UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SILICON LABORATORIES, INC.
Petitioner

v.

CRESTA TECHNOLOGY CORPORATION
Patent Owner

CASE: IPR2015-00626
Patent No. 7,265,792

Title: Television Receiver for Digital and Analog Television Signals

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SUPPLEMENTAL DECLARATION OF DOUGLAS HOLBERG IN SUPPORT OF REPLY TO PATENT OWNER'S RESPONSE

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DECLARATION BY DOUGLAS HOLBERG

I, Douglas Holberg, hereby declare, affirm and state the following:

I. INTRODUCTION

1. The facts set forth below are known to me personally and I have firsthand knowledge of them. I am a U.S. citizen over eighteen years of age. I am fully competent to testify as to the matters addressed in this Declaration. I understand that this Declaration is being submitted along with and in support of Petitioner's Reply to Patent Owner's Response ("POR") in Case No. IPR2015-00626 regarding US Patent No. 7,265,792 ("the '792 patent").

2. In this declaration, I was asked to respond to the opinions expressed by Dr. Opris in his Declaration Regarding the Validity of US Patent No. 7,265,792, Exhibit 2032 (hereafter "Opris Dec.") as well as the arguments raised by the Patent Owner in its Patent Owner Response to the Petition (hereafter "POR"). As described in detail in this Declaration, it remains my opinion that claims 17-19, 24-26, and 28-29 of the '792 Patent are unpatentable, Dr. Opris's opinion notwithstanding.

II. RELATED TESTIMONY IN IPR2015-00615

3. Many of the arguments raised in the POR and echoed in Dr. Opris's declaration are identical to those raised by the Patent Owner in IPR2015-00615 involving the '585 Patent. In fact, as shown in the chart below (and as he

confirmed during his deposition), it appears that Dr. Opris's testimony is identical on the issues that are common across the two cases.

IPR2015-00626 ('792 Patent)	IPR2015-00615 ('585 Patent)
Ex. 2032, ¶¶68-70 ("select signal")	Ex. 2032, ¶¶73-75 ("select signal")
Ex. 2032, ¶¶76-82 (claim 24)	Ex. 2032, ¶¶97-103 (claim 11)
Ex. 2032, ¶¶85-87 (claim 25)	Ex. 2032, ¶¶106-108 (claim 12)
Ex. 2032, ¶¶89-97 (claim 26)	Ex. 2032, ¶¶80-88 (claim 13)
Ex. 2032, ¶¶100-103 (claim 28)	Ex. 2032, ¶¶91-94 (claims 15, 20)
Ex. 2032, ¶¶106-109 (claim 27)	Ex. 2032, ¶¶111-114 (claim 14)

Rather than repeat my response to that testimony, I direct the Board to my Reply declaration from IPR2015-00615, which I understand is being filed concurrently in this case as Exhibit 1061. When necessary, I may refer to my previous reply declaration by the abbreviation "Holberg Rep."

4. In addition, I will summarize my related testimony in IPR2015-00615 where appropriate as well as address those issues or facts that are unique to the '792 Patent.

III. MATERIALS CONSIDERED

5. In forming the opinions expressed herein, I have reviewed and considered numerous documents, including the following materials:

A. Exhibits submitted by Petitioner: Exhibits 1001-1040, 1053-1055, and 1059-1061.

B. Exhibits submitted by Patent Owner: Exhibits 2001-2011 and 2020-2037.

C. Patent Owner Response, Paper No. 17 (Nov. 30, 2015) (hereafter "POR").

D. Final Written Decision, IPR2014-00809, Paper No. 56 (Oct. 21, 2015), Exhibit 1062 (hereafter "FWD").

IV. THE '792 PATENT

Board's Previous Constructions

6. In its Final Written Decision in IPR2014-00809, the Board construed the following terms as follows:

- "**input RF Signals**"—"Signals that are input having a frequency between 10 kHz and 100 GHz";
- "**frequency conversion circuit**"—"a circuit for converting the frequency of the input RF signal to an intermediate frequency signal having an intermediate frequency";
- "**input RF signals encoding information in one of a plurality of formats**"—"requiring that each received input RF signal encode information in exactly one format";
- "**signal processor for processing … in accordance with said format**"—"a digital module that processes signals in the digital

domain in the exactly one format in which each received input RF signal is encoded." and

- "**Format**"—"analog and digital signals are examples of distinct formats";
- "**Baseband signal**"—"a signal without transmission modulation";

FWD at 7–14. I have used these constructions in formulating the opinions expressed herein.

Patent Owner's Proposed Constructions

7. In its Patent Owner response, Patent Owner raises two claim construction issues, one explicitly and one implicitly. As discussed below in detail, I do not agree with either of Patent Owner's proposed constructions because they do not reflect the plain and ordinary meaning of those terms as would be understood by a POSITA in light of the specification.

8. "**select signal**"— In my opinion, this term should be given the same meaning in the '792 Patent as in the '585 Patent given the similarity in the language and the disclosures. Both the Patent Owner and Dr. Opris appear to agree. Accordingly, in my opinion, the broadest reasonable construction of "select signal" in light of the '792 Patent specification to a POSITA is "a select signal that serves as a sign or indication of or is suggestive of a format of said input RF signal." *See* Ex. 1061 at ¶¶ 14-32.

9. **"carrier signals"**— In my opinion, this term should be given the same meaning in the '792 Patent as in the '585 Patent given the similarity in the language and the disclosures. While there are slight differences between the disclosures with respect to "carrier signals," as discussed below, the import of the teaching is the same. *See, infra*, ¶¶ 49-50. Accordingly, in my opinion, the broadest reasonable construction to a POSITA in light of the '792 Patent specification of the term "carrier signals" is "[a] wave having at least one characteristic that may be varied from a known reference value by modulation." *See* Ex. 1061 at ¶¶ 33-44 (quoting Ex. 1054 at 134 (IEEE Dictionary)).

V. OPINIONS RELATING TO EACH OF THE GROUNDS

10. I will now address each of the arguments raised in the Patent Owner's response and, in particular, Dr. Opris's opinions expressed in support of those arguments.

A. Ground 1: Claim 29 is Obvious

11. Claim 29 depends from claim 1. Claim 29 recites the following:

> **29**. The television receiver of claim **1**, wherein the input RF signal comprises an RF signal received from terrestrial broadcast, an RF signal received from satellite broadcast, and an RF signal received from cable transmission.

In its Final Written Decision, the Board concluded that claim 1 was unpatentable in light of the obvious combination of Thomson and Harris. FWD at 28.

Thomson Renders 29 Obvious

12. Patent Owner argues that the now unpatentable television receiver of claim 1 is rendered non-obvious by specifying the source of the television signal. In particular, Patent Owner argues that while Thomson admittedly discloses a multi-format TV receiver capable of processing an RF signal transmitted by a satellite, it would not be obvious for Thomson to also process an RF signal transmitted by antenna or over cable. Patent Owner's argument is inconsistent with both Thomson and its own specification.

Thomson's Receiver Can Process the IF_{SAT} Signal Transmitted from All Three Sources

13. All that claim 29 requires is that the receiver be able to process "the input signal" of claim 1 where that signal includes "an RF signal" that originates from three different sources—satellite, cable, and terrestrial. Patent Owner admits that Thomson's receiver is capable of receiving "an RF signal" from a satellite source. Thomson is also capable of receiving that same signal ("IFSAT") if it had been transmitted via cable or over an antenna. Thomson's receiver does not care whether the input RF signal was originally transmitted via satellite, cable or terrestrial. All that it cares about is that the input signal be within a given frequency range and that the television signal be in either an analog or digital

format. As long as those two conditions are satisfied, Thomson's receiver will process the input signal, regardless of its original source.

Patent Owner's Argument is Undermined by the '792 Patent

14. The inventors admitted in their specification that a TV receiver, almost by definition, receives and processes TV signals from these three sources:

> A television (TV) or video recorder includes a television signal receiver (or television receiver) to receive terrestrial broadcast, cable television or satellite broadcast television signals and to process the television signals into the appropriate video signals for display or for recording. Television

Ex. 1001 at 1:14-18; Ex. 1060 at 131:4-9. Thomson reinforces this proposition when it states that "[n]owadays, a multi-standard TV receiver should be able to function also as a satellite broadcast receiver." Ex. 1004 at 1:55-56. In other words, a multi-standard TV receiver should also be able to receive RF signals from satellite in addition to terrestrial and cable. *See* Ex. 1004 at 2:3 ("contrary to terrestrial and cable transmission"). During his deposition, Dr. Opris agreed. Ex. 1060 at 133:4-9.

15. Patent Owner's argument also is rather ironic in light of the complete absence of any disclosure relating specifically to an embodiment that has "the capability of processing" an RF signal received from all three sources. POR at 14. The word "satellite" only appears twice in the '792 Patent—once in the specification and once in claim 29. The sole reference in the specification to

"satellite" is the passage quoted above (1:14-18) describing the admitted state of the art. Ex. 1001 at 1:14-18. The words "cable" and "terrestrial," on the other hand, appear twice in the specification—once in connection with the admitted prior art and again in connection with "the present invention." That passage states that "[t]he input RF signals can be received from terrestrial broadcast or cable transmissions." *Id*. at 4:53-55. Notably absent from this list of signal sources is "satellite." This omission confirms that there are no patentable distinctions between an RF signal received from a satellite and one from any other source.

16. The inventors also do not describe any specific differences between the embodiment(s) that process "terrestrial broadcast or cable transmissions" and the one that processes satellite transmissions. The reason is that there are no significant differences, beyond those implementation details that are well known to a POSITA. During his deposition, Dr. Opris admitted that "it was well known at the time how to process a signal in a given format if you knew what the format was." Ex. 1060 at 132:13-17 ("Yes"). The inventors also admitted that, in "accordance with the principles of the present invention, a dual-format television (TV) receiver for receiving analog and digital TV signals *uses a single signal processing circuit for processing the received input RF television signal*," regardless of its source. Ex. 1001 at 3:9-12 (emphasis added); *see also id*. at 3:45-49 ("Another advantage of the dual-format TV receiver of the present invention is

that the digital signal processor circuit of the receivers uses a single signal processing path to process television signals in either the analog format or the digital format."). To now argue that the differences between processing an RF signal from a cable or terrestrial source is somehow non-obvious is inconsistent with the patent's specification. In addition, Dr. Opris admitted during his deposition that the differences were well known to a POSITA. Ex. 1060 at 129:7-19 ("I think that was known in the art at that time of the invention").

17. I agree that, to the extent that there are any differences between processing an RF signal from a terrestrial or cable source and one from a satellite, those differences are implementation details that are well within the skill of the art. For example, if the IF signal frequency differs between those three sources, a POSITA would know that the LO frequency would need to be chosen to accommodate those differences. As the '792 patent admits, such a design choice is well within the skill of the art. Ex. 1001 at 5:10-12 ("The value of the IF in an integrated tuner is a matter of design choice."). Likewise, to the extent that there are differences in the bandwidth of the TV signals transmitted over those sources, those differences are easily accommodated by designing the filter characteristics accordingly. Again, such implementation details are well within the ordinary skill in the art. Accordingly, it is my opinion that claim 29 is obvious to a POSITA.

B. Ground 2: Claims 24 and 25 are Obvious

Claim 24 is Obvious in Light of Grumman

18. Claim 24 depends from claim 1. Claim 24 recites the following:

> **24**. The television receiver of claim **1**, wherein the plurality of finite impulse response filters are stored in a memory, and the signal processor indexes the memory to retrieve one of the plurality of finite impulse response filters.

Claim 24 is essentially identical to claim 11 of the '585 Patent. The only difference being that claim 11 uses the more formal definite article "said," while claim 24 uses the informal article "the." Because Patent Owner makes the same arguments in support of claim 24's patentability as it did with respect to claim 11 of the '585 Patent, I refer the Board to my testimony in response to those arguments. Ex. 1061 at ¶¶45-75. In summary:

19. Thomson describes a single adaptive digital filter, not two parallel filters. *Id*. at ¶¶51-52.

20. Harris teaches a single reprogrammable FIR filter—rather than multiple, dedicated filters—with different sets of FIR filter coefficients stored in memory to save "cost and board space." *Id*. at ¶¶53-54.

21. Grumman discloses a dual-memory architecture for an adaptive FIR filter that includes two sets of filter coefficients that are swapped in and out of the filter transparently. *Id*. at ¶¶54-63.

22. Grumman describes two parallel processing circuits—one to process the real component and the other to process the imaginary component—that together with the "swap" circuitry comprise a "signal processor." *Id*. at ¶¶65-69.

23. A POSITA would be motivated to use Grumman's dual-memory architecture to implement Thomson's adaptive filter because of its transparent switching, which would result in minimal disruption to the viewer. *Id*. at ¶¶50, 71.

24. In my, claim 24 is obvious to a POSITA in light of Grumman for these same reasons.

Claim 25 is Obvious in Light of Grumman

25. Claim 25 recites the following:

> **25**. The television receiver of claim **1**, wherein the signal processor comprises a first computing unit and a second computing unit, the first computing unit processing a real part of the finite impulse response filter operation while the second computing unit processing an imaginary part of the finite impulse response filter operation.

26. Claim 25 is essentially identical to claim 12 of the ’585 Patent. The only difference being that claim 12 uses the more formal definite article “said,” while claim 25 uses the informal article “the.” Because Patent Owner makes the same arguments in support of claim 25’s patentability as it did with respect to claim 12 of the ’585 Patent, I refer the Board to my testimony in response to those arguments. Ex. 1061 at ¶¶72-75. In summary:

27. Grumman clearly describes two computing units—one “processing a real part of said finite impulse response filter operation” and another “processing an imaginary part.” Ex. 1008 at FIG. 1b; Ex. 1061 at ¶72. Dr. Opris agrees. Ex. 1060 at 94:18–21.

28. I articulated a rational basis to combine Grumman with Thomson and Harris. Ex. 1061 at ¶¶72–75.

29. Patent Owner’s premise that Harris includes “only” real filters is false, as shown by Patent Owner’s own exhibit. Ex. 2011-13 (NCOM “converts the signal of interest to baseband, generating a real component [Q] and an imaginary component [I].”); Ex. 1061 at ¶¶74-75.

30. Parallel processing of imaginary and real components of a complex signal was well known. The ‘792 Patent does nothing more than apply a known technique, in a known way, to achieve predicable

results. Ex. 1001 at 6:1-4 ("DSP 141 includes two computing units to speed up the computation time."). That is obvious. I disagree that using parallel processing, as taught by Grumman (among others), would be unduly complicated to a POSITA.

31. In my opinion, claim 25 is obvious to a POSITA in light of Grumman for these same reasons.

C. Ground 3: Claims 26 and 28 are Obvious

32. Claims 26 and 28 of the '792 Patent correspond to claims 13 and 15, respectively, of the '585 Patent. In my opinion, these claims are obvious.

Claim 26 is Obvious in Light of Zenith

33. Claim 26 depends from claim 1 and recites the following:

> **26**. The television receiver of claim **1**, further comprising a format/standard selection circuit coupled to the signal processor, the format/standard selection circuit generating a select signal indicative of a format of the input RF signal and the signal processor selecting a finite impulse response filter in response to the select signal.

Claim 26 tracks closely the language of claim 13 of the '585 Patent. There are three slight differences between the two. None of these differences, however, alter my analysis.

34. The first difference is that the circuit of claim 26 is part of the television receiver while the circuit of claim 1 is part of "said channel filter." Patent Owner does not argue that this difference is material to the analysis; I agree.

35. The second difference between the two sets of claims is that claim 26 of the '792 Patent refers to a "format/standard selection circuit" while claim 13 of the '585 Patent claims a "format selection circuit." Once again, Patent Owner does not argue that the claims should be construed differently. I agree given that the operative language—"a select signal indicative of a format of the input RF signal"—is the same in both claims. As a result, it is my opinion that the term should be construed consistently across the two patents.

36. Finally, like the other claims, claim 26 uses "the" in lieu of "said." Once again, that is a distinction without a difference.

37. Because Patent Owner makes the same arguments in support of claim 26's patentability as it did with respect to claim 13 of the '585 Patent, I refer the Board to my testimony in response to those arguments. Ex. 1061 at ¶¶76-89. In summary:

38. Patent Owner's primary argument is premised on a faulty claim construction of "select signal." *Id*. at ¶¶13-32, 77-78.

39. When properly construed, the Zenith µP output signal provides an "indication of" the format of the television format. *Id*. at ¶¶78-84.

40. Patent Owner's attempt to impose additional requirements on the "select signal" finds no support in the text of the claims or the specification. *Id*. at ¶84.

41. The fact that Zenith infers the presence of the digital format in the absence of a valid sync signal, rather than affirmatively detects the digital signal, is irrelevant. *Id*. at ¶85. The selection circuit in the '792 patent also detects the "absence" of a carrier signal.

42. Patent Owner cannot distinguish Zenith's selection circuit on this basis without also excluding its own preferred embodiment. *Id*. at ¶¶37, 85.

43. In my opinion, claim 26 is obvious to a POSITA in light of Zenith for these same reasons.

Claim 28 is Obvious in Light of Zenith

44. Claim 28 depends from claim 26 and recites the following:

> **28**. The television receiver of claim **26**, wherein the format/standard selection circuit generates the select signal by detecting carrier signals identifying one of the formats of the input RF signals.

Claim 28 tracks closely the language of claim 15 of the '585 Patent. There are three slight differences between the two. For the reasons explained above with respect to claim 26, however, none of these differences alter my analysis.

45. Because Patent Owner makes the same arguments in support of claim 28's patentability as it did with respect to claim 15 of the '585 Patent, I refer the Board to my testimony in response to those arguments. Ex. 1061 at ¶¶88-89. In summary:

46. Zenith satisfies the broadest reasonable construction of "carrier signals." *Id*. at ¶¶77-88.

47. Format detection is implemented in Zenith by "detecting in the baseband signals the presence or absence of [sync signals] which uniquely identify the television standards." *Id*. at ¶85 (quoting Ex. 2022 at 5:12–18).

48. The Balaban patent, cited by the applicant, expressly teaches that "detecting a carrier signal includes detecting at least one of a picture carrier, a sound carrier, and a synchronization signal." Ex. 1053 at 19:18–20, 15:33–37; Ex. 2022 at 1; Ex. 1061 at ¶89.

49. Patent Owner's attempt to distinguish between the slight differences between the '585 and '792 specifications mischaracterizes the '792 format/standard selection circuit. POR at 47. The '585 Patent explicitly states that the standard selection circuit detects the carrier signals "in the baseband signals." Ex. 2022 at 5:12-15. Patent Owner argues that, unlike the '585 Patent, "[t]he '792 patent never states that the carrier signal may be in the baseband signal." POR at

47. Once again, Patent Owner fails to acknowledge the entirety of the patent's teaching.

50. The totality of the '792 specification makes clear that this selection circuit detects the carrier signals in the baseband signal, just as in the '585 Patent. The '792 specification explains that in the "auto-detection mode" a "detection circuit can be included in receiver 100 for generating a signal which is fed back to the format/standard selection circuit 133 indicating which television format and standard the input signal is encoded." Ex. 1001 at 6:17-21. That detection circuit detects in the "first and second output signals the presence or absence of carrier signals." *Id*. at 6:12-14. These "first and second output signals" are the signals output on the first and second output terminals (104, 105) of the output circuit (140). *Id*. at 3:57-63. Those "two output terminals selectively provide the ***video baseband signals and audio baseband signals***…." *Id*. at 10:17-18 (emphasis added). For example, "the first output signal is a Composite Video Baseband Signal (CVBS) … and the second output signal is the audio baseband signal…." *Id*. at 7:28-32; 9:5-6; FIG. 1 ("CVBS"). While the descriptions are slightly different, the format/standard selection circuit in the '792 Patent detects the carrier signal in the baseband signals, just as in the '585 patent. In conclusion, claim 26 is obvious to a POSITA in view of Zenith's teaching.

D. Ground 4: Claim 27 is Obvious

51. Claim 27 depends from claim 26, which further depends from claim 1. Claim 27 recites the following:

> **27**. The television receiver of claim **26**, wherein the format/standard selection circuit generates the select signal in response to an input signal from a user.

Claim 27 tracks closely the language of claim 14 of the '585 Patent. There are three slight differences between the two. For the reasons explained above with respect to claim 26, however, none of these differences alter my analysis.

52. Because Patent Owner makes the same arguments in support of claim 27's patentability as it did with respect to claim 14 of the '585 Patent, I refer the Board to my testimony in response to those arguments. Ex. 1061 at ¶¶90-93. In summary:

53. Claim 27 does not exclude any sort of automatic detection. *Id*. at ¶¶90-91.

54. The '792 patent does not "explicitly distinguish[]" between "manual selection" and "automatic selection." *Id*. at ¶91.

55. A POSITA would understand that a combination of the two embodiments could be used to implement the format/standard selection circuit. *Id*. at ¶91.

56. It is hard to imagine a more obvious feature of a television receiver than a circuit that generates a select signal in response to a user input. *Id*. at ¶92.

57. It is my opinion that the broadest reasonable interpretation of claim 27 embraces a combination of manual and automatic detection. *Id*.

58. Birleson explicitly describes generating a select signal in response to the user changing the channel. Ex. 1015 at 11:20; Ex. 1061 at ¶¶92-93.

59. In my opinion, Claim 27 is obvious to a POSITA in light of Birleson.

E. Ground 5: Claims 18 and 19 are Obvious

Claim 18 is Obvious

60. While long, claim 1 is relatively simple. It recites two "digital-to-analog converter[s]" and three "driver circuit[s]." There is no argument that each of these elements is well known. There is also no argument that the two elements are being used in any way other than a conventional manner—the D-to-A converter converts a digital signal to an analog signal and the circuit drivers are driving the outputs of the D-to-A converters onto output terminals. The only argument that Patent Owner makes is that the specific circuit configuration is not obvious. I disagree.

61. Patent Owner claims to have invented two notoriously well known design techniques—signal multiplexing and differential signaling—in a multi-format television architecture. Petitioner's expert provided a rational basis for using both in the circuit of claim 18 in light of Oku, Ericsson and Nguyen, among others. Oku provides the basic output driver architecture that shows a DAC followed by a driver circuit that is specific to a particular device. Oku also shows that a single DAC can drive multiple drivers. Petition at 52. As I previously explained, claim 18 is simply an obvious variation of this basic DAC-driver architecture. Ex. 1009 at ¶¶76-89.

62. The fact that the signals are video and audio is irrelevant because the signals are well known and behave in predictable ways. A POSITA would have been motivated to implement the output circuit in this way to reduce the pin count of the resulting circuit. That person would understand that the differential output terminals used to supply the digital audio and video could and should be used to carry the analog audio and video signals because these output terminals would be unused when the incoming TV signal is the analog TV format. A POSITA would not want to dedicate two additional output terminals to the circuit because that would unnecessarily increase the pin count and possibly the resulting chip package size. This, in turn, would increase the size and cost of the circuit. Such a practical, common-sense, cost-savings decision is the epitome of obviousness.

63. The use of differential signaling is likewise notoriously well known. Contrary to Patent Owner's argument, I provided a fact-based, rational underpinning for this combination of references. My testimony is based on decades of IC design experience. As I, explained, a POSITA would have naturally thought to use differential signaling in a television application to improve the signal to noise ratio.

64. Patent Owner argues that the proposed combination fails because Oku only describes a single-ended output, rather than a differential one. POR at 52. Oku does not describe the outputs of the driver circuits as single ended; Oku is agnostic. Oku leaves it to the designer to select the signaling that is appropriate under the circumstances. A POSITA would have been motivated to select a differential output for the digital television output because of the high data rate of that signal in order to improve the fidelity of the signal.

65. Patent Owner next argues that Petition failed to provide a reason to combine Oku with Thomson and Harris. POR at 53. That is wrong. Thomson only describes a television tuner, not a complete television. Even Patent Owner's expert admits that additional components would be necessary to reproduce the transmitted video and audio. Ex. 1060 at 140:3-13. To convert the digital output of the Thomson receiver, a POSITA would understand that the digital signals would need to be converted back to analog signals before they could be reproduced

on a screen or a speaker. *Id*. at 140:17-25. Oku's output architecture provides a natural fit for that application because, like Thomson, it too is focused on television signals in both "analog and digital broadcasts." Ex. 1018 at 1. A POSITA would have naturally looked to Oku because of its "high picture quality."

66. Patent Owner next argues that Oku does not teach providing a differential output of "both video and audio information." POR at 54. Patent Owner fails to recognize that this follows naturally from the digital format of the television signal in Thomson. As I explained, the digital television format in Thomson is encoded using the MPEG format, which includes both video and audio. Ex. 1009, ¶54. As a result, the digital output of the Thomson digital demodulator includes both video and audio information, which would be reproduced by the output circuit of Oku.

67. All that remains of claim 18 is time division multiplexing the analog television signals and the digital television signals onto the same output terminals. As I previously explained, a POSITA would have been motivated to implement the output circuit in this way to reduce the pin count of the resulting circuit. Ex. 1009, ¶88. Such a practical, common-sense, cost-savings decision is the epitome of obviousness.

Claim 19 is Obvious

68. Claim 19, which depends from 18, recites the following:

> **19**. The television receiver of claim **18**, wherein the signal output circuit further comprises:
>
> a low pass filter coupled between the first digital-to-analog converter and the first and second driver circuits, the low pass filter providing low pass filtering function.

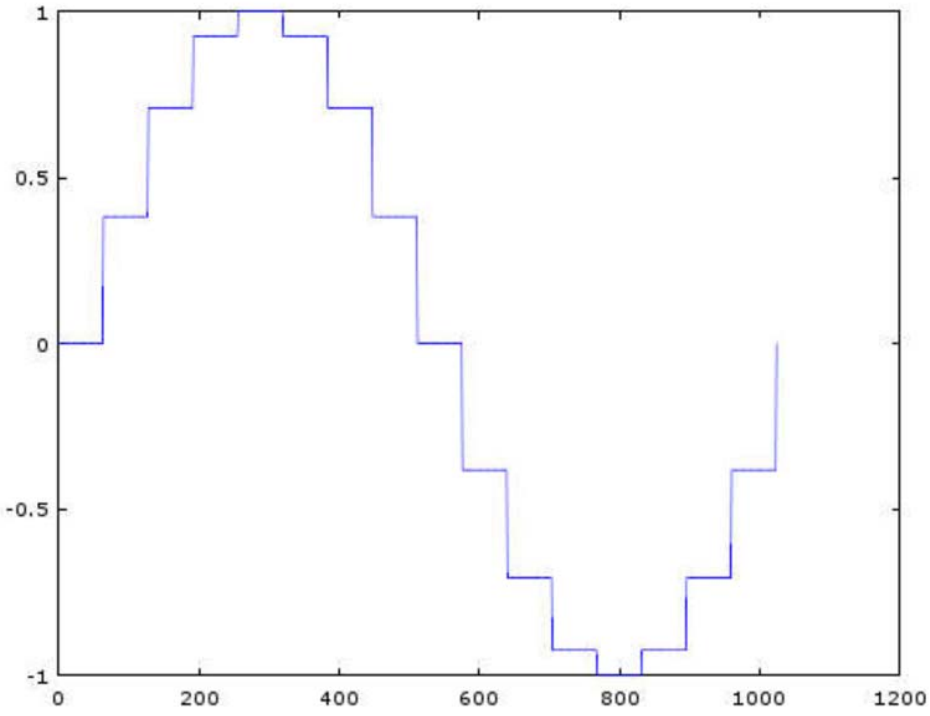
69. As shown above, claim 19 adds a low-pass filter between the DAC and the output driver circuit. As I previously explained, "[a] low-pass filter smoothes out waveforms and reduces or eliminates high-frequency noise which may introduced by the electronic circuitry including the DAC." Ex. 1009, ¶90. Patent Owner argues that, in the case of the '792 Patent, a LPF is unnecessary because the "signal has already been bandwidth limited." POR at 56 (citing Ex. 2032, ¶113). While it is true that the signal has already been "bandwidth limited," the DAC introduces high frequency components that need to be filtered out to produce a smoother analog signal.

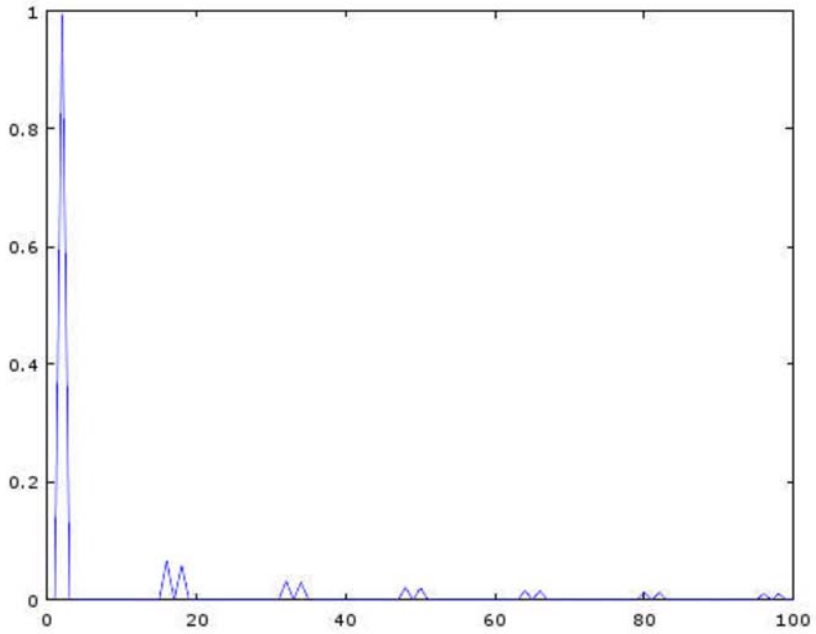
70. The use of a low-pass filter at the output of the DAC is particularly important when a lower sampling rate is used. The '792 Patent notes that the lower the sampling rate, the more important it is to smooth out the DAC output:

> In the above embodiments, the signal output circuit generates the audio output signal for analog television using a DAC and a single-ended driver. This configuration is suitable when the sampling rate of the DAC is high enough so that no filtering of the converted analog signal is needed. In other embodiments, a low-pass filter can be added between the DAC and the single-ended driver. In that case, the sampling rate of the DAC can be reduced.

Ex. 1001 at 9:16-23. Consider, by way of example, the DAC output shown below.

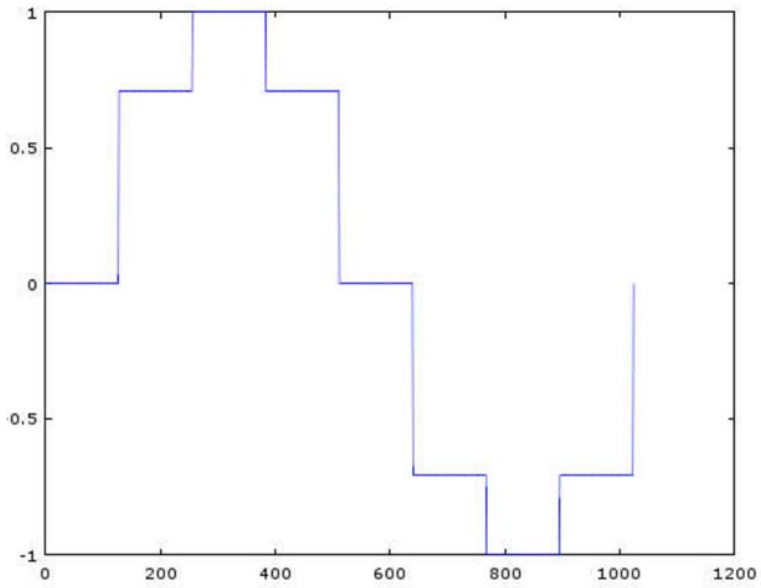
71. The corresponding frequency domain plot of this signal is shown below:

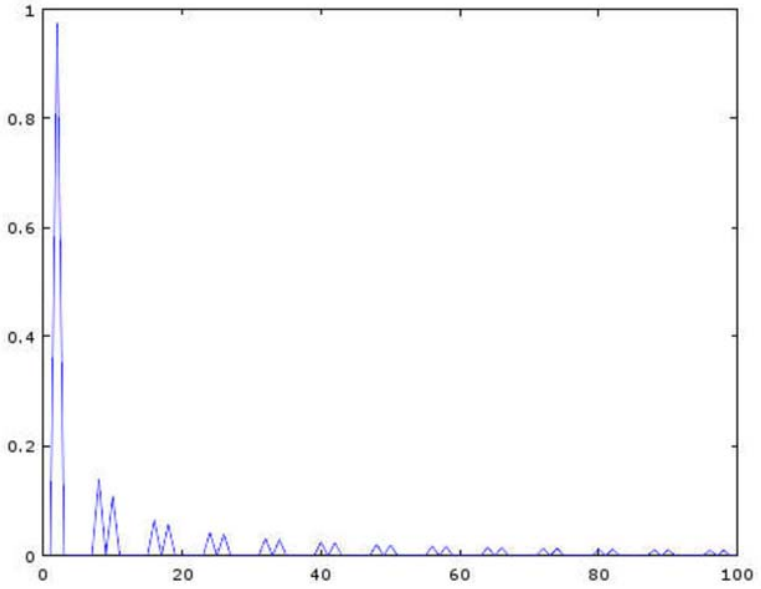




The FFT shows a fundamental the frequency spurs due to sampling. Given the magnitude and frequency of these frequency spurs, a low-pass filter might be required (the "high enough" sample rate case mentioned in the '792 specification).

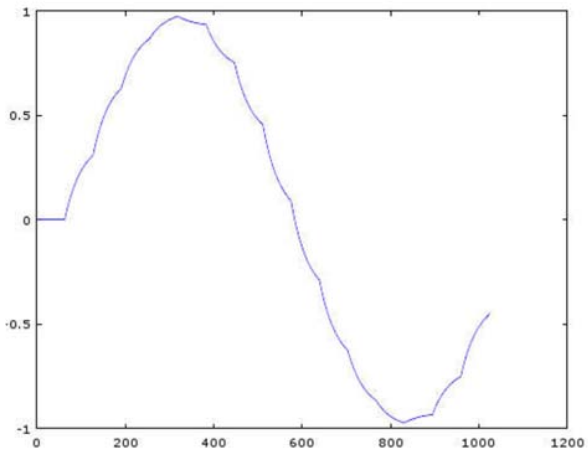
72. Now consider another DAC output where the sampling rate has been reduced by one half, shown below and the FFT that follows.

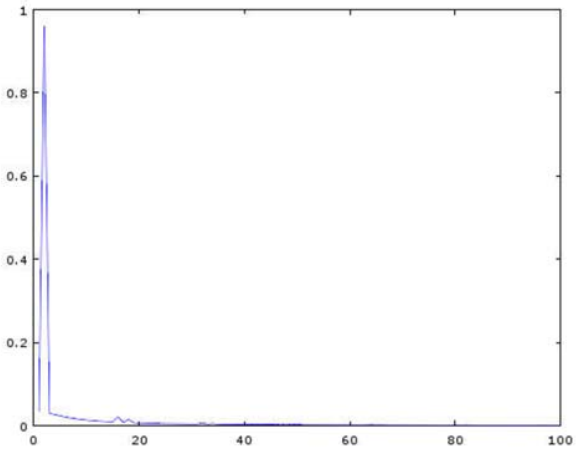




It is clearly seen that for the DAC output with the lower sampling rate, the frequency spurs are closer to the fundamental and greater in amplitude. These two plots demonstrate that even though the signal is bandwidth limited that high frequency components may be introduced into the output of the DAC as a function

of its sampling rate. A low-pass filter would be used to remove the high frequency components, producing a smoother waveform, as shown below:





73. This is why it was common to use a LPF following a DAC in many applications, including television. The Patent Office recognized this fact when it rejected original claims 16 and 17 in view of Oku and Gray (Ex. 1019), as noted in my previous declaration. Ex. 1009, ¶9. As the Examiner explained:

> Gray notes that the inclusion of a lowpass filter following a D/A convertor is typically done to make sure that conversion artifacts are removed (element 111 in Fig 9: col. 15 lines 21-25).

Ex. 1010 at 77 (citing Ex. 1019 at 15:21-25). The Applicant(s) did not even attempt to refute this argument. Ex. 1010 at 91. Nor could they because the prior art is replete with examples of using a LPF to smooth out the waveform (i.e., "make sure conversion artifacts are removed"). For example, the "TV & Video Engineer's Reference Book" illustrates a typical implementation of a digital TV receiver:

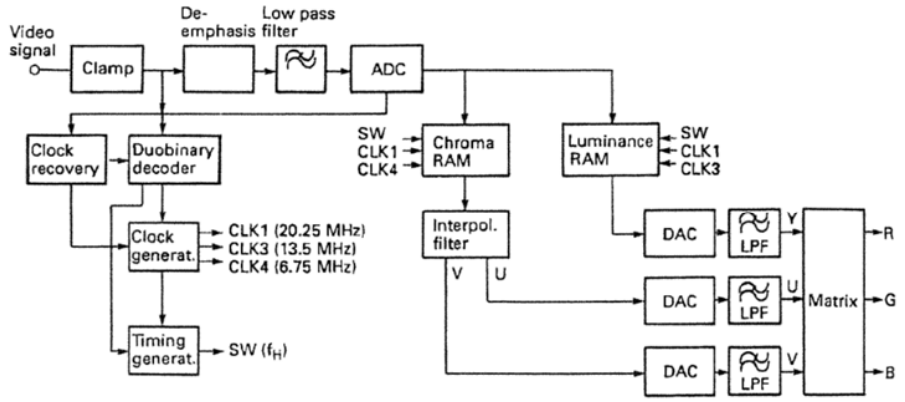


Figure 31.23 Notional diagram of a typical MAC vision decoder

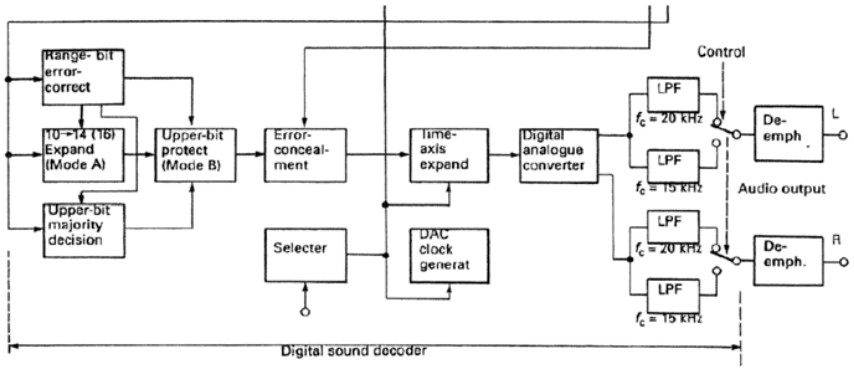


Figure 31.24 Sound/data signal processor (digital subcarrier/NTSC). LPF = low pass filter

See, e.g., Ex. 1059 at 28-29. This confirms that it was well known in the art at the time to use LPF following a DAC for both audio and video in television receivers.

74. Not only does this produce a smoother signal, thereby improving the quality of the video and audio, but also reduced electromagnetic radiation. This is particularly important for consumer electronics such as a television because the Federal Government tightly regulates EMI from televisions, for both health and safety as well as interference with other wireless communication. *See, e.g.,* 21 C.F.R. § 1010.10(c) ("Exposure rate limit. Radiation exposure rates produced by a television receiver shall not exceed 0.5 milliroentgens per hour at a distance of five (5) centimeters from any point on the external surface of the receiver, as measured in accordance with this section."), available at http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?FR=1020.10; 47 C.F.R. §15.101 (listing "TV broadcast receiver").

75. Dr. Opris agrees that "EM radiation is a problem for signals that flow through circuit elements that are susceptible to radiate," but disagrees with me that this is such a circuit. Ex. 2032, ¶114. Dr. Opris's opinion, however, is premised on the assumption that the DAC and the output circuit are in close proximity, even on the same chip. *Id*. There is no basis for such an assumption. When that assumption is put aside, he agrees that a LPF would reduce EM radiation, which is

tightly regulated in television receivers. Accordingly, Petitioner provided a rational basis for the proposed combination of references.

76. The reality is that Patent Owner tries to claim a well known circuit that is used in a well known way to achieve a predictable result (i.e., "providing low pass filtering"). This is the epitome of obviousness.

VI. SECONDARY CONSIDERATIONS

77. I have considered the so-called evidence of secondary considerations of non-obviousness relied upon by the Patent Owner. POR at 59-60. This evidence does not change my opinion that the challenged claims are obvious in view of the prior art. I disagree that there was a "long felt need" in the industry for the subject matter covered by the claims, as evidenced by Thomson, Harris, Zenith, and Birleson. Patent Owner also fails to link the "industry praise" to the subject matter of the claims. As a result, it is my opinion that there is no nexus connection the evidence and the challenged claims.

VII. CONCLUSION

78. In summary, it remains my opinion that claims 17-19, 24-26, and 28-29 of the '792 Patent are obvious on the grounds instituted by the Board. Nothing contained in the Patent Owner's Response (Paper 17*)* or Dr. Opris's declaration (Ex. 2032) have caused me to change my opinions. In contrast, my opinions were

further reinforced by Dr. Opris's cross examination testimony (Ex. 1060), as explained above.

79. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

80. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises and to take into account new information as it becomes available.

VIII. ACKNOWLEDGEMENT

81. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Signed in Wimberley, Texas on February 11, 2016

Douglas Holberg