

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

THETA IP, LLC,
Patent Owner.

Case IPR2024-00816
U.S. Patent No. 7,010,330

**PATENT OWNER'S RESPONSE
UNDER 37 C.F.R. §42.120**

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Patent Owner's Exhibit List	
EX2001	Declaration of Corey Johanningmeier in Support of Motion for <i>Pro Hac Vice</i> Admission
EX2002	"Yannis Tsividis, Path-Breaking Researcher and Educator," IEEE Solid State Circuits Magazine, Fall 2014
EX2003	Y. Tsividis <i>et al.</i> , "Internally Varying Analog Circuits Minimize Power Dissipation," IEEE Circuits & Devices Magazine, Jan. 2003
EX2004	Y. Tsividis, "Signal-to-Noise Ratio, Dynamic Range, and Power Dissipation," IEEE Solid State Circuits Magazine, Fall 2018
EX2005	Declaration of Professor Lawrence Larson, Ph.D. under 37 C.F.R. § 1.68 in support of Patent Owner's Preliminary Response in IPR2024-00816, -00817, -00818, -00819, and -00820.
EX2006	<i>Curriculum Vitae</i> of Professor Larson
EX2007	IPR2023-00694, Paper 10, Decision Denying Institution (P.T.A.B. Oct. 23, 2023)
EX2008	IPR2023-00694, Paper 14, Decision Denying Rehearing (P.T.A.B. Feb. 7, 2024)
EX2009	U.S. Patent No. 5,001,776 (<i>Clark</i>)
EX2010	Excerpts of Invalidity Contentions, <i>Theta IP, LLC v. Samsung Electronics Co., Ltd. et al.</i> , No. 2-16-cv-00527 (E.D. Tex.)
EX2011	Excerpts of Invalidity Contentions, <i>Theta IP, LLC v. Lenovo (United States) Inc., et al.</i> , 1-22-cv-03441 (N.D. Ill.)
EX2012	Excerpts of Invalidity Contentions, <i>Theta IP, LLC v. Apple Inc.</i> , No. 6:23-cv-00314-ADA (W.D. Tex.)
EX2013	Second Amended Scheduling Order, <i>Theta IP, LLC v. Apple Inc.</i> , No. 6:23-cv-00314-ADA (W.D. Tex. Aug. 6, 2024), ECF No. 91

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EX2014	Claim Construction Order, <i>Theta IP, LLC v. Samsung Electronics Co., Ltd. et al.</i> , 6:20-cv-00160-ADA (W.D. Tex. Jan. 7, 2021), ECF No. 57
EX2015	March 25, 2024 Email from Court listing Preliminary Constructions, <i>Theta IP, LLC v. Apple Inc.</i> , No. 6:23-cv-00314-ADA (W.D. Tex.)
EX2016	March 25, 2024 Email from Apple to Court re: <i>Markman, Theta IP, LLC v. Apple Inc.</i> , No. 6:23-cv-00314-ADA (W.D. Tex.)
EX2017	Transcript of <i>Markman</i> hearing, <i>Theta IP, LLC v. Apple Inc.</i> , No. 6:23-cv-00314-ADA (W.D. Tex. Mar. 26, 2024)
EX2018	Minute Order setting <i>Markman</i> hearing, <i>Theta IP, LLC v. Lenovo (United States) Inc., et al.</i> , 1-22-cv-03441 (N.D. Ill. July 2, 2024), ECF No. 104
EX2019	Reserved
EX2020 (new)	Declaration of Professor Lawrence Larson, Ph.D. in support of Patent Owner's Preliminary Responses in IPR2024-00816, -00817, -00818, -00819, and -00820
EX2021 (new)	Deposition Transcript of Dr. Asad Abidi – March 11, 2025
EX2022 (new)	IPR2023-00697, Paper 32, Final Written Decision Determining No Challenged Claims Unpatentable (P.T.A.B. Oct. 16, 2024)
EX2023 (new)	IPR2023-00698, Paper 33, Final Written Decision Determining No Challenged Claims Unpatentable (P.T.A.B. Oct. 16, 2024)
EX2024 (new)	IPR2023-00694, Paper 11, Rehearing Request (P.T.A.B. Nov. 22, 2024)

Patent Owner Theta IP, LLC (“Theta”) respectfully submits this Response to Apple Inc.’s (“Apple” or “Petitioner”) above-captioned Petition for *Inter Partes* Review of United States Patent No. 7,010,330 (“the ’330 Patent”).

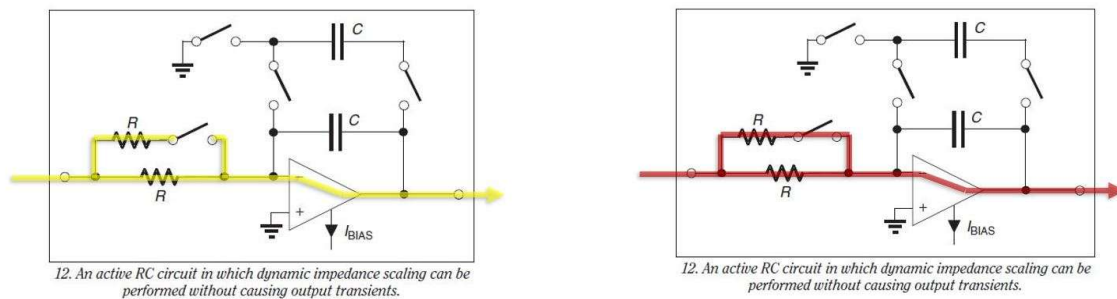
I. Introduction

Apple’s challenges to Theta’s foundational Tsivdis Patents are based on alleged prior art that Theta and Professor Tsivdis themselves disclosed to the Patent Office more than twenty years ago, as part of the first application in this patent family. EX1001, 2; EX1002, 62 (disclosing *Behbahani* and *Tan*).

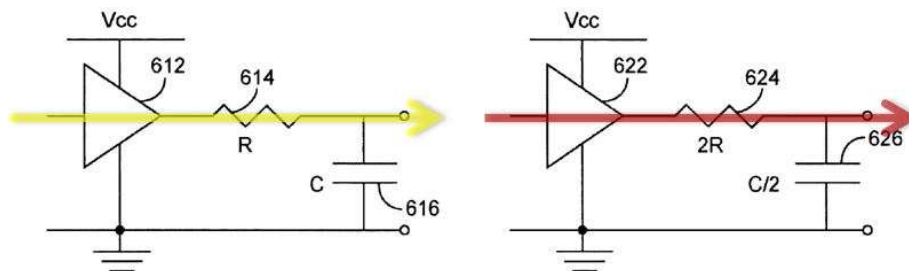
The dispositive distinction here—between the wholesale filter swap and signal path re-routing of the cited *Behbahani* papers, and the dynamic impedance adjustments *in the signal path* that are claimed in the ’330 Patent—was understood by Theta and was also explained in Professor Tsivdis’ own 2003 article. EX2020, ¶¶64-72; EX1011, 8 (“*switching individual filter elements* rather than entire filters”), 9 (“use a single filter and *vary its structure dynamically*” and “dynamic impedance scaling (*Figure 12*)”), Fig. 12 (“An active RC circuit in which dynamic impedance scaling can be performed”).¹ That article was published in 2003 and was also disclosed to the Patent Office with the ’330 Patent application. EX1002, 62.

¹ All *bold italic* emphasis herein added.

In Figure 12 of Professor Tsividis' 2003 article as shown below, for example, impedance R that is “in the signal path” can be dynamically changed to $R/2$ by adding in a second parallel R to the existing signal path. EX2020, ¶168; EX1011, Fig. 12 (annotated to show signal path before the R to $R/2$ change in yellow, and after in red):

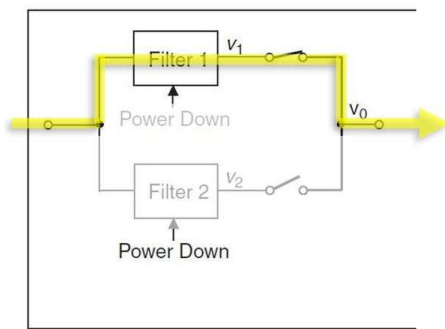


This is also what Professor Tsividis showed in the example dynamic impedance change of Figure 6 of the '330 Patent—where load impedance R that is “in the signal path” can be dynamically changed to $2R$ by increasing its value. EX2020, ¶47; EX1001, Fig. 6 (annotated to show signal path before the R to $2R$ change in yellow, and after in red).

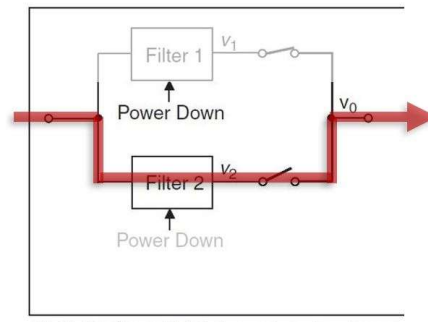


In these examples, the signal path does not change, and no circuit needs to be swapped in or out of operation. Rather “an impedance” R that is already “in the

signal path” is dynamically changed in value—to $R/2$ or to $2R$. This is different from the swap approach in the *Behbahani* papers or in Figure 11 of Professor Tsividis’ 2003 article—where initially Filter 1 is in the signal path and Filter 2 is off, and then the signal path is re-routed, and Filter 2 is switched on while Filter 1 is switched off. EX2020, ¶¶67; EX1011, Fig. 11 (annotated to show signal path before filter swap in yellow, and after in red):



11. Method to switch between two signal processes



11. Method to switch between two signal processes

This distinction—between the wholesale filter swap and signal path re-routing of the cited *Behbahani* papers, and “dynamically changing” “*an* impedance *in* the signal path”—was taught and disclosed by Professor Tsividis, considered, and understood decades ago. It is, unsurprisingly, also reflected in, and understood by a person of ordinary skill in the art from, the plain claim language. *See, e.g.*, EX1001, Claim 1 (“reducing a switching current *in* the signal path by dynamically changing *an* impedance of a component *in* the signal path”); EX2020, ¶¶66-72.

The Examiner reviewed the *Behbahani* papers and Professor Tsividis’ 2003 article in December 2004. EX1002, 335. The Office then issued the claims of the

'330 Patent, and later Theta obtained seven further patents with claims based from the same specification. Discovering years later that the industry was using its inventions without license, Theta asserted several of the Tsivdis Patents against infringement by Samsung—eventually reaching a courthouse-steps settlement without any IPR being filed. And then Theta asserted several of the Tsivdis Patents against infringement by Lenovo and its subsidiary Motorola Mobility—opposing and defeating three IPRs without a single claim being amended or invalidated. EX2007, EX2008, EX2022, EX2023. Now Apple has filed defective follow-on Petitions, going back to references already disclosed, and already distinguished, by Theta and Professor Tsivdis decades ago.

Indeed, this is the second time that an IPR brought against the '330 Patent has turned on the “dynamically changing” “an impedance in the signal path” language of the claims. In Lenovo’s failed IPR2023-00694, a Board panel found an alleged impedance change to be outside of the signal path. *See, e.g.*, EX2007; EX2008, Decision Denying Rehearing, 2, 8-9:

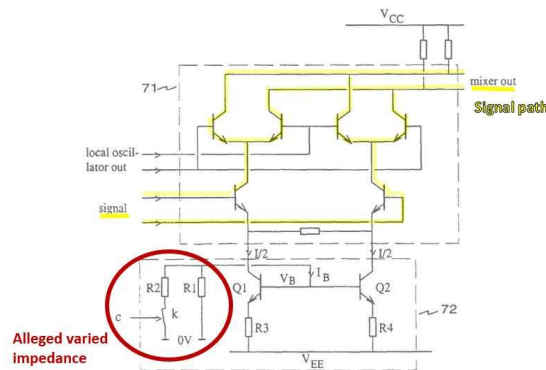


Fig. 7

The Board also denied Lenovo’s attempts to draw a larger box around the disclosed circuit seeking to encompass the claim language. *See, e.g., id.*, 9-10.

Here, the plain claim language requires that “*an* impedance” be dynamically changed, and that individual changed impedance be “*in* the signal path.” Neither of these conditions are met by the cited filter swap of the *Behbahani* papers. The impedance and bias parameters of each filter do not change by virtue of the swap. EX2020, ¶¶57-63, 76-80. And neither filter is “in the signal path” throughout the swap. *Id.*, ¶¶71, 74-75.

In Theta’s Preliminary response and here, Professor Larson offered the analogy of a light socket, comparing a swap of a 25W light bulb for a 100W light bulb, with instead using a single dimmable bulb in the socket. Only the latter meets a requirement that a brightness of *a* bulb *in* the socket change—even though in both cases the overall brightness of the room may change. *Id.*, ¶78.

It may also be helpful to imagine two alternative statements about a hypothetical Board panel determination:

- 1) “That outcome requires changing the opinion of the panel.”
- 2) “That outcome requires changing an opinion of a judge on the panel.”

At first glance, these may seem to be equivalent statements—until one considers the possibility of swapping a judge on the panel for one who was not originally on the panel. In the case of the swap, neither the opinion of the outgoing judge, nor the opinion of the incoming judge, need *change*. The overall opinion of the panel could change by virtue of the swap, without anyone changing their mind. The second statement is therefore different in scope, as it plainly requires “*an* opinion” of a judge already “*on* the panel” to change. Similarly here, the claims require “*an* impedance” of a component remaining “*in* the signal path” to change.

In the discussion of the *Behbahani* papers, no individual impedance changes by virtue of the disclosed filter swap. EX2020, ¶¶57-63, 76-80. One static impedance has been swapped for another by re-routing the signal path. *Id.*, ¶¶58-63, 67, 71, 75, 82-83; EX2021 (Abidi Depo.), 70:9-23, 77:17-24. But the claims at their broadest require “*an* impedance” that is already “*in* the signal path” to change—to be “dynamically adjusted.” EX1001, Claim 23 (“*an* impedance *in* the signal path is configured to be dynamically adjusted”), Claim 1 (“dynamically changing *an* impedance of a component *in* the signal path”), Claim 29 (“*an*

impedance *in* the second circuit is configured to be dynamically adjusted” where “the signal path” includes the second circuit); *see also id.*, Claim 10 (“dynamically changing *a* bias current *in* the signal path”), Claim 26 (“*a* bias current *in* the signal path is configured to be dynamically adjusted”). The swap approach of the *Behbahani* papers just does not meet this requirement.

The Board’s institution decision correctly apprehended the core dispute in these proceedings, but did not fully credit the distinction that arises from applying the claim language to the filter swap that the *Behbahani* papers are purported to disclose. Theta has attempted to further clarify this distinction herein. Each claim requires a dynamic change to “*an* impedance [] *in* the signal path” or “*a* bias current *in* the signal path.” EX1001. This claim language is not met by, or obvious from, the disclosed filter swap—in which no particular impedance changes and only the signal path is re-routed.

The Board’s institution decision instead discussed something broader: an increase to “*the* impedance in the receiver,” “*the* impedance in the device,” or “*the overall* impedance.” Paper 12 at 41-42. But just as a panel opinion can change—via reconstitution—without any particular panel members’ opinion changing, the overall impedance of the receiver can change without any particular impedance within it dynamically changing. It is possible to change the overall impedance without changing “*an* impedance” already “*in* the signal path.”

This does not mean that the claims need be limited to “only one possible path” through the device, and Theta did and does not suggest that they are. *See* Paper 12, Institution Decision, 43-44. Signals may be and are re-routed, without implicating these claims. But the change required by the claim language is a dynamic change to “*an* impedance *in* the signal path,” not a change produced by reconstituting the path. The *Behbahani* approach of re-routing the signal path would not infringe, and does not teach, these claims. As explained further below, an ordinary artisan applying these claims would understand the distinction here. EX2020, ¶¶58, 62, 70-71, 74-77, 85.

Apple’s and Professor Abidi’s allegations about the *Behbahani* papers fall clearly outside the challenged claim language. This should not come as a surprise because Theta and Professor Tsivdis—*knowing about and disclosing the Behbahani papers to the Office more than twenty years ago*—chose this claim language in part to make this very distinction, between what was new and claimed, and what was known and already disclosed by others. Shortly before filing the application that led to the ’330 Patent, Professor Tsivdis wrote publicly about these new techniques under investigation. EX1011, 71-72:

It may also be possible to *use a single filter and vary its structure dynamically*, using techniques related to the ones discussed. This approach has not been investigated to any extent yet.

The Examiner reviewed, and presumptively understood, the *Behbahani* papers,

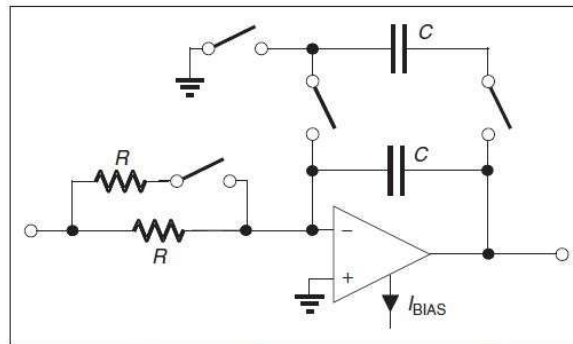
Professor Tsividis' 2003 article, and the claims that were subsequently allowed.

And as shown further below, this claim language can make the distinction over the *Behbahani* papers approach without relying solely on line-drawing around a component, a circuit, a function block, a bigger functional block, or even the whole receiver. At whatever granularity the system is viewed, re-routing the signal path to experience a new overall impedance doesn't alter "an [individual] impedance" that was in the original path. Even in the larger "filter functional block" that Professor Abidi draws around the two swapped low-pass filters, he agrees that the alleged impedance change occurs by changing the signal path—so that the signal is "traveling through different components"—rather than by changing the particular impedances of the components traveled through. EX2021, 67:25-69:18, 73:16-74:17, 77:17-24. Professor Abidi chose to re-route the signal path, for his students' work as described in the *Behbahani* papers. *Id.*, 72:8-74:17. Professor Tsividis instead invented systems and methods for, and claimed dynamically changing something already "in the signal path."

And again, Professor Tsividis' contemporaneous publishing—also disclosed to the Office more than twenty years ago—illustrates the distinction as well. EX1011, 8-9, Fig 12, 9-10:

Individual element switching: One can diminish the delay involved above by *switching individual filter elements rather than entire filters*.

An example is shown in Figure 12. ...



12. An active RC circuit in which dynamic impedance scaling can be performed without causing output transients.

... It may also be possible to ***use a single filter and vary its structure dynamically***, using techniques related to the ones discussed. This approach has not been investigated to any extent yet.

As shown herein, Apple’s sole Ground—relying only on alleged explicit teaching for the elements discussed herein—fails to properly apply, or to show any prior art teaching of, key elements common to all challenged claims.

For example, Apple fails to relate the complete filter circuit swap—that it identifies in the *Behbahani* papers—to the specific claim language requiring, *e.g.*, “dynamically changing an impedance of a component in the signal path.” EX1001, 12:65-67 (Claim 1). This is because the identified complete filter circuit swap doesn’t do that. EX2020, ¶¶62, 71, 76, 79-80. The *Behbahani* papers do not disclose or suggest the claimed dynamic impedance variation of any individual impedance, component, or circuit that is in the signal path. As further detailed below, changing the signal path to “experience” a different, unchanged filter does

not change “*an* impedance” remaining “*in* the signal path” “during operation.” Both filters in Professor Abidi’s approach remain static. Professor Abidi’s approach is like swapping a bulb with a less bright bulb, while these claims require an admittedly different approach like a dimmable bulb. *See* EX2021, 74:18-76:15.

Apple points to Professor Tsividis’ 2003 article discussing *Behbahani*’s approach. Petition, 36-39. But Apple omits the part of the article where Professor Tsividis notes problems with, and teaches improvements to, the *Behbahani* filter swap solution. *Id.*; EX1011, 8 (“switching individual filter elements *rather than entire filters*”), 9. And Apple omits the forward-looking discussion at the end of the article wherein Professor Tsividis discusses a new, not yet fully investigated approach—that was disclosed, discussed, and claimed in the ’330 Patent. *Id.*, 9-10 (“*use a single filter and vary its structure dynamically*”), Figure 12.

As detailed in Theta’s Preliminary Response, this Petition is merely a follow-on to failed efforts to invalidate the Tsividis Patents by Samsung (in district court litigations) and Lenovo (before the Board). Apple self-describes its challenge as trying to correct a gap in the prior art that has “plagued prior invalidity challenges.” Petition, 36. But using prior challenges as a roadmap, as Apple does here, is an inefficient and unfair use of the Board’s resources.²

² The Board has already written four opinions finding lack of merit in challenges to

And Apple brings nothing new, citing references that Professor Tsividis himself told the Office about twenty years ago. EX1002, 62 (*citing Behbahani and Tan*); EX1001, 2 (same). The Petition is cumulative of the Examiner’s original review during prosecution.

Apple fails its burden to support its allegations concerning each challenged claim, including because it fails to properly apply or address the implications of the “in the signal path” language of the claims—on which the Board denied the prior IPR. As further discussed above and in Sections III.A through .C below, the required dynamic adjustments during operation to “an impedance” or “a bias current” “in the signal path” are neither disclosed nor rendered obvious by the discussion of wholesale filter substitution in the *Behbahani* papers. *Behbahani*’s filter swap is not the solution taught or claimed in the ’330 Patent, as further explained below. EX2020, ¶¶40-48, 57-63, 70-71, 73-85. Apple’s entire Petition fails on this point alone.

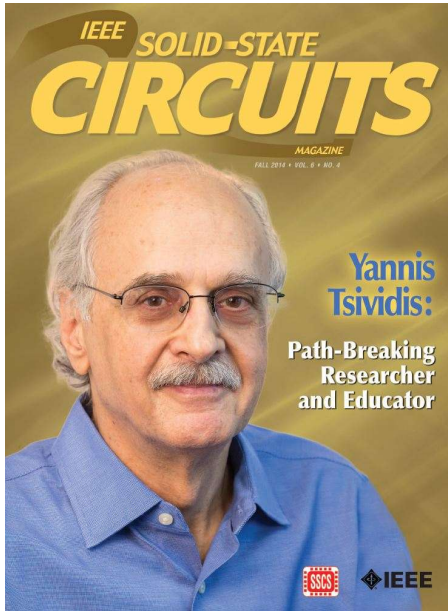
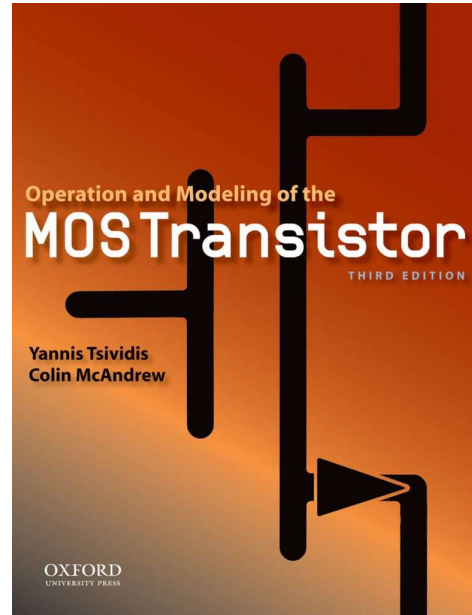
the ’330 Patent and to the related ’825 and ’202 Patents. *See, e.g.*, EX2007; EX2008, Decision Denying Rehearing, 14-15. The Board denied institution of a challenge to ’330 Patent claims because it failed to show change to an impedance in the signal path. *Id.*, 9, 15. The Board also held a trial on the ’825 and ’202 Patents, upholding all challenged claims in Final Written Decisions. EX2022, EX2023.

And Apple has failed to show other claim elements as well. For example, the cursory discussion of test points for sensing signals in *Behbahani* does not teach or render obvious specific challenged claim elements requiring, *e.g.*, a “signal strength indicator circuit” that is “configured to determine a first signal strength.” Professor Abidi and his students didn’t include measurement circuits for this purpose in their design. EX2021, 91:20-92:9, 94:3-18. And they didn’t discuss specifics in their papers. *Id.* (“...they’re not discussed in the papers either though; right? A. Correct. Correct.”).

For all of these reasons, as explained more fully below, Apple has failed to meet its burden. The Board should uphold the challenged claims.

II. Overview, History, and Construction of the ’330 Patent

The inventor of the ’330 Patent, Yannis Tsividis, is the Edwin Howard Armstrong Professor of Electrical Engineering at Columbia University in New York City. He has taught circuits and devices for over 45 years, is beloved by his students, and has written or edited multiple widely-used textbooks on devices and circuits. Not only is Dr. Tsividis a prolific inventor and life fellow of the IEEE, but in 2014, the IEEE publication Solid State Circuits devoted an entire Special Edition of its magazine to him. EX2002.



The '330 Patent is the first in a series of patents that teach and claim foundational inventions for controlling high-power analog circuits in radio frequency (RF) transceivers used in every cell phone. The patents' chief purpose and benefit is power savings, enabling the longer battery life that smartphone consumers demand.

Intelligent circuit design for power conservation was and remains a vital issue in the mobile communications industry—about which Professor Tsividis has published and taught many times throughout his distinguished career, and throughout the life of the patents. *See, e.g.*, EX2003; EX2004 (Tsividis, Y., “Signal-to-Noise Ratio, Dynamic Range, and Power Dissipation,” IEEE Solid State Circuits Magazine, Fall 2018):

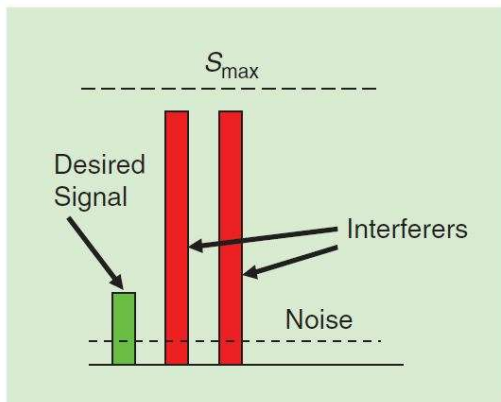


FIGURE 18: The worst-case scenario: minimum desired signal with maximum interference.

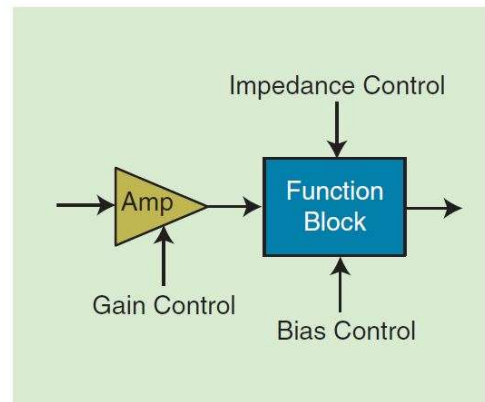


FIGURE 11: The three adaptive power strategies: adaptive gain, adaptive bias, and adaptive impedance.

The '330 Patent application first taught and claimed these power-saving circuit design techniques more than twenty years ago—demonstrating multiple ways that circuits could adapt to desired signal and interferer signal conditions to save power. For example, and relevant to the challenged claims of the '330 Patent, circuit designers could use impedance variation to dynamically vary drive currents in an RF receiver system. EX1001, 7:44-67, Fig. 6. The specification also discusses—and other claims address—separate dynamic controls for bias currents (*id.*, 7:24-43, Fig. 5), and for gain of amplifier circuits (*id.*, 8:1-16, Fig. 7). *See also id.*, Figs. 2B, 8A:

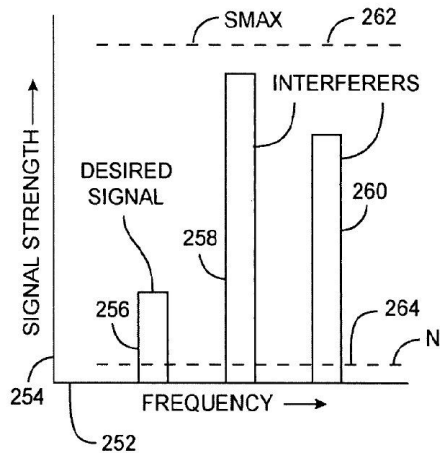
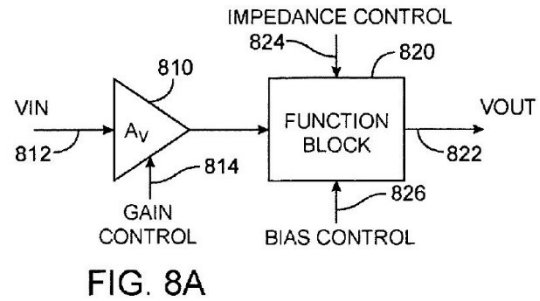


FIG. 8A

The '330 Patent taught that by dynamically adjusting one or more of these variables for a function block in response to determined signal conditions, circuit designers can “reduce power dissipation in response to better-than-worst case conditions.” *Id.*, 1:55-58. And it taught many specific approaches to doing so, based on variations in possible signal conditions. *See, e.g., id.*, 9:42-59, Figs. 9B & 9C (demonstrating a signal spectrum where impedance varying to raise the noise floor N can save power):

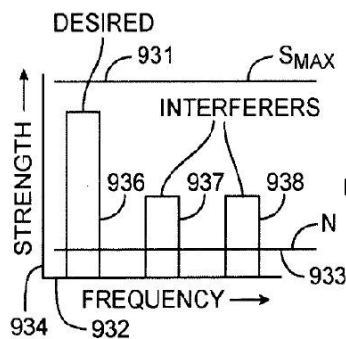


FIG. 9B

INCREASE
IMPEDANCE

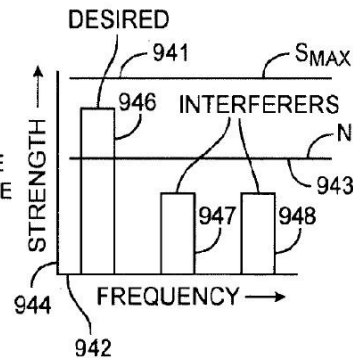


FIG. 9C

The application and specification that led to issuance of the '330 Patent also led to seven additional patents. Moreover, the '330 Patent has been widely cited by the industry and by Examiners during the prosecution of other patents, including those of Qualcomm, Samsung, Intel, Marvell, Ericsson, Matsushita, and others. For example, Qualcomm, itself a pioneer in RF circuits for wireless, has been forced by patent Examiners in the USPTO and Europe to cite to and even quote Professor Tsividis' foundational '330 Patent in its own applications. *See, e.g.*, EP2151924B1 at [0004]; EP2018705B1 at [0005]; U.S. Patent No. 8,781,426.

Patents in this family were the subject of two district court litigations against Samsung, leading to a courthouse-steps settlement within hours of the start of a jury trial. Notably, Samsung—the most prolific filer of IPRs since the proceeding was created—never filed IPRs against the Tsividis patents.³ Samsung's challenges to validity in district courts, which included *Behbahani*, proved unsuccessful before it settled with Theta.

The '330 Patent and others were also asserted in district court litigation against Lenovo and its Motorola subsidiary, who did file IPRs. The Board denied

³ According to the Lex Machina database as queried on August 8, 2024, Samsung and related entities were a Petitioner on at least 1,012 (or 6.3%) of the 16,176 *Inter Partes* Review petitions then filed.

institution—for lack of merit—of Lenovo’s Petition challenging the ’330 Patent. EX2007, 20 (“Petitioner fails to demonstrate sufficiently that *Rauhala* meets the limitation in claim 1 requiring ‘dynamically changing an impedance of a component in the signal path’”); *see also* EX2008 (“for those claims that, ... require changing an *impedance* of circuits in the signal path (*see* claim 8 in IPR2023-00697 and claims 7 and 19 in IPR2023-00698), we concluded, as here and in our Decision, that Petitioner’s challenge based on *Rauhala* fails to meet the test for institution”).

As industry participants, litigants, Examiners, and the Board have acknowledged, the ’330 Patent and its family made important, valuable contributions to the public knowledge—just as Professor Tsivdis has always been known for doing in his distinguished teaching and professional career. EX2002.

In short, Professor Tsivdis’ foundational teaching patents here are nothing like the proverbial “bad patents” for which Congress responded to industry pressure and created the *Inter Partes* Review procedure. There are no flaws in the Tsivdis patents’ lengthy and continued prosecution by Office Examiners, and nothing wrong with their claim scope. The inventions therein are novel, were not obvious to persons of ordinary skill—and offer valuable contributions not previously disclosed in the art.

Against this background establishing the foundational importance and non-obviousness of the inventions in Professor Tsivdis’ patents here, Apple brings

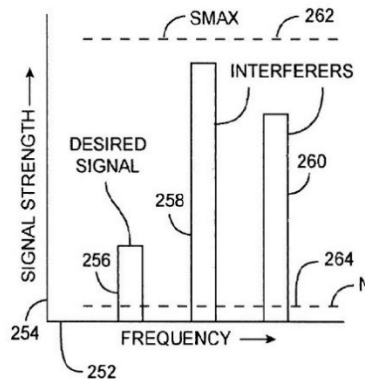
references that were first shown to the Patent Office by Professor Tsividis himself—with his original application twenty years ago. EX1002, 62 (citing *Behbahani* and *Tan*); EX1001, 2 (same). Apple adds nothing with its misguided attempt to improve upon past challenges and undo the Office’s detailed examination and issuance of this patent family. Apple’s Petition fails to meet its burden and should be dismissed.

A. The ’330 Patent

The ’330 Patent was first in a series of patents that disclose and claim Professor Tsividis’ inventive systems and techniques for optimizing mobile wireless device power consumption—and thus battery life. *See, e.g.*, EX1001 (“’330 Patent”), Abstract, 1:52-58. In the early days of mobile communications, receivers were designed to operate in the worst-case conditions to ensure that connectivity was available to the greatest extent possible. This meant that devices operated at a high power level all the time, quickly draining the battery. *Id.*, 1:31-37.

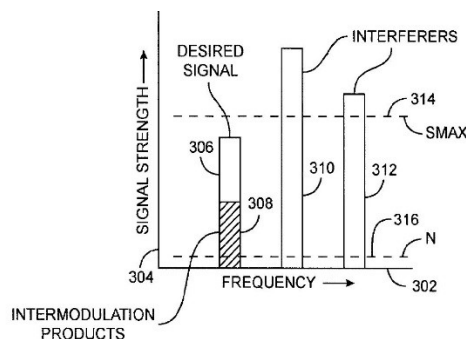
Professor Tsividis invented systems and methods that optimized battery life by making various adjustments to components in a receiver based on determining signal strength—or the relationships between the strength of desired signal (such as the signal carrying voice data) and the strength of interferer signals (originating from other wireless devices or electronic equipment, for example)—to achieve

power savings. *Id.*, 2:11-15, 5:17-27, 5:51-52, Figs. 2A & 2B (showing example desired signal and interferer signal spectrum):



B. The '330 Patent Specification

The '330 Patent specification explained and showed examples of when to employ the various power saving circuit techniques, based on different signal spectra being determined to be better than a worst-case condition. *Id.*, 1:55-64, 8:46-10:56. A worst-case condition occurs when a low desired signal is accompanied by high interferer signals—and can result in unacceptable levels of distortion, *e.g.*, intermodulation products, if the maximum signal handling capability is not kept sufficiently high. *See, e.g., id.*, 6:28-46, Fig 3:



The '330 Patent describes three different adjustments, or “degrees of freedom” that can be dynamically optimized to reduce power in response to the various ways signal conditions can improve over a worst case. Specifically, the patent discusses dynamic changes to bias currents, circuit impedances, and gain. *See, e.g., id.*, Abstract (“Embodiments of the present invention use bias current reduction, impedance scaling, and gain changes either separately or in combination to reduce power dissipation.”), 1:55-64, Fig. 9A:

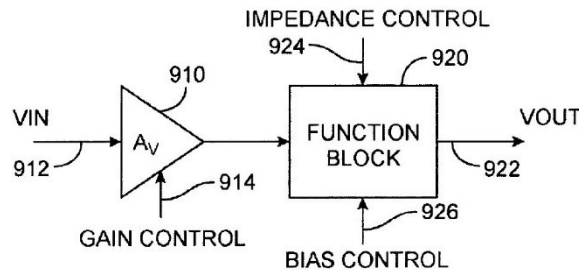
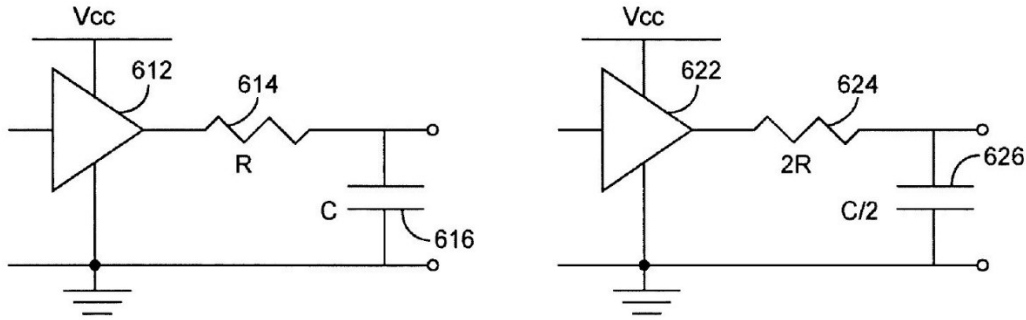


FIG. 9A

For example, the specification discusses circumstances calling for changes to bias currents, and techniques for doing so. *Id.*, 7:24-43, Fig. 5. For example, a bias current might be changed by increasing a resistance “by opening switches across portions of the resistance.” *Id.*, 7:36-41.

Alternatively, and in contrast, “a circuit’s impedances may be scaled to reduce drive currents” or even associated bias currents. *Id.*, 7:44-59, Fig 6. A basic example of this, with a common RC impedance load on a driver, is shown in Figure 6:



In this figure, the driver load impedance from R and C is changed to impedance from 2R and C/2, such that: “the impedance of the load seen by driver 622 is double that seen by 612, thus the output current required by the driver 622 is reduced by one-half.” *Id.*, 7:47-55.

The '330 Patent also discusses and gives examples of gain adjustment. *See, e.g., id.*, 8:1-15, Fig. 7. It then goes on to discuss that: “These variables, or degrees of freedom, specifically reducing bias currents, increasing impedances, and increasing gain may be used as in the following examples.” *Id.*, 8:17-19. A lengthy discussion follows, providing particular examples of signal spectra and corresponding adjustments that can advantageously be made. *See id.*, Figs. 8A & 8B, 9A & 9B, 10A & 10B, 11A & 11B, 12, and corresponding text discussions:

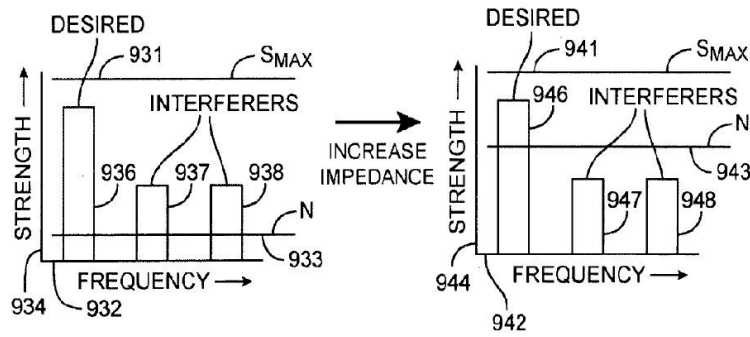


FIG. 9B

FIG. 9C

See also *id.*, 3:30-46 (“FIGS. 9A-9C illustrate one of the possible power saving techniques that may be used when a received desired signal is strong while all interfering signals are at a low power level.”), Fig. 9A, 9:42-49:

Accordingly, one or more impedance[s] in the function block 920 may be increased, such that the noise floor 943 rises as shown in FIG. 9C. In this way one or more [of] the driving currents in the function block 920 may be reduced.

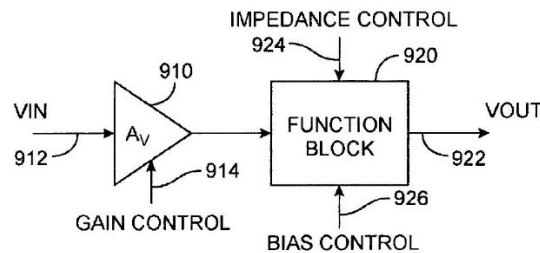


FIG. 9A

Again, the adjustments made to circuits in the claimed inventions are dynamic, based on monitoring the interferer signal levels and desired signal levels to optimize the changes in gain, bias, and impedance of the circuit components.

The '330 Patent also teaches specific examples and techniques for locations within receiver circuits at which the beneficial power-saving dynamic adjustments can be performed. *See, e.g., id.*, 11:61-64 (low noise amplifier (LNA) adjustments), 11:65-12:2 (mixer), 12:3-15 (voltage controlled oscillator (VCO) adjustments).

In keeping with Professor Tsividis' long teaching career, the specification of the '330 Patent explains the embodiments of the disclosed and claimed inventions in clear detail and with examples much like those in his textbooks, magazine articles, and teaching slides. *See, e.g.,* EX2003; EX2004, Figs. 11, 18. As described above, the industry has shown continued interest in these techniques even decades after their invention by Professor Tsividis. For example, in Fall of 2018, he provided an article to the IEEE Solid-State Circuits magazine teaching many of these power-saving techniques. EX2004.

In Figure 18 of the 2018 article, there is an example showing a combination of both impedance scaling (multiplying RC impedance by n via nR_x combined with C/n), and also bias current scaling (dividing I_{bias} by n):

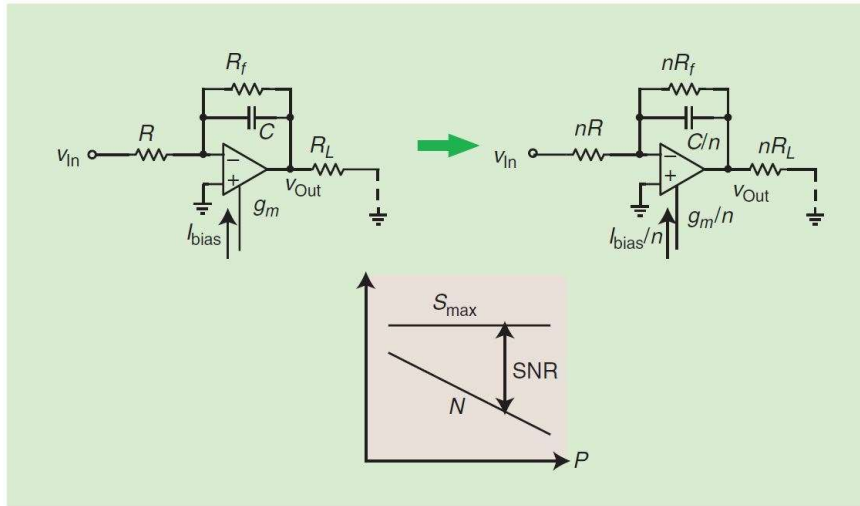
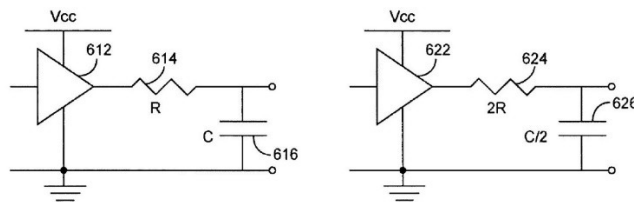


FIGURE 16: Bias-impedance scaling for an active RC circuit.

This example is similar to the impedance scaling described in the '330 Patent, Figure 6, where the scaling factor “n”—by which the resistor (“R”) and capacitor (“C”) components of the circuits are dynamically changed—is equal to 2. EX1001, Fig. 6 (circuit before and after scaling):



In Figure 23 of the 2018 article, the effect of a combination of bias and impedance adjustments is shown: lowering maximum signal handling capability and raising the noise floor, respectively, with creation of some intermodulation products. EX2004, Figure 23:

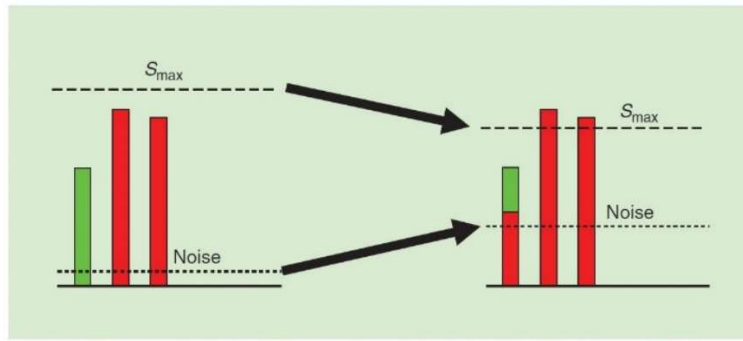
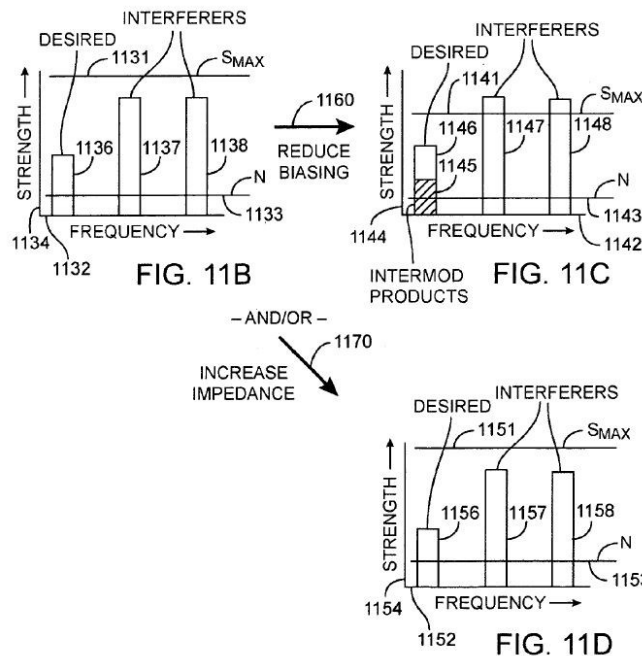


FIGURE 23: Power adaptation in the case of a medium desired signal and large interference.

The same combination of dynamic adjustments to impedance and to bias current as in Figure 23 above was also discussed by Professor Tsividis more than fifteen years prior, in the specification of the '330 patent. EX1001, 10:27-56, Figs. 11B, 11C, & 11D:



The '330 Patent discloses that decreases in bias current can be used to lower the maximum signal handling capability. *See, e.g., id.*, 9:5-7. The '330 Patent also discloses that the noise floor can be “increased by increasing impedances in the

function block,” which also “reduces the required drive current.” *See, e.g., id.*, 10:15-18.

The fact that the IEEE remained interested in publishing Professor Tsividis’ innovative approaches for dynamic circuit adjustments for power savings, even in the Fall of 2018, is one of the many indicators of the non-obviousness of the inventions also taught and claimed in the ’330 Patent. Others are mentioned above. The ’330 Patent was groundbreaking and foundational, and the inventions taught and claimed therein are still used throughout the mobile communications industry.

C. The ’330 Patent Prosecution History

The application that issued as the ’330 Patent was filed on February 23, 2004 and claims priority to two provisional applications filed on March 1, 2003 (App. Nos. 60/451,229 and 60/451,230).

The pending claims were initially rejected as obvious over a combination that included the *Clark* reference (U.S. Patent No. 5,001,776). EX1002, 286. *Clark* did not explicitly or inherently disclose “dynamically changing an impedance” of a “component in the signal path.” *Id.*, 286-287. Instead, the Examiner asserted obviousness based on disclosure of varying an injection voltage and “the current consumption of the mixer 110.” *Id.*, 286 (citing *Clark*, 2:34-4:66); EX2009 (*Clark*), 3:62-4:3.

Applicant responded to this rejection in two ways. First, rejected independent claims 1 and 23 were amended to clarify that the dynamic impedance adjustment would be to “reduce a switching current.” EX1002, 302, 305. Second, applicant argued that the identified disclosures of *Clark* only taught changing a “bias current,” which was understood to be different than a switching or drive current. *Id.*, 308:

A bias current is not the same as a switching current. One skilled [in] the art understands that a bias current is a DC or quiescent current, while a switching current is a dynamic or transient current that occurs during voltage transitions. (See for example, the pending application, Figure 6 and related discussion.)

See also EX1001, 7:44-59 (“In this way, an impedance can be scaled in order to decrease a circuit’s required drive current.”), Fig. 6.

The Examiner then reversed the prior obviousness rejection and allowed the claims based on Applicant’s amendments and arguments. EX1002, 330-331. The Examiner recognized that *Clark*’s disclosure of modifying a DC or quiescent current did not disclose or render obvious “reducing a switching current by dynamically changing an impedance.” *Id.*, 331.

Behbahani, Tan, and Professor Tsividis’ 2003 article were before, and were reviewed by, the Examiner. EX1002, 335. As the Examiner presumptively recognized, and as shown below, the *Behbahani* papers fail to show or suggest

dynamic adjustment of circuit components in the signal path as claimed in the '330 Patent. They instead employ the inferior solution of re-routing the signal path to a different static circuit. EX1011, 8 (noting problems of “output transients” and “loss of data,” and suggesting improvement to *Behbahani*’s approach “by switching individual filter elements rather than entire filters”); EX2020, ¶¶67-70, 75-76; EX2021, 71:15-74:17 (“what we have chosen to do is ... substitute a bigger transconductor for a smaller one”). As the Examiner presumptively understood, neither of *Behbahani*’s alternative fixed filter transconductors is ever altered while in the signal path or dynamically changed per the claims. EX2020, ¶¶61-62, 81-83; EX2021, 67:25-69:5.

D. The '330 Patent Prior IPR

Lenovo and Motorola’s failed IPR2023-00684, challenging claims 1, 23, 29, and 30, is now also part of the prosecution history of the '330 Patent. That proceeding, along with IPR2023-00697 challenging claims of the '825 Patent, and IPR2023-00698 challenging claims of the '202 Patent—was based primarily on a prior art reference known as *Rauhala*, which was alleged to have disclosed the “dynamically changing/adjusting” “an impedance” “in the signal path” elements of the claims. *See, e.g.*, EX2007, Decision Denying Institution, 12-14.

Rauhala disclosed, *e.g.*, a mixer circuit in which an impedance, composed of a combination of resistors selected from among R1 and R2, could be varied to adjust

a DC bias current. *Id.*, 19-20. Theta pointed out, including with annotations to the circuit diagram supported by testimony from Professor Larson, that this change to “an impedance” was not “in the signal path.” *Id.* (showing annotated Fig. 7 from *Rauhala*):

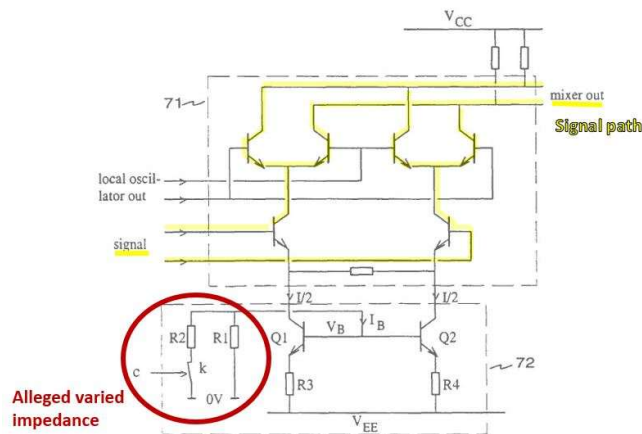


Fig. 7

In denying institution of the '330 Patent challenge, the Board agreed with Theta's understanding of the disclosed circuits and agreed that they did not teach or suggest changing “an impedance” that is “in the signal path” according to each variation of that language in independent claims 1, 23, or 29. *Id.*, 19-21.

Lenovo sought rehearing of this result, which the Board denied. EX2008. In doing so, Lenovo argued that **all** of the circuit shown in *Rauhala* Figure 7 was part of a larger functional block, namely “mixer” M1 or M2 of high-level block diagram Figure 2. *Id.*, 5, 10; *see also* EX2024, Rehearing Request, 4-5 (circling M1 and M2 in Fig. 2 and drawing box around all of Fig. 7). The Board correctly declined to erase the disclosed and understood distinction it had found between the “separate

components” described in *Rauhala*, by abstracting to a higher-level block diagram symbol or a more generalized description of the signal path. EX2008, 10, 12-13.

In short, Lenovo’s attempt on rehearing to replace Theta’s circuit analysis with a general reference to a “mixer” functional block, did not change the fact that the *Rauhala* reference failed to teach changing “an impedance” that was “in the signal path.” Here, Apple’s similar attempt to abstract to a high-level “filter functional block” with multiple internal impedances does not change the fact that the *Behbahani* papers do not disclose changing any one impedance that was “in the signal path.” See, e.g., EX2020, ¶¶81-85; EX2021, 70:9-23, 76:16-77:24.

The Board’s prior rehearing denial went on to note that its analysis—rejecting challenges based on *Rauhala* for failure to teach changing “an impedance” “in the signal path”—also applied to claims that require changing an impedance of circuits in the signal path in the ’825 Patent and the ’202 Patent. EX2008, 14-15.

The Board’s prior analysis and determinations concerning the Tsvidis Patents in IPR2023-00694 are relevant to Apple’s challenges in multiple ways. Most significantly, they confirm that the language requiring dynamic change during operation to “*an* impedance” that is “*in* the signal path” are meaningful, differentiating elements of these claims. This language is available and useful to distinguish alleged disclosure or suggestion of references that do not meet the challenged claims.

E. The '330 Patent Challenged Claims

Apple challenges eighteen claims of the '330 Patent here. Each of the five challenged independent claims contains elements requiring a dynamic change to “*an* impedance” (claims 1, 23, 29) or “*a* bias current” (claims 10, 26)—that is “*in* the signal path,” or is in the claimed “second circuit,” which is in the signal path (claim 29). EX1001, 12:57-67 (claim 1), 13:23-36 (claim 10), 14:15-28 (claim 23), 14:50-67 (claim 26), 15:21-16:12 (claim 29).

For example, challenged independent method claim 1 recites:

1. A method of receiving a signal using an integrated circuit, the integrated circuit comprising a signal path including a low-noise amplifier configured to receive the signal, a mixer having an input coupled to an output of the low-noise amplifier, and a low-pass filter having an input coupled to an output of the mixer, the method comprising:

determining a first signal strength at a first node in the signal path in the integrated circuit; and

reducing a switching current in the signal path by dynamically changing an impedance of a component in the signal path based on the first signal strength.

Similarly, challenged independent system claim 23 recites:

23. A wireless transceiver integrated circuit comprising:
a receiver comprising a signal path, the signal path comprising:
a low-noise amplifier;
a mixer having an input coupled to an output of the low-noise amplifier; and
a low-pass filter having an input coupled to an output of the mixer, and
a first signal strength indicator circuit coupled to the signal path, and configured to determine a first signal strength;
wherein *an impedance in the signal path is configured to be dynamically adjusted to reduce a switching current* in response to the first signal strength.

Challenged independent system claim 29 also requires “an impedance” in a second circuit in the signal path be “configured to be *dynamically adjusted*” in response to a signal strength determination. *Id.*, 15:21-16:12 (“...the *signal path comprising*: ... a second circuit” and “*an impedance* in the second circuit”).

Challenged method claim 10 and system claim 26 require “a *bias current*” rather than an impedance be “*dynamically*” changed, but again require that this is “a bias current *in the signal path.*” *Id.*, 13:23-36, 14:63-67. The Petition relies on the same static filter swap of *Behbahani* for both alleged impedance and alleged

bias current changes (*see* Petition, 51, 57-58, 66)—completely ignoring and vitiating the Tsividis patents’ teaching of these as separate adjustments. *See, e.g.*, EX1001, Abstract, Fig. 11 (“reduce biasing” “and/or” “increase impedance”), 1:55-57, 8:17-19, Fig 9A:

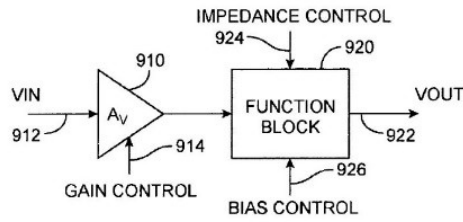


FIG. 9A

As discussed below, *Behbahani*, with or without additional disclosures of *Tan*, does not disclose or suggest these elements, which are included directly or by dependency in every challenged claim. Apple’s Petition relies only on *Behbahani*’s disclosure of re-routing the signal path to completely swap one static filter circuit for another static filter circuit. *See, e.g.*, Petition, 51 (“switching from *Behbahani*’s high-power filter to its low-power filter”). No impedance of either filter, or any component therein, changes. *See, e.g.*, EX2020, ¶79. That is simply *not* dynamically changing an impedance (or bias) in the signal path as required by the claims. EX2020, ¶¶77-80.

Apple’s Petition fails completely on proof with respect to key elements of all independent challenged claims and should be dismissed, with all of the challenged claims upheld.

F. Claim Construction

For purposes of *inter partes* review, disputed claim terms are construed to give them “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *See* 83 Fed. Reg. 51340, 51341 (Oct. 11, 2018) (adopting the standard of *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005)). The proper construction is considered in the context of, and must be consistent with, the specification—and the claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art. *See, e.g., Phillips*, 415 F.3d at 1313.

According to Professor Larson, a person of ordinary skill in the art with respect to the '330 Patent would have at least a Bachelor's Degree in Electrical or Electronics Engineering, along with “approximately five years of relevant experience in the design of transceiver architecture, RF systems and components, and analog and mixed signal circuits, as well as experience in control algorithms for such system and familiarity with wireless standards.” Additional education could substitute for experience and vice versa. EX2020, ¶51.

Claims of the '330 Patent and related patents have been construed multiple times by district courts. *See, e.g.,* EX2014, EX2015 (preliminary constructions).

The claims will be construed in district court again.⁴ This heightens the importance of guidance that the Board should not construe terms beyond what is necessary to make its determinations. *See, e.g., Sandoz Inc. v. Abbvie Biotechnology Ltd.*, No. IPR2017-01987, 2018 WL 1230583, at *5 (P.T.A.B. Mar. 9, 2018) (“[B]ecause neither of those phrases requires construction for us to resolve the instant dispute, we decline to construe them. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (‘only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy’).”).

The challenged independent claims here have specific elements requiring “dynamically” changing “an impedance” or a “bias current” of a component that is “in the signal path.” *See* Section II.E above. It is at least those elements that Apple has failed to show disclosed or taught in the prior art asserted here.

1. “dynamically changing” and “dynamically adjust[ed]”

In Theta’s litigation against Samsung in the Western District of Texas, the

⁴ The district court has yet to hold a *Markman* hearing in Theta’s litigation against Lenovo and Motorola. In Theta’s litigation against Apple, the district court has not scheduled further argument on the *Markman* hearing begun on March 26, 2024. EX2017. It will likely issue an Order adopting the preliminary constructions. EX2015. Trial is currently set in that case for December 8, 2025.

district court found that the “dynamically” varying elements in related Tsivdis Patents should be given their “Plain-and-ordinary-meaning, wherein the plain-and-ordinary meaning is ‘adjusting during operation based—at least in part—on information gained during operation.’” EX2014, 2. As Apple notes, Theta also consistently argued this construction for the ’330 Patent in its litigation against Apple. Petition, 10; EX2015, 2-3. The court issued a preliminary “Plain-and-ordinary meaning” construction there, rejecting Apple’s contrary proposal. EX2015, 2.

Apple adopts Theta’s “adjusting during operation” construction “for purposes of this proceeding” here, even though it had disparaged it, and argued for something else, in district court. Petition, 10; EX2016, 2, 4.

In its Institution Decision, the Board applied the “adjusting during operation based, at least in part, on information gained during operation” construction. Paper 12, 13. Theta agrees, consistent with Theta’s prior assertions, that to the extent that the Board finds that it must interpret the claim terms, this interpretation reflects the plain meaning to one of ordinary skill, and is a proper way to read the “dynamically” claim elements. This interpretation is consistent with Theta’s own prior arguments in *Theta IP, LLC v. Samsung Electronics Co. Ltd.*, No. W-20-CV-00160-ADA (W.D. Tex.), with the court’s construction there (EX2014), with Theta’s arguments in its litigations against Lenovo and Apple, and with the court’s

preliminary construction in *Theta IP, LLC v. Apple Inc.*, No. 6:23-cv-00314-ADA (W.D. Tex.) (EX2015).

Theta preserves its objection that Apple’s adoption of a construction in an IPR that it has disagreed with in district court—without providing any “sufficient basis to support the claim construction it relies on here,” fails to meet the particularity requirements of 37 C.F.R. § 42.104(b)(3) and warrants dismissal of the resulting deficient Petition. *Samsung Elecs. Am., Inc. v. Cobblestone Wireless, LLC*, IPR2024-00319, Paper 16, at 13-23 (P.T.A.B. Jun. 24, 2024) (“Petitioner ... consequently has failed to establish a reasonable likelihood that its unpatentability arguments, which are based on that construction, have merit.”); *see also Hologic, Inc. v. Enzo Life Sciences, Inc.*, IPR2018-00019, Paper 21 at 5-7 (P.T.A.B. Nov. 28, 2018) (“Petitioner does not satisfy Rule 42.104(b)(3)” when it disagrees with its “proffered constructions”); *see also Cambridge Mobile Telematics, Inc. v. Sfara, Inc.*, IPR2024-00952, Paper 12, at 5-9 (P.T.A.B. Dec. 13, 2024) (designated informative, Mar. 20, 2025) (“the Petition should have explained why the plain and ordinary meaning ... should apply in this proceeding (why the inconsistent positions are warranted)”).

Besides being mandated by regulation, requiring Apple to substantiate and support the construction it proposes here is fair, and is consistent with Office policy. *See, e.g.*, 83 Fed. Reg. 51340, 51350 (Oct. 11, 2018) (“prevent parties from taking

inconsistent positions” and “patent challengers will have less flexibility to advance inconsistent arguments about claim scope, and will instead be required to choose a single claim construction”). The alternative—allowing Apple to adopt a broad construction “for purposes of this [invalidity] proceeding” while retaining its inconsistent argument for a narrow construction for non-infringement purposes in district court or on appeal to the Federal Circuit—would be manifestly unfair.

Apple has not abandoned its incorrect district court claim construction position—that it asserted seeking a non-infringement argument there. EX2016, 1 (indicating intent to argue “dynamically” terms at any hearing). Apple also notes here that it disputes the issue. Petition, 9. It has not provided support for either its, or Theta’s, proposed construction here, despite having the burden to do so. Nor has Apple alleged that the claims would be invalid under either construction in the alternative, as was the case in *10X Genomics, Inc. v. Bio-Rad Labs., Inc.*, IPR2020-00086, Paper 8 at 21-22 (Apr. 27, 2020). Apple does not suggest invalidity under its (preliminarily rejected and incorrect) district court proposal.

Here, as in *Hologic*, *Samsung v. Cobblestone*, and *Cambridge Mobile Telematics*, Apple is trying to rely on a construction “for purposes of this proceeding” that it disagrees with in district court—and therefore is unwilling to provide evidence in support of that construction here. Petition, 10; EX2016. Apple hasn’t explained why the inconsistent positions could be warranted. As a matter of

policy, the Board should not countenance a Petitioner’s inconsistent positions. The concern over prejudice and unfairness from inconsistent positions that underlies these cited decisions is not cured by Apple’s willingness to agree with Theta—who has been consistent in both places—here.

Theta acknowledges the Board’s distinction based on the district court having adopted the here-agreed construction (Paper 12, 14). But in the particular circumstances of these proceedings, the district court’s “adoption” was preliminary, and Apple has not renounced continuing to seek to reverse it. For this reason, Theta maintains its objection to Apple’s taking of inconsistent positions, and its disregard for the specificity requirements of the rules for its Petition. 37 C.F.R. § 42.104(b)(3); *Hologic*, IPR2018-00019, Paper 21 at 5-7.

In any event, for purposes of this proceeding, it is undisputed—as Theta has consistently argued—that a dynamic adjustment should be one that is done “during operation” of the circuit or component being adjusted. Paper 12, 13.

2. “switching current”

Independent claims 1 and 23 of the ’330 Patent require that “dynamically changing” or adjusting an impedance results in “reducing a switching current.” EX1001, 12:65-67, 14:26-28. Apple argues, and Theta does not disagree, that a “switching current” in the context of the ’330 Patent refers to an AC current in the signal path. *See, e.g.*, Petition, 4, fn. 3; *see also id.* at 9 (proposing a construction

of a current “that carries a signal through a load”). Claim 1 explicitly requires “reducing a switching current *in the signal path*.” EX1001, 12:65-67. Claim 23 requires that the dynamic change “reduce a switching current,” but the surrounding language, as well as the parties’ agreement about the plain meaning of “switching current,” makes it clear that the switching current must be *in the signal path* for this claim as well. *Id.*, 14:26-28.

Theta does not suggest that this term requires construction, but instead applies it below consistently with this agreed ordinary understanding.

3. “in the signal path”

The Board’s institution decision noted that the signal path terms do not need construction. Paper 12, 12. And indeed, there is nothing confusing about the words or the phrase “in the signal path.” As noted by the Board, and as discussed in Section I above, the parties do dispute the application of this claim language to the disclosures of the *Behbahani* papers. *Id.*

Theta has shown, and Apple and Dr. Abidi have not disputed, that no singular “an impedance” changes by virtue of the cited filter swap. EX2020, ¶¶62, 71, 76-80. In deposition, Dr. Abidi confirmed that he was pointing to the swapping of one transconductance block for another—not a changed impedance in either block. EX2021, 67:5-69:18 (“... We turn it off. We haven’t changed the transconductance of the low-pass filter; right? A. Yes. Okay.”), 70:9-23, 76:16-77:24, 97:5-8 (“Q.

Now, when you say ‘those are the things that change,’ those are the things that change when you swap the two filters; right? A. Yes.”).

But Dr. Abidi’s assertion—that somehow changing *the signal path* such that “*the* [overall] signal path impedance” changes (EX1003, ¶124), or “*the* impedance *experienced by* the signal” changes (EX2021, 70:13-72:7) is “the important thing”—does not comport with the claim language, alone or in context. The claims do not require “the impedance experienced by the signal” to change, but rather “an impedance” of a component or circuit to change while “in the signal path.” Professor Abidi is the one re-interpreting what the claims mean according to his own personal view and his own chosen implementation. *See, e.g.*, EX2021, 72:8-74:17 (“A. *To me, ...*”).

The claims require that “*an* [individual] impedance” or “*an* impedance of *a* component” or “*an* impedance in [a] circuit” change. *See, e.g.*, EX1001, Claim 23, Claim 1, Claim 29. These singular references to “an” individual impedance cannot be read on changes, arising from signal path rerouting, to “the” overall impedance of large blocks containing multiple individual components, circuits, and impedances—none of which experience an impedance change. EX2020, ¶¶76-85.

All challenged claims also require that this change to “*an* impedance” or “*a* bias circuit” occur “dynamically,” which means “during operation.” *See* subsection 1 above. A requirement to change a thing “during operation” is not compatible

with a solution like that of the *Behbahani* papers—which undisputably takes that thing out of operation, to substitute another thing that was originally turned off.

And as discussed above, all challenged claims require that this change be to a thing that is “in the signal path.” A requirement to change a parameter of a thing that is “in the signal path” is not compatible with a solution like that of the *Behbahani* papers— which undisputably takes that thing out of the signal path—without changing it—to substitute in another unchanged thing that began out of the signal path.

Again, as the Board’s institution decision recognized, these are issues not of construction but of *applying* the claim language, in its context, to alleged disclosures. Paper 12, 12. But as detailed herein, Theta disagrees with the Board’s preliminary discussion applying these elements—and accepts the Board’s invitation to explain further. *Id.*, 41-44.

As shown herein, and detailed further below, the claim language *does* define the inventions in a way that distinguishes the filter swap of the *Behbahani* papers from the new approach of the Tsividis Patents—involving dynamic adjustments to individual circuits and components *while they are in the operational signal path*.

Professor Tsividis told the public about this distinction and new approach in his 2003 article. *See, e.g.*, EX1011, 9-10 (“...*use a single filter and vary its structure dynamically*, using techniques related to the ones discussed. This

approach has not been investigated to any extent yet.”). Theta and Professor Tsividis responsibly disclosed the *Behbahani* papers, along with the 2003 article explaining the distinction, to the Examiner’s original review. EX1002, 62, 335.

And Theta and Professor Tsividis claimed the inventions in the ’330 Patent with language that incorporates and embodies this distinction—over the same materials they were disclosing to the Office. *See, e.g.*, EX1001, Claim 1 (“reducing a switching current in the signal path by dynamically changing an impedance of a component in the signal path”).

Professor Tsividis continued his work investigating and teaching new techniques for dynamically adjusting circuits while they remain “in the signal path.” *See, e.g.*, EX1011, 9-10; EX2004, 9 (*citing* EX1001, EX1011, other papers: “However, techniques for applying the discussed techniques even *in the presence of signals*, without causing disturbances at the output, have been developed”). Professor Abidi’s prior work described in the *Behbahani* papers simply does not teach these approaches. EX2021, 75:12-76:15 (“It’s hypothetical and does not serve our purposes.”); EX2020, ¶¶67-72.

III. Petitioner failed to prove that the challenged claims are taught by the *Behbahani* papers

Behbahani—with or without *Tan*, the only references cited to or relied on for alleged teaching of several important elements of each independent challenged

claim—does not disclose or render obvious those elements as claimed. For example, the Petition does not properly interpret, or show teaching or suggestion in the *Behbahani* papers of, dynamically adjusting “an impedance”—or “a bias current”—that is “in the signal path” as required by each independent challenged claim. This gap in Apple’s required proof is fatal to its challenges and all claims should be upheld.

Behbahani, along with the papers that Apple cites to allegedly supply detail of the *Behbahani* system (*e.g.*, *Tan*), fails to disclose or teach the elements requiring, *e.g.*, “dynamically changing an impedance of a component in the signal path”—as in each of the challenged claims of the ’330 Patent. As discussed above, and not disputed by Apple, ***Behbahani instead changes the signal path***, to route signal through a different, static filter circuit. EX2020, ¶¶57-63, 75, 82; EX2021 (Abidi Depo.), 67:5-69:18, 70:9-23, 76:16-77:24, 97:5-8. It is also not disputed that *Behbahani*’s two alternate filters each undergo ***no change in their circuit components or parameters*** via the switch. EX2020, ¶¶62, 71, 76, 79-80; EX2021, 67:5-69:18. *Behbahani*’s solution simply does not match the claim language.

Notably, while Apple’s sole Ground is asserted under section 103, Apple only uses obviousness with respect to combining the multiple *Behbahani* papers—that describe portions of Professor Abidi’s and his students’ “proof of concept” work. EX2021, 17:4-18:15, 20:14-21, 23:25-24:9; Petition, 20-25, 41, 61

(discussing motivation to combine). Apple only uses the word “obvious” twice in its sole Ground, and only with reference to “signal strength indicator circuits.” Petition, 62, 65. Professor Abidi does not use the word “obvious” anywhere in his “Opinions” section. EX1003, ¶¶23-203.

For the dynamically adjusting an impedance—or a bias current—in the signal path elements, Apple relies only on allegations of explicit disclosure and teaching. Petition, 35-36 (“*Behbahani* teaches”), 39-40 (“*Behbahani* teaches” and “*Behbahani* expressly teaches”), 41-43 (“*Tan* describes” and “*Tan*’s teachings confirm”). The Petition does not argue, and Professor Abidi does not opine, that these elements would be obvious to a person of skill in the art from the *Behbahani* papers. For all the reasons discussed herein, they are not disclosed or taught by the *Behbahani* papers either.

Apple has the burden of proof here. 35 U.S.C. §316(e):

In an inter partes review . . . , the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.

Harmonic Inc. v. Avid Tech., Inc., 815 F.3d 1356, 1363 (Fed. Cir. 2016) (“the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable”) (citing 35 U.S.C. §312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports

the grounds for the challenge to each claim”)).

If Apple fails its burden to provide evidence that proves invalidity, it loses, even if Theta were to offer no response beyond identifying that failure. *Apple Inc. v. Zipit Wireless, Inc.*, IPR2021-01124 *et al.*, Paper 14, Decision on Director Review (P.T.A.B. Dec. 21, 2022) (designated precedential: Jan. 4, 2023). Apple must do more than simply raise questions—it must show evidence to support its alleged answer to them. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (“if the fact trier of the issue is left uncertain, the party with the burden loses”). The burden of persuasion never shifts to Theta. *Id.*

As already discussed, and as explained further below, the ’330 Patent teaches and claims an approach based on dynamically changing specific parameters of a component or circuit “during operation” while it is “in the signal path.” *See, e.g.*, EX1001 (claim 1: “dynamically changing an impedance of a component in the signal path”). Apple’s challenge—relying instead on *Behbahani*’s wholesale re-routing of the signal path to use an alternative static filter circuit—is not consistent with the claim language.

Apple ignores and fails to address this distinction, never acknowledging in the Petition that it has reinterpreted “an impedance in the signal path” to mean something it plainly does not—something like the overall impedance “experienced by” the signal. *See, e.g.*, EX2021, 70:20-23 (“But neither of -- the impedance of

those transconductors don't change by virtue of the swap; right? A. But the impedance experienced by the signal does change.”). The *Behbahani* papers' re-routing of the signal path and complete filter swap approach does not comport with the actual claim language. In short, Apple's challenge is not based on the claims of the '330 Patent, but on a false premise misread from Professor Tsividis' 2003 article.

Each of Apple's failures of proof discussed below are fatal to the Petition and the corresponding challenged claims should be upheld.

A. Petitioner failed to show that the *Behbahani* papers disclose or teach dynamically adjusting “an impedance” “in the signal path” according to the challenged claims

Apple failed to show that *Behbahani*, including in alleged combination with *Tan*, discloses or suggests to a person of ordinary skill in the art dynamically adjusting an impedance in the signal path—as taught and claimed in the '330 Patent. *See, e.g.*, EX1001, 12:57-67 (claim 1: “dynamically changing an impedance of a component in the signal path”), 14:15-28 (claim 23: “an impedance in the signal path is configured to be dynamically adjusted”), 15:21-16:12 (claim 29). The alleged static filter swap via re-routing of the signal path of *Behbahani* does not disclose or suggest these elements.

1. The challenged claims require dynamic adjustment of circuit components in the signal path

As explained, challenged '330 Patent claims 1, 23, 29, and their dependents,

require dynamically adjusting (or changing) “*an* impedance” that is “*in* the signal path.” The plain language requires adjusting a variable impedance of a circuit or component thereof, while it is in the signal path. *See, e.g.*, EX1001, 12:57-67 (claim 1: “dynamically changing an impedance of a component in the signal path”), 14:15-28 (claim 23: “an impedance in the signal path is configured to be dynamically adjusted”). The plain language does not comport with switching out one circuit for another, without changing the impedance of either, by re-routing the signal path.

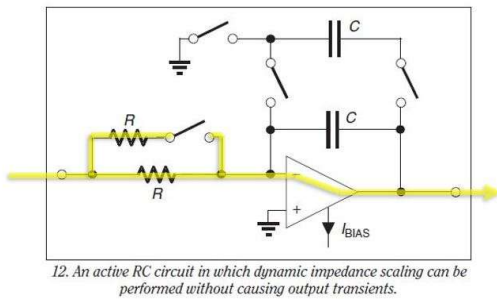
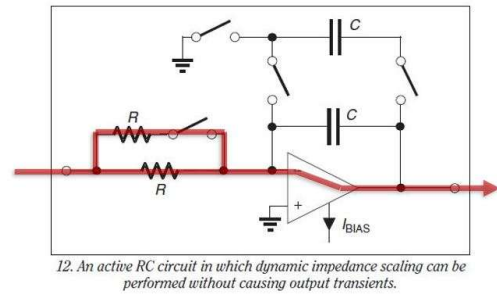
As discussed in Section II.F above, the plain claim language, read together and in context, makes clear that the claims are directed to dynamic changes of, *e.g.*, “an” individual impedance that is, and remains, “in the signal path” for the adjustment. Section II.F.3. This is not the overall impedance of multiple components, but rather “an impedance” that is “of a component” or a “circuit” or is “configured to be dynamically adjusted.” EX1001, 12:57-67 (Claim 1), 14:15-28 (Claim 23). An individual impedance that is and remains in the signal path must change.

The adjustment is done dynamically, that is, “during operation.” Section II.F.1. The adjustment “reduces” a switching current that is “in the signal path”—again a different approach from swapping one current for another in a different path. Section II.F.2.

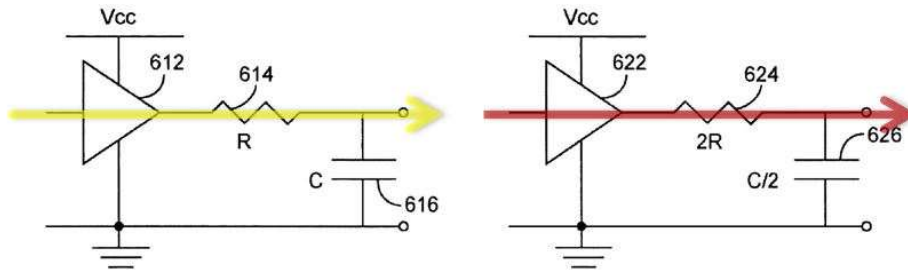
A person of ordinary skill in the art would understand this claim language in this way. EX2020, ¶¶71, 82-85. They would read the plain language requirement to dynamically change something “in the signal path” to require an adjustment to something existing and remaining “in the signal path.”

Professor Abidi understood this distinction, disparaging an inline attenuator example consistent with the approach of the claims. EX2021, 74:18-76:15 (“Yes, but that would not have been a good solution to the problem of a receiver”). Professor Abidi believes that “us[ing] a variable impedance in front of one filter” instead of switching between two filters is “hypothetical and does not serve our purposes.” *Id.*, 75:23-76:15.

Professor Abidi may be correct that an approach using a single filter with a variable impedance in the signal path does not suit Apple’s purpose—because it is not what the *Behbahani* papers taught, it is within what Professor Tsividis discussed as a new approach under investigation in his 2003 article, and it is within the plain language of the claims. *See, e.g.*, EX2020, ¶¶47-48, 68-71; EX1011, Fig. 12 (annotated to illustrate signal path before the R to $R/2$ impedance change in yellow, and after in red):



A variable impedance, adjusted while “in the signal path,” is also what Professor Tsividis showed in the example dynamic impedance change of Figure 6 of the '330 Patent—where load impedance R that is “in the signal path” can be dynamically changed to $2R$ by increasing its value. EX2020, ¶47; EX1001, Fig. 6 (annotated to show signal path before the R to $2R$ change in yellow, and after in red).



The independent claim language, and the specification teaching in support of it, require dynamically adjusting an impedance that exists and remains in the signal path. As shown above, a person of ordinary skill in the art would understand from the claim language and '330 Patent disclosures that this is not *Behbahani*'s static filter swap. EX2020, ¶¶58, 62, 70-71, 74-77, 85. No impedance—not of a component of either filter, nor of either filter as a whole—changes or is adjusted by

that swap. *Id.*, ¶¶62, 71, 76, 79-80. That filter swap is not a change effected by varying something “in the signal path,” but rather one effected by re-routing the signal path.

Apple argues that *Behbahani* changes “Signal Path Impedance” by changing the signal path. *See* Petition, 39. But the claims require “dynamically” adjusting “an impedance” of a component *within* the signal path—plainly not the same thing, and not what *Behbahani*’s filter swap does. Apple failed to show disclosure or suggestion of these claimed elements in the *Behbahani* papers, and thus failed its burden of proof as to any claim here.

Further, as discussed above in Section II.F1, the Petition proposes, and the Board has adopted, a definition of “dynamically” varying that includes the concept of “adjusting [an impedance] during operation.” Petition, 10; EX2014, 2; EX2015, 2-3. But Apple cannot, and makes to explanation attempting to, square this “adjusting during operation” construction with *Behbahani*’s filter swap. In the *Behbahani* approach, one filter is taken completely out of operation to be replaced by another. This is not “adjusting [an impedance] during operation,” because again, no impedance of a component or filter in the signal path is adjusted—and because the components either leave, or come into, operation and the signal path. The parameters of each filter are not changed by virtue of being included in or excluded from the signal path. EX2020, ¶¶57-63, 76-80; EX2021, 67:5-69:18, 70:9-23.

On page 44 of the Petition, Apple rests its argument for this element on a cite to paragraph 124 of the Abidi declaration. EX1003, ¶124. There, Professor Abidi only opines that *Behbahani*’s swap of filters increases “*the* signal path impedance”—he *does not* say that this is the dynamic adjustment of “*an* impedance of a component *in* the signal path,” because it isn’t. *Id.*:

Petition, pg. 44	Declaration of Dr. Abidi ¶124
A POSITA would have understood that, consistent with the ’330 Patent and its inventors own publications, switching from <i>Behbahani</i> ’s high-power filter to its low-power filter <i>dynamically changes (increases) an impedance of a component (the filter) in the signal path, as claimed.</i> Dec., ¶124.	124. A POSITA would have understood, consistent with the ’330 Patent and Dr. Tsividis’ 2003 paper, that <i>Tan</i> ’s teachings confirm <i>Behbahani</i> ’s switch from high-power to low-power filter <i>does in fact increase the signal path impedance.</i>

As discussed above, one can “increase the signal path impedance” without “dynamically adjusting an impedance of a component in the signal path”—for example by re-routing the signal path through a different filter, changing neither filter. The plain language of the independent claim elements selects varying “an impedance” “in the signal path,” rather than re-routing the signal path among static components—and puts the approach of the *Behbahani* papers outside of the claims here.

Apple’s contrary attorney argument on page 44 of its Petition shown above

is just that—attorney argument unsupported by Professor Abidi’s testimony. “Attorney argument is not evidence.” *Icon Health and Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (reversing Board for relying on argument); M.P.E.P. §2145 (“arguments of counsel cannot take the place of factually supported objective evidence”).

Professor Abidi has not testified that the *Behbahani* papers teach “dynamically adjusting an impedance of a component in the signal path”—but instead testified that “the signal path impedance” (EX1003, ¶124) or “the impedance experienced by the signal” or “encountered by” the signal is what is “important” (EX2021, 70:13-73:15). But this opinion is based on his view of his own work, not on any analysis of the claim language. EX2021, 72:8-74:17 (“A. *To me, ...*”), 75:23-76:15 (“does not serve our purposes”). The actual claim language requires a change to “an impedance” existing “in the signal path.” *See, e.g.*, EX1001, Claim 23. The *Behbahani* papers do not teach the actual claim language.

2. The Behbahani papers do not teach dynamic adjustment of circuit components in the signal path

As explained above, no impedance in the signal path is dynamically adjusted via the *Behbahani* filter swap—which instead takes one fixed filter out of operation and out of the path, and puts another fixed filter into operation and into the path.

Petition, 39 (“switches between two scaled filters”); EX1004, 1207 (“the high-power scaled filter is switched in”); *see also* EX2020, ¶¶79, 82; EX2021, 29:7-30:6, 42:7-25, 66:2-68:20. The parameters—including impedance and bias current—of each filter are static, in that they do not change before and after the switch. EX1004, 1207; EX1006, 488 (“low-power and high-power versions of the LPF drain 5.4 and 56 mA ... respectively”); *see also* EX2020, ¶¶62, 77, 82.

Apple does not allege otherwise. Professor Abidi repeatedly confirmed that the change he was identifying occurred as a result of re-routing through one static low-pass filter instead of another. *See, e.g.*, EX2021, 29:7-30:6, 66:2-69:18, 70:9-23, 73:16-74:17, 76:16-77:24, 97:5-8. He also confirmed that whichever filter was swapped out of use would be powered down. *Id.*, 33:5-15, 42:14-25; *see also* EX2020, ¶¶58, 67, 75; EX1004, 1205 (“adaptive use of circuit blocks”), 1206 (“substituting a scaled version of a nominal circuit”), Fig. 4(b) (“substitution of a scaled circuit block”).

A person of ordinary skill in the art would know that *Behbahani*’s “substitution” of filter circuit blocks involves changing the signal path—to remove the first circuit block from the path, turning it off to save power, and instead turning on and sending the signal through the second circuit block. EX2020, ¶58. Figure 4 of the *Behbahani* paper shows this filter swap. *See, e.g., id.* (Fig. 4 excerpts annotated below to show alternative signal paths):

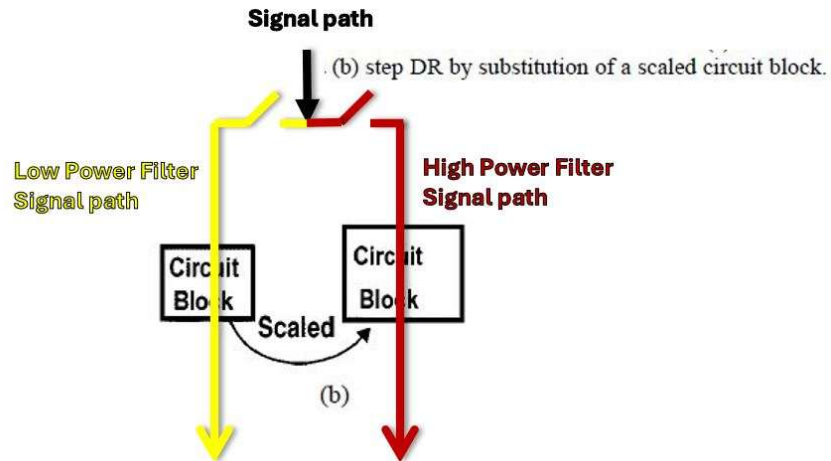
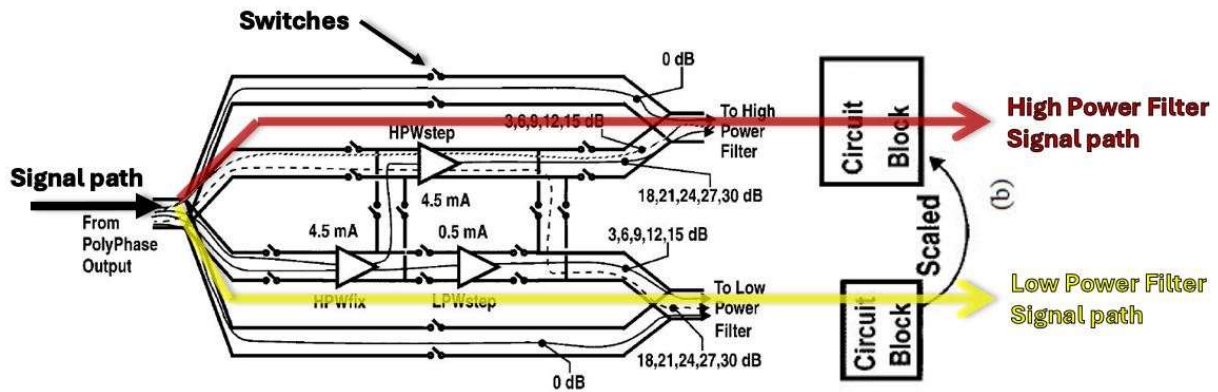
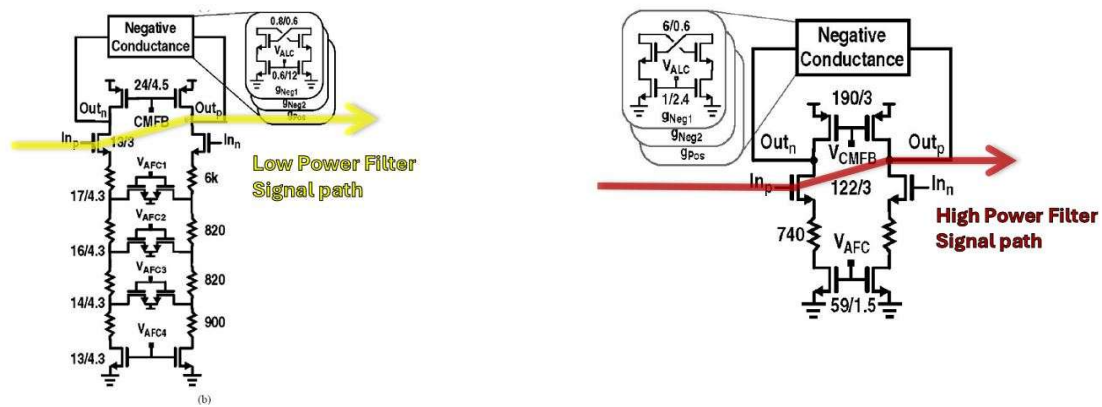


Figure 9 of the *Behbahani* paper shows the circuitry for changing the signal path through the device. EX1004, Fig. 9. Switches operate to route the signal path to one filter “Circuit Block” or to another scaled filter block. EX2020, ¶¶59 (showing Figure 9 and excerpt of Figure 4, annotated with two alternate signal paths through this portion of the device):

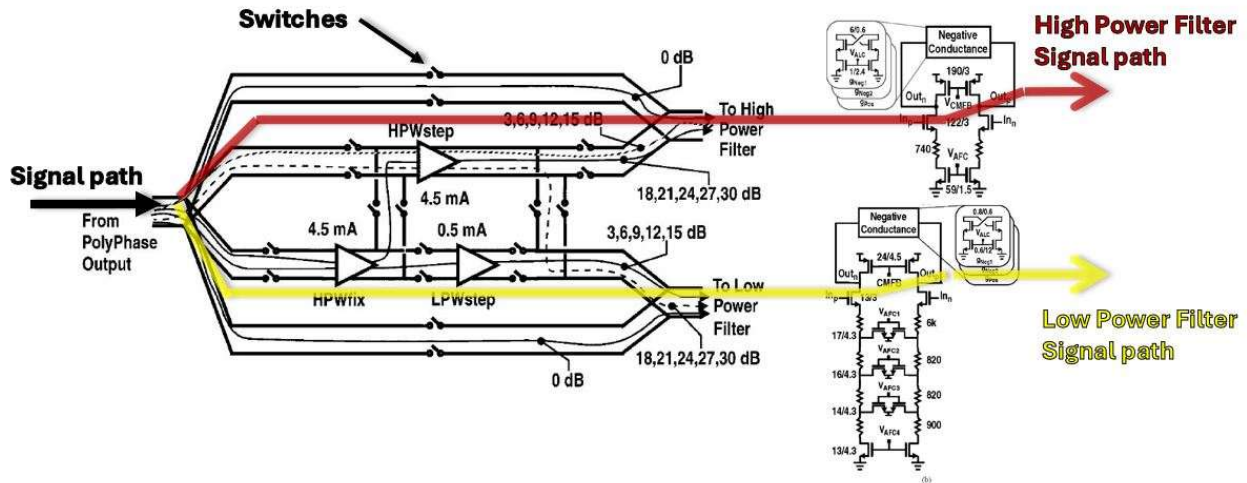


Asked to identify the specific circuits or components that he was alleging change, Professor Abidi repeatedly identified the individual “transconductor” circuits of the two low-pass filters. EX1003, ¶103 (showing *Tan*, Fig. 6); EX2021,

58:7-13, 67:25-68:20, 76:16-77:24. *Tan* shows the transconductance portions of the low power low-pass filter in Figure 6(b), and the high power low-pass filter in Figure 6(a). EX1006 at Fig. 6. Those are static circuits for purposes of *Behbahani*'s "step" filter substitution. See EX2020, ¶61 (annotating Fig. 6 excerpts with alternate signal paths through the components):



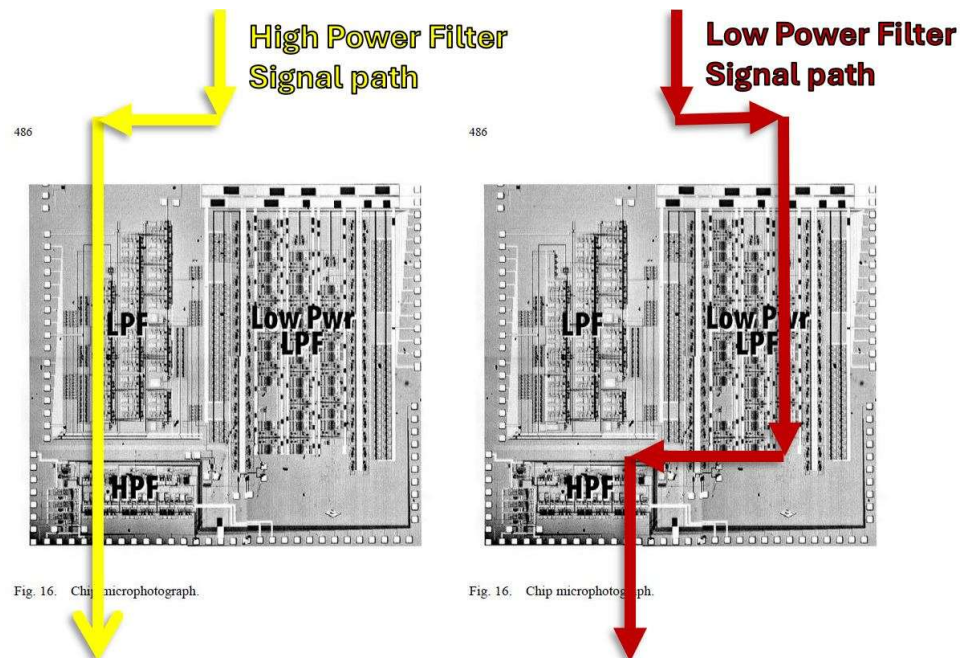
Professor Larson illustrated the combined circuits and alternate signal paths, as alleged and relied on by Professor Abidi, including the unchanged filter transconductance blocks he repeatedly identified. EX2020, ¶62:



In preliminary Reply, and in leading questioning by Apple’s counsel at Professor Abidi’s deposition, Apple has suggested that the relevant structure of the *Behbahani* papers for the “dynamically adjusting/changing” elements the overall band-pass filter functional block. EX2021, 95:24-96:9.⁵ But drawing a larger box around more of the receiver block diagram does not change the underlying circuits or their operation. The band-pass filter of the *Behbahani* papers, like the alternate low-pass filters and the high-pass filter comprising it, does not have any individual impedance “in the signal path” that changes dynamically during operation. EX2020, ¶82.

⁵ In his declaration, and before and after these questions, Professor Abidi identified “the transconductors” of the low-pass filters as the alleged changed impedance. EX1003, ¶103; EX2021, 58:7-13, 67:25-68:20, 76:16-77:24, 96:11-25 (“as shown in one of the diagrams we looked at, with transconductors and capacitors”).

A change to the overall impedance of the receiver, or of a section of the receiver chain containing multiple circuit blocks—that results only from re-routing the signal path—is not dynamically changing “an impedance,” “an impedance of a component,” or “an impedance” of a circuit, that is “*in* the signal path” as used in claims. *Id.*, ¶83; *see also id.* ¶¶75, 82 (annotating *Tan*, Figure 16 to showing the signal path alternatively going through the low-power low pass filter “Low Pwr LPF,” or the high-power low pass filter “LPF”):



Each low pass filter “LPF” in the *Behbahani* device sits idle while the signal path is re-routed such that the other LPF is put in operation. *Id.* Neither is changed by being switched on or off. *Id.*, ¶¶75-76, 82-83.

Switching operation from one static filter to another is a different, and inferior, approach—versus dynamically changing the components or structure of a

single filter block in the signal path in operation. *See, e.g., id.*, ¶¶77-80 (drawing analogy to difference between swapping 25W and 100W light bulbs, vs. using a single variable bulb on a dimmer control); EX1011, 8-9. Professor Abidi understands that these are different approaches—although he disagrees about whether his approach is better. EX2021, 74:18-76:15 (“that would not have been a good solution to the problem”).

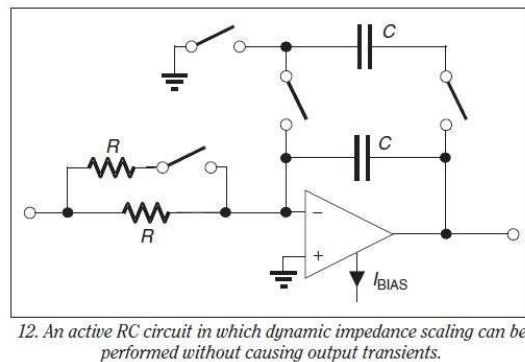
Apple never applies the claim language to explain how re-routing the signal path to put a different fixed filter into operation could fit within the meaning of, e.g., dynamically adjusting circuit components within the signal path as claimed. Petition, 36-44. *Behbahani*’s filter swap approach does not fit with the claim language, so Apple ignores the claim language—or has its expert invent new language—failing to meet its evidentiary burden in the process. EX2021, 70:20-23 (“*the impedance experienced by the signal*”).

3. Professor Tsividis’ 2003 article does not put *Behbahani*’s approach within the claims

Apple’s reliance instead on Professor Tsividis’ 2003 article—which is, of course, *not* a determiner of the scope of the ’330 Patent’s challenged claims—completely misconstrues, and ignores contrary portions of, the discussion in the article, as explained further below.

The article notes problems with *Behbahani*’s approach. EX1011, 8 (“output

transients” and “loss of data”), 8 (“delay” from attempt to mitigate transients with hand-off); *see also* EX1004, 1208 (“bit error rate “BER” increases”). And then the article *teaches improvements on Behbahani’s* approach—specifically relevant here is *dynamic* scaling of a *single filter’s structure via individual elements*. EX1011, 8 (“switching individual filter elements rather than entire filters”), 9 (“use a single filter and vary its structure dynamically”); EX2020, ¶¶66-70. Professor Tsividis’ article refers to *dynamic* impedance scaling only with reference to its own Figure 12—which shows a single RC circuit, adjusted via switching individual elements that are in the signal path. EX1011, 9 (“dynamic impedance scaling (Figure 12)”), Fig. 12 (“An active RC circuit in which dynamic impedance scaling can be performed”):



Professor Tsividis’ article simply *does not* point to *Behbahani* as “an exemplary means” for dynamic impedance scaling—Apple’s statement to the contrary and out-of-context treatment of the article is misleading and wrong. *See* Petition, 38. Reading on from Apple’s excerpts reveals that Professor Tsividis’

article instead teaches *away* from *Behbahani*'s error-prone approach, and towards “vary[ing] structure dynamically” in a single filter and using “individual filter elements rather than entire filters.” EX1011, 8, 9, Fig. 12; EX2020, ¶¶66-74. In other words, Professor Tsvidis' article teaches away from *Behbahani* and towards the language of the claims. *See, e.g.*, EX1001, 12:57-67 (“dynamically changing an impedance of a component in the signal path”).

As shown above, the individual element switching improvements described in the article—unlike the filter swap cited and discussed therein—fit with the teaching and plain language of the claims of the '330 Patent. *See, e.g.*, EX1001, Fig. 9A, 9:36-59 (“Accordingly, one or more impedance in the function block 920 may be increased”), 12:65-67 (claim 1: “dynamically changing *an* impedance of a component in the signal path”), 13:21-22 (claim 9: “wherein the component in the signal path is *included in* the low-pass filter”).

Professor Tsvidis' article was published in IEEE Circuits & Devices Magazine in January of 2003. EX1011, footer. In the meantime, and separately, Theta and Professor Tsvidis were in fact investigating and developing techniques for dynamically varying circuit structure via adjusting internal components. They filed provisional patent applications, and then the '330 Patent on February 23, 2004. EX1001, 1.

When Theta and Professor Tsividis filed the original non-provisional application (which issued as the '330 Patent), they cited to *Behbahani* and *Tan*. EX1002, 62. They also cited Professor Tsividis' 2003 article—guaranteeing that the Examiner would understand the distinction from, and improvement of the '330 Patent over, the approach of the *Behbahani* papers. *Id.* These references have been on the face of the '330 Patent for twenty years, through seven continuation prosecutions, and through multiple invalidity challenges—before Apple, in its desperation to get around shortcomings in the art that “plagued prior invalidity challenges,” brought them out for its cumulative follow-on Petitions here.

Apple failed in its burden to show teaching of any challenged claim. The Petition merely asserts—completely without support—that *Behbahani*'s filter swap is within the elements as claimed. It is not, and a person of skill in the art would not understand it to be in the context of the teaching and claims of the '330 Patent, for all the reasons given above. *See, e.g.*, EX2020, ¶¶47-48, 58, 62, 70-71, 74-77, 85.

In sum, Petitioner's arguments are facially deficient, and do not show that the *Behbahani* papers teach any challenged claim. There is simply no teaching or suggestion in the references of the claimed dynamic adjustment of “an impedance” that is “in the signal path” as claimed. Petitioner's Ground, which cites to and relies only on *Behbahani* and *Tan* for alleged disclosure of these elements, must fail. *See,*

e.g., In re Smith Int'l, Inc., 871 F.3d 1375, 1381 (Fed. Cir. 2017) (all claim elements must be shown).

B. Petitioner failed to show that the *Behbahani* papers disclose or teach dynamically adjusting “an impedance” of “a component” or “a circuit” “in the signal path” according to the challenged claims

For all of the reasons discussed above, Apple failed to show teaching in the *Behbahani* papers of dynamically adjusting “an impedance in the signal path” according to, *e.g.*, challenged Claim 23. For example, Claim 23 requires “an” individual impedance, that exists “in the signal path,” and is “configured to be dynamically adjusted” during operation—none of which is properly applied to an overall impedance that changes only by virtue of the signal path being re-routed to pass through different static impedances. None of the identified impedances in the *Behbahani* papers are “configured to be dynamically adjusted” via the filter swap.

Challenged independent claims 1 and 29 each have additional requirements, namely that “an impedance” be of “a component,” or “in” “a second circuit.” EX1001, 12:57-67 (Claim 1: “dynamically changing an impedance of a component in the signal path”), 15:21-16:12 (Claim 29: “the signal path comprising: ... a second circuit” and “an impedance in the second circuit”).

These additional requirements raise further incompatibilities with the alleged teaching of the *Behbahani* papers. The relevant “circuits” or “components” identified from the *Behbahani* papers are static and undisputedly do not change via

the filter swap, as discussed above. *See* EX1003, ¶85 (“a low-pass filter”), ¶103 (transconductor blocks); EX2021, 67:25-68:20 (“the transconductors” “of the low-pass filter”), 72:8-73:15 (“the component is a transconductor”), 76:16-77:24, 96:11-25 (“transconductors and capacitors”).

The ’330 Patent uses “a circuit” or “a component” to refer to individual units or elements of the receiver such as an amplifier, “the low pass filter,” “a mixer,” “a MOS transistor,” “a resistor,” etc. *See, e.g.*, EX1001, 13:13-22 (“wherein the component in the signal path comprises,”), 7:44-46 (“FIG. 6 is an example of how *a circuit’s* impedances may be scaled to reduce drive currents, and, depending on the circuit configuration used, associated bias currents as well.”); *see also id.*, 7:57-59 (“In this way, an impedance can be scaled in order to decrease *a circuit’s* required drive current.”). But Apple and Professor Abidi do not identify any circuit or component like this that changes impedance value in the static filter swap. *See* Petition, 44 (“a component (the filter)”).

With respect to the claims requiring a dynamic change to an impedance of “a component” or “a second circuit,” Petitioner’s arguments are facially deficient, and fail to show that the *Behbahani* papers teach the challenged claims.

C. Petitioner failed to show that the *Behbahani* papers disclose or teach dynamically adjusting “a bias current” “in the signal path” according to the challenged claims.

Challenged independent claims 10 and 26, and their dependents, require

dynamically adjusting *a* bias current *in the signal path*. EX1001, 13:23-36 (Claim 10: “dynamically changing a bias current in the signal path”), 14:50-67 (Claim 26: “a bias current in the signal path is configured to be dynamically adjusted”). For all of the reasons given above for the “an impedance” claims, Apple’s challenge to these claims—relying on the same filter swap of *Behbahani*—also fails.

As was the case for Apple’s identification of the alleged dynamically adjusted impedance—discussed in sub-section A above—here Apple relies only on the filter swap of the *Behbahani* papers. Petition, 57-58, 66. While the two filters may draw different supply currents when turned on—see EX1006, 488 (“drain 5.4 and 56 mA ... respectively”)—for the reasons discussed above the bias of each filter is not taught to be dynamically *adjusted* by virtue of the signal path being re-routed to pass through it, or thereafter. EX2020, ¶¶76, 80; *see also* Petition, 58 (“bias current supplied after switching filters is maintained”). *Behbahani* re-routes the signal path without adjusting the bias current of either swapped filter.

As discussed above, the plain claim language and the specification of the ’330 Patent—which Apple never applies or discusses for these elements—do not support including *Behbahani*’s wholesale filter swap in the scope of the challenged claims. Apple fails to identify any single bias current that is “configured to be dynamically adjusted.” *See, e.g.*, EX1001, 14:50-67 (claim 26: “a bias current in the signal path is configured to be dynamically adjusted”); *see also id.*, 8:36-39

(“one or more bias currents in the function block are under control of one or more signals on bias control lines 826”), Fig. 8A:

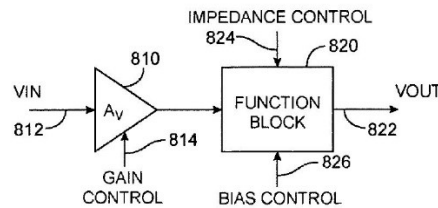
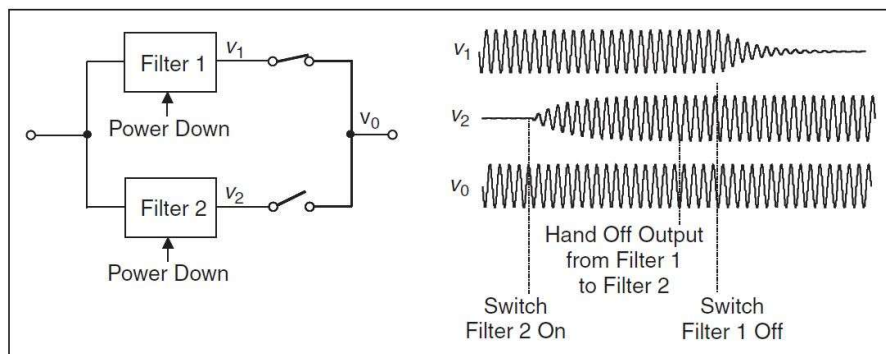


FIG. 8A

And as discussed above, Professor Tsividis’ 2003 article confirms problems with the *Behbahani* filter swap and illustrates improvements. EX1011, 8 (“causes transients at the output,” and “the result may be loss of data”), Fig. 11 (showing use of handoff to mitigate transients from hard switch between two filter function blocks):



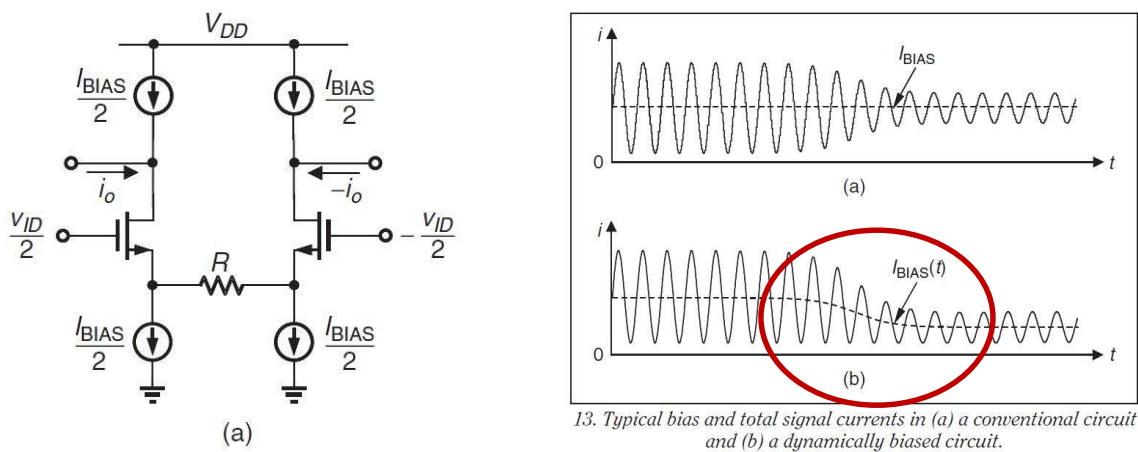
11. Method to switch between two signal processors with the same input-output behavior, without causing output transients.

Reading further in the article reveals a different, alternative solution to *Behbahani*’s—that of “dynamic biasing” of a single circuit by changing component parameters. *Id.*, 8-9:

In many cases it is desirable to do this *dynamically, without*

interrupting the filter operation. For example, in the transconductor of Figure 3 all four bias currents can be scaled down together, without causing major output disturbances...

An example circuit utilizing this dynamic, in-operation, bias adjustment is shown in Figure 3(a). And the resulting adjustment to bias current of such a circuit is shown in Figure 13(b). EX1011, Fig. 3 (detail below), Figure 13 (annotated below):



A person of skill in the art would have understood from the discussion of the 2003 article that this dynamic biasing solution was different from the hard filter swap disclosed in the cited *Behbahani* papers. EX2020, ¶72.

Dynamically adjusting a bias current of a single amplifier or filter function block in the signal path—unlike the signal path re-routing and hard filter swap of *Behbahani*—fits with the teaching and claims of the '330 Patent, as discussed above. See, e.g., EX1001, 14:62-67 (claim 26: “a bias current *in* the signal path is *configured to be dynamically adjusted*”).

In sum, Petitioner’s arguments are facially deficient, and do not show that the *Behbahani* papers could render obvious any challenged claim. There is simply no teaching or suggestion in the references of the dynamic adjustment of “a bias current” in the signal path as claimed. Petitioner’s Ground relying only on *Behbahani* and *Tan* for alleged disclosure of these elements, must fail, and these challenged claims should be upheld.

D. Petitioner failed to show that the *Behbahani* papers disclose or teach a signal strength indicator circuit according to the challenged claims

Apple also failed to show teaching or suggestion in the *Behbahani* papers of independent claim elements requiring a signal strength indicator circuit.

The challenged claims require “determining a first signal strength at a first node in the signal path” (Claims 1, 10), or “a first signal strength indicator circuit coupled to the signal path, and configured to determine a first signal strength” (Claims 23, 26, 29). EX1001.

For each of these elements, Apple identifies points labeled “A_I” and A_O” in Fig. 2 of *Behbahani*, and a cursory discussion of measurements in that paper. *See* Petition, 32-34. This discussion does not provide any physical implementation details. *Id.*

For the claims requiring a “signal strength indicator circuit,” Apple admits that *Behbahani* “does not provide details” about any circuit to be used. *Id.*, 60. In

fact, Professor Abidi and his students didn't include measurement circuits for this purpose in their design. EX2021, 91:20-92:9, 94:3-18. And they didn't discuss specifics of any measurement circuit for this purpose in their papers. *Id.* ("...they're not discussed in the papers either though; right? A. Correct. Correct.").

Without any disclosed circuit to point to, Apple mentions a peak detector circuit, used for a different purpose, shown in a figure of the *Tan* paper. Petition, 60-61; *see also* EX2021, 89:4-19. A peak detector, even if it were applied to the task of measuring at points " A_I " and A_O "—and it was not in Professor Abidi's design—can detect that a signal has gone above a preset threshold. EX2021, 89:12-14; EX1004, Fig. 8 ("VRef").

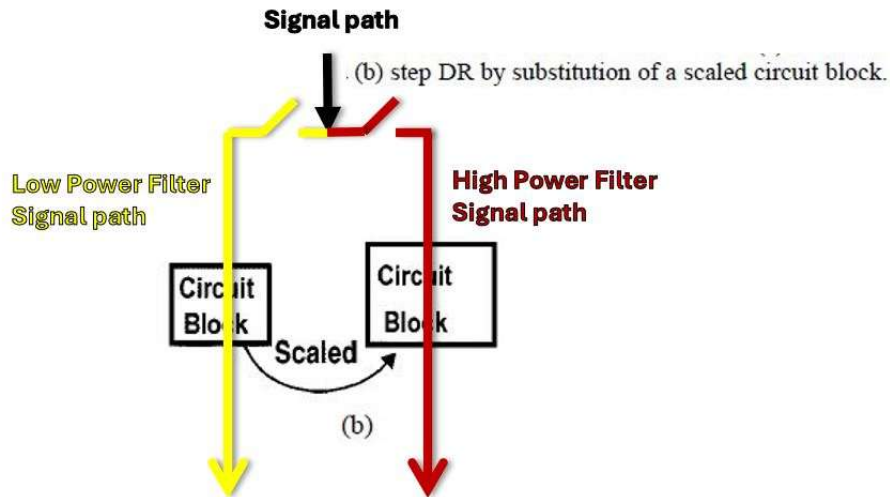
Apple does not support its assertion that a person of skill in the art would find it obvious to use a peak detector, admittedly disclosed for a different purpose in *Tan*, as a "signal strength indicator circuit" to perform the measurements allegedly described in *Behbahani*. As mentioned above, Professor Abidi's declaration never used the word obvious in its opinions section, and does not opine about what would or wouldn't be obvious to a person of skill in the art. EX1003, ¶¶179-181. Even if the references were considered together as Professor Abidi argues they would be, he has failed to suggest or support why a person of ordinary skill in the art would employ a peak detector from *Tan* for a different purpose than for which it is disclosed.

Apple has the burden to produce evidence here and has failed to do so. For these additional reasons, at least independent Claims 23, 26, 29, and their dependents should be upheld.

IV. Conclusion

As detailed above, with the '330 Patent, Professor Tsividis made foundational inventive and teaching contributions to the field. The techniques taught and claimed in his patents have been recognized for their importance and cited across the industry, and have remained interesting and worthy of publication to this day. EX2004.

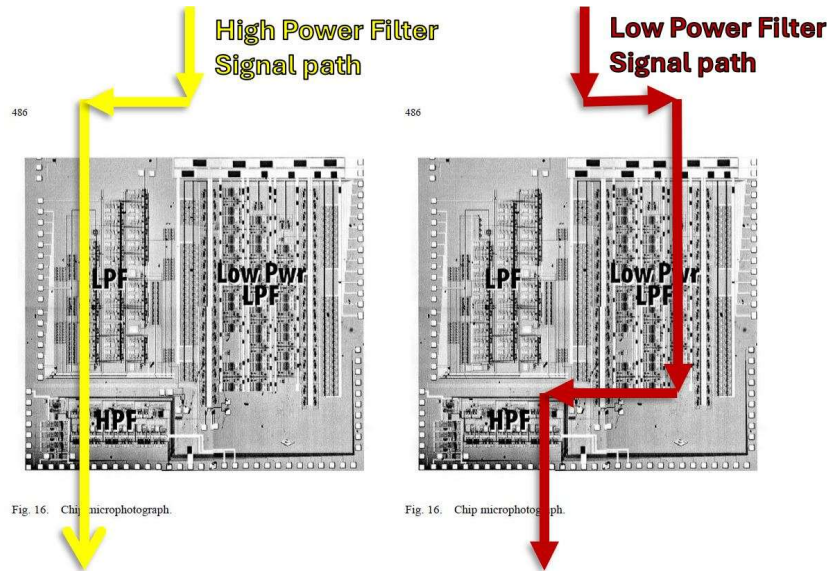
To understand why Apple's challenge fails, the Board need only try to apply the plain language of the challenged claims to, *e.g.*, *Behbahani's* Figure 4—depicting the “substitution of a scaled [filter] circuit block” that is alleged to disclose the dynamic variation elements discussed above. EX1004, Fig. 4 (excerpts annotated below):



This substitution of one fixed block for another does not modify either circuit block, and does not teach or suggest any adjustment to *an* impedance or *a* bias current *in* the signal path—instead changing the entire signal path without changing an impedance of either block. The '330 Patent, in contrast, teaches and claims dynamic modifications to components within the signal path of the circuit itself. *See, e.g.*, EX1001, 8:17-45, Figure 8A, 12:57-67 (Claim 1).

The *Behbahani* filter swap—alleged to be the claimed dynamic variation of an impedance in the signal path—instead only changes the signal path, and does not alter any individual impedance or bias of any component. EX2020, ¶¶57-63, 71, 75-76, 79-80, 82. The impedance of the first filter is the same before and after being switched in or out of operation. The impedance of the second filter is the same before and after being switched in or out of operation. *Id.* Again, taking one entire filter circuit out of operation to be replaced by another is not the dynamic

adjustment to *an* impedance or *a* bias current that is *in the signal path* as required by the claims. *See also* EX1006, Fig. 16 (annotated below):



For all the reasons detailed above, the challenged claims should be upheld.

Dated: March 21, 2025

Respectfully submitted,

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37 C.F.R. §42.24(d) CERTIFICATION

The undersigned hereby certifies that this submission, excluding the tables of contents, certificate of word count, exhibit list, and certificate of service, contains **13,852** words, as determined using the standard word counting feature of the Microsoft Word program.

Dated: March 21, 2025

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CERTIFICATE OF SERVICE

Petitioners have consented to e-mail service in this proceeding. Pursuant to 37 C.F.R. §42.6, the undersigned certifies that on March 21, 2025, a copy of the foregoing document was served by email upon the following counsel at the below email addresses:

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