

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARRIS GROUP, INC., ARUBA NETWORKS, INC.,
HEWLETT PACKARD ENTERPRISE COMPANY, and
HP, INC.,
Petitioner,

v.

MOBILE TELECOMMUNICATIONS TECHNOLOGIES, LLC,
Patent Owner.

Case IPR2016-00768¹
Patent 5,659,891

Before MEREDITH C. PETRAVICK, SCOTT A. DANIELS, and
MIRIAM L. QUINN, *Administrative Patent Judges*.

PETRAVICK, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

¹ Case IPR2016-00766 has been joined with the instant proceeding.

I. INTRODUCTION

A. Background

Aruba Networks, Inc., Hewlett Packard Enterprise Company, and HP Inc. (collectively, Petitioner) filed a Petition requesting *inter partes* review of claims 1–5 of U.S. Patent No. 5,659,891 (Ex. 1001, “the ’891 patent”). Paper 1 (“Pet.”). ARRIS Group, Inc. filed a nearly identical Petition, which was the subject of IPR2016-00766, and we joined IPR2016-00766 to the instant *inter partes* review. See Paper 26.

Inter partes review was instituted (Paper 13, “Inst. Dec.”) on the following grounds:

References	Basis	Claims Challenged
Petrovic ²	§ 102	1–5
Petrovic, Raith, ³ and Alakija ⁴	§ 103	5

Patent Owner, Mobile Telecommunications Technologies, LLC, filed a Corrected Patent Owner’s Response on June 12, 2017. Paper 42 (“PO Resp.”). Petitioner filed a Corrected Reply to the Patent Owner’s Response. Paper 44 (“Pet. Reply”).

An oral hearing was held on June 20, 2017. A transcript of the hearing is included in the record. Paper 50 (“Tr.”).

² Ex. 1013, Rade Petrovic, Walt Roehr & Dennis Cameron, *Permutation Modulation for Advanced Radio Paging*, IEEE PROC. SOUTHEASTCON, Apr. 1993.

³ Ex. 1014, Raith et al., WO 89/08355 (Sept. 8, 1989).

⁴ Ex. 1015, C. Alakija & S.P. Stapleton, *A Mobile Base Station Phased Array Antenna*, IEEE INT’L CONF. ON SELECTED TOPICS WIRELESS COMM., 188 (June 1992).

B. Related Proceedings

Both parties indicate that the '891 patent is the subject of numerous district court proceedings. Pet. 1–2; Paper 8, 2–4.

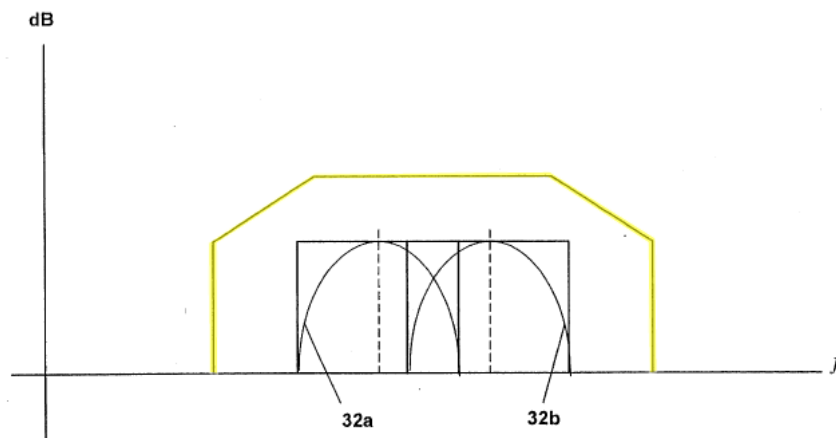
In addition, both parties also indicate that the '891 patent was the subject of other *inter partes* review proceedings. Pet. 2–3; Paper 8, 4. *Juniper Networks, Inc. v. Mobile Telecommunications Technologies, LLC*, Case IPR2017-00640 (PTAB filed Jan. 10, 2017) (“the *Juniper* IPR”) is pending. The following *inter partes* review proceedings were terminated, during trial, pursuant to settlement agreements between the respective parties: *Apple Inc. v. Mobile Telecommunications Technologies, LLC*, Case IPR2014-01035 (PTAB filed June 27, 2014); *T-Mobile USA Inc. v. Mobile Telecommunications Technologies, LLC*, Case IPR2015-00018 (PTAB filed Oct. 3, 2014), and *Samsung Electronics Co., Ltd. v. Mobile Telecommunications Technologies, LLC*, Case IPR2015-01726 (PTAB filed Aug. 13, 2015) (“the *Samsung* IPR”). Institution was denied in *Samsung Electronics Co., Ltd. v. Mobile Telecommunications Technologies, LLC*, Case IPR2015-01727 (PTAB filed Aug. 13, 2015).

C. The '891 Patent

The '891 patent (Ex. 1001), titled “Multicarrier Techniques in Bandlimited Channels,” generally relates to a method for multicarrier modulation using geographically co-located transmitters to achieve a higher frequency transmission capacity within FCC emission mask limits. The method provides for a plurality of overlapping subchannels within a single mask-defined, bandlimited channel to provide higher data transmission capacity for a mobile paging system. Ex. 1001, 2:15–59. The technique

involves transmitting a plurality of paging carriers, in corresponding overlapping subchannels, from the same location and within the mask-defined, bandlimited channel, without band-limiting each of the individual subchannels. *Id.* In this way, with the center frequencies of the plurality of modulated carriers within the single bandlimited channel, an optimum transmission capacity is provided and the plurality of carriers may emanate from the same transmission source, i.e., an antenna. *Id.*

An annotated version of Figure 3B of the '891 patent, reproduced below, depicts two adjacent carriers asymmetrically located within a single, mask-defined, bandlimited channel.



“FIG. 3B is a graph depicting the power spectra of two carriers asymmetrically located within a single mask-defined, bandlimited channel.” *Id.* at 3:13–15. The vertical axis represents the power level of the signal in decibels (dB), and the horizontal axis represent the frequency (f). As depicted by Figure 3B of the '891 patent, above, two carriers 32a and 32b are shown operating over two subchannels (no reference number) within a band-limiting mask (annotated in yellow) defining the channel. The subchannels are asymmetrically aligned within the mask resulting in partial

subchannel overlap. *Id.* at 4:24–30. The center frequencies of the carriers 32a and 32b are shown by the vertical dashed lines, and, concomitant with the subchannels, carriers 32a and 32b also overlap. According to the '891 patent, geographic co-location of the transmitters reduces interference problems between adjacent subcarriers, thus allowing the spacing between subchannels to be reduced. *Id.* at 4:12–20. The '891 patent explains that the practical implications of such an asymmetrical arrangement are a greater range of operating parameters, essentially because more subchannels can be fit within the bandlimited mask without undue interference. *Id.* at 4:36–46.

D. Illustrative Claim

Claims 1, 3, and 5 are independent. Claims 2 and 4 depend from claims 1 and 3 respectively. Claim 1 illustrates the claimed subject matter and is reproduced below:

1. A method of operating a plurality of paging carriers in a single mask-defined, bandlimited channel comprising the step of transmitting said carriers from the same location with said carriers having center frequencies within said channel such that the frequency difference between the center frequency of the outer most of said carriers and the band edge of the mask defining said channel is more than half the frequency difference between the center frequencies of each adjacent carrier.

II. CLAIM CONSTRUCTION

A. Legal Standard

The '891 patent is expired, and “the Board’s review of the claims of an expired patent is similar to that of a district court’s review.” *In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). In this context, claim terms generally are given their ordinary and customary meaning, as understood by

a person of ordinary skill in the art, at the time of the invention, taking into consideration the language of the claims, the specification, and the prosecution history of record because the expired claims are not subject to amendment. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Only terms which are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. Asymmetric Condition

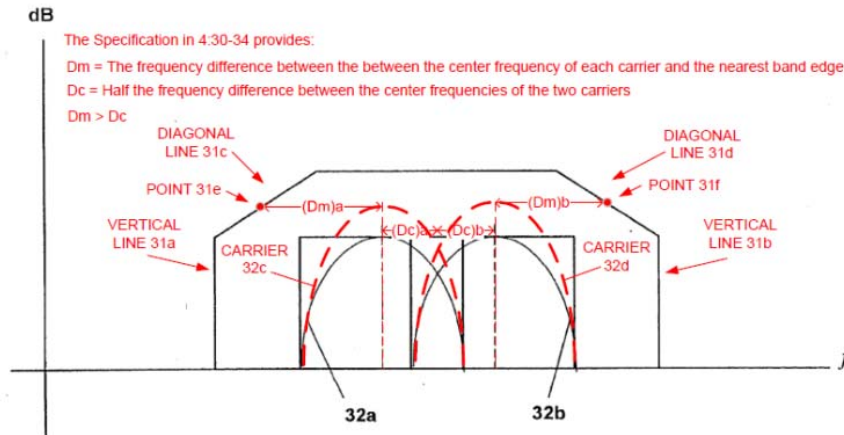
Independent claims 1, 3, and 5 of the ’891 patent recite that “the frequency difference between the center frequency of the outer most of said carriers and the band edge of the mask defining said channel is more than half the frequency difference between the center frequencies of each adjacent carrier.” Patent Owner refers to this limitation as “the asymmetric condition” in its Response. PO Resp. 2–3. For convenience, we shall also refer to the limitation, as it is recited by the claims, as the asymmetric condition.

i. Parties’ Proposed Constructions and Arguments

Petitioner and Patent Owner dispute the proper construction of the term “the band edge” in the asymmetric condition. Petitioner proposes that “the band edge” should be construed as “a band edge of the single mask-defined, bandlimited channel.” See Pet. 7–8; Pet. Reply 1–16. Patent Owner proposes that the “band edge of the mask” should be construed as “the nearest band edge of the mask,” where “the nearest band edge” is defined as “the band edge that is nearest to the center frequency of each

outer most carrier at the highest power level of each outer most carrier.”⁵
See PO Resp. 9–37.

Annotation B of Figure 3B of the ’891 patent from the Patent Owner’s Response (PO Resp. 20) is reproduced below and is helpful for illustrating the parties’ proposed constructions of “band edge of the mask.”



ANNOTATION B OF FIGURE 3B

FIGURE 3B

⁵ Patent Owner’s proposed construction in its Patent Owner’s Response is different from its proposed construction in its Preliminary Response (Paper 12, “Prelim. Resp.”) and in related district court proceedings. There, Patent Owner proposed that “the band edge” be construed as “the innermost frequencies at which the mask requires attenuation of the signal.” See Prelim. Resp. 14; Ex. 1007, 30–35. Patent Owner abandons this proposed construction in its Patent Owner’s Response. PO Resp. 16 (“Patent Owner no longer construes the band edge to be the inner most frequencies”). Patent Owner’s proposed construction in its Patent Owner’s Response is also different than in the *Juniper* IPR. There, Patent Owner proposed that the mask must be defined relative to the center frequencies of the carriers, when the carrier is unmodulated, and does not argue that the “the band edge” should be construed to mean “the nearest band edge of the mask.” The *Juniper* IPR, Paper 13, 14.

Annotation B of Figure 3B depicts carriers 32a and 32b operating over two subchannels within a band-limiting mask defining the channel. The band-limiting mask is annotated to label the mask as having left vertical line 31a, right vertical line 31b, diagonal line 31c, and diagonal line 31d. Dashed lines are added allegedly to depict carriers 32a and 32b when the carriers are not power limited by the subchannels. *See* PO Resp. 20.

Under Petitioner’s proposed construction, “the band edge of the mask” in Annotation B of Figure 3B is at left vertical line 31a or right vertical line 31b because those are the edges of the mask that define the channel (i.e., the frequency range). *See generally* Pet. Reply 2–9; Ex. 1018 ¶¶ 9, 12–14. Under Patent Owner’s proposed construction, “the band edge of the mask” is at point 31e along diagonal line 31c or point 31f along diagonal line 31d because those are the points of the mask that are allegedly nearest to the center frequencies of carriers 32a and 32b at the highest power level of carriers 32a and 32b, when carriers 32a and 32b are not power level limited by subchannels.

ii. Analysis

We are persuaded by Petitioner that the correct construction of “the band edge” is “a band edge of the single mask-defined, bandlimited channel” because Petitioner’s proposed construction is consistent with the plain language of the claims, the specification, and the drawing of the ’891 patent. *See* Pet. 7–8; Pet. Reply 1–16. Additionally, we are also persuaded by Petitioner’s declarant Dr. Kakaes’s testimony that its proposed construction is consistent with how a person of ordinary skill in the art (“POSITA”) would have understood “the band edge.” *See* Ex. 1018 ¶¶ 9–28.

The asymmetrical condition recites “the band edge of the mask defining the channel,” referring to the “single mask-defined, bandlimited channel” also recited by the claims. A channel is a range or band of frequencies. See Pet. 5–6; see also Ex. 2001 ¶ 49; Ex. 2011 ¶ 48 (testimony of Patent Owner’s declarant Dr. Kesan that “[t]he word ‘band’ of ‘band edge’ refers to a frequency band or range.”). The language of the claims, themselves, thus indicates that “the band edge” is the edge of the mask that defines the range or band of frequencies of the channel. For example, in Annotation B of Figure 3B the left vertical line 31a and right vertical line 31b are the edges of the mask that define the range or band of frequencies of the channel. In other words, the entire range or band of frequencies of the channel are between left vertical line 31a and right vertical line 31b.

The specification of the ’891 patent also indicates that “the band edge” is the edge of the mask that defines the range or band of frequencies of the channel. The specification of the ’891 patent explains that an emission mask attenuates the signal at “the band edge”:

The FCC requires signals to be confined within emission limit *masks* in order to prevent interference caused by signals straying or spilling into adjacent channels. FCC *masks* typically require the power spectral density of a signal to be attenuated at least 70 dB *at the band edge*.

Ex. 1001, 1:57–61 (emphases added). The specification depicts an example of the described 70dB attenuation at the band edge 10 kHz from the center frequency, in Figure 4, shown below:

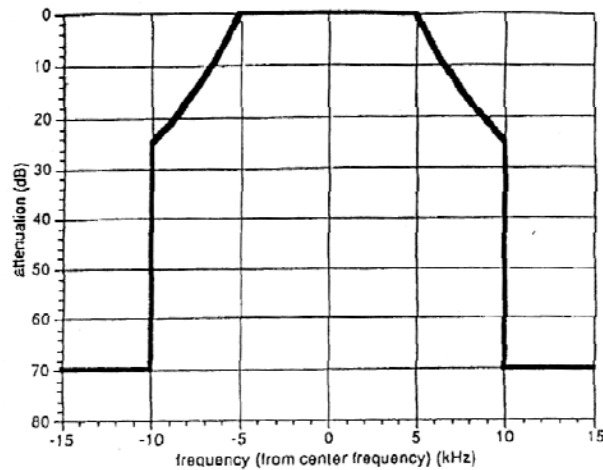


FIGURE 4

Figure 4 is a graph of an FCC emissions mask requiring the power spectral density to be attenuated to at least 70dB within 10 kHz from center frequency. *Id.* at 3:16–18. The specification and the drawings, thus, indicate that the “the band edge” is at 10 kHz either side of the center frequency. *See* Ex. 1018 ¶ 10.

Dr. Kakaes testifies that:

a POSITA would have understood that the band edge of the mask defines the channel, as required by the claims, which expressly recite: “the band edge of the mask defining said channel” and a “single mask-defined bandlimited channel.” Ex.1001, claims 1, 3, 5. In my opinion, a POSITA would have understood the ‘891 claims thus require “the band edge of the mask defining the channel” to be located where the entire channel has been included. If “the band edge of the mask” is located so as to include only a portion of the channel, it will no longer “defin[e] the channel.”

Id. ¶ 9; *see also id.* ¶¶ 10–14; Ex. 2012, 37:11–25, 38:1–15, 46:24–47:10; Ex. 2013, 180:5–181:4. Dr. Kakaes’s testimony is persuasive. We agree that if “the band edge” is located so as to include only a portion of the channel, as it would under Patent Owner’s proposed construction, the band

edge no longer defines the channel and the claims explicitly recite “the band edge of the mask defining said channel” (Ex. 1001, claims 1, 3, 5). As Dr. Kakaes testifies, “a POSITA would have understood the ’891 specification describes ‘the band edge of the mask’ as one point on the left side of the mask and one point on the right side of the mask—not as multiple points along the mask.” Ex. 1018 ¶ 15.

For the above reasons, we are persuaded by Petitioner that the correct construction of “the band edge” is “a band edge of the single mask-defined, bandlimited channel.”

We are not persuaded by Patent Owner that the correct construction of “the band edge” is “the nearest band edge of the mask,” where “the nearest band edge” is defined as “the band edge that is nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier,” because Patent Owner’s proposed construction improperly imports limitations into the claims. If a feature is not necessary to give meaning to what the inventor means by a claim term, it would be “extraneous,” and should not be read into the claim. *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998); *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed. Cir. 1988). Patent Owner’s proposed construction imports the word “nearest” into the claims from the specification of the ’891 patent and also imports a requirement that “the band edge that is nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier,” based upon the testimony of Patent Owner’s declarant Dr. Kesan. *See generally* PO Resp. 9–37.

Patent Owner argues that “the band edge” of the mask can include any point along the mask not just at the edge of the mask where it defines the channel and, thus, for clarity, we must import a limitation from the specification of the ’891 patent to specify a certain point on the one of the alleged multiple band edges of the mask. *See, e.g.*, PO Resp. 22 (“these masks can have multiple band edges”); Ex. 2011 ¶¶ 49, 50, 51. Patent Owner directs our attention to the following statement in the ’891 patent: “In accordance with this asymmetry, the frequency difference between the center frequency of each carrier and the *nearest* band edge of the mask is greater than half the frequency difference between the center frequencies of the two carriers.” Ex. 1001, 4:31–34 (emphasis added). Patent Owner argues that we should import the word “nearest” into the claims because otherwise the meaning of “the band edge” is not clear from the plain language of the claim. PO Resp. 11.

Patent Owner’s argument is unpersuasive. The meaning of “the band edge” is clear from plain language of the claims. The claims do not recite the word “nearest” and, as discussed above, the claims, themselves, indicate that the “the band edge” is an edge of the mask that limits or defines the range or band of frequencies of the channel (i.e., one point on the left side of the mask and one point on the right side of the mask). Patent Owner’s proposed construction, where the band edge is the band edge that is nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier, thus, is contrary to the language of the claims.

Patent Owner points to the cross-examination testimony of Petitioner’s declarant Dr. Kakaes to support its assertion that the term “the band edge of the mask” is not clear. *Id.* at 11 (citing Ex. 2012, 35:22–36:2),

34–37. For example, Patent Owner relies upon the following portion of Dr. Kakaes’s testimony.

22 Q. Sure. Is the band edge of the mask at
23 frequency -- or let me rephrase the question, more
24 open-ended.
25 Where is the band edge of the mask?
1 A. Like I said, it’s not clear where the band
2 edge of the mask is.

Ex. 2012, 35:22–36:2. Patent Owner, however, mischaracterizes Dr. Kakaes’s testimony. The testimony reproduced above is part of a lengthy exchange concerning where the band edge of the mask is in Figure 1 of Petrovic and is not directed to the meaning of “the band edge” in the claims. *See generally id.* at 13:4–36:2; *see also* Ex. 1018 ¶¶ 11, 18. The relied upon testimony, thus, does not support Patent Owner’s argument that the term “the band edge” is not clear from the plain language of the claims.

In addition, Patent Owner’s argument that the specification of the ’891 patent supports its proposed construction of “the band edge” is unpersuasive. First, Patent Owner’s reliance upon the statement that “[i]n accordance with this asymmetry, the frequency difference between the center frequency of each carrier and the *nearest* band edge of the mask is greater than half the frequency difference between the center frequencies of the two carriers” (Ex. 1001, 4:31–34 (emphasis added)) fails to take into account the context in which the statement is made. For example, in the paragraph proceeding the statement, the specification discusses the frequency spacing “between the band edges of the mask and the nearest respective carrier.” *Id.* at 4:17–20. This discussion, combined with the other disclosures concerning “the band edge” being at 70dB in Figure 4, suggests that “the nearest band edge” refers to, for example, left vertical line

31a in Annotation B of Figure 3B and its relationship to the center frequency of the left-most carrier 32a, as compared with right vertical line 31b, farther away, on the right side of Figure 3B. *See* Ex. 1018 ¶¶ 12–13. The specification of the '891 patent contains no discussion of the band edge being the nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier and provides no explicit example of a band edge at any point along the mask defining the channel.

Second, Patent Owner asserts that if carriers 32c and 32d in Annotation B of Figure 3B “are not power level limited by subchannels,” the nearest band edges to the center frequencies of carriers 32c and 3d are points 31e and 31f. PO Resp. 20. Patent Owner, however, cites no evidence to support this assertion. *See generally id.* at 19–21. Attorney arguments and conclusory statements that are unsupported by factual evidence are entitled to little probative value. *In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997).

Third, according to Dr. Kesan, example masks described in the specification of the '891 and other extrinsic evidence support Patent Owner's proposed construction. PO Resp. 21–33 (citing Ex. 2011). Dr. Kesan's testimony is unpersuasive because it is not adequately supported by the cited evidence. *See* Pet Reply. 6–13. For example, Dr. Kesan testifies that “FCC emission masks can have multiple band edges,” meaning “all points along the edge of the mask that limits the frequency band” (Ex. 2011 ¶¶ 48–51 (citing *id.* at Appendix C)). However, the material cited by Dr. Kesan does not mention the term “the band edges.” *See id.* at Appendix C. As another example, Dr. Kesan testifies that drawing the mask depicted in Figure 4 of the '891 patent on Figure 5A of the '891 patent proves that “not

choosing the nearest band edges of the mask of Figure 4 would cause the two carriers of Figure 5A to exceed the diagonal band edges of the masks when the carriers are modulated.” PO Resp. 28–30 (citing Ex. 2011 ¶¶ 71–76). Dr. Kesan, however, does not sufficiently explain why his placement of the Figure 4 mask on Figure 5A is the correct placement. *See generally* Ex. 2011 ¶¶ 71–76; *see also* Ex. 1018 ¶¶ 20–25 (testimony of Dr. Kakaes indicating the Dr. Kesan’s placement is incorrect).

Further, Patent Owner’s argument that a POSITA would construe “the band edge” according to its proposed construction is unpersuasive. *See generally* PO Resp. 21–30. Patent Owner relies upon the testimony of Dr. Kesan for support. *Id.* We give Dr. Kesan’s testimony little weight because it is not credible due to inconsistency in his testimony. For example, in its Preliminary Response, Patent Owner points to an annotation of Figure 3B of the ’891 patent by Dr. Kesan in related district court litigation. *See* Prelim. Resp. 27 (reproducing a figure from Ex. 2010⁶, 5). Annotated Figure 3B from the related district court litigation is reproduced below.

⁶ The Preliminary Response (Paper 12) mistakenly cites to Exhibit 2009. The figure, however, is actually found in Exhibit 2010.

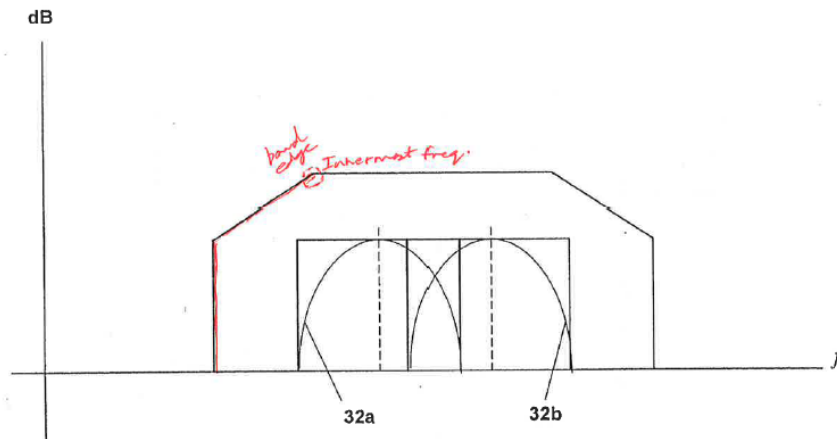


FIGURE 3B

On Annotated Figure 3B, Dr. Kesan identifies the band edge of the mask at a different point than point 31e along diagonal line 31c or point 31f along diagonal line 31d in Annotation B of Figure 3B of the '891 patent from the Patent Owner's Response. See Ex. 2010, 5; PO Resp. 20. Dr. Kesan labels the band edge as the inner most frequency in Annotated Figure 3B from the Preliminary Response, yet testifies in a later-filed declaration that "a POSITA would understand that the band edge of the asymmetric condition is the edge of the mask that is nearest to the outer most carrier when that carrier is modulated" (Ex. 2011 ¶ 90).⁷

For the above reasons, we are not persuaded by Patent Owner that the correct construction of "the band edge" is "the nearest band edge of the mask," where "the nearest band edge" is defined as "the band edge that is

⁷ Dr. Kesan's testimony in the *Juniper* IPR is also inconsistent with his testimony here. In the *Juniper* IPR, Dr. Kesan testifies that a POSITA would understand that asymmetric condition "must be defined relative to the center frequencies of the *unmodulated carriers*." The *Juniper* IPR, Ex. 2001 ¶ 20.

nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier.”

After consideration of both Petitioner’s and Patent Owner’s arguments and evidence, we are persuaded by Petitioner that the construction, using the plain and ordinary meaning to a person of ordinary of skill in the art, of “the band edge” is “a band edge of the single mask-defined, bandlimited channel.”

2. *Transmitting Carriers from the Same Location*

Claims 1 and 3⁸ recite “transmitting said carriers from the same location.” Ex. 1001, 6:6, 6:17–18. Patent Owner proposes that this limitation should be construed to mean “transmitting multiple carriers from the same location at the same time.” PO Resp. 37–39. Patent Owner argues that because the purpose of the asymmetric condition is “that adjacent carriers can be spaced closer together due to co-location, which in turn, means more carriers can be used to increase the message capacity of a channel” and the purpose of co-location is the solution to the near-far interference problem, the “at the same time” requirement should be imported into the claims. *Id.* at 37–39. Patent Owner relies upon Dr. Kesan’s testimony for support.⁹ *Id.* at 37–39 (citing Ex. 2011 ¶¶ 21, 34, 36, 41, 87).

⁸ Patent Owner asserts that claim 5 recites “transmitting carriers from the same location.” PO Resp. 37. Claim 5 does not recite this limitation, but recites a similar limitation, “co-locating said plurality of transmitters such that said plurality of carriers can be emanated from the same transmission source.” See Ex. 1001, 6:27–44. In as much as Patent Owner’s proposed construction applies to claim 5, we are not persuaded by Patent Owner that claim 5 requires that the carriers be emanated at the same time for the same reasons as discussed with respect to claims 1 and 3.

⁹ Dr. Kesan’s testimony in the *Juniper* IPR is inconsistent with his testimony here. In the *Juniper* IPR, Dr. Kesan testifies that a POSITA would

Petitioner disagrees and argues that Patent Owner’s proposed construction improperly imports a temporal limitation, “at the same time,” into the claims. Pet. Reply 14–15 (citing Ex. 1018, testimony of Dr. Kakaes). We are not persuaded by Patent Owner that its proposed construction is the correct construction because Patent Owner’s proposed construction improperly imports limitations into the claims. Claims 1 and 3 do not recite any temporal requirement, i.e., that all the carriers must be transmitted *at the same time*, only that the carriers must be transmitted from the same location. See Ex. 1001, 6:6, 6:17–18. Nor does the specification of the ’891 patent explicitly disclose that the carriers must be transmitted at the same time. See *generally* Ex. 1001; Ex. 1018 ¶ 29. For example, the ’891 patent does not explicitly disclose that the carriers depicted in Figure 1 must be transmitted at the same time. See Ex. 1018 ¶ 30.

We also are not persuaded by Dr. Kesan’s testimony that the carriers must be transmitted at the same time in order to improve message capacity or prevent near-far interference. See Ex. 2011 ¶¶ 37, 45 89–88, 21, 42, 44. As Dr. Kakaes testifies, message capacity may be increased by being able to operate multiple carriers in a channel, though not necessarily at the same time, and interference can be caused by things other than carriers being operated at the same time. Ex. 1018 ¶¶ 32–39. In any event, claims 1 and 3 do not require a method of operating carriers to increase message capacity or prevent near-far interference. The claims simply recite “[a] method of operating.” Ex. 1001, 6:4–12, 6:15–24.

understand that “transmitting said carriers from the same location” means “the multiple paging carriers emanate from the same location or antenna.” The *Juniper* IPR, Ex. 2001 ¶ 13.

After consideration of both Petitioner's and Patent Owner's argument and evidence, we are not persuaded by Patent Owner that the correct construction of "transmitting said carriers from the same location" is "transmitting multiple carriers from the same location at the same time."

3. Adjacent Carriers Overlap

Claim 2 depends from claim 1 and additionally recites "wherein adjacent carriers overlap with each other." Ex. 1001, 6:13–14. Similarly, claim 4 depends from claim 3 and recites "wherein adjacent subchannels overlap with each other". *Id.* at 6:25–26.

Patent Owner does not propose an explicit construction for this limitation but does imply that the claimed overlap is required to be "overlap that causes two signals to interfere in the near-far problem" (PO Resp. 54) or, in other words, overlap above a certain power level. *See id.* at 53–56 (citing Ex. 2011 ¶¶ 112, 114, 116–122). Petitioner disagrees. *See* Pet. Reply 28–32.

We are not persuaded by Patent Owner that its implied construction is the correct construction because Patent Owner's implied construction improperly imports limitations into the claims. Claims 2 and 4 do not recite that the overlap is of those portions of the carriers that would be recognized by a receiver as the carrier except for near-far interference. Claims 2 and 4 broadly recite that the carriers overlap, and are silent as to the amount of overlap. Nor does the specification of the '891 patent explicitly disclose that the overlap is such. *See* Ex. 1018 ¶¶ 59–62. We are not persuaded by Dr. Kesan's testimony that a POSITA would from the '891 patent's specification that the overlap must be above a certain power level. Ex. 2011 ¶¶ 111–112. As Dr. Kakaes testifies, and we agree, the overlap disclosed in

the '891 patent occurs at different power levels ranging from 35dB to 70dB. See Ex. 1018 ¶¶ 59–62.

After consideration of both Petitioner's and Patent Owner's argument and evidence, we are not persuaded by Patent Owner that the correct construction of "overlap" requires "overlap that causes two signals to interfere in the near-far problem." PO Resp. 54.

III. ANALYSIS

A. Claims 1–5 – Anticipation by Petrovic

Petitioner asserts that claims 1–5 are anticipated by Petrovic. Pet. 12–30 (citing Ex. 1003 for support). Patent Owner disagrees. PO Resp. 40–59 (citing Ex. 2001 for support). "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). We determine that Petitioner has shown by a preponderance of the evidence that claims 1–5 are anticipated for the reasons explained below.

1. Overview of Petrovic

Petrovic discloses a multicarrier modulation technique for a radio paging system, simultaneously broadcasting the same information, in the same channel, by different transmitters with overlapping coverage areas, to improve the reliability of reception by a receiver, i.e., a pager device, in any given coverage area. Ex. 1013, 1. Petrovic explains that this simulcasting technique also provides an increased bit rate and better frequency spectrum efficiency across paging radio channels. *Id.*

Figure 1 of Petrovic, reproduced below, depicts a signal spectrum having four carriers, all within an emission mask denoted by the dashed line. *Id.* at 2 ¶ 8.

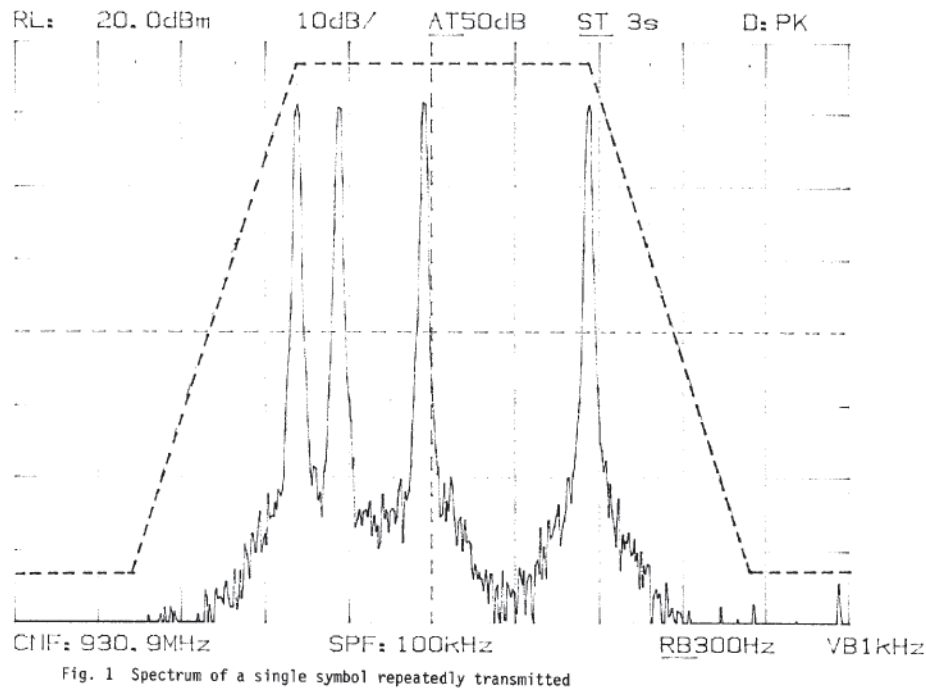


Figure 1 illustrates a spectrum of a single symbol repeatedly transmitted. Pointing out that radio paging systems generally were known to operate within a 25 kHz channel, Petrovic’s modulation technique proposes “doubling the channel bandwidth in order to allow higher throughput. This should be done by moving the current emission mask boundaries away from the center frequency by +/- 12.5 kHz.” *Id.* at 1 ¶ 6. Petrovic further explains that the 50 kHz frequency range provides “a 35 kHz pass band in the middle of the channel and 7.5kHz guard bands on each side.” *Id.*

Petrovic explains, in accordance with the symbols shown in Figure 1, that to best utilize the allocated 50 kHz spectrum, the multicarrier modulation technique uses eight (8) symbols, i.e., carriers, each center

frequency spaced 5 kHz apart, and that in any given carrier interval, 4 of the carriers are “ON,” while 4 others are “OFF.” *Id.* at 1 ¶ 7.

Petrovic also describes a series of laboratory and field experiments in the 930 MHz frequency band where “[e]ach transmitter has four subtransmitters capable of 4-FSK over a subset of the 8 frequencies. Outputs of the subtransmitters are combined and sent to a common antenna.” *Id.* at 2 ¶ 6. The experiments included two transmitters “installed seven miles apart and synchronized to provide a simulcast overlap area with approximately 35 dB μ V/m signal strength.” *Id.*

2. Independent claims 1, 3, and 5

Petitioner contends that Petrovic meets all the limitations of claims 1 and 3. Pet. 13–14, 23–26; Pet. Reply 16–28. Patent Owner disagrees because Petrovic allegedly does not meet the asymmetric condition or the limitation requiring transmission of the carriers from the same location. PO Resp. 41–52.

Upon review of Petitioner’s evidence and analysis, which we agree with and hereby adopt, we determine that Petitioner has shown by a preponderance of the evidence that claims 1, 3, and 5 are anticipated by Petrovic. Pet. 13–14, 23–26; Pet. Reply 16–28. In particular, we are persuaded by Dr. Kakaes’s testimony that Petrovic meets the asymmetric condition. Dr. Kakaes testifies that in Petrovic:

the frequency difference between the center frequency of the outer most of the carriers and the band edge of the mask defining said channel (which is greater than 7.5 kHz) is more than half the frequency difference between the center frequencies of each adjacent carrier (which is 5 kHz), as required by claim 1.

Ex. 1003 ¶ 22. Dr. Kakaes’s testimony is based upon Petrovic’s description of doubling the 25 kHz bandwidth to 50 kHz to provide “a 35 kHz pass band in the middle of the channel and 7.5 kHz guard bands on each side,” with eight subcarriers spaced 5 kHz apart.” Ex. 1013 1.

Further, we are persuaded by Petitioner that Petrovic describes transmitting the carriers from the same location. Petrovic states that “[e]ach transmitter has four subtransmitters capable of 4-FSK over a subset of the 8 frequencies. Outputs of the subtransmitters are combined and sent to a common antenna.” *Id.* at 2; *see also* Ex. 1003 ¶¶ 25, 26.

We are not persuaded by Patent Owner that Petrovic fails to anticipate claims 1, 3, and 5 because Patent Owner’s arguments are not commensurate with the scope of the claims. *See* PO Resp. 41–52. First, Patent Owner contends that Petrovic does not meet the asymmetric condition when “the band edge of the mask” is construed, according to Patent Owner’s proposed construction, as “the nearest band edge of the mask,” where “the nearest band edge” is defined as “the band edge that is nearest to the center frequency of each outer most carrier at the highest power level of each outer most carrier.” *Id.* at 42–50. As discussed above, however, we determine that Patent Owner’s proposed construction of “the band edge of the mask” is not the correct construction. Second, Patent Owner argues that Petrovic does not describe transmitting the carriers from the same location because it does not describes transmitting multiple carriers from the same location at the same time. PO Resp. 51–52. As also discussed above, claims 1, 3, and 5 do not require the carriers to be transmitted at the same time. Claims 1, 3, and 5 do not recite any temporal requirement, i.e., that all the carriers must be transmitted *at the same time*, only that the carriers must be transmitted

from the same location. Patent Owner's arguments, thus, are not commensurate with the scope of the claims.

After consideration of both Petitioner's and Patent Owner's argument and evidence, Petitioner has shown by a preponderance of the evidence that claims 1, 3, and 5 are anticipated by Petrovic.

3. *Dependent claims 2 and 4*

With respect to the additional limitations of dependent claims 2 and 4, Petitioner proffers annotated versions of Petrovic's Figure 1 (Pet. 22–23) to show that adjacent carriers (claim 2) and subchannels (claim 4) “overlap with each other,” as recited in these claims. *Id.* at 21–23, 27. Figure 6 and Figure 7, the annotated versions of Petrovic's Figure 1, are reproduced side-by-side below.

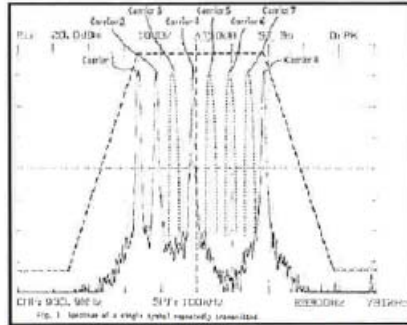


Figure 6: Annotation of Petrovic's Fig. 1.

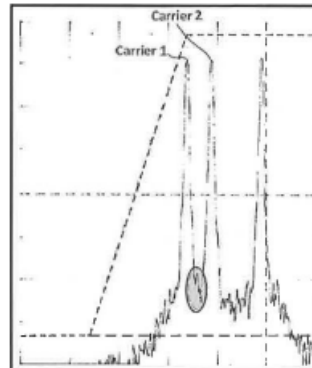


Figure 7: Annotation of Petrovic's Fig. 1.

Figure 6 depicts Petrovic's Figure 1 with annotations to show transmission levels if subchannels 1–8 are all on. Pet. 21; Ex. 1003 ¶ 23. Figure 7 depicts a portion of Petrovic's Figure 1 around carrier 1 and carrier 2 and has been annotated to highlight the overlap.

According to Patent Owner, to meet claims 2 and 4, Petrovic must “teach overlap of the carriers that could be recognized by a receiver as the carrier except for near-far interference.” PO Resp. 53–59. Patent Owner

argues that Petrovic does not teach overlapping carriers, because Petrovic's overlap is caused by near-far interference and is at a very low power. PO Resp. 53–56 (citing Ex. 2011 ¶¶ 112, 115–120). Patent Owner argues that overlap must be overlap of those portions of a carrier that could be recognized by a receiver as the carrier except for near-far interference. *Id.* at 54.

As discussed above, when the limitations are given the correct construction, the claims do not require the overlap at a power level above where noise starts to affect the carrier signal. Patent Owner's arguments, thus, are not persuasive. As Petitioner points out and as can be seen in Figures 6 and 7, reproduced above, Petrovic describes adjacent carriers that overlap with each other. Pet. 21–23; Ex. 1003 ¶¶ 23–24; Pet. Reply 28–35. Ex. 1018 ¶¶ 59–72.

After consideration of both Petitioner's and Patent Owner's argument and evidence, Petitioner has shown by a preponderance of the evidence that claims 2 and 4 are anticipated by Petrovic.

B. Claim 5 – Obviousness over Petrovic, Raith, and Alakija

Section 103(a) forbids issuance of a patent when “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The ultimate determination of obviousness under § 103 is a question of law based on underlying factual findings. *In re Baxter Int'l, Inc.*, 678 F.3d 1357, 1362 (Fed. Cir. 2012) (citing *Graham v. John Deere Co.*, 383

U.S. 1, 17–18 (1996)). These underlying factual considerations consist of: (1) the “level of ordinary skill in the pertinent art,” (2) the “scope and content of the prior art,” (3) the “differences between the prior art and the claims at issue,” and (4) “secondary considerations” of non-obviousness such as “commercial success, long-felt but unsolved needs, failure of others, etc.”¹⁰ *KSR*, 550 U.S. at 406 (quoting *Graham*, 338 U.S. at 17–18).

Petitioner contends that claim 5 is obvious over Petrovic, Raith, and Alakija. Pet. 31. Claim 5 recites “co-locating said plurality of transmitters such that said plurality of carriers can be emanated from the same transmission source.” See Ex. 1001, 6:27–44. Petitioner states that in a related district court proceeding “[t]he district court has stated that transmitting multiple signals or outputs from a single structural unit does not constitute a plurality of transmitters.” Pet. 31 (citing Ex. 1011, 5). According to Petitioner, “[u]nder such a construction, Petrovic discloses a plurality of transmitters, but may not explicitly disclose co-location of transmitters” and “[i]f such a construction is adopted, Petrovic combined with Raith and Alakija renders claim 5 of the ’891 Patent obvious.” Pet. 31.

Upon review of Petitioner’s evidence and analysis, with which we agree and hereby adopt, we determine that Petitioner has shown by a preponderance of the evidence that claim 5 is not only anticipated by Petrovic but also obvious over Petrovic, Raith, and Alakija. Pet. 31–38; Pet. Reply 36–38. As discussed above, Petrovic states that “[e]ach transmitter has four subtransmitters capable of 4-FSK over a subset of the 8 frequencies. Outputs of the subtransmitters are combined and sent to a common antenna.” Ex. 1013, 2. Petrovic, thus, describes co-locating said plurality of

¹⁰ The record contains no evidence of secondary considerations.

subtransmitters such that multiple carriers can be emanated from the same antenna. We, thus, are persuaded by Petitioner that Petrovic alone discloses the claimed co-locating. *See* Pet. 17–18.

In addition, we are persuaded by Petitioner that the combination of Petrovic, Raith, and Alakija teaches the claimed co-locating. Petrovic describes an experiment in which two transmitters are located seven miles apart and synchronized to provide a simulcast overlap area. Ex. 1013, 2. Raith describes a similar cellular digital mobile radio system with plural base station transmitters. Pet. 33 (citing Ex. 1014, Title). Raith describes dividing a geographical area into multiple cells and providing two transmitters, which simultaneously transmit the same message information to mobile stations, in each cell. Ex. 1014, Abstract, 6:1–3; Ex. 1003 ¶ 30. For adjacent cells, Raith teaches co-locating groups of three base transmitters to transmit information to contiguous cells. *See* Ex. 1014, 6:11–15; *see also* Pet. 33 (reproducing Figure 1 of Raith with annotations to illustrate the co-located transmitters). Dr. Kakaes testifies that a POSITA

would have been motivated to expand the experimental paging system configuration described in Petrovic to include multiple adjacent paging cells/regions similar to the structure illustrated in Figure 1 of Raith . . . in order to provide messaging services to a larger geographic area and a larger number of mobile devices.

Ex. 1003 ¶¶ 31–32; Ex. 1018 ¶ 73. Alakija describes a “mobile communications base station antenna, which utilizes a cylindrical array design.” Ex. 1015, Abstract. Alakija describes that, “[b]y combining a number of feed networks into a single antenna system, an antenna with multiple independently steerable beams is achieved.” Ex. 1015, 1–2; *see also id.* at Fig. 6. Dr. Kakaes testifies that a POSITA

would have been motivated to utilize a single cylindrical antenna structure to emit the output signals of the three co-located transmitters described by Petrovic in view of Raith instead of three separate antennas, because a single antenna structure “[c]an be used to realize advantages such as...hardware savings, low manufacturing costs, [and] low installation costs,” as recognized by Alakija.

Ex. 1003 ¶ 36 (quoting Ex. 1015, 3); Ex. 1018 ¶ 73.

We are not persuaded by Patent Owner that claim 5 is not obvious over Petrovic, Raith, and Alakija. See PO Resp. 60–63. Patent Owner initially contends that neither Raith nor Alakija cure the defects with respect to any of Petitioner’s arguments discussed above with respect to anticipation by Petrovic. PO Resp. 60–61. As discussed above, however, we have found Petitioner’s arguments regarding Petrovic persuasive.

Second, we find unpersuasive Patent Owner’s argument that Petitioner has failed to present articulated reasoning with rational underpinnings. *Id.* at 61–62. As discussed above, we have found Petitioner provides sufficiently articulated reasoning with rational evidentiary underpinning. See Pet. 31–38; Ex. 1003, ¶¶ 31–32, 35; Ex. 1018 ¶ 73.

Patent Owner next argues that these references cannot be combined “because the combination would render the purpose of *Petrovic* locating two transmitters at different locations inoperable.” PO Resp. 61–63. Patent Owner suggests that the approximately 35 dB μ V/m signal strength in the overlap area, as described by Petrovic, *might* be compromised by “co-locating” the transmitters. *Id.* This position, however, does not explain why Petrovic’s modulation technique, or experiment, would be inoperable, only that the overlap signal strength potentially could be affected. See Ex. 1018 ¶ 73 (testimony of Dr. Kakaes that “a POSITA would have been

motivated to do so even if it meant that a trade-off of those benefits would be a decrease in Petrovic's signal strength for the simulcast overlap area.”)

Finally, Patent Owner argues that Petrovic cannot be combined with Raith and Alakija because “Petrovic specifically states that its teachings cannot be applied in cellular systems as these systems are inherently different: ‘the higher efficiency attained in cellular networks is a result of the inherent differences in the type of services offered.’” PO Resp. 63 (citing Ex. 1013, 4; Ex. 2011 ¶ 128). Petitioner, however, does not propose applying Petrovic's modulation technique in the systems of Raith and Alakija but propose modifying Petrovic's transmitters to be co-located as in Raith and Alakija. See Pet. 34–38; Pet. Reply 37; Ex. 1003 ¶¶ 29–36; Ex. 1018 ¶ 74.

After consideration of both Petitioner's and Patent Owner's argument and evidence, Petitioner has shown by a preponderance of the evidence that claim 5 is unpatentable as obvious over Petrovic, Raith, and Alakija.

IV. CONCLUSION

For the foregoing reasons, we determine that Petitioner shows by a preponderance of the evidence that claims 1–5 of the '891 patent are unpatentable.

V. ORDER

For the reasons given, it is

ORDERED that claims 1–5 of U.S. Patent No. 5,659,891 are unpatentable; and

FURTHER ORDERED that because this is a Final Written Decision,

IPR2016-00768
Patent 5,659,891

parties to the proceeding seeking judicial review of the decision must
comply with the notice and service requirements of 37 C.F.R. § 90.2.

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