustic coupling means’ may be used to convey the bio-signal into the telephonic transmission portion of the combined device. APPLE-1008, [0034].” Pet. 62. Petitioner asserts a “POSITA would have understood that the combined device has a transmitter that is configured to transmit the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz to the computing device. APPLE-1003, ¶219.” Pet. 61.

f) [1.5] a housing containing the electrode assembly, the converter assembly, and the transmitter, and configured to couple the electrode assembly, the converter assembly, and the transmitter to a surface of the computing device

Petitioner asserts

Batkin discloses that the invention can be incorporated into a cell phone case that is attached to a surface of the cell phone (computing device). APPLE-1008, [0024]-[0028], FIG. 2. As shown in FIG. 2, the cell phone case (housing) includes ECG electrodes 2-4 (electrode assembly) and an electronic circuit 5 (converter assembly and transmitter). APPLE-1008, FIG. 2; [0024]-[0028], [0046]; APPLE-1003, ¶223.

Pet. 62–63. Petitioner asserts “it would have been obvious to modify Batkin by incorporating Vyshedskiy’s converter assembly to Batkin’s cell phone case. APPLE-1003, ¶224; APPLE-1008, [0022], [0024]; APPLE-1006, 4:21-29.” Pet. 63. Petitioner asserts that when combining the teachings of Batkin

and Vyshedskiy, the resulting device would comprise a “cell phone case (housing) containing the electrode assembly, the converter assembly, and the transmitter, is configured to couple the electrode assembly, the converter assembly, and the transmitter to a surface of the cell phone (computing device). APPLE-1003, ¶224.” Pet. 64.

g) [1.6] wherein the computing device is configured to receive the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz and display an ECG signal on the display

Petitioner asserts

in the Batkin-Vyshedskiy combination, the combined device converts, through frequency modulation, the ECG electric signals to frequency modulated ECG acoustic signals **with a carrier frequency from about 6 kHz to about 20 kHz** to generate a composite acoustic signal (APPLE-1008, [0034]; APPLE-1005, [0028]); and transmits the composite acoustic signal into a microphone of a mobile device (e.g., smartphone) (APPLE-1008, [0034]; APPLE-1005, [0010]-[0011]), where the mobile device (e.g., smartphone) digitizes and demodulates the composite signal so that **both a phonocardiogram and an electrocardiogram can be displayed/visualized together** (APPLE-1005, [0013]). APPLE-1003, ¶227.

Pet. 64.

2. *Claim 1–3, 7–9, 13, and 14 – Patent Owner’s position*

Patent Owner asserts that Petitioner “fails to articulate why a POSA would have been further motivated to select a particular carrier frequency for the ECG signal data as recited in the claims. POR, 25-27.” PO Resp. 41.

Patent Owner asserts “either (1) a POSA would not have looked to Vyshedskiy at all for supplying details to Batkin’s ‘simultaneous transmissions’ using ‘frequency division multiple access’ or (2) if a POSA

applied Vyshedskiy's method to Batkin's 'frequency division multiple access,' such modification would be irrelevant to the claims." PO Resp. 42. Patent Owner also asserts "even assuming a POSA would have been motivated to modify Batkin to provide for simultaneous transmission of body sounds (including voice communications) and ECG data into the microphone of a cell phone, Petitioner fails to explain how the references teach such a configuration." *Id.*

Patent Owner asserts "Batkin's methods addressing 'simultaneous transmissions' of voice and bio-signal data concern the transmission of voice and bio-signal data *out* of the cellphone—*i.e.*, over telephonic networks *after* the acquisition of bio-signal data into the cellphone, making any such modifications to this portion of Batkin's system irrelevant to the claims." PO. Resp. 44. Patent Owner asserts "Petitioner's statements in a related IPR involving the same combination reveal that its motivation is a red herring and a prop used to shoe-horn in Vyshedskiy's method into Batkin's system without any actual basis." *Id.* at 45.

Patent Owner asserts

a POSA would not have "look[ed] to Vyshedskiy" for "the details of 'frequency division[] multiple access'" disclosed in Batkin because a POSA would have viewed Vyshedskiy's technique as irrelevant to data transmission over cellular networks. EX2003, ¶88 Second, even if a POSA would have "appl[ied] Vyshedskiy's known technique" to Batkin's "frequency divisional multiple access," such a modification would be irrelevant to the claims.

PO Resp. 50.

Patent Owner asserts "when discussing a configuration that utilizes 'simultaneous transmission' of voice and bio-signal data, Batkin still incorporates a switch to control the type of signal (*i.e.*, voice or data) being

inputted into the cellphone. EX2003, ¶93” PO. Resp. 52 (emphasis omitted). Patent Owner asserts

Dr. Sarrafzadeh’s inability to provide an evidentiary basis as to how Batkin’s disclosure demonstrates the simultaneous acoustic transmission of voice and bio-signal data *into* the microphone of a device—without resorting to the ’042 patent itself or other references like Vyshedskiy, neither of which provide such evidence—demonstrates Petitioner is merely starting with the claimed invention and working backward to retrofit the prior art to the claims.

Id. at 54.

Patent Owner asserts “[g]iven the known incompatibility between simultaneous speaking and measurement of body sounds using a stethoscope, a POSA would not have viewed Vyshedskiy’s EKG Stethoscope system as being compatible with a system aimed at providing ‘simultaneous’ voice transmission and bio-signal data into the microphone of the device. EX2003, ¶103.” PO Resp. 58. Patent Owner asserts “a POSA considering modifications to a system transmitting signals acoustically would not have turned to systems utilizing different transmission methods (*i.e.*, electronic or wireless), such as Vyshedskiy, because a POSA would have understood that acoustic systems involve design considerations and problems that are distinct from those faced by electronic or wireless systems.” *Id.* at 59.

a) Analysis

We begin our analysis by noting that both Petitioner’s expert Dr. Sarrafzadeh and Patent Owner’s expert Dr. Jafari agree that “Batkin discloses ‘simultaneous transmissions’ of the ECG signal (bio-signal) and voice telephonic transmissions.” Ex. 1003 ¶ 192; *see* Ex. 1027, 229:11–13 (“the Batkin invention talks about a simultaneous transmission of voice and

biosignal out of a cell phone.”). Dr. Jafari acknowledges that “Batkin discloses that ‘either an acoustic coupling means or an electrical connection may be employed in order to convey the bio-signal into the telephonic transmission portion of the combined device.’” Ex. 2003 ¶ 81 (citing Ex. 1008 ¶ 34).

Batkin teaches

an acoustic coupling means . . . may be employed in order to convey the bio-signal into the telephonic transmission portion of the combined device. In the case of use of a cell phone for ECG, the first and second pickup electrodes, the reference electrode (preferentially all ohmic), and the electrical circuitry of the invention may readily be carried within a case or attachment, coupled to the cell phone by an internal or external connector which extends from the circuitry of the invention to the microphone or data port of the cell phone to permit inclusion of the bio-signal into the cell phone’s telephonic communications.

Ex. 1008 ¶ 34. That is, consistent with claim 1 of the ’042 patent, Batkin teaches an acoustic signal (Ex. 1008 ¶ 51) sent through the microphone circuitry in order to further analyze the data. Dr. Sarrafzadeh states

based on disclosure in Batkin 98 and Vyshedskiy related to using PDAs and cell phones as the computing device and a POSITA’s general knowledge by 2010 that smartphones represented evolutions of these devices and were used for ECG monitoring and transmission of ECG signals to remote computing devices, a POSITA would have found it obvious to use a smartphone (with a display) as Batkin-Vyshedskiy’s computing device, and to display the ECG signal on the smartphone’s display. APPLE-1010, Abstract.

Ex. 1003 ¶ 203.

We next turn to the specific language in claim 1 of the ’042 patent. Claim 1 recites, in part, a requirement for delivery of a “transmitter configured to transmit the frequency modulated ECG audio signal having a carrier frequency in the range of from about 6 kHz to about 20 kHz to the

computing device.” Claim 1 does not require that the frequency modulated ECG audio signal be simultaneous with voice or other acoustic signals.

While the Petition reasons that “Batkin discloses ‘simultaneous transmissions’ of the ECG signal (bio-signal) and voice telephonic transmissions” (Pet. 53), Petitioner’s reasoning does not require simultaneous recording of an acoustic ECG signal and a voice signal, only simultaneous transmission. *See* Pet. 53–54. As applied to claim 1 of the ’042 patent, we are persuaded by Petitioner’s reasoning that it would have been obvious to improve Batkin’s simultaneous transmission of signals using Vyshedskiy’s approach, and in particular, “to apply Vyshedskiy’s known technique of “frequency divisional multiple access” to Batkin’s method that is ready for improvement to yield predictable results. APPLE-1003, ¶192.” Pet. 54.

Dr. Sarrafzadeh states “because Batkin does not disclose the details of ‘frequency divisional multiple access,’ a POSITA would have been motivated to look to Vyshedskiy for such details and to apply Vyshedskiy’s known technique of ‘frequency divisional multiple access’ to Batkin’s method that is ready for improvement to yield predictable results.” Ex. 1019

¶ 23. We recognize that Dr. Jafari responds that

a POSITA would not “have been motivated to look to Vyshedskiy” for details on “frequency division multiple access” because Batkin’s methods address “simultaneous transmissions” of voice and bio-signal data concerning the transmission of voice and bio-signal data *out* of the cell phone—*i.e.*, over telephonic networks *after* the acquisition of bio-signal data into the cell phone, making any such modifications to this portion of Batkin’s system irrelevant to the claims.

Ex. 2003 ¶ 80. But Dr. Jafari also states that “I capture the biosignal, then I switch back to the voice mode, I put my voice commands on top of it, and I switch and go back. But I do not see any embodiments on how these two signals could be truly acquired at the same time.” Ex. 1027, 59:4–10.

As we balance these statements, we find that Dr. Jafari’s deposition statement that the two signals could not be acquired at the same time is irrelevant to claim 1, and does not substantially weaken Petitioner’s reasoning that input of frequency modulated acoustic ECG signals of Batkin would select known carrier frequencies used generally by frequency modulated signals disclosed by Vyshedskiy. *See* Ex. 1008 ¶¶ 34, 56; Ex. 1005 ¶¶ 17, 28. We find Dr. Sarrafzadeh more persuasive as to the actual limitations recited in claim 1, which require a device with a transmitter configured to digitize and demodulate a frequency modulated ECG acoustic signal with a particular carrier frequency, where Batkin can receive an acoustic ECG signal *into* the microphone of the device. *See* Ex. 1008 ¶ 34 (“[A]n acoustic coupling means . . . may be employed in order to convey the bio-signal into the telephonic transmission portion.”)

Patent Owner also asserts that “a POSA would have viewed Vyshedskiy’s EKG stethoscope as incompatible with such transmission” and “a POSA would have recognized that Vyshedskiy’s method for signal transmission was distinct from methods using acoustic signal transmission, which involve different design considerations.” Pet. 43. We find this unpersuasive as Vyshedskiy teaches “physiological data from multiple sensors, such as acoustic pick-up sensors, are transmitted into the computing device via a single microphone port.” Ex. 1005 ¶ 17. Vyshedskiy teaches to “transmit an audio signal from an electronic stethoscope . . . into a computing device via the microphone port.” Ex. 1005 ¶ 11. We therefore

agree with Petitioner that “Vyshedskiy is broad enough to cover acoustic transmission.” Pet. Reply 9.

Petitioner provides specific reasons, evidence, and arguments explaining why claims 2, 3, 7–9, 13, and 14 would have been obvious over Batkin and Vyshedskiy. Pet. 65–66, 68–71; Ex. 1003 ¶¶ 230–238, 249–264. Patent Owner does not provide separate arguments for these claims. *See, e.g.*, PO Resp. 60–61.

We find that Petitioner has shown, by a preponderance of the evidence, that claims 1–3, 7–9, 13, and 14 of the ’042 patent would have been obvious over Batkin and Vyshedskiy. *See In re NuVasive, Inc.*, 841 F.3d at 974.

3. *Analysis of Contested Dependent claims*

a) *Claims 4–6*

Petitioner asserts that claims 4–6 are unpatentable as obvious over the combination of Batkin and Vyshedskiy. Pet. 66–68. We have already addressed claims 4–6 and the statements of Dr. Sarrafzadeh and Dr. Jafari in our analysis of these claims in section X.C.4.a). As already discussed, both experts acknowledge that piezoelectric devices function as speakers for transmission of acoustic signals and Dr. Sarrafzadeh provides a number of reasons for selecting piezoelectric speakers as the acoustic transmitters including reduced cost and space. *See* Ex. 1003 ¶ 138. As already noted, Boschetti teaches “a device that transforms a digital signal into an acoustic signal, making use of a standard phase modulation . . . and an acoustic transducer (2) of the piezoelectric kind.” Ex. 1021, 1:9–12.

Accordingly, we determine that Petitioner shows, by a preponderance of the evidence, has established that claims 4–6 would have been obvious over Batkin and Vyshedskiy.

F. Ground 4: Obviousness over Batkin, Vyshedskiy, and Annavaram

Petitioner asserts that claims 7, 8, and 10–12 are unpatentable as obvious over Batkin, Vyshedskiy, and Annavaram. Pet. 71–75. For claims 7 and 8, Dr. Sarrafzadeh states “a POSITA would have found it obvious to use a smartphone (with a display) as the computing device, and to display the ECG signal on the smartphone’s display.” Ex. 2003 ¶ 147. For claims 10–12, Dr. Sarrafzadeh states “Annavaram discloses that ECG data can be combined with accelerometer data to accurately detect a user’s physical activity and energy expenditure. APPLE-1007, 2.” Ex. 2003 ¶ 170.

Beyond the arguments already discussed above with respect to Ground 3, Patent Owner does not otherwise argue these claims. *See generally* Pet. 61. Nor does Dr. Jafari address the particular limitations of claims 7, 8, and 10–12. *See* Ex. 2003 ¶ 113.

We determine that Petitioner has shown, by a preponderance of the evidence, that claims 7, 8, and 10–12 would have been obvious over Batkin, Vyshedskiy, and Annavaram. *See In re NuVasive, Inc.*, 841 F.3d at 974.

G. Ground 5: Obviousness over Albert, Vyshedskiy, Platt, and Batkin

Petitioner asserts that claims 8 is unpatentable as obvious over Albert, Vyshedskiy, Batkin, and Annavaram. Pet. 76–77. For claim 8, Dr. Sarrafzadeh states “a POSITA would have been motivated to implement the

container/housing of the combined device as a smartphone protective case. APPLE-1008, [0024].” Ex. 2003 ¶ 291.

Beyond the arguments already discussed above with respect to Grounds 1 and 3, Patent Owner does not otherwise argue these claims. *See generally* Pet. 61. Nor does Dr. Jafari address the particular limitations of claim 8. *See* Ex. 2003 ¶ 114.

We determine that Petitioner has shown, by a preponderance of the evidence, that claim 8 would have been obvious over Albert, Vyshedskiy, Platt, and Batkin. *See In re NuVasive, Inc.*, 841 F.3d at 974.

H. Grounds 6 and 7: Obviousness over Albert, Vyshedskiy, Platt, and Boschetti or Batkin, Vyshedskiy, and Boschetti.

Petitioner asserts that claim 5 is unpatentable as obvious over Albert, Vyshedskiy, Platt, and Boschetti or Batkin, Vyshedskiy, and Boschetti. Pet. 78–81. We have already addressed claim 5 and the statements of Dr. Sarrafzadeh and Dr. Jafari in our analysis of claim 5 in section X.C.4.a. As discussed therein, both experts acknowledge that piezoelectric devices function as speakers for transmission of acoustic signals and Dr. Sarrafzadeh provides a number of reasons for selecting piezoelectric speakers as the acoustic transmitters including reduced cost and space. *See* Ex. 1003 ¶ 138. As already noted, Boschetti teaches “a device that transforms a digital signal into an acoustic signal, making use of a standard phase modulation . . . and an acoustic transducer (2) of the piezoelectric kind.” Ex. 1021, 1:9–12.

Accordingly, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 5 would have been obvious over Albert, Vyshedskiy, Platt, and Boschetti or Batkin, Vyshedskiy, and Boschetti.

X. CONCLUSION

After considering the evidence and arguments presently before us in the complete trial record, we conclude that Petitioner has demonstrated, by a preponderance of the evidence, that Challenged Claims 1–14 of the '042 patent are unpatentable.⁹

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1–9, 13, 14	103	Albert, Vyshedskiy, Platt	1–9, 13, 14	
7, 8, 10–12	103	Albert, Vyshedskiy, Platt, Annavaram	7, 8, 10–12	
1–9, 13, 14	103	Batkin, Vyshedskiy	1–9, 13, 14	
7, 8, 10–12	103	Batkin, Vyshedskiy, Annavaram	7, 8, 10–12	
8	103	Albert, Vyshedskiy, Platt, Batkin	8	
5	103	Albert, Vyshedskiy, Platt, Boschetti	5	
5	103	Batkin,	5	

⁹ Should Patent Owner wish to pursue amendment of the Challenged Claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding, 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. §§ 42.8(a)(3), (b)(2).

		Vyshedskiy, Boschetti		
Overall Outcome			1-14	

XI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1-14 of U.S. Patent 9,649,042 B2 patent are determined to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-01186
Patent 9,649,042 B2

For PETITIONER:

Walter Karl Renner
Jeremy J. Monaldo
Fish & Richardson P.C.
axf-ptab@fr.com
jjm@fr.com

For PATENT OWNER:

Michael T. Rosato
Matthew A. Argenti
Tasha M. Thomas
Yahn-Lin Chu
WILSON SONSINI GOODRICH & ROSATI
mrosato@wsgr.com
margenti@wsgr.com
tthomas@wsgr.com
ychu@wsgr.com