

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Case IPR2024-00432
Patent 9,210,362

EXHIBIT 2009

DECLARATION OF SAMUEL H. RUSS, PH.D.

TABLE OF CONTENTS

	Page
I. INTRODUCTION.....	1
II. QUALIFICATIONS	2
III. BASES OF OPINIONS.....	5
IV. APPLICABLE LEGAL STANDARDS	5
A. Level Of Ordinary Skill In The Art	5
B. My Understanding Of Legal Standards	7
V. CLAIMS-AT-ISSUE (CLAIMS 1-20).....	10
VI. OPINIONS.....	11
A. Overview: Zhang, Unlike The '362 Patent, Extracts All Channels, Both Desired And Undesired, From The Input Signal.....	11
B. Petitioner Fails To Show “Digital Circuitry Configured To Select Said Plurality Of Desired Television Channels From Said Digitized Plurality Of Frequencies” (Claims 1-10, 11-20, All Grounds).....	14
1. Zhang’s Channels C ₁ -C _n Include All Channels In The “Entire Signal Band,” Both Desired And Undesired, Extracted Without Any “Selection.”	16
2. Zhang’s Channels D ₁ -D _m Are Not Selected “From Said Digitized Plurality Of Frequencies.”	32
VII. CONCLUSION.....	37

I. INTRODUCTION

1. My name is Samuel H. Russ. I have been retained as an expert witness to provide my independent opinion in regard to the matters at issue in *inter partes* review of U.S. Patent No. 9,210,362 (“the ’362 patent”) in IPR2024-00432. I have been retained by Entropic Communications, LLC (“Entropic”), the Patent Owner in this proceeding. The Petitioner is Comcast Cable Communications, LLC (“Comcast” or “Petitioner”).

2. I am being compensated at my standard hourly rate for my time spent working in connection with this case. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is in no way related to the outcome of this litigation. If called as a witness, I would testify as to the statements and opinions contained in this report.

3. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to amend or supplement my opinions based on additional documents or evidence I am presented, including without limitation any arguments or expert declarations advanced by Petitioner in this case.

4. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

II. QUALIFICATIONS

5. I have more than 20 years of experience in the fields of broadband cable networks and communications engineering. As explained below, I have authored a reference textbook on signal processing, authored or co-authored 32 journal articles and conference papers in the areas of video storage, video networking and consumer electronics. I am a named inventor on 51 patent applications, which have led to 29 issued U.S. patents and 9 European patents. My professional career has been dedicated to issues relating to signal integrity, communication systems, and home networking more generally. A detailed record of my professional qualifications is set forth in the attached Exhibit 2010, which is my *curriculum vitae*, including a list of publications, awards, research grants, and professional activities. My *curriculum vitae* also lists the matters in which I have served as an expert.

6. I received a Bachelor of Science in Electrical Engineering with Highest Honors from Georgia Institute of Technology in 1986 and a Ph.D. in Electrical Engineering from Georgia Institute of Technology in 1991. My Ph.D.

dissertation was titled “An Information-Theoretic Approach to Analysis of Computer Architectures and Compression of Instruction Memory Usage.”

7. I am currently an Associate Professor in the Department of Electrical and Computer Engineering at the University of South Alabama. I joined the Electrical and Computer Engineering faculty in 2007. I have taught a number of classes including classes in signal integrity, embedded systems, and the design of high-speed digital systems. During that time, I won awards for excellent teaching and have been actively publishing research in signal integrity, home networking, and digital video recording (DVR) technologies.

8. Previously, from 1994 to 1999, I served on the faculty of Mississippi State University as an Assistant Professor in the Department of Electrical & Computer Engineering. I taught circuit board design and two-way interactive video classes, among other topics.

9. I also have significant industry experience. From 2000 to 2007, I was the manager in the Advanced Technologies R&D group for Scientific-Atlanta (later Cisco, now Technicolor). As part of this work, I explored major new technologies including home networking and multi-room video distribution and managed a cable set-top box (STB) design group that designed four STB models for the cable television industry, including the Explorer 4200 (non-DVR) and 8300 (DVR) models. Both models were produced in high volumes and sold several

million units. As the design-group manager, I was responsible for managing the design and prototyping activities of the group and for interfacing with other groups (especially integrated circuit design, procurement, software developers, the factory where prototypes were built, and product managers). I also maintained the hardware and mechanical development schedule.

10. While at Scientific-Atlanta, I became a staff expert in home networking, and conducted demonstrations of wireless video technology. I also managed a group that developed a new coaxial home networking system. This coaxial system won a Technology and Engineering Emmy Award in 2013. Further, I was a staff expert in digital video recorder (DVR) reliability, and led a team that improved the software, hardware, repair, and manufacturing processes.

11. I am the author of *Signal Integrity: Applied Electromagnetics and Professional Practice*, Springer, 1st ed. 2016, 2nd ed. 2022. I have also researched and written about video storage, multimedia broadcasting over networks, embedded systems, consumer electronics, set-top boxes, access of stored video from peer devices in a local network, electronic manufacturing systems, and other topics in video and image processing. I have authored or co-authored 32 journal articles and conference papers in these areas of video storage, video networking and consumer electronics. One of my conference papers on digital video recording

won second place in a “Best Paper” competition at the 2011 International Conference on Consumer Electronics in Las Vegas, Nevada.

12. I am a named inventor on 51 patent applications that were filed while I was at Scientific-Atlanta, many of which focus on cable technology. These applications have led to 29 issued U.S. patents and 9 as European patents, including U.S. Patent No. 7,908,625 (“Networked Multimedia System”).

III. BASES OF OPINIONS

13. In the course of conducting my analysis and forming my opinions, I have reviewed materials including those listed below:

- i. U.S. Patent No. 9,210,362 (“the ’362 patent”) (Ex. 1001) and its prosecution history;
- ii. The Petition and all cited exhibits therein;
- iii. Declaration of David B. Lett (Exhibit 1002) and all exhibits cited therein;
- iv. The Institution Decision (Paper 13);
- v. All the exhibits cited in my declaration herein.

IV. APPLICABLE LEGAL STANDARDS

A. Level Of Ordinary Skill In The Art

14. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, which I understand is sometimes referred to as

an “ordinary artisan” or by the acronyms “POSITA” or “PHOSITA,” as of the time of the invention, which I understand is here assumed to be the effective filing date (April 17, 2009) provisional application from which the ’362 patent issued. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. By “relevant,” I mean relevant to the challenged claims of the ’362 patent.

15. I understand that factual indicators of the level of ordinary skill in the art include the various prior art approaches employed, the types of problems encountered in the art, the rapidity with which innovations are made, the sophistication of the technology involved, and the educational background of those actively working in the field. I understand that, in assessing the level of skill of a person of ordinary skill in the art, one should consider the type of problems encountered in the art, the prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention.

16. In this case, Mr. Lett has asserted in his declaration that a person of ordinary skill in the art as of the time of the ’362 patent would have had:

a degree in electrical engineering or a similar discipline, along with three-to-four years of experience with digital signal processing (DSP) and radio frequency (RF) tuning systems for satellite and/or cable

communications. Additional education may substitute for professional experience, and significant work experience may substitute for formal education.

Ex. 1002 [Lett-Decl.] ¶ 31.

17. For the purposes of this declaration, I have applied Mr. Lett's proposed qualifications of a POSITA.

18. As further discussed below, my opinions as stated in this declaration are valid even if the Board adopts a slightly different level of ordinary skill in the art.

B. My Understanding Of Legal Standards

19. When considering the '362 patent and stating my opinions, I rely on the following legal standards as described to me by the attorneys for Entropic.

20. I understand that a patent claim is unpatentable if the claimed invention was anticipated by a prior art reference or would have been obvious to a person of ordinary skill in the art at the time of the purported invention.

21. I understand that anticipation requires that every limitation of the claim at issue be disclosed, either expressly or under principles of inherency, in a single prior art reference.

22. I understand that inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of

circumstances is not sufficient. Instead, it must be proven that the claim limitation not expressly found in the reference necessarily follows from what is found there.

23. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) any objective indicia of non-obviousness, including any praise of the invention.

24. I also understand that obviousness may be established under certain circumstances by combining or modifying the teachings of the prior art. Specific teachings, suggestions, or motivations to combine any first prior art reference with a second prior art reference can be explicit or implicit, but must have existed before the date of purported invention. I understand that prior art references themselves may be one source of a specific teaching or suggestion to combine features of the prior art, but that such suggestions or motivations to combine art may come from the knowledge that a person of ordinary skill in the art would have had.

25. I understand that a reference may be relied upon for all that it teaches, including uses beyond its primary purpose, but also including teachings that lead away from the invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, although the mere disclosure of alternative designs does not teach away.

26. I further understand that whether there is a reasonable expectation of success in combining references in a particular way is also relevant to the analysis.

27. I understand that it is improper to use hindsight to combine references or elements of references to reconstruct the invention using the claims as a guide. My analysis of the prior art is made from the perspective of a person of ordinary skill in the art at the time of the invention.

28. I understand that in order to be eligible as prior art in obviousness and therefore form a reference in one of the instituted grounds, a reference must be analogous art to the '362 patent. I also understand that it is Petitioner's burden to prove that their asserted references are analogous art to the '362 patent.

29. I am not offering any legal opinions in this declaration nor am I qualified to do so. I only consider such legal standards in framing my opinions and conclusions as well as placing assertions made by Petitioner in the Petition into the proper context. Additionally, from a subject matter perspective, I understand that

the petitioner always has the burden of persuasion regarding a challenge of patentability of an invention under an inter partes review.

V. CLAIMS-AT-ISSUE (CLAIMS 1-20)

30. I understand that Petitioner has challenged the claims as follows:

- Ground A: Claims 1-3, 8, 9, 11-13, 18, and 19 anticipated by Zhang under pre-AIA 35 § 102;
- Ground B: Claims 1-3, 8, 9, 11-13, 18, and 19 as obvious under pre-AIA § 103 based on Zhang;
- Ground C: Claims 2, 3, 12, and 13 as obvious under pre-AIA § 103 based on Zhang in view of Pandey;
- Ground D: Claims 1-3, 4-6, 8-9, and 14-16 as obvious under pre-AIA § 103 based on Zhang in view of Mirabbasi;
- Ground E: Claims 7 and 17 as obvious under pre-AIA § 103 based on Zhang in view of Mirabbasi and Karabinis;
- Ground F: Claims 10 and 20 as obvious under pre-AIA § 103 based on Zhang in view of Jensen;
- Ground G: Claims 2 and 3 as obvious under pre-AIA § 103 based on Zhang in view of Mirabbasi and Pandey;
- Ground H: Claim 10 as obvious under pre-AIA § 103 based on Zhang in view of Mirabbasi and Jensen.

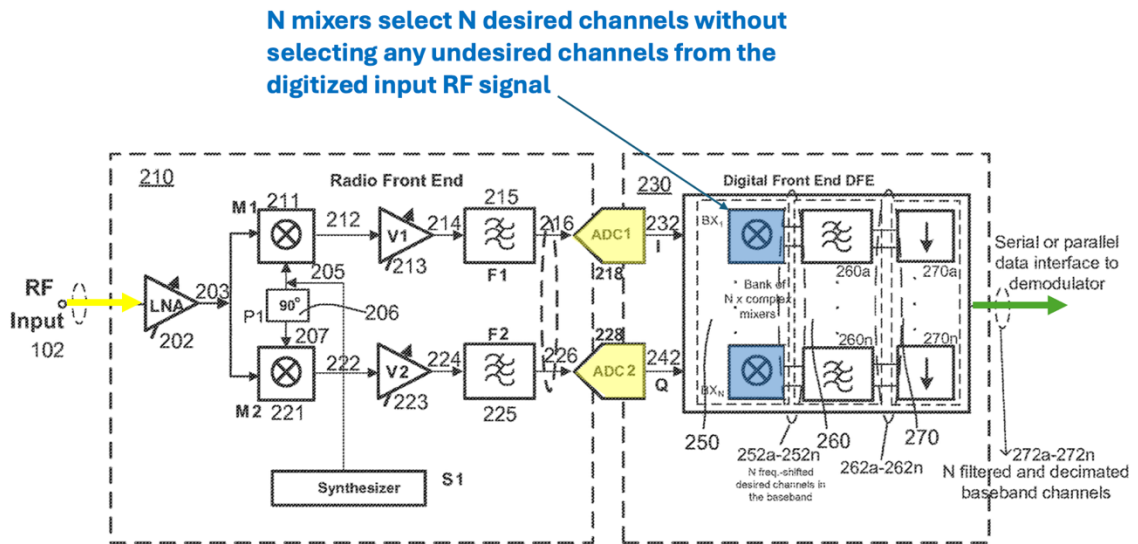
VI. OPINIONS

A. Overview: Zhang, Unlike The '362 Patent, Extracts All Channels, Both Desired And Undesired, From The Input Signal.

31. Zhang is the cornerstone of each of Petitioner's grounds. Pet., 18.

Although both Zhang and the '362 patent involve a digitized RF input signal, and, ultimately, output desired RF channels, the method by which they achieve this result is critically different. Specifically, the '362 patent *only* selects desired channels from the digitized input RF signal without selecting any undesired channels. In contrast, Zhang blindly extracts *all* channels, *both* desired and undesired, from the digitized input RF signal, and only later selects the desired channels from the extracted channels.

32. The Figure 2 embodiment of the '362 patent, annotated below, is illustrative. There, the analog input RF signal (yellow) is first digitized in the analog to digital converters (yellow). Ex. 1001 ['362] 5:28-31. Then, a bank of N mixers (blue) selects N desired channels, without selecting any undesired channels, from the digitized input RF signal. *Id.*, 5:31-37, 5:49-56. Specifically, each of the N mixer paths is responsible for extracting a desired channel from the digitized input signal. The selected desired channels are then output to demodulators (green). *Id.*, 5:55-60.



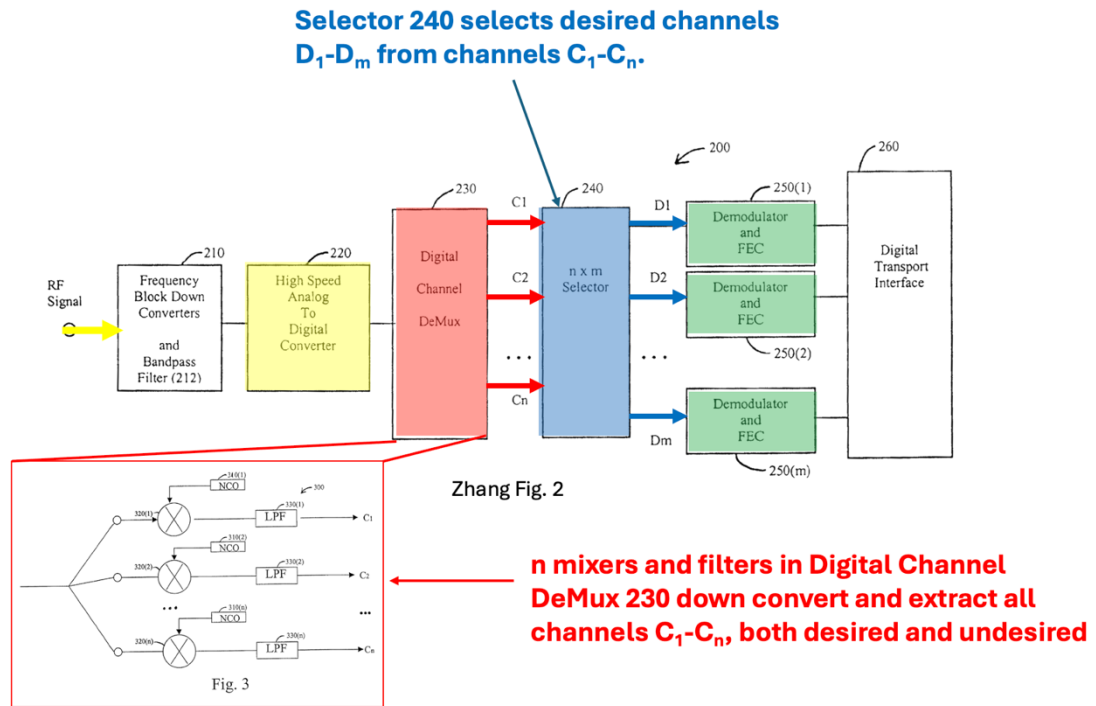
'206 Pat. Fig. 2 (modified and annotated)

33. In Zhang, creating an output of desired channels is achieved through a different method, which I explain in the context of Zhang's Figures 2 and 3, annotated below. Similar to the '362 patent, Zhang digitizes an input signal (yellow), consisting of "n" channels, both desired and undesired, in the analog to digital converter 220 (yellow). Ex. 1013 [Zhang] [0027] ("In this specific embodiment, ADC 220 is a high-speed ADC so that an entire signal band with n channels can be converted"). Note that the letter "n" in Zhang denotes the number of channels in the entire signal band, both desired and undesired, whereas the letter "N" in the '362 patent denotes the number of desired channels.

34. Unlike the '362 patent, however, Zhang's method then extracts from the digitized RF input signal **all** channels C_1 - C_n in the entire signal band, **both** desired **and** undesired, in the Digital Channel DeMux 230 (red) without making

any selection among them. *Id.*, [0028] (“A digital channel demultiplexer 230 then demultiplexes the multi-channel digital RF signal into separate digital RF channels C_1 to C_n .”). The exemplary architecture of Zhang’s Digital Channel DeMux 230 is shown in Zhang’s Figure 3, annotated below. Note that though Zhang’s Digital Channel DeMux 230 uses complex mixers similar to the ’362 patent to extract channels, unlike the ’362 patent, it extracts all channels, both desired and undesired.

35. Once all channels C_1 - C_n are extracted from the digitized input signal, the channels C_1 - C_n are sent as the input to the digital selector 240 (blue). *Id.*, [0028]. Using the channels C_1 - C_n as input, the digital channel selector 240 (blue) then selects the desired channels and outputs them to demodulators (green). *Id.*, [0028] (“an $n \times m$ digital selector 240 receives the demultiplexed digital RF channels C_1 to C_n and then selects one or more of the RF channels D_1 to D_m from one or more of the digital RF channels C_1 to C_n .”); [0039] (“In operation, digital selector 500 digitally selects one or more RF channels D_1 to D_m from the digital RF channels C_1 to C_n and then sends them to appropriate demodulators”).



36. As explained below, the different methodologies utilized by Zhang and the '362 patent result in the Petition's grounds failing to disclose or render obvious multiple claim limitations.

B. Petitioner Fails To Show “Digital Circuitry Configured To Select Said Plurality Of Desired Television Channels From Said Digitized Plurality Of Frequencies” (Claims 1-10, 11-20, All Grounds).

37. Limitation 1[d] recites “digital circuitry configured to select said plurality of desired television channels from said digitized plurality of frequencies.” Ex. 1001 ['362] cl. 1. Independent claim 11 recites an identical limitation in method form. *Id.*, claim 11 (limitation 11[d]). Petitioner contends that Zhang alone discloses this limitation for all grounds. Pet., 34 (“Thus, Zhang

teaches Element 1[D]”); 42 (limitation 11[d]).¹ In a set of “alternate” grounds, Petitioner also relies on the combination of Zhang and Mirabbasi to show limitation 1[d]. Pet., 72-74. However, that combination only modifies how Zhang’s circuitry is implemented and does not affect the arguments presented here, which equally apply to these “alternate” grounds. Further still, Petitioner only presents these “alternate grounds” as an “alternative” and “[t]o the extent” the claimed “digital circuitry” is construed to be a means-plus-function term. Pet., 72, 74. Patent Owner here does not assert that “digital circuitry” is a means-plus-function term, and consequently, these “alternate” grounds on their own terms, are irrelevant.

38. Petitioner argues either that Zhang’s “Digital Channel Demultiplexer 230” alone, or “in combination with all or part of Digital Selector 240” perform limitation 1[d]. Pet., 28. The Petition presents two alternatives as to how Zhang allegedly discloses the claimed “plurality of desired television channels” that are

¹ The Petition relies on its discussion of limitation 1[d] for the corresponding limitation 11[d], as claim 11 elements [a]-[e] are the elements of claim 1 [a]-[e] recited as method steps. Therefore, I discuss limitation 1[d] with the understanding that the same argument applies to claim 11[d] and dependents thereof.

selected “from said digitized plurality of frequencies.” *See* Ex. 1001 [’362] cls. 1, 11. The Petition first argues that Zhang’s channels C_1 - C_n constitute the claimed “plurality of television desired channels.” Pet., 29 (arguing that “Zhang uses the same technique described in the ’362 patent for selection and outputting of desired channels C_1 - C_n ”). Alternatively, Petitioner argues that Zhang’s channels D_1 - D_m disclose the claimed “desired channels.” Pet., 31 (“Digital Selector 240 selects channels D_1 - D_m which comprise any or all of channels C_1 - C_n .”); Pet. 32 (arguing that “a channel that is both demultiplexed by [demultiplexer] 230 and switched by [selector] 240 to a demodulator is ‘desired.’”). Both of Petitioner’s potential alternatives fail.

1. Zhang’s Channels C_1 - C_n Include All Channels In The “Entire Signal Band,” Both Desired And Undesired, Extracted Without Any “Selection.”

39. Petitioner first argues that Zhang’s channels C_1 - C_n disclose the claimed “plurality of desired television channels” that are “select[ed]” by the claimed “digital circuitry:

Digital Channel Demultiplexer 230 receives the multi-channel digital RF signal from ADC 220 and selects from this signal a number “n” of *desired channels C_1 - C_n* (green), each at a unique “target” RF channel...

... As shown below, Zhang uses the same technique [in demultiplexer 230] described in the ’362 patent for selection and outputting of *desired channels C_1 - C_n* .

Pet., 29.

40. But, as I discuss below, both Zhang and its prosecution history confirm that channels C_1 - C_n encompass all channels in the “entire signal band,” both desired and undesired. Therefore, the digital channel demultiplexer 230 that demultiplexes channels C_1 - C_n does not “select” any channels. Moreover, Petitioner’s mapping of Zhang’s channels C_1 - C_n to the claimed “plurality of desired channels” contradicts Petitioner’s mapping in other claim limitations.

41. The letter “n” in Zhang denotes the number of channels, both desired and undesired, in the “entire signal band.” For example, Zhang explains:

An ADC 220 then converts the down-converted multi-channel analog RF signal to a multi-channel digital RF signal. In this specific embodiment, ADC 220 is a high-speed ADC so that *an entire signal band with n channels* can be converted.

Ex. 1013 [Zhang] [0027].

42. Zhang then explains that its digital channel demultiplexer 230 demultiplexes the input RF signal into channels C_1 - C_n :

A digital channel demultiplexer 230 then demultiplexes the multi-channel digital RF signal into separate digital RF channels C_1 to C_n .

Ex. 1013 [Zhang] [0027]. Consequently, because “n” in Zhang denotes the total number of channels, both desired and undesired, the demultiplexed channels C_1 to

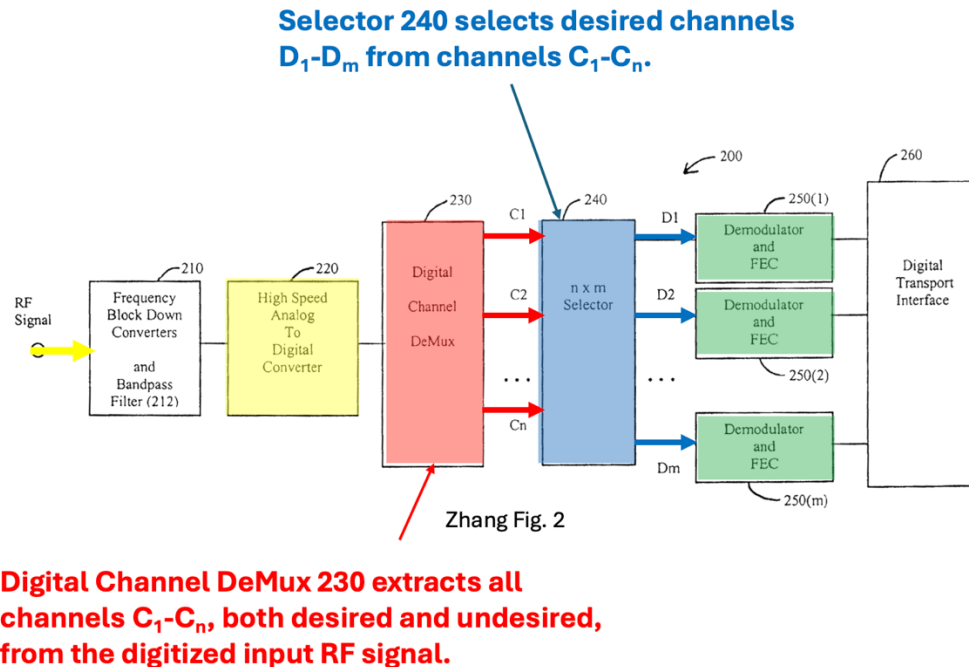
C_n , therefore, also encompass all channels in the “entire signal band,” both desired and undesired, without any “selection” of desired channels.

43. Zhang’s balance further confirms that channels C_1 to C_n include both desired and undesired channels, and that Zhang’s Digital Channel Demultiplexer 230 does not perform any “select[ion].” Specifically, Zhang explains that after channels C_1 - C_n are extracted from the input RF signal, a module actually called a selector, an $n \times m$ ***Selector*** 240, selects the desired channel D_1 - D_m from the total channels C_1 - C_n :

Still referring to FIG. 2, an $n \times m$ digital selector 240 receives the demultiplexed digital RF channels C_1 to C_n ***and then selects one or more of the RF channels D_1 to D_m from one or more of the digital RF channels C_1 to C_n .*** ... [O]nly the selected channels are later demodulated unlike the systems using RF tuners which demodulate all of the RF channels.

Ex. 1013 [Zhang] [0028]; *see also id.*, [0039] (“In operation, digital ***selector 500*** ***digitally selects one or more RF channels D_1 to D_m from the digital RF channels C_1 to C_n and then sends them to appropriate demodulators*** or output ports (not shown) through different data buses (not shown).”); [0042] (“For example, in FIG. 6, there are 35 separate RF channels C_1 to C_{35} . Of those RF channels, 20 RF channels D_1 to D_{20} are selected. Those 20 selected RF channels are sent to a set of demodulators 650(1 ... 20) for demodulation.”).

44. Zhang's operation is shown in its Figure 2, annotated below, showing that the digital channel demultiplexer 230 demultiplexes channels C_1 - C_n containing both desired and undesired channels, and $n \times m$ selector 240 selecting desired channels D_1 - D_m for transmission to demodulators 250 (green):



45. Zhang's prosecution history also confirms that the digital channel demultiplexer 230 outputs all channels C_1 - C_n , both desired and undesired, and that it is the selector 240 that selects the desired channels D_1 - D_m . Zhang's European Patent Application claims recited "a digital channel demultiplexer ... to demultiplex the digital RF signal into separate digital RF channels (C_1 ... C_n)," and "a selector ... configured to receive the separate digital RF channels and to select

one or more separate digital RF channels ($D_1 \dots D_m$).” Ex. 2012 [Zhang-EPO-Reply] 6.

46. The European Patent Office (EPO) noted that the independent claims “appear to be not new.” Exhibit 2011 [EPO-Communication-Annex] 2-3. In response, the applicant explained that it is the selector that distinguished Zhang from its prior art, where all of the channels were demodulated:

The provision of a selector allows the selection of specific RF channels for demodulation dependent on the specific application in which the apparatus is implemented (paragraph 37 of the application) this allows for power consumption to be optimized because only the selected channels are later demodulated *unlike systems which demodulate all of the RF channels* (e.g. [Reference] D1 and [Reference] D2). Thus, the invention provides apparatus which is not only faster, but also dissipates less heat, than systems such as those in D1 and D2, because fewer resources are required when demodulating only the selected RF channels (paragraph 25).

Ex. 2011 [EPO-Communication-Annex] 2-3. Subsequently, the EPO accepted the Zhang applicant’s argument and allowed the claims without any further rejection.

Ex. 2013 [EPO-Grant-Intent] 1.

47. A POSITA reviewing the above would recognize that from Zhang’s applicant’s own perspective, the digital channel demultiplexer 230, like Zhang’s prior art, demultiplexed all channels C_1 - C_n , both desired and undesired, and it was

Zhang's selector 240 that, unlike Zhang's prior art, selected desired channels D_1 - D_m to send to demodulators.

48. Thus, Zhang's prosecution history further confirms its express disclosures in its specification that channels C_1 - C_n contain all channels, both desired and undesired, and that its Digital Channel Demultiplexer 230 does not perform any "select[ion]."

49. Petitioner first relies on the fact that Zhang's Digital Channel DeMux 230 in an embodiment is implemented through complex mixers and argues that because the '362 patent also relies on complex mixers to extract channels, it supposedly follows that channels C_1 - C_n are the claimed "desired channels." Pet., 29-30 ("Zhang uses the same technique described in the '362 patent for selection and outputting of desired channels C_1 - C_n : first using a bank of complex mixers (purple) to frequency-shift a digitized version of the down converted wideband signal....").

50. But, as explained above, even though Zhang and the '362 patent both use complex mixers to extract channels from the digitized input RF signal, and unlike the '362 patent's mixers, Zhang's mixers extract all channels, both desired and undesired, from the digitized input RF signal. This is shown below by adding additional annotations (red) to Petitioner's annotation comparing Zhang Figure 3 with the '362 patent Figure 2 (at Pet., 30). As can be seen in the figures and

explained in more detail below, in Zhang, the number of complex multipliers 320 (1...n) is the same number “n” as the number of all channels, both desired and undesired, in the entire signal band. In contrast, the number of mixers N in the ’362 patent is the number of desired channels.

In Zhang, “n” mixers in Digital Channel DeMux 230 extract all channels C_1 - C_n , both desired and undesired, from the digitized input RF signal.

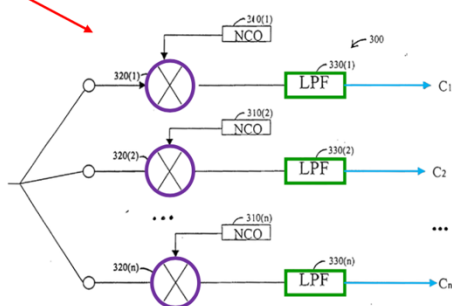
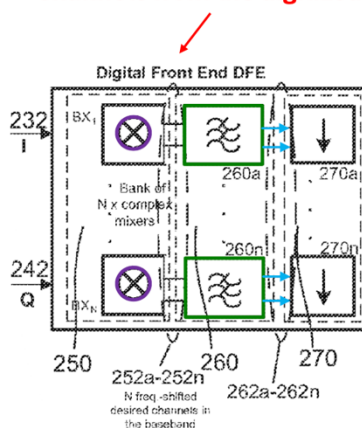


Fig. 3

Ex. 1013, Fig. 3 (annotated)

In the ’362 patent, N mixers select N desired channels without selecting any undesired channels from the digitized input RF signal



Ex. 1001, Fig. 2 (excerpted/annotated)

51. At a high level, if Zhang’s Figure 3 down converted and output only desired channels, there would have been no need for the subsequent channel selector 240 to select desired channels D_1 - D_m from channels C_1 - C_n . This is in contrast to the ’362 patent’s Figure 2, where the output of the Digital Front End is sent to demodulators because the down conversion in the Digital Front End is only for the desired channels. Details of Zhang’s Figure 3 confirm this distinction.

52. Zhang explains that its Figure 3 “can be used to implement digital channel demultiplexer 230 of Fig. 2.” Ex. 1013 [Zhang] [0030] (cited by Pet., 29).

Zhang further explains that its Figure 3 contains “complex multipliers 320 (1 ...n).” Ex. 1013 [Zhang] [0030]. These “complex multipliers 320 (1 ...n)” are the complex mixers relied upon by Petitioner. Pet., 30. It can be readily shown, however, that the complex mixers 320 (1...n) in Zhang extract both desired and undesired channels from the digitized input RF signal. First, Zhang confirms that the output of its Figure 3 circuitry is channels C_1 to C_n . Ex. 1013 [Zhang] [0032] (“Digital tuner circuit 300 then outputs the separated RF channels C_1 to C_n , each RF channel being centered at the baseband.”). As explained above, Zhang is clear that channels C_1 - C_n include both desired and undesired channels.

53. Second, there are “n” complex multipliers 320 (1...n), each used for extracting a single channel. Ex. 1013 [Zhang] [0030] (“One chain of each of these elements is used for each RF channel.”). As also explained above, Zhang is clear that the number “n” in its disclosure denotes both desired and undesired in “entire signal band.” Ex. 1013 [Zhang] [0027]. Thus, the number of complex multipliers 320 (1...n) further confirms that Zhang’s Figure 3 output both desired and undesired channels.

54. Petitioner attempts to capitalize on Zhang’s use of the phrase “target channel” in its discussion of Figure 3 to argue that Figure 3 only outputs desired channels. Pet., 30 (citing Ex. 1013 [Zhang] [0028], [0030]-[0032]). Petitioner is incorrect. As I explained, Zhang is clear that its Figure 3 outputs both desired and

undesired channels, and Petitioner is incorrect in its interpretation of Zhang’s use of the phrase “target channel.”

55. In Zhang’s Figure 3, annotated below, the digitized input RF signal is sent in parallel to multiple data paths, each of which is responsible for extracting one of the channels C_1 - C_n from the digitized input signal. It is in this context that Zhang states that each data path is responsible for extracting its “target channel,” which only means the specific one of channels C_1 - C_n that the particular data path is responsible for. “Target channel,” thus, does not refer to a “desired” channel but, rather, a particular channel for a particular data path, which may ultimately be desired or undesired.

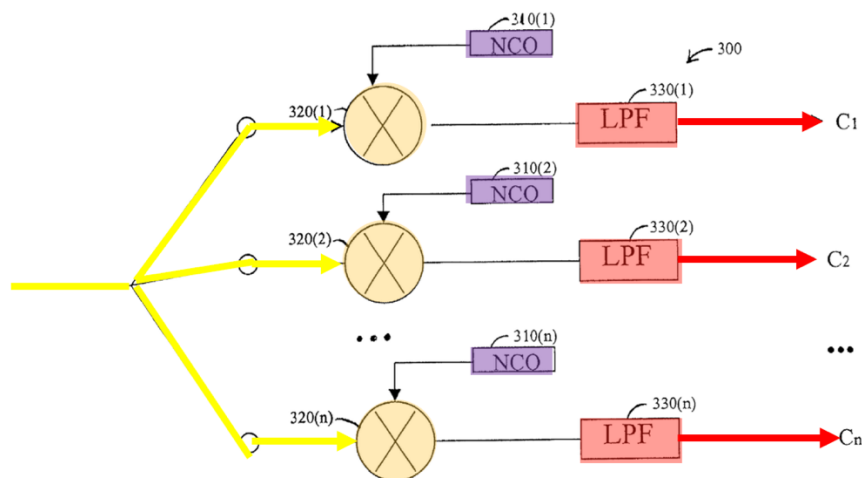


Fig. 3

56. Notably, if Zhang’s digital channel demultiplexer 230 (as implemented in its Figure 3) demultiplexed only desired channels, that would negate the function of the digital channel selector 240 that follows the digital

channel demultiplexer 230. As explained, the digital channel selector 240 takes the output of the digital channel demultiplexer 230 (channels C_1 - C_n) as input, and selects and outputs desired channels D_1 - D_m .

57. In Zhang's Figure 3 above, the digitized input RF signal (yellow) is transmitted in parallel through multiple data paths, each of which is responsible for extracting one of channels C_1 - C_n . Ex. 1013 [Zhang] [0030]-[0031]. In each data path, the way a channel is extracted is that a numerical local oscillator NLO 310 (purple) provides the frequency for the one of channels C_1 - C_n for which that specific data path is responsible. *Id.*, [0032]. A multiplier 320 (orange) multiplies the digitized input RF signal with the provided frequency to bring the channel to baseband. *Id.* Then a corresponding low pass filter LPF 330 (red) filters out all channels other than the one of C_1 - C_n for that data path. *Id.* In this context, Zhang states that the complex mixer 320 (orange) is provided with the "characteristic frequency of a desired RF channel," which means the frequency of the one of channels C_1 - C_n for which this specific data path is responsible. Similarly, Zhang states that the LPF (red) only permits the "target RF channel" to pass, which, again, means the specific one of channels C_1 - C_n for which this specific data path is responsible. *Id.* Nothing in Zhang's discussion of its Figure 3 changes its consistent disclosure that channels C_1 - C_n contain both desired and undesired channels.

58. Petitioner also relies on Zhang’s claims 34 and 36-41 to argue that channels C_1 - C_n contain only desired channels. Pet., 29. But, as I explain, those claims closely follow Zhang’s Figure 3 embodiment discussed above, and Petitioner misapprehends their disclosure—which, of course, cannot claim a system that is different from Zhang’s specification. Claims 34 and 36-41 depend from independent claim 28. Claim 28 claims the function of Zhang’s digital channel demultiplexer in Zhang’s Figure 3, which extracts both desired and undesired channels from the input signal, and recites “[a] method for demultiplexing a digital multi-channel RF signal into a plurality of separate content channels.” As detailed in the table below, claims 34, and 36-41 recite various details of Zhang’s digital channel demultiplexer 230 from Zhang’s Figure 3, including functions of the mixers, local oscillators and low pass filters. As noted above, however, Zhang’s discussion of its Figure 3 is the *only* disclosure in Zhang of “target channels” and “target frequencies,” and Zhang’s use of these phrases does not mean selecting only desired channels as the ’362 patent does. Rather, it only refers, in context, to the specific one of channels C_1 - C_n (consisting of both desired and undesired channels) for which a particular data path is responsible for extracting.

Zhang Claims	Zhang Fig. 3 (Annotated)
34. The method of claim 28 wherein the demultiplexing further comprises: providing a plurality of select frequencies, each select frequency being associated with a corresponding and separate RF channel; and multiplying the at least one multi-channel RF signal with each of the select frequencies to obtain separate RF channels. 36. The method of claim 34 further comprising shifting the target RF channel to a baseband. 37. The method of claim 34 further comprising filtering undesired RF channels and passing only the target RF channel. 38. The method of claim 37 wherein the filtering is achieved with a low-pass filter (LPF) 39. The method of claim 38 wherein the LPF is a fine impulse response (FIR) filter. 40. The method of claim 39 wherein the FIR filter is a high-speed filter. 41. The method of claim 34 wherein the select frequencies are generated by numeric control oscillators.	Fig. 3

59. Thus, as is clear from the above, similar to Zhang's Figure 3, "target RF channel" in Zhang's claims refers to the one of the channels C_1 - C_n for which this path is responsible, and "undesired RF channels" refers to the remaining ones of channel C_1 to C_n other than the one for which this path is responsible. Other claims of Zhang similarly follow its embodiments described above.

60. Petitioner also relies on Zhang's statement that "RF channels C_1 to C_n contain channels that are selected or used by a subscriber." Pet., 29 (quoting Exhibit 1013 [Zhang] [0028], [0030]-[0032], [0042]). Those portions of Zhang do not state that channels C_1 to C_n contain "only" desired channels. Instead, in context, a representative passage reproduced below, Zhang states simply that the "channels that are selected or used by a subscriber" are contained within the broader set of "RF channels C_1 to C_n ." Consistent with this, Zhang states that channels C_1 to C_n contain all potentially desirable channels from which actual desired channels D_1 to D_m can be selected:

Still referring to FIG. 2, an $n \times m$ digital selector 240 receives the demultiplexed digital RF channels C_1 to C_n and then selects one or more of the RF channels D_1 to D_m from one or more of the digital RF channels C_1 to C_n . RF channels C_1 to C_n contain content channels that are selected or used by a subscriber. Channel-search capabilities of the digital selector 240 renders it much faster than traditional analog channel switching through RF tuners.

Ex. 1013 [Zhang] [0028]. This passage explains the actual purpose of the two-step process disclosed in Zhang – because the Digital Channel Demultiplexer 230 outputs all channels, the Selector 240 is able to rapidly switch between them. The system does not need to wait on the NLOs to settle to new frequencies when a channel is changed.

61. Petitioner also argues that in the incidental situation where all of channels C_1 - C_n separated out by Digital Channel Demultiplexer 230 are subsequently selected by the Selector 240, then the Digital Channel Demultiplexer 230 has extracted (and thus, supposedly selected) all desired channels. Pet., 32 (“Where D_1 to D_m includes all C_1 to C_n , Digital Channel Demultiplexer 230 selects the desired channels and filters out the undesired channels as described above.”). To the extent Petitioner’s argument rests on the theoretical happenstance that sometimes all channels C_1 - C_n may subsequently be selected, and by happenstance channels C_1 - C_n and channels D_1 - D_m would happen to be the same set (*i.e.*, n would happen to equal m), I disagree for multiple reasons.

62. First, Digital Channel Demultiplexer 230 blindly extracts all channels C_1 - C_n in the “entire signal band,” regardless of whether or not they are desired, or whether they will be ultimately selected by the channel selector 240. Thus, the Digital Channel Demultiplexer 230 does not “select” any channels even if all of its extracted channels are subsequently selected by the selector 240.

63. Second, Petitioner does not point to any disclosure in Zhang that teaches or suggests that all extracted channels C_1 - C_n could be the desired channels D_1 - D_m .

64. Third, the theoretical happenstance that all extracted channels C_1 - C_n could be the desired channels D_1 - D_m cannot disclose the claimed method. That would mean that it makes no difference whether all channels are desired, or are not desired, or if no one had ever conceived of using the distinction between desired and undesired channels at all.

65. For the foregoing reasons, Petitioner's arguments contradict Zhang's express disclosures.

66. In fact, not only is Petitioner's assertion that Zhang's channels C_1 - C_n disclose the claimed "desired channels" incorrect and contrary to Zhang's disclosure, but it is also inconsistent with Petitioner's mapping of Zhang to other claim limitations. For example, limitation 1[d] recites "output said selected plurality of television channels to a demodulator as a digital datastream." Petitioner relies on Data Bus 1 within Zhang's $n \times m$ selector 240 for this limitation. Pet., 32-33. Zhang's $n \times m$ selector 240 is annotated below:

Figure 5 “selects one or more RF channels D_1 to D_m from the digital RF channels C_1 to C_n and then sends them to appropriate demodulators or outputs ports ... through different data buses” Ex. 1013 [Zhang] [0039]

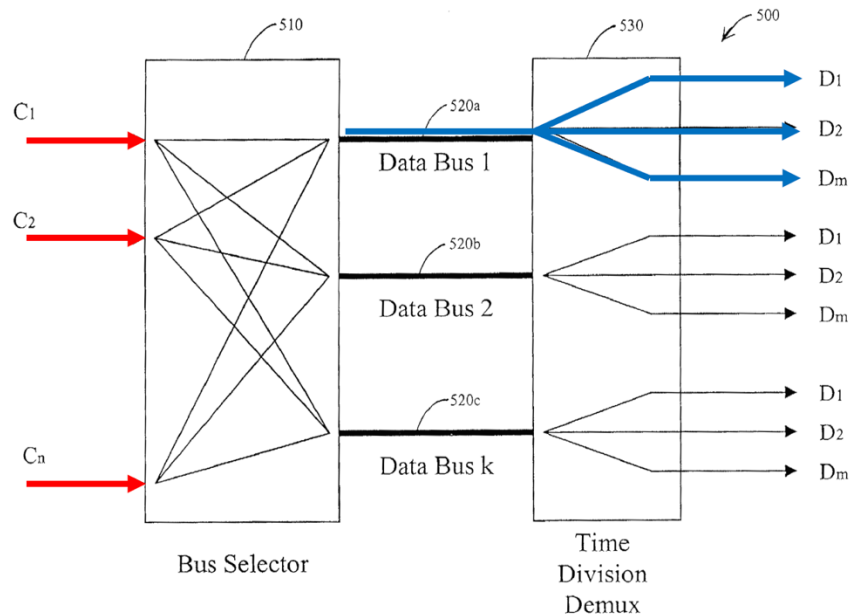


Fig. 5

67. As is clear from the figure, what is “output” on Data Bus 1 in the selector 240 are channels D_1 - D_m (blue), not channels C_1 - C_n (red). This is consistent with the balance of Zhang’s disclosure that explains the digital selector in Fig. 5 “selects one or more RF channels D_1 to D_m from the digital RF channels C_1 to C_n and then sends them to appropriate demodulators or outputs ports” Ex. 1013 [Zhang] [0039].

68. Thus, to the extent Petitioner’s mapping relies on Zhang’s channels C_1 - C_n as the claimed “plurality of desired channels,” that mapping contradicts Petitioner’s reliance on channels D_1 - D_m as “the plurality of desired channels” output on data bus 1.

69. For the foregoing reasons, Petitioner's reliance on Zhang's channels C₁-C_n as the "plurality of desired channels" that are "selected" by Zhang's Digital Channel Demultiplexer 230 is incorrect, contrary to Zhang's express disclosures, and inconsistent with Petitioner's mapping elsewhere.

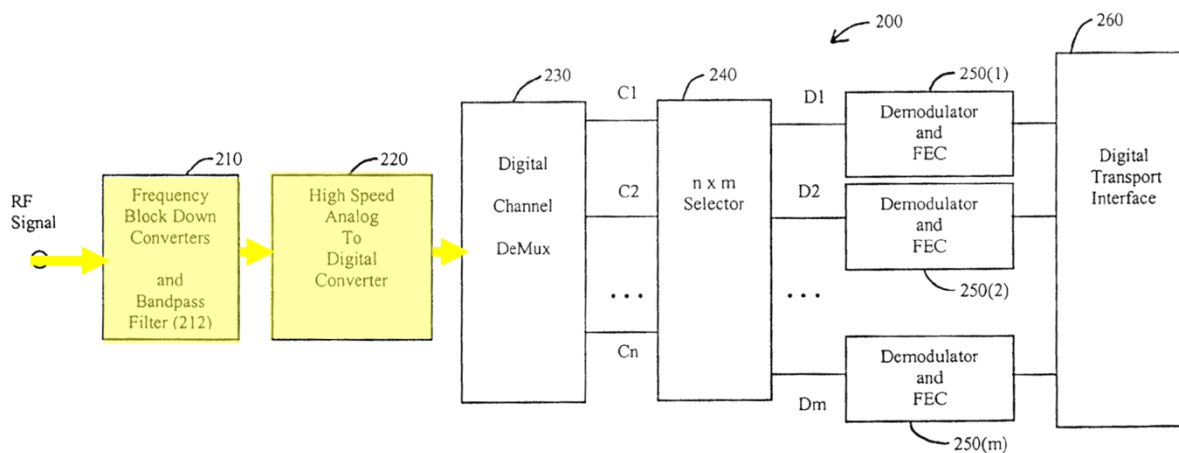
2. Zhang's Channels D₁-D_m Are Not Selected "From Said Digitized Plurality Of Frequencies."

70. To the extent Petitioner relies on channels D₁-D_m as the claimed "plurality of desired television channels," that reliance fails to disclose or render obvious the claims because channels D₁-D_m are not selected "from" the same "plurality of frequencies" down converted and digitized in limitations 1[b] and 1[c], as required.

71. Limitation 1[b] recites "a mixer module configured to ***downconvert a plurality of frequencies*** that comprise a plurality of desired channels and a plurality of undesired channels." Limitation 1[c] subsequently recites "a wideband analog-to-digital converter (ADC) module configured to ***digitize said plurality of frequencies***" Limitation 1[d] subsequently requires circuitry to select "said plurality of desired television channels ***from said digitized plurality of frequencies.***" The antecedent basis for "said digitized plurality of frequencies" in limitation 1[d] is the "plurality of frequencies" that was downconverted in limitation 1[b] and digitized in limitation 1[c]. Thus, limitation 1[d] requires "select[ing] said plurality of desired channels" from the same "plurality of

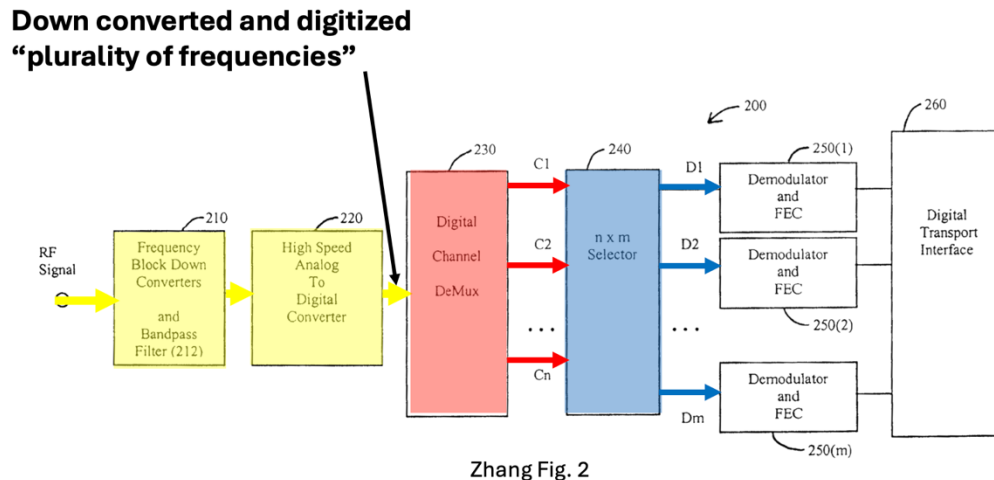
frequencies” that were downconverted in limitation 1[b] and digitized in limitation 1[c].

72. Channels D_1 - D_m , relied upon by Petitioner as the alternative “desired channels” in limitation 1[d], are not selected “from” the same “plurality of frequencies” relied upon by Petitioner as the downconverted and digitized “plurality of frequencies” in limitations 1[b] and 1[c]. Specifically, Petitioner relies on Zhang’s Frequency Block Downconverters 210 for the disclosure of the claimed mixer module in limitation 1[b], and on Zhang’s Analog to Digital Converter 220 for the disclosure of the claimed analog-digital converter in limitation 1[c]. Pet., 25, 27. Petitioner’s mapping is schematically shown below, with Zhang’s down converter 210 and analog-digital converter 220 relied upon by Petitioner highlighted in yellow:



Zhang Fig. 2

73. As I explain with reference to the following annotated figure, channels D_1 - D_m are not selected “from” the same “plurality of frequencies” relied upon by Petitioner as digitized in limitation 1[c]:



74. Zhang receives an RF input signal, down converts it in Frequency Block Down Converter 210, and digitizes it in Analog To Digital Converter 220. Ex. 1013 [Zhang] [0024]-[0027]. These elements are shown in yellow. As I explained in paragraphs 42-44, the digital channel demultiplexer 230 (red) then receives this down converted, digitized signal as input, and extracts all channels C_1 - C_n . Ex. 1013 [Zhang] [0028] (“A digital channel demultiplexer 230 then demultiplexes the multi-channel digital RF signal into separate digital RF channels C_1 to C_n .”). The output channels C_1 - C_n of the digital channel demultiplexer 230 (red) is then fed into the selector 240 (blue), which selects channels D_1 - D_m from the input channels C_1 - C_n . Ex. 1013 [Zhang] [0028] (“an $n \times m$ digital selector 240

receives the demultiplexed digital RF channels C_1 to C_n and then selects one or more of the RF channels D_1 to D_m from one or more of the digital RF channels C_1 to C_n .”); [0039] (“digital selector 500 digitally selects one or more RF channels D_1 to D_m from the digital RF channels C_1 to C_n .”).

75. Channels C_1 - C_n , from which channels D_1 - D_m are selected, are not the same “plurality of frequencies” digitized by Zhang in its analog-digital converter 220 (which, in Zhang’s implementation is the entire input). In Zhang, channels C_1 - C_n together are generally only a non-contiguous subset of the digitized input signal. Because of the specific way in which Zhang first extracts all channels in the signal before any selection occurs, there are many frequency ranges that exist in the digitized input signal, including between the channels, that do not exist in the channels C_1 - C_n . These may include frequency guard bands are placed between different RF channels in an input signal to avoid interference between channels or blank frequency ranges that do not contain channels. In the specific architecture of Zhang, none of these exemplary frequency ranges would be included in the demultiplexed channels C_1 - C_n , even though they exist in the digitized input signal and due to the way in which Zhang operates, this means that channels D_1 - D_m are not selected from the same “plurality of frequencies” digitized by Zhang, because Zhang digitizes the entire input.

76. A comparison of the claims of the '362 patent with claims in US 11,381,866, which has a common specification with the '362 patent, also confirms the significance of selecting the desired channels “from said digitized plurality of frequencies.” For example, claim 1 of the '866 patent recites a “digital front end” that is configured to “concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels,” but does not explicitly recite that the selection must be “from said digitized plurality of frequencies.” Ex. 2015 ['866-Patent] cl. 1. This is shown in the table below:

'362 Patent Limitation 1[d] and 11[d]	'866 Patent Limitation 1[b]
Limitation 1[d] : “select said plurality of desired television channels from said digitized plurality of frequencies” Limitation 11[d]: “selecting, by digital circuitry of said wideband receiver system, said plurality of desired television channels from said digitized plurality of frequencies”	“a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels, via a serial interface, without providing any of the plurality of undesired channels.”

77. Thus, while claim 1 of the '362 patent recites that the selection of desired channels must be “from the input signal,” claim 1 of the '866 patent does

not explicitly recite the source signal from which the selection must be performed. If claim 1 of the '362 patent were read so broadly as to cover the selection of Zhang's channels D_1 - D_m , then the language of the claim requiring that these channels be selected "from the input signal" would be rendered superfluous.

78. Thus, for all these reasons, to the extent that Petitioner relies on Zhang's channels D_1 - D_m as the claimed "plurality of desired television channels," they fail to meet the claims because they are not selected "from said plurality of frequencies" as required.

VII. CONCLUSION

79. For the foregoing reasons, based on my expertise and experience and the record of this case that I have reviewed, it is my opinion that the challenged claims are not shown to be disclosed or obvious.

80. I understand that my opinions discussed above support a legal conclusion that the challenged claims are nonobvious.

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, I will appear for cross-examination within the United States during the time allotted.

I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are 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 and that any such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Respectfully submitted,

Dated: January 14, 2025



Samuel H. Russ, Ph.D.