Federal Court Cour fédérale

Date: 20220815

Docket: T-952-20

Citation: 2022 FC 1116

Ottawa, Ontario, August 15, 2022

PRESENT: The Honourable Mr. Justice Zinn

BETWEEN:

GOOGLE LLC

Plaintiff
(Defendant by Counterclaim)

and

SONOS, INC.

Defendant
(Plaintiff by Counterclaim)

PUBLIC JUDGMENT AND REASONS

(Confidential Judgment and Reasons issued July 26, 2022)

I. INTRODUCTION

[1] The Plaintiff, Google LLC [Google], is suing the Defendant, Sonos, Inc. [Sonos], for infringement of Claim 7 of Canadian Patent No. 2,545,150 entitled "Method and Apparatus for

Adaptive Echo and Noise Control" [the 150 Patent]. Sonos is counterclaiming alleging that Claim 7 of the 150 Patent is invalid as it is obvious and not inventive.

[2] Google is the owner of the 150 Patent.

[3] Sonos carries on business, among other things, as an importer, manufacturer, distributor, exporter, promoter, marketer, and retailer of smart speakers and associated products in Canada. A smart speaker is a speaker that may be controlled by the user's voice and use of a "virtual assistant." It can answer questions, perform various automated tasks, and control other compatible smart devices. For example, it may tell you the weather, answer questions, and play music.

[4] The Sonos products at issue are the Sonos One (Gen 1 and Gen 2), Sonos Move, Sonos Arc, Sonos Beam (Gen 1 and Gen 2), and Sonos Roam [each a Sonos Device and collectively the Sonos Devices].

[5] Claim 7 of the 150 Patent reads as follows:

> 7. An electronic device, comprising:
>
> an audio input configured to receive a received signal;
>
> an audio output configured to output an output signal;
>
> a transceiver configured to transmit a transmitted signal; and
>
> an adaptive echo and noise control system coupled to the audio input, the audio output, and the transceiver, the adaptive echo and noise control system including
>
> an echo canceller; and
>
> a noise suppressor,

> wherein the adaptive echo and noise control system is configured to adaptively determine an order of echo cancellation and noise suppression based on an amount of noise in the received signal to generate a desired signal, and
>
> wherein the adaptive echo and noise control system is further configured to send the desired signal to the transceiver.

II. ISSUES

[6] This action was bifurcated, with issues of remedy being put aside until liability, if any, is determined. Accordingly, there are three questions the Court must answer in this phase of the litigation:

1. What is the proper construction of Claim 7?
2. Does Sonos directly infringe or induce infringement of Claim 7 by importing, manufacturing, distributing, promoting, advertising, using, exporting, or selling the Sonos Devices?
3. Is Claim 7 invalid because its subject matter was obvious to the person of skill in the art contrary to section 28.3 of the *Patent Act*, RSC 1985 c P-4, having regard to the common general knowledge of the skilled person and the state of the art as of November 20, 2003, the claim date of the 150 Patent?

III. THE EVIDENCE

[7] The parties entered into evidence a 93-paragraph Joint Agreed Statement of Facts. Each party called one expert witness. Google called Chris Kyriakakis, PhD and Sonos called Michael T. Johnson, PhD. Both testified as to the common general knowledge [CGK], how the person of

skill in the art [POSITA] would construe Claim 7, whether the Sonos Devices infringe Claim 7, and whether Claim 7 is obvious.

[8] Initially Google informed the Court that it would call a second expert, Robert S. Plachno, who would speak to the source code for the software on the Sonos Devices [the Sonos Source Code].

[9] Following the testimony of Dr. Kyriakakis, Google informed the Court that it had decided not to call Mr. Plachno. Accordingly, his report [the Plachno Report] is not in evidence. However, in the Joint Agreed Statement of Facts, the parties agreed on a number of the statements in the Plachno Report. Those agreed facts are evidence in this trial. Dr. Kyriakakis in his report and testimony relied, to some extent, on the Plachno Report. To the extent that he relied on any portions of the Plachno Report not agreed upon by the parties, the evidence is inadmissible.

[10] Sonos made several complete versions of the Sonos Source Code available for Mr. Plancho to review, each version representing the code on a specific date. Dr. Kyriakakis did not review the full Sonos Source Code that was made available by Sonos to Mr. Plancho. Rather, in addition to the Plachno Report, he relied on PDF excerpts of the Sonos Source Code requested by Mr. Plachno.

[11] Dr. Johnson did review the entirety of the Sonos Source Code. For that reason, where there is a difference between the two experts relating to the Sonos Source Code, I prefer the evidence of Dr. Johnson.

[12] Sonos also called one fact witness, Nicholas Millington, one of the first employees of Sonos. He commenced his employment at Sonos in April 2003 and is currently employed as its Chief Innovation Officer.

[13] I shall provide a brief summary of the evidence of these three witnesses but shall refer to their evidence in more detail when discussing the issues before the Court. Generally, I found all three to be credible. The two experts offered significantly different interpretations of Claim 7 and opinions on invalidity; however, they were both credible and agreed on many matters relevant to the action.

[14] Mr. Millington was also found to be credible. Many objections were made to his evidence – both allegations that he was offering an opinion rather than fact evidence and that his evidence was hearsay, especially with respect to the Sonos Source Code, as he had not personally written it or examined it.

[15] In reaching a decision, I have relied only on his evidence as to facts within his knowledge, observation, and experience at Sonos.

How the Sonos Devices Operate

[16] The evidence of all the witnesses and the Joint Agreed Statement of Facts is the basis for the following description of the operation of the Sonos Devices.

[17] The Sonos Devices are smart speakers designed for home use. They have a number of very small microphones embedded in them to capture voice commands and one or more large speakers to produce sound. They must be connected to an electrical source and the Internet to enable their "smart" functions.

[18] The Sonos Devices are compatible with both the Amazon Alexa and the Google Assistant voice assistants. Only one can be configured for use at a time. A voice assistant is software designed to understand a speaker's command and take action on the speaker's request. The voice assistant is activated when its "wake word" is detected. "Alexa" is Amazon's default wake word, and "Hey Google" or "OK Google" is Google's wake word.

[19] Two simple examples illustrate the use of the Sonos Devices after the product is set up and configured. Example 1: The user says "Alexa, what is the temperature in Ottawa right now?" Amazon detects the wake word, interprets the command, searches the internet for the answer to the question, and responds through the product's speaker(s) saying, "Environment Canada reports that the current temperature in Ottawa is 20 degrees centigrade." Example 2: The user says "Hey Google, play 60's music." Google detects the wake word, interprets the command, searches the internet for the answer to the request, responds through the product's

speaker(s) saying, “This is Spotify’s 60’s music playlist,” and then streams the music from that playlist.

[20] The Sonos Devices must be set up and configured. Out of the box, the Sonos Devices are merely speakers. The voice assistant is not configured, the microphone is off, and the beep tone that acknowledges that the wake word has been received is off. It can be activated by the user if it is desired.

[21] The Sonos Devices must be connected to the power cord and plugged into an electric outlet. The user needs to download the Sonos app that guides the user through the steps required to set up the product. Relevant to this action is that the user has a choice of three configurations regarding the voice assistant: (i) no voice assistant, (ii) voice assistance with Google Assistant, or (iii) voice assistance with Amazon Alexa. To configure with either the Google or Amazon voice assistant, the user must have an account with that service.

[22] The Sonos Devices are designed to send a clean signal to the voice assistant so that it will be able to detect the wake word and interpret the user’s request accurately. The process used to clean the signal is described as the “Sonos Voice Pipeline.” The focus of the Sonos Voice Pipeline is to address echo — the part of the signal caused by the sound coming from the product’s speakers being picked up by the microphones — and noise — any undesired part of the signal, which in the case of the Sonos Devices is anything other than the user’s voice.

[23] The Sonos Voice Pipeline processes the audio captured by the microphones by performing a number of discrete processing steps. These steps can be viewed as functional "blocks" which form a chain or pipeline, and the signal moves along this chain, being processed by each of the blocks. For example, there is a block that removes [redacted] and another that implements a [redacted]

[24] The specific blocks that the signal travels through is not always the same. Blocks can be turned on or off depending on which of the two voice assistants is activated as well as the state of the Sonos Device, for example whether the Sonos Device is currently playing music. When a device is switched on, the sub-steps within it do not change — although there may be different parameters used to account for the other processing steps that are performed upstream (e.g. multiplication by a different factor). While this is an oversimplification of the Sonos Voice Pipeline, it is sufficient for the purposes of resolving the issues in dispute.

[25] The Sonos Voice Pipeline was reviewed by the experts as source code. Source code is human-readable computer code. It represents a series of instructions for a computer processor to carry out. The Sonos Source Code is written in the C++ programming language and represents 4.5 GB of data over tens of thousands of files.

[26] The Sonos Devices do not contain the Sonos Source Code. Rather, the human-readable source code is converted into executable code by a compiler and this executable code is installed on and used to operate the Sonos Devices. Dr. Johnson's explanation of this process, below, accords with the evidence of Mr. Millington and Dr. Kyriakakis:

> 45. Source code in file folders represents the software for many different products and models. To create executable code that is intended to be loaded into a specific product model for operation, it must be "**compiled**" using instructions and configuration settings needed for operation on its processor and in that specific environment. This is done through a "**makefile**" that calls the compiler and gives it instructions for exactly how to turn the source code into executable code.
>
> 46. The devices themselves do not store the source code, but rather the executable code produced based on the source code by the compiler, which generates the code that is intended to be installed on the product and used.
>
> 47. Indeed, source code generally includes many elements that will not be used when compiled and executed for a specific product. When reading source code, one must be careful in identifying what is compiled, executed, and impacts the device operation, and what does not. Code that does not impact device operation includes, for example, non-code elements, code excluded through preprocessor directives, unexecuted code, and unused code.

[27] As noted by Dr. Johnson, not all of the Sonos Source Code operates. Dr. Johnson explained that pre-processor directives can be used to instruct the compiler as to what should and should not be included in the executable code and that source code can also contain unexecuted code and unused code. According to Dr. Johnson, unexecuted code is code that "defines classes or methods never called by the main program and therefore never run." Unused code is code "which is called and executed but whose results are never used and therefore has no impact on the system operation."

[28] In order to understand how the Sonos Devices operate, one must read the Sonos Source Code, taking care to determine which code is called upon and actually performs a function.

The Experts' Opinions

[29] Dr. Kyriakakis was qualified as an expert in signal processing, including digital signal processing, audio signal processing, voice signal processing, echo and noise control, audio algorithms, adaptive signal processing, and optimization of these systems.

[30] He authored an initial report [the First Kyriakakis Report] in which he offered his opinion of the POSITA, the construction of the 150 Patent from the perspective of the POSITA as of June 9, 2005, in light of the then-prevailing CGK, and whether the Sonos Devices comprise all of the essential elements of Claim 7.

[31] It is his opinion that the POSITA is a person with a Masters-level understanding of electric engineering with particular focus on audio signal processing as well as some years of experience working in the field of audio signal processing.

[32] His opinion, generally speaking, is that Claim 7 is a method and device for echo and noise control in a device that adaptively determines an order of noise suppression and echo cancellation based on noise in the input signal. In his opinion, the Sonos Devices comprise all of the essential elements of Claim 7:

> 43. The Sonos devices are voice-controlled, Internet-connected, smart speakers which facilitate communications between the Sonos devices and their users and accept voice commands to play content. The Sonos devices implement a voice signal pathway (in software running on a microprocessor) for identifying the user's voice commands and sending those commands to the personal digital assistants that are integrated into the Sonos devices, namely Amazon Alexa and Google Assistant.

> 44. The voice signal pathway implemented in the Sonos devices (and, in particular, the microprocessors and software running within) processes the input signal, determines the noise in the input signal, and, based on noise in the signal, determines an order of noise suppression and echo cancellation.

[33] Dr. Kyriakakis authored a second report on invalidity [the Second Kyriakakis Report], responding to the report of Dr. Johnson. He concludes that Claim 7 is not obvious.

[34] Dr. Johnson was qualified as an expert in speech and signal processing, including digital signal processing, optimal and adaptive signal processing and speech processing.

[35] He authored an initial report [the First Johnson Report] in which he offered his opinion of the POSITA, the construction of Claim 7 from the perspective of the POSITA as of June 9, 2005, and whether Claim 7 is obvious based on the CGK of the POSITA and documents made available to the public prior to November 20, 2003.

[36] It is his opinion that the POSITA would have:

> [A]t least a bachelor's degree in electrical or computer engineering or a related field, and have at least four years of experience in the field of audio and/or voice signal processing and communications, or a similar area, with a basic knowledge of adaptive signal processing and signal enhancement algorithms. For example, audio and/or voice signal processing and communications can include telephony, mobile communications, or audio broadcasting. Additional educational background in this field could substitute for some amount of engineering experience, or visa versa [*sic*].

[37] In his opinion, Claim 7 "presents an echo and noise control system which is able to adaptively determine and change the order of echo cancellation and noise suppression." Specifically:

> 205. The system of Claim 7 comprises an audio input, an audio output, a transceiver, and an adaptive echo and noise control system that includes an echo canceller and a noise suppressor. The adaptive echo and noise control system is configured to adaptively determine an order of [echo cancelation] and [noise suppression] based on an amount of noise in the received signal to generate a desired signal and send the desired signal to the transceiver.

[38] Dr. Johnson's second report [the Second Johnson Report] is on infringement and responds to Dr. Kyriakakis' report. He concludes that many of the essential elements in Claim 7 are not contained in the Sonos Devices. Specifically, it is his opinion that the order of echo cancellation and noise suppression in the Sonos Devices never changes, and that transitions between operating modes are not adaptively determined, but instead triggered by the user outside the Sonos Voice Pipeline.

IV. CONSTRUCTION

[39] The legal principles of claims construction are well known and largely agreed upon by the parties. The principles were recently summarized by the Federal Court of Appeal in *Tearlab Corporation v I-MED Pharma Inc*, 2019 FCA 179 as follows:

> [31] The *Patent Act* promotes adherence to the language of the claims, which in turn promotes fairness and predictability. The words of the claims must, however, be read in an informed and purposive way, with a mind willing to understand. On a purposive construction, it will be apparent that some elements of the claimed invention are essential while others are non-essential. The interpretative task of the court, in claim construction, is to separate and distinguish between the essential and the non-essential

> elements, and to give the legal protection to which the holder of a valid patent is entitled only to the essential elements.
>
> [32] To identify these elements, the claim language must be read through the eyes of a POSITA, in light of the latter's common general knowledge. As noted in *Free World Trust*:
>
> > [51] …The words chosen by the inventor will be read in the sense the inventor is presumed to have intended, and in a way that is sympathetic to accomplishment of the inventor's purpose expressed or implicit in the text of the claims. However, if the inventor has misspoken or otherwise created an unnecessary or troublesome limitation in the claims, it is a self-inflicted wound. The public is entitled to rely on the words used *provided* the words used are interpreted fairly and knowledgeably. [Emphasis in the original.]
>
> [33] Claim construction requires that the disclosure and the claims be looked at as a whole "to ascertain the nature of the invention and methods of its performance, … being neither benevolent nor harsh, but rather seeking a construction which is reasonable and fair to both patentee and public". Consideration can thus be given to the patent specifications to understand what was meant by the words in the claims. One must be wary, however, not to use these so as "to enlarge or contract the scope of the claim as written and … understood". The Supreme Court recently emphasized that the focus of the validity analysis will be on the claims; specifications will be relevant where there is ambiguity in the claims.
>
> [34] Finally, it is important to stress that claim construction must be the same for the purpose of validity and for the purpose of infringement.
>
> [citations omitted]

[40] One area of disagreement between the parties is when, if ever, one may have recourse to the disclosure when construing the claims. Google submits that recourse to the patent disclosure to ascertain the meaning of terms in the claims is impermissible when the terms in the claim are unambiguous. Neither expert perceived any ambiguity in the claim terms in the 150 Patent.

Google also submits that Dr. Johnson's construction of "an order" is "based exclusively" on the disclosure.

[41] In my view, Google takes too broad a view of the law. Forty years ago, the Supreme Court in *Consolboard Inc v MacMillan Bloedel (Sask) Ltd*, [1981] 1 SCR 504 at 520 observed:

> We must look to the whole of the disclosure and the claims to ascertain the nature of the invention and methods of its performance, being neither benevolent nor harsh, but rather seeking a construction which is reasonable and fair to both patentee and public.
>
> [citation omitted]

[42] In *Guest Tek Interactive Entertainment Ltd v Nomadix, Inc*, 2021 FC 276 [*Guest Tek*] at paragraphs 41 to 48, Justice McHaffie recently examined the jurisprudence of the Supreme Court of Canada and the Federal Court of Appeal as to when recourse to the disclosure in claim construction is appropriate. He concludes at paragraph 47:

> [T]he exercise of construction must consider both the disclosure and the claims, with the claims being purposively construed in the context of the patent as a whole and in light of the CGK of the POSITA. However, the focus remains on the language of the claims, which defines the scope of the monopoly. The disclosure should not be used to enlarge or contract the scope of the claims, particularly through the addition of words or limitations not found in the claims.

[43] Justices Grammond and Manson recently reached effectively the same conclusion: see *Bauer Hockey Ltd v Sport Maska Inc (CCM Hockey)*, 2020 FC 624 at paras 54 to 59, aff'd 2021 FCA 166; *ViiV Healthcare Company v Gilead Sciences Canada, Inc*, 2020 FC 486 at paras 45, 49 to 66 & 128, aff'd 2021 FCA 122 at paras 57 to 61.

[44] I agree. As I noted in *Janssen-Ortho Inc v Canada (Minister of Health)*, 2010 FC 42, one must first look to the claims. Reference may be had to the disclosure in order to understand or confirm what the claims say, but cannot be used to change the scope of the claims. "[O]ne should not take an unescorted and unchaperoned romp through the disclosure; one must have a guide or compass which one obtains from first examining all of the claims of the patent."

[45] Dr. Kyriakakis and Dr. Johnson agree on many aspects of the construction of Claim 7. However, they are in disagreement with respect to what is meant by the "received signal," the "output signal," the "echo canceller," the "noise suppressor," the "order of echo cancellation and noise suppression," and what it means for something to be "based on an amount of noise." They agree that all of the elements of Claim 7 are essential. For ease of reference, I will set out Claim 7 and bold those terms where there is disagreement between the experts.

> 7. An electronic device, comprising:
>
> an audio input configured to receive **a received signal**;
>
> an audio output configured to output **an output signal**;
>
> a transceiver configured to transmit a transmitted signal; and
>
> an adaptive echo and noise control system coupled to the audio input, the audio output, and the transceiver, the adaptive echo and noise control system including
>
> **an echo canceller**; and
>
> **a noise suppressor**,
>
> wherein the adaptive echo and noise control system is configured to adaptively determine **an order of echo cancellation and noise suppression based on an amount of noise** in the received signal to generate a desired signal, and
>
> wherein the adaptive echo and noise control system is further configured to send the desired signal to the transceiver.

[46] The gravamen of this dispute is the competing interpretations of the following element of Claim 7: "wherein the adaptive echo and noise control system is configured to adaptively determine an order of echo cancellation and noise suppression based on an amount of noise in the received signal to generate a desired signal." This is where the shoe pinches, as first described in Canada by Justice Hughes in *Shire Biochem Inc v Canada (Health)*, 2008 FC 538 at paragraph 22:

> The Court, however is not to construe a claim without knowing where the disputes between the parties lie. To quote Justice Floyd of the England and Wales High Court (Patent Court) in *Qualcomm Incorporated v Nokia Corporation* [2008] EWHC 329 (Pat) at paragraphs 7 to 11, who in turn quoted the late Justice Pumfrey (as he then was) in *Nokia v Interdigital Technology Corporation* [2007] EWHC 3077 (Pat), "it is essential to see where the shoe pinches so that one can concentrate on the important points."

[47] The disagreement between the experts as to what is meant by "echo cancellation" and "noise suppression" is largely motivated by the question of whether "echo cancellation" is a subset of "noise suppression" or whether the two terms are mutually exclusive.

[48] As noted above, echo is the part of the received signal caused by the sound coming from the device's speakers being picked up by the audio input while noise, broadly defined, is any undesired part of the signal. Dr. Kyriakakis' opinion is that since echo is an undesired part of the signal, it is a form of noise. His opinion is also that there is no meaningful difference between cancellation and suppression:

> 61. Noise is a general term for unwanted signals and is context-dependent. For example, in a recording session, the intention may [be] for the microphone to capture a singer's performance. Any input other than the sound of the singer's voice would be noise (including the wind, traffic, ventilation systems, distant conversations, people's movements) and any electrical signals

> introduced by the microphone or any other equipment. Similarly, in the case of a personal digital assistant trying to decode a voice input, noise would be any sound other than the voice input, including any sound generated by the device itself.
>
> […]
>
> 63. One source of unwanted sound (i.e., noise) is echo. Echo occurs, among other ways, when an audio signal is repeated and causes unwanted effects.
>
> […]
>
> 96. The skilled person would understand that the terms "cancellation" and "suppression" in the context of noise and echo control and the 150 patent have substantially similar meanings. Real-world echo cancellers reduce or suppress echo, but they do not eliminate or "cancel" it entirely.

[49] Dr. Johnson disagrees. He says that "suppression" and "cancellation" are distinct processes. Furthermore, Sonos submits that while that echo is, strictly speaking, a type of noise, the way these terms are used in the 150 Patent indicates that they are to be treated as distinct processes.

[50] I agree with Sonos. On a purposive reading of the claims of the 150 Patent, it is clear that "noise suppression" and "echo cancellation" are meant to be two distinct and mutually exclusive processes. If "noise suppression" includes "echo cancellation," then Claim 7 would include a device that has two echo cancellers. In that case, it would not be possible to determine an order of noise suppression and echo cancellation, as the order would always be simultaneously both Echo Cancellation → Echo Cancellation and Noise Suppression → Noise Suppression. In order for Claim 7 to be given meaning, echo cancellation and noise suppression must be distinct, mutually exclusive options.

[51] This interpretation of “noise suppression” and “echo cancellation” is further supported by the disclosure of the 150 Patent. Throughout the disclosure, echo is always treated as a separate and distinct phenomenon from noise. Similarly, echo cancellation and noise suppression are treated as distinct processes. There is no suggestion of any overlap between the two.

[52] For these reasons, “noise” must be construed as “noise other than echo” and, to the extent that echo cancellation is a subset of noise suppression, “noise suppression” must be construed as “noise suppression other than echo cancellation.”

[53] The experts agreed in their first reports as to what the POSITA would understand by the phrase “adaptive” and “adaptively determine” in Claim 7.

[54] Dr. Kyriakakis writes in his first report:

> “Adaptively determining” an order of noise suppression and echo cancellation “based on the background noise in the signal” means that the claimed method can change between potential orders of noise suppression and echo cancellation with reference in some way to the background noise in the signal characterized in the previous element. This element does not restrict the method to any particular adaptation in the order, nor does the claim restrict how the background noise is to be referenced in adapting the order.

[55] Dr. Johnson writes in his first report:

> “Adaptively” means that [the] order of Echo Cancellation and Noise Suppression can change during operation.
>
> […]
>
> “Amount” would be understood by a POSITA to mean a numerical value related to the average amplitude level of the background noise.

> [To generate a desired signal] would be understood to mean that the determination of the order of [noise suppression] and [echo cancellation] is used in some way to generate a result, which presumably has echo and noise removed and is thus referred to as a "desired signal."

[56] Google submits that Dr. Johnson changed his interpretation of this element in the Second Johnson Report to add that the system changes automatically without being triggered or requested by the user. It points to the following passage in the Second Johnson Report:

> There is a clear distinction between a change happening in real-time during a system operation and a change triggered or requested by the user. Otherwise, the term "adaptively" would be superfluous. Changes to system operation or system state that are caused by user requests are not representative of "adaptive" performance within the system.

[57] I do not accept Google's submission. In the First Johnson Report, Dr. Johnson writes, "In general, the term "adaptive" in signal processing or communications refers to a process that can change in real-time during system operation in response to some criteria or algorithm." I simply do not accept Google's suggestion that this statement does not exclude a change triggered by a user command. A user command is not "some criteria or algorithm" as described by Dr. Johnson. The term adaptive suggests some degree of automatic response. A device that changes based on direct user inputs is more properly described as "adjustable" or "configurable." A lightbulb that changes brightness as the sky gets darker is adaptive; a lightbulb with a dimmer switch is not.

[58] In any event, Claim 7 of the 150 Patent provides that the device is not adaptive in general, but rather adaptive "based on an amount of noise in the signal." The experts agree that

noise is the undesired part of a signal. A user command is therefore not noise, and any change based on a user command would not fall within the scope of the claim.

[59] While the experts agree on the meaning of "determine," they disagree as to what is meant by "an order," and the proper construction of this phrase is critical to the position the parties take.

[60] Dr. Kyriakakis states, "the adaptive echo and noise control system is configured to adaptively determine an order of echo cancellation and noise suppression 'based on an amount of noise in the received signal'." Dr. Johnson agrees. Dr. Kyriakakis says:

> [A]n order of noise suppression and echo cancellation" indicates that the claimed method encompasses various orders of noise suppression and echo cancellation. The claim does not restrict the possible orders in any way other than to indicate that there be "an" order.

[61] In the First Johnson Report, Dr. Johnson says:

> The term "order" refers to the order of operation of the noise suppression and echo cancellation components specifically. Given the wording of the '150 Patent claims and the wording of the supporting patent description, a POSITA would understand the "order" to mean that each of these components is present in the system sequentially, with one of them happening "first" and one of them happening "second".
>
> [emphasis added]

[62] Unlike Dr. Johnson, Dr. Kyriakakis is of the view that a system that has both noise suppression and echo cancellation functions available may have an order even if one of them is not performed. He explained this in cross-examination:

> Q Okay. So if I have a system going from echo cancelling alone to noise suppression alone, or vice versa, it would still determine an order of echo cancellation and noise suppression?
>
> A. It would because those blocks would have to be there all the time and just turned on and off, and so – –
>
> Q. Okay.
>
> A. – – the order is there.

[63] In my view, Dr. Kyriakakis' view is flawed. If a device has the possibility of engaging two processes, A and B, then the order of those processes can be A → B, or B → A. If one of those processes, although available, is not performed, then A → Nil or Nil → B is not an order of the two processes. An order is a sequence, and there is no sequence if only one of the processes is being run. The absurdity of Dr. Kyriakakis' view is revealed if one considers the situation where neither A or B is engaged. What is the order of those processes then? Nil → Nil? There is no order to the processes as there are no processes.

[64] I agree with Dr. Johnson's interpretation that to have "an order of echo cancellation and noise suppression" both functions must be performed in a sequence. This means that the device of Claim 7 must have at least two operating states that include both noise suppression and echo cancellation, with the sequence of echo cancellation and noise suppression in those states being different. Which of those operating states is active must be determined by the system based on the amount of noise in the received signal, which does not include a user command.

V. INFRINGEMENT

Direct Infringement

[65] I agree with the submission of Sonos that the Sonos Devices do not directly infringe the 150 Patent. As noted above, out of the box, the Sonos Devices do not have the voice assistant configured, the microphone is off, and the beep acknowledgement tone is disabled. The Sonos Voice Pipeline, the allegedly infringing item, is only used after and when the voice assistant is enabled. Accordingly, out of the box, the Sonos Voice Pipeline is not used at all. There is therefore no echo cancellation or noise suppression, nor any received signal.

Indirect Infringement

[66] Justice McHaffie recently summarized the law on inducing infringement in *Guest Tek* at paragraphs 56 to 59:

> [56] Inducing infringement is simply a form of patent infringement rather than a distinct tort: *Hospira* at para 45; *Western Oilfield (FCA)* at para 60. The parties agree that allegations of inducing infringement are governed by the three-part test adopted in *Warner Lambert Co v Wilkinson Sword Canada Inc*, [1988] FCJ No 70, 19 CPR (3d) 402 (FCTD) and reiterated by the Federal Court of Appeal in *Corlac* at para 162:
>
> > It is settled law that one who induces or procures another to infringe a patent is guilty of infringement of the patent. A determination of inducement requires the application of a three-prong test. First, the act of infringement must have been completed by the direct infringer. Second, the completion of the acts of infringement must be influenced by the acts of the alleged inducer to the point that, without the influence, direct infringement would not take place. Third, the influence must knowingly be exercised by the inducer, that is, the inducer knows

> that this influence will result in the completion of the act of infringement.
>
> [Emphasis added; citations omitted.]
>
> [57] With respect to the first component of the test, "[d]irect infringement occurs when the direct infringer has performed all of the essential steps in the claimed invention": *Western Oilfield (FCA)* at para 70. This does not necessarily require evidence coming directly from the direct infringer, but there must be evidence from which the Court can conclude on a balance of probabilities that direct infringement has occurred: *Western Oilfield Equipment Rentals Ltd v M-I LLC*, 2019 FC 1606 at paras 126, 129, aff'd *Western Oilfield (FCA)* at paras 67–68.
>
> [58] Guest Tek argued the second requirement creates a "but for" test that asks whether the infringing conduct would have occurred but for the defendant's conduct: *Western Oilfield (FC)* at paras 127, 130, aff'd *Western Oilfield (FCA)* at para 70. I agree the "without the influence" aspect of the second element of the *Warner Lambert/Corlac* test creates a "but for" test. But the test is whether the infringement would have occurred but for the *defendant's influence*, and not simply but for the *defendant's sale of a product* used by the direct infringer in the course of infringement. Again, proof of influence need not involve direct evidence from customers that they were induced to infringe by instructions given by the inducer, if this can be inferred from the inducer's and the inducee's conduct: *Western Oilfield (FC)* at paras 126, 130–131, aff'd *Western Oilfield (FCA)* at paras 67–69.
>
> [59] Similarly, with respect to the knowledge component in the third element of the test, as Justice O'Reilly stated in *Western Oilfield (FC)*, "the alleged inducer simply has to know what the third party is likely to do in response to its influence": *Western Oilfield (FC)* at para 133. The issue is not simply knowing what the third party is likely to do. It is knowing what the third party is likely to do *in response to the defendant's influence*.
>
> [emphasis in original]

[67] I accept the submissions of Google that if there is an act of infringement by the user, Sonos will be found to have induced that infringement.

[68] It is a prerequisite of a finding of infringement that the user has activated the voice assistant. As noted by Sonos, Dr. Kyriakakis only examined whether the Sonos Devices configured with the Amazon Alexa voice assistant infringed Claim 7. He did not examine the issue if the Sonos Devices were configured with the Google Assistant voice assistant. Accordingly, the only evidence of Google relates to the Sonos Devices when configured with the Amazon Alexa voice assistant.

[69] Sonos influences users to enable the Amazon Alexa voice assistant, and Sonos would know that in response to its influence a user is likely to enable the assistant. While initially disabled, Sonos provides the Sonos Voice Pipeline to its users and advertises that the Sonos Devices are compatible with the Amazon Alexa voice assistant. For example, the user manuals included in evidence inform users that the Sonos Devices support the Amazon Alexa voice assistant and provide links so that they can learn more about setting up the voice assistant.

[70] The question therefore is whether a user, when using the Sonos Devices with the Amazon Alexa voice assistant enabled, infringes Claim 7.

[71] Google's evidence of infringement comes from Dr. Kyriakakis. In the First Kyriakakis Report, he identifies four different states in which the Sonos Voice Pipeline operates [the States]. He says that an examination of these States and the transition between them reveals the infringement of Claim 7. They are as follows: State No. 1 — System powered on but idle, State No. 2 — System recognizes wake word, State No. 3 — System plays content, and State No. 4 —

Pauses during playback where no sound is being played out of the loudspeakers (he says this is like State No 1 except that the system is not idle).

[72] I will attempt to explain and analyze his conclusion regarding the echo cancellation and noise suppression order in each State, so far as is possible without referencing the technical and confidential detail in the Sonos Source Code. Dr. Kyriakakis concludes the order in each State is as follows:

> State 1: Noise Suppression → Nil → Noise Suppression
>
> State 2: Noise Suppression → Echo Cancellation → Noise Suppression
>
> State 3: Noise Suppression → Echo Cancellation → Echo Suppression
>
> State 4: Noise Suppression → Nil → Noise Suppression

[73] It will be noted that each State begins with noise suppression. That function is the [redacted] performed in the [redacted] of the Sonos Pipeline.

[74] Microphones often produce low or zero frequency signal components that result from their own DC power needs. In the Sonos Pipeline, these components are removed [redacted]

[75] Dr. Johnson questions Dr. Kyriakakis' description of this as "noise suppression" saying that it is "a standard signal processing operation that simply removes any small level shift in the

signal" and "has no audible impact on the signal." In addition, Dr. Johnson observes that [redacted] is not adaptive. It runs whenever the microphone is on.

[76] Whether one accepts that [redacted] is noise suppression, the proper interpretation of Claim 7 requires both echo cancellation and noise suppression and only the transition between States 2 and 3 could infringe Claim 7, as both of those operations are present only in those States.

[77] However, in both States 2 and 3 the order begins with noise suppression followed by echo cancellation. This is then followed by either noise suppression (State 2) or echo suppression (State 3). "Echo suppression" is not a term used in Claim 7 or elsewhere in the 150 Patent. I agree with Dr. Johnson that Dr. Kyriakakis probably used the term "echo suppression" in State 3 "because the word 'echo' is present in the variable and method names within the Sonos Source Code." I further agree that Dr. Kyriakakis implies, by his use of coloured fonts in his description of the States, that it is the same as echo cancellation.

[78] I prefer the evidence of Dr. Johnson as to the third step in State 3. Step 3 is performed by a [redacted], which Dr. Johnson says is a well-known method of noise suppression.

> 280. A [redacted] is a well-known version of the [redacted] that can be used with multiple microphones. It is not an echo canceller and does not model the acoustic echo path or perform echo cancellation in any way.
>
> 281. It is also useful to note that "echo suppression" and "residual echo suppression" are terms commonly used in the literature to describe noise suppressors placed after echo cancellers. This point was discussed in my First Report as well,

since a number of prior art systems disclose residual echo suppression.

282. In line with these references and the understanding of a POSITA, the Sonos Source Code:

a. uses the [redacted] parameters to optimize [redacted],

b. uses the [redacted] parameters to optimize [redacted].

283. The name of the parameter chosen by Sonos is directly in line with this operation: it simply reflects the circumstances in which the parameters are set. The name of the set of parameters is in no way determinative of what [redacted] does.

[…]

285. These parameters represent numerical changes in the operation of the [redacted], but do not change its operation procedure, turn on or off any of its components, or change anything about the [redacted] algorithm used.

286. A POSITA would know what a [redacted] is and clearly understand that the [redacted] component of the Sonos Voice Pipeline is a noise suppressor no matter the values of the parameter settings as described above.

[79] With this understanding, States 2 and 3 are identical and operate as follows:

State 2: Noise Suppression → Echo Cancellation → Noise Suppression

State 3: Noise Suppression → Echo Cancellation → Noise Suppression

[80] I agree with Dr. Johnson's observation that within each State there is no change in the order of the processes. Moreover, as he further observes, the triggering event that moves from one State to another is not adaptive, but is user controlled or done in a pre-determined manner.

> 296. …The triggering events to these operating state changes are the following:
>
> a. From State 1 to State 2: the user says the wake word.
>
> b. From State 2 to State 1: the "beep" acknowledgement tone stops.
>
> c. From State 1 to State 3: System starts playing content (music) in response to a user's request.
>
> d. From State 3 to State 4: Music is playing, and there is a pause.
>
> e. From State 4 to State 3: Music resumes.
>
> 297. These are all large-scale operating modes of the Sonos Products: playing music, not playing music, receiving a command, executing the command.
>
> 298. Every one of these is triggered by user events. The transitions (a), (c), (d), and (e) are all operating mode transitions that are explicitly triggered by user commands – it is users that say the wake word, request the device to play music, and cause music to pause and to resume. Transition (b) happens a pre-specified amount of time after the beep acknowledgment caused by wake word detection, which, as noted, is itself triggered by the user.
>
> 299. The key point is that there is nothing adaptive to these changes. None of these changes happen in real-time during normal system operation as a result of the system trying to improve its performance. These changes are not anything other than simple predetermined operating modes triggered by users.

[81] In brief, I find that the Sonos Devices are not "configured to adaptively determine an order of echo cancellation and noise suppression based on an amount of noise in the received signal to generate a desired signal" and therefore do not infringe Claim 7.

VI. INVALIDITY

[82] It is agreed that the principles governing the obviousness analysis are those set out by the Supreme Court of Canada in *Apotex Inc v Sanofi-Synthelabo Canada Inc*, 2008 SCC 61 [*Sanofi*]. At paragraph 67, a four step approach was described:

> (1) (a) Identify the notional "person skilled in the art";
>
> (b) Identify the relevant common general knowledge of that person;
>
> (2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
>
> (3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;
>
> (4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

(1)(a) POSITA

[83] The experts' views of the POSITA do not materially differ. Generally, the POSITA has a degree in electrical or computer engineering, experience in audio signal processing and communication, with some basic knowledge of adaptive signal processing.

(1)(b) CGK

[84] Similarly, there is little dispute between the parties as to the CGK of the POSITA. Dr. Johnson says that the CGK includes the following articles:

- Y. Guelou, A. Benamar, and P. Scalart, "Analysis of Two Structures for Combined Acoustic Echo Cancellation and Noise Reduction", *1996 IEEE International Conference on Acoustics, Speech, and Signal Processing Conference Proceedings (ICASSP)*, pp 637-640, May 1996 [Guelou 1996]

- C. Beaugeant, V. Turbin, P. Scalart, and A. Gilloire, "New Optimal Filtering Approaches for Hands-Free Telecommunication Terminals", Signal Processing, Vol. 64, No. 1, pp 33-47, January 1998 [Beaugeant 1998]

- Jeannès, Scalart, Faucon, and Beaugeant, "Combined Noise and Echo Reduction in Hands-Free Systems: A Survey", IEEE Transactions on Speech and Audio Processing, Vol. 9, No. 8, pp 808-820, November 2001 [Jeannès 2001]

[85] Dr. Johnson says that each of these documents "relates directly to the area of echo cancellation and noise suppression in communications systems, and would have been readily available and easily accessible to a POSITA at the time." Google accepts that these articles form part of the CGK as of the claim date.

(2) The Inventive Concept

[86] The experts generally agreed on the inventive concept of Claim 7: the ability to adaptively determine the order of the echo cancellation and noise suppression components in an echo and noise control system based on the amount of noise in the received signal. However, they disagreed on the meanings of "adaptively" and "order." As noted above, I have accepted Dr. Johnson's view of the meaning of these terms.

(3) Differences between the CGK and the Inventive Concept

[87] Generally, it was known that echo cancellation and noise suppression were effective in cleaning a signal. I accept Google's summary of the prior art which is as follows.

[88] Guelou 1996 discusses a system where echo cancellation is performed before noise suppression and a system where noise suppression is performed before echo cancellation. It does not discuss any system that determines an order of noise suppression and echo cancellation from multiple options, any system that adaptively determines an order of noise suppression and echo cancellation, or any system that determines an order of noise suppression and echo cancellation based on the noise in the received signal.

[89] Beaugeant 1998 discusses a system where echo cancellation is performed before noise suppression, a system where noise suppression is performed before echo cancellation, and trade-offs in performance between these two systems. This prior art proposes a theoretical combination of echo cancellation and noise suppression as an optimal result. It does not disclose a system that adaptively determines an order of echo cancellation and noise suppression.

[90] Jeannès 2001 reviews the state of the art at 2001. It discusses systems where echo cancellation is performed before noise suppression and systems where noise suppression is performed before echo cancellation. It does not discuss or identify any prior art that discusses any system that determines an order of noise suppression and echo cancellation from multiple options, any system that adaptively determines an order of noise suppression and echo

cancellation, or any system that determines an order of noise suppression and echo cancellation based on the noise in the received signal.

[91] Dr. Johnson's opinion on obviousness requires more than these three pieces of prior art. In his first report, he relies on United States Patent No. 5,668,871 "Audio Signal Processor and Method Therefor for Substantially Reducing Audio Feedback in a Communication Circuit" [the 871 Patent] alone or with US Application No. 2002/0041678 A1 "Method and Apparatus for Integrated Echo Cancellation and Noise Reduction for Fixed Subscriber Terminals" [the 678 Patent Application]. However, in its closing, Sonos relied only on the 871 Patent.

[92] Google submits that the 871 Patent is not eligible prior art because it would not have been located in a reasonably diligent search. The proof of that, it says, is that it was not cited by Sonos in its initial or first amended pleading but was raised by Sonos only in April 2022, when it notified Google that it intended to supplement its prior art pleading by referencing the 871 Patent. Moreover, it was not found by either expert despite their personal familiarity with the field and despite Dr. Johnson having conducted a diligent search. He admitted that it had been provided to him by Sonos' counsel. Neither he nor Dr. Kyriakakis had known of or read the 871 Patent prior to the recent amendment to Sonos' pleading.

[93] Google relies on Justice Kane's decision in *Teva Canada Innovation v Pharmascience Inc*, 2020 FC 1158 [*Teva*].

[94] Specifically, Google relies on Justice Kane's statement at paragraph 796, which it says is on all-fours with the current situation:

> First, the prior art relied on by Pharmascience would not all have been found by the POSITA, as it was not all found by Dr. Green in his search. Notably, Dr. Green stated that he did not turn up the FDA SBOA, Khan 2008, Caon 2009 or Devonshire 2006. Dr. Green noted that he was not aware of the FDA SBOA or Flechter 2002 in 2009. Dr. Green also agreed that the POSITA would not look at Devonshire 2006.

[95] Google notes that the Federal Court of Appeal affirmed Justice Kane on this point:

> I am not convinced that the Trial Judge improperly discounted or ignored any of the prior art cited by Pharmascience. The Trial Judge understood the law concerning the relevance of prior art that would not be found in a diligent search (see paragraphs 499 to 501 of her reasons, and references therein to *Hospira Healthcare Corporation v. Kennedy Trust for Rheumatology Research*, 2020 FCA 30), and was apparently concerned that, given the difficulty in locating certain prior art, the PSA would not have been led directly and without difficulty to combine these references. This reasoning was not erroneous.
>
> *Pharmascience Inc v Teva Canada Innovation*, 2022 FCA 2 [*Pharmascience*] at para 32.

[96] I am of the view that Google goes too far when it says that the 871 Patent is not eligible prior art because it would not have been located in a reasonably diligent search. Indeed in *Hospira Healthcare Corporation v Kennedy Trust for Rheumatology Research*, 2020 FCA 30 [*Hospira*], Justice Locke held at paragraph 86: "I conclude that it is an error to exclude from consideration prior art that was available to the public at the relevant date simply because it would not have been located in a reasonably diligent search."

[97] Justice Locke also authored the reasons of the Federal Court of Appeal that affirmed Justice Kane's reasoning in *Teva*. In so doing, he did not reverse what he said in *Hospira*. In my view, what both Justice Kane and Justice Locke were saying was that the obscure prior art reference is eligible prior art at step three of the *Sanofi* analysis. However, the difficulty of locating a document is a matter that may be considered at the final step. This is made clear by Justice Locke in the remaining sentences of paragraph 86 of *Hospira*:

> The likelihood that a prior art reference would not have been located by a PSA may be relevant to consideration of step 4 of the obviousness analysis (whether differences between the state of the art and the inventive concept constitute steps which would have been obvious to the PSA) in that the uninventive PSA might not have thought to combine that prior art reference with other prior art to make the claimed invention. However, excluding prior art simply because it is difficult to find is problematic because it would result in the possibility of a valid patent on an invention that had, but for some non-inventive tweak, already been disclosed to the public. In my view, that is not what Canada's patent regime is intended to permit.

[98] The question thus becomes whether, given the obscure nature of the 871 Patent, the uninventive POSITA might have thought to combine the 871 Patent with other prior art to make the claimed invention.

(4) Do Those Differences Constitute Steps Which Would Have Been Obvious to the POSITA or Do They Require Any Degree of Invention

[99] The 871 Patent states that it is addressing a well-known problem of acoustic feedback associated with communication units, particularly hands free telephones. Dr. Johnson describes the invention as follows:

> [A]n an audio signal processor that reduces noise in a telephone system by implementing noise attenuators in both the forward and

> reverse paths of the system, and turning these on and off such that one is enabled, and one is disabled depending on the voice activity in the signal paths. During operation, the voice detection system compares the sound level to one of several thresholds to determine whether an attenuator is placed before the echo canceller or after the echo canceller.

[100] Although Dr. Johnson used the term "noise attenuators," he agreed in cross-examination that the 871 Patent speaks only of "attenuators" and that they are used to turn the volume down on the whole signal to reduce feedback when it is determined that there is no voice in the signal. They do not discriminate between noise and the desired part of the signal. This is not noise suppression. They do not clean the signal.

[101] The prior art regarding the cleaning of signals was that both echo cancellation and noise suppression were available tools. The POSITA knew that when both were used, there were advantages and disadvantages for the order in which they occurred. No one had considered whether there was a method of changing the ordering based on the amount of noise in the signal.

[102] Although the 871 Patent teaches turning the attenuators on and off based on the signal, it is effectively just turning down the volume to reduce feedback. It is not cleaning the signal using echo cancellation and noise suppression.

[103] Google notes that in the First Johnson Report, Dr. Johnson states when speaking of Claim 7, "It would be simple and obvious to a POSITA to consider replacing the attenuator from the '871 Patent with a noise suppression system for additional performance." I agree with Google's submission that "Dr. Johnson provides no reasons for this conclusion, no explanation

of what is meant by ‘additional performance’, and no discussion of what would lead the POSITA to make this substitution.” Such is required, especially because the POSITA is uninventive in the fourth step of the analysis.

[104] I accept Dr. Kyriakakis’ explanation why the POSITA would not consider replacing the attenuator with a noise suppressor:

> 385. As discussed above, the 871 patent is not addressed to removing echo and noise from an input signal. Rather, it is addressed to reducing feedback by turning down the volume of a signal that is input at a microphone and travels to a transmitter when a separate signal travelling from a receiver to a loudspeaker contains speech, and *vice versa*. The system of the 871 patent does not attempt to remove noise from any signal.
>
> 386. Feedback arises from any locally amplified signal regardless of whether it is noise or otherwise. The skilled addressee would understand that using a noise suppressor in the system of the 871 patent in place of an attenuator would actually reduce the performance of the system because it would only address a portion of the signal. The skilled addressee would thus not seek to make this switch for “additional performance”.

[105] In any event, like Justice Kane in *Teva*, I find, given the difficulty in locating the 871 Patent, that the POSITA would not have been led directly and without difficulty to combine these references.

[106] For these reasons, I reject the Sonos submission that the 150 Patent was obvious based on any combination involving the 871 Patent. The Counterclaim must be dismissed.

[107] Although Sonos was unsuccessful in its Counterclaim, it was successful in the most important aspect of the action – defending the claim of infringement. The Counterclaim also

directly overlapped with Sonos' defence to Google's claim, as Sonos argued, *inter alia*, that the 150 Patent was invalid due to obviousness. Accordingly, it is entitled to its reasonable costs, but at a somewhat discounted percentage.

[108] The parties were asked at trial to provide submissions on costs, but none has yet been received. If the parties are unable to agree on costs, Sonos is to provide its written submissions on costs, not exceeding 10 pages, within 10 days of the receipt of these reasons, Google's reply submissions are to be delivered within 10 days thereafter.

[109] Public Reasons shall issue after the parties have advised the Court, within 10 days after receipt of these Confidential Reasons, of any redactions they propose be made.

JUDGMENT in T-952-20

THIS COURT'S JUDGMENT is that

1. The Claim is dismissed; the Sonos Devices do not infringe Claim 7 of Canadian Patent No. 2,545,150;

2. The Counterclaim is dismissed; Claim 7 of Canadian Patent No. 2,545,150 is not invalid for obviousness; and

3. Costs are reserved.

"Russel W. Zinn"
Judge

FEDERAL COURT

SOLICITORS OF RECORD

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