

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Inter Partes* Review of:)
U.S. Patent No. 10,833,908)
Issued: Nov. 10, 2020)
Application No.: 16/902,740)
Filing Date: Jun. 16, 2020)

For: **Channel Probing Signal For A Broadband Communication System**

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,833,908**

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PETITIONER’S EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 10,833,908 B2 to Li et al.
1002	Prosecution History of U.S. Patent No. 10,833,908 B2
1003	Declaration of Leonard J. Cimini, Jr., Ph.D.
1004	<i>Curriculum Vitae</i> of Leonard J. Cimini, Jr., Ph.D.
1005	Declaration of Sylvia Hall-Ellis, Ph.D.
1006	Declaration of Gordon MacPherson
1007	S. Kaiser and K. Fazel, “A flexible spread-spectrum multi-carrier multiple-access system for multi-media applications,” Proceedings of 8th International Symposium on Personal, Indoor and Mobile Radio Communications - PIMRC ’97, 1997, pp. 100- 104 vol.1, doi: 10.1109/PIMRC.1997.624371 (“ Kaiser ”)
1008	Jerry D. Gibson, “The Mobile Communications Handbook,” 2nd Edition, CRC Press LLC, 1999 (“ Gibson ”)
1009	WO 99/60729 to Frank et al. (“ Frank ”)
1010	U.S. Patent No. 6,574,267 to Kanterakis et al. (“ Kanterakis ”)
1011	Proceedings of 8th International Symposium on Personal, Indoor and Mobile Radio Communications - PIMRC ’97, 1997, title page, copyright page, and table of contents.
1012	IEEE <i>Xplore</i> metadata: S. Kaiser and K. Fazel, “A flexible spread-spectrum multi-carrier multiple-access system for multi- media applications.”
1013	Library of Congress Catalog record: “Waves of the year 2000+ : PIMRC’97 : the 8th IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications : September 1-4, 1997 : the technical program, proceedings.”
1014	U.S. Copyright Office record: Waves of the year 2000+ : PIMRC ’97 : the 8th IEEE international symposium on personal, indoor, and mobile radio communications, September 1-4, 1997, Marina Congress Center, Helsinki, Finland : technical program : proceedings : vol[s.] 1-3.
1015	B. Natarajan and C. R. Nassar, “Introducing novel FDD and FDM in MC-CDMA to enhance performance,”

Exhibit No.	Description
	RAWCON 2000. 2000 IEEE Radio and Wireless Conference (Cat. No.00EX404), 2000, pp. 29-32, doi: 10.1109/RAWCON.2000.881841.
1016	IEEE <i>Xplore</i> metadata: B. Natarajan and C. R. Nassar, “Introducing novel FDD and FDM in MC-CDMA to enhance performance.”
1017	U.S. Copyright Office record: RAWCON 2000 : 2000 IEEE radio and wireless conference : proceedings, Denver Marriott Southeast, Denver, Colorado, USA, September 10-13, 2000.
1018	U.S. Copyright Office record: The mobile communications handbook / editor-in-chief, Jerry D. Gibson.
1019	Alan Gatherer and Edgar Auslander, “The Application of Programmable DSPs in Mobile Communications,” John Wiley & Sons, Ltd., 2002.
1020	<i>Dell Inc. v. Neo Wireless LLC</i> , IPR2022-00277, Paper 10 (PTAB June 21, 2022).
1021	Joint Claim Construction Statement, <i>Neo Wireless, LLC v. Dell Technologies Inc. et al.</i> , Case No. 6:21-cv-00024-ADA (W.D. Tex.), filed December 21, 2021 (ECF No. 56)
1022	F. Tobagi, “Multiaccess Protocols in Packet Communication Systems,” in IEEE Transactions on Communications, vol. 28, no. 4, pp. 468-488, April 1980, doi: 10.1109/TCOM.1980.1094698.
1023	IEEE <i>Xplore</i> metadata: F. Tobagi, “Multiaccess Protocols in Packet Communication Systems.”
1024	June 14, 2022 Transfer Order, <i>In Re: Neo Wireless, LLC Patent Litigation</i> , Case MDL No. 3034
1025	Docket Sheet, <i>Neo Wireless, LLC v. Volkswagen Group of America, Inc. et al.</i> , Case No. 2:22-cv-11404-TGB (E.D. Mich.)
1026	United States District Courts – National Judicial Caseload Profile, June 2022
1027	June 21, 2022 Memorandum: Interim Procedure for Discretionary Denials in AIA Post Grant Proceedings with Parallel District Court Litigation (“June 2022 Memo”)

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Exhibit No.	Description
1028	Declaration of Dr. Todor Cooklev (“Cooklev Decl.”)
1029	Curriculum Vitae of Dr. Todor Cooklev
1030	Declaration of Ingrid Hsieh-Yee

I. INTRODUCTION

Ford Motor Company (“Ford” or “Petitioner”) petitions for *inter partes* review of claims 1-30 of U.S. Patent No. 10,833,908 (“the ’908 patent”) assigned to Neo Wireless LLC (“Patent Owner”).

The ’908 patent describes and claims cellular communications technologies that were well-known and widely implemented in existing cellular systems by the earliest possible priority date, January 29, 2004. The claims are generally directed to a mobile station and related method that transmits: an uplink signal using orthogonal frequency division multiplexing (OFDM), and a random-access signal followed by a guard period. According to certain dependent claims, the random-access signal is a spread-spectrum signal.

OFDM, spread-spectrum signaling, random-access signals, and guard periods were all well-known and routinely used in cellular systems by January 2004, which the prior art presented below confirms. Briefly, Kaiser, which is an IEEE article from 1997, describes a mobile station transmitter that employs a multiple-access scheme based on a combination of spread-spectrum techniques and OFDM. Gibson, a comprehensive treatise on mobile communications from 2000, explains that systems like Kaiser’s systems need to employ a separate random-access channel in the uplink to facilitate a mobile station’s initial access to a base station, and for channel assignment. Gibson also establishes that using guard

periods (in the time domain) and guard intervals (in the frequency domain) was routine. Finally, Frank, an application published in 1999, teaches using a spread- spectrum, random-access signal that is followed by a guard period.

As explained below, the teachings of the prior art fit together like pieces of a puzzle and render all of the challenged claims obvious. Accordingly, the Board should institute review and cancel claims 1-30.

At present, one other IPR challenging the '908 patent has been filed: IPR2023-00086 filed by Volkswagen (“Volkswagen IPR”). *See* Conditional Motion for Joinder (filed concurrently). Petitioner seeks to join the Volkswagen IPR. *Id.* Volkswagen refused to share experts for the purposes of this IPR, which would leave Petitioner without experts for cross-examination if Volkswagen settles out before its experts have been deposed. *Id.* Accordingly, Petitioner retained Dr. Todor Cooklev, who prepared a declaration adopting the opinions set forth in Ex. 1003, the declaration of Dr. Leonard Cimini submitted in IPR2023-00086, as his own. Petitioner cites Dr. Cooklev’s declaration (Ex. 1028), and notes there are corresponding, identical opinions in Dr. Cimini’s declaration at the same paragraph numbers (with the exception of the paragraphs discussing the expert’s qualifications and the like).

Similarly, Petitioner retained Dr. Hsieh-Yee, who prepared a librarian declaration that, like Dr. Hall-Ellis’s declaration (Ex. 1005), establishes the public

availability of prior-art references Gibson and Kaiser. This is a simple factual issue in this case, as Gibson is a readily available treatise and Kaiser is a readily available IEEE publication.

Petitioner Ford will rely on Dr. Cooklev's and/or Dr. Hsieh-Yee's testimony only if Ford is no longer in the understudy role due to Volkswagen's settlement and Patent Owner has not already deposed Dr. Cimini and/or Dr. Hall-Ellis and the time to do so has not expired. See Conditional Motion for Joinder. In addition, *all cites herein to Dr. Cooklev's declaration (Ex. 1028) should therefore be read as citing Dr. Cimini's declaration (Ex. 1003) unless those circumstances occur.*

II. MANDATORY NOTICES (37 C.F.R. § 42.8(A)(1))

REAL PARTY IN INTEREST: The real party-in-interest is Petitioner Ford Motor Company.

RELATED MATTERS: The '908 patent is the subject of the following civil actions: *Neo Wireless LLC v. Dell Technologies Inc.*, 6-21-cv-00024 (W.D. Tex), filed January 12, 2021; *Neo Wireless LLC v. Dell Technologies Inc.*, 1-22-cv- 00060 (W.D. Tex.), filed January 12, 2021; *Neo Wireless LLC v. LG Electronics Inc.*, 6-21-cv-00025 (W.D. Tex.), filed January 13, 2021; *Neo Wireless LLC v. Apple Inc.*, 6-21-cv-00026 (W.D. Tex.), filed January 13, 2021; *Neo Wireless, LLC v. Ford Motor Company*, 4-22-cv-00210 (W.D. Mo.), filed March,

29, 2022; *Neo Wireless, LLC v. American Honda Motor Co., Inc.*, 2-22-cv-01824 (S.D. Ohio), filed March 29, 2022; *NEO Wireless, LLC v. Nissan North America Inc.*, 3-22-cv-00220 (M.D. Tenn.), filed March 29, 2022; *Neo Wireless LLC v. Toyota Motor North America, Inc.*, 2-22-cv-00093 (E.D. Tex.), filed March 29, 2022; *Neo Wireless LLC v. General Motors Company*, 2-22-cv-00094 (E.D. Tex.), filed March 29, 2022; *Neo Wireless LLC v. Tesla, Inc.*, 2-22-cv-00095 (E.D. Tex.), filed March 29, 2022; *Neo Wireless, LLC v. Volkswagen Group of America, Inc.*, 1-22- cv-00076 (E.D. Tenn.), filed March 29, 2022; *In re: Neo Wireless, LLC Patent Litigation*, 2-22-md-03034 (E.D. Mich.), filed June 23, 2022; *Neo Wireless, LLC v. Ford Motor Company*, 2-22-cv-11402 (E.D. Mich.), filed June 27, 2022; *Neo Wireless, LLC v. American Honda Motor Co., Inc.*, 2-22-cv-11403 (E.D. Mich.), filed June 27, 2022; *Neo Wireless, LLC v. Volkswagen Group of America, Inc.*, 2- 22-cv-11404 (E.D. Mich), filed June 28, 2022; *Neo Wireless, LLC v. Nissan North America Inc.*, 2-22-cv-11405 (E.D. Mich), filed June 29, 2022; *Neo Wireless LLC v. Toyota Motor North America, Inc.*, 2-22-cv-11406 (E.D. Mich), filed June 28, 2022; *Neo Wireless LLC v. General Motors Company*, 2-22-cv-11407 (E.D. Mich.), filed June 28, 2022; *Neo Wireless LLC v. Tesla Inc.*, 2-22-cv-11408 (E.D. Mich), filed June 28, 2022; *Neo Wireless, LLC v. FCA US LLC*, 3-22-cv-01252 (N.D. Ohio), filed July 15, 2022; *Neo Wireless, LLC v. Mercedes-Benz USA, LLC*, 3-22-cv-00780 (M.D. Fla), filed July 15, 2022.

Volkswagen Group of America, Inc. filed an IPR petition (IPR2023-00086) against the '908 patent. That petition is currently pending, and no institution decision has been made. Petitioner is concurrently filing a Conditional Motion to Join IPR2023-00086 herewith, and requests the Board consider that motion as explained therein.

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SERVICE INFORMATION:

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney from Ford is attached.

Ford consents to electronic service.

FEE FOR *INTER PARTES* REVIEW

The Director is authorized to charge the fee specified by 37 C.F.R.
§ 42.15(a) to Deposit Account No. 506269.

III. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

The undersigned and Petitioner certify that the '908 patent is available for
inter partes review and Petitioner is not barred or estopped.

IV. IDENTIFICATION OF CHALLENGE (37 C.F.R. § 42.104(B))

A. Citation of Prior Art

The '908 patent claims priority to January 29, 2004. EX1001, (60). Without
conceding entitlement to this date, all applied references qualify as prior art as of
January 29, 2004.

Kaiser (EX1007) was publicly available in 1997, and thus is prior art under pre-AIA §102(b). EX1005, ¶¶37-45; EX1030, ¶¶27-49. Kaiser was publicly disseminated at the 8th International Symposium on Personal, Indoor and Mobile Radio Communications, held on September 1-4, 1997, in Helsinki, Finland. EX1006, 0002, ¶11; EX1011, 0004 (“C5.1”). Kaiser had also “been received, cataloged, and indexed at the Library of Congress and made part of the OCLC bibliographic database” by October 24, 1997. EX1005, ¶¶40-45; *see also* EX1013 (“c1997”); EX1014 (“1997-09-01”); EX1030, ¶¶27-49.

Kaiser was also cited in the Natarajan article, EX1015, 0004, which itself was publicly available in 2000, EX1005, ¶¶46-54; EX1006, 0011-12. Natarajan is a “research aid” confirming Kaiser was publicly available by at least 2000. EX1005, ¶55; *see Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1350 (Fed. Cir. 2016). Finally, Kaiser was available via IEEE *Xplore* by August 6, 2022. EX1005, ¶39; EX1006, 0001-05; EX1012, 0001; EX1030, ¶¶31. Kaiser’s citation in Natarajan and availability in IEEE *Xplore* further confirm that Kaiser is §102(b) prior art.

Gibson (EX1008) was publicly available by at least September 2000, and thus is prior art under §102(b). EX1005, ¶¶56-62; EX1030 ¶¶50-71. Gibson was published by an established publisher, CRC Press, with a 1999 copyright date. EX1005, ¶56; EX1008, 0007; EX1030 ¶¶50, 69; *see VidStream LLC v. Twitter*,

Inc., 981 F.3d 1060, 1065 (Fed. Cir. 2020) (“When there is an established publisher there is a presumption of public accessibility as of the publication date.”). The U.S. Copyright Office’s record shows Gibson was published February 23, 1999. EX1018. Gibson had also “been cataloged and indexed at the Library of Congress and made part of the OCLC bibliographic database, and at least by September 2000, when the physical copy was sent to [the Binding and Collections Care Division (BCCD)].” EX1005, ¶61.

Frank (EX1009) published November 25, 1999, and thus is prior art under §102(b). EX1009, (43).

Kanterakis (EX1010) issued June 3, 2003, and was filed March 22, 1999, and thus is prior art under §102(a), (e). EX1010, (45), (22). If the ’908 patent is not entitled to the January 2004 priority dates, Kanterakis is prior art under §102(b).

B. Statutory Grounds for the Challenge

Ground	Claims	35 U.S.C.	Prior Art
1	1, 4, 6-11, 14, 16-21, 24, 26-30	§103	Kaiser, Gibson, Frank
2	2-3, 5, 12-13, 15, 22-23, 25	§103	Kaiser, Gibson, Frank, Kanterakis

V. TECHNICAL BACKGROUND

A. Multiple Access

Multiple access techniques—including frequency-division multiple access (FDMA), time-division multiple access (TDMA), and code-division multiple access (CDMA)—were well-known in cellular communication systems by 2004. EX1028, ¶¶46-49; EX1008, 0312-24, 0435. In FDMA systems, “[s]imultaneous access to the radio channel is facilitated by assigning nonoverlapping frequency bands to different users.” EX1008, 0323. TDMA “[s]ystems assign nonoverlapping time slots to different users in a round-robin fashion.” EX1008, 0324. CDMA “[s]ystems use signals with very small cross-correlations to facilitate sharing of the broadcast radio channel. Correlators are used to extract the desired user’s signal while simultaneously suppressing interfering, parallel transmissions.” EX1008, 0323. “[B]ecause of their wideband nature CDMA systems are often called spread- spectrum systems.” EX1008, 0320; *see also* EX1008, 435 (“direct-sequence [spread spectrum multiple access] ... is usually referred to as CDMA”). Gibson explains that “[t]here are also many hybrids of these systems.” EX1008, 0435.

Figure 17.1 of Gibson, below, illustrates FDMA, TDMA, and CDMA.

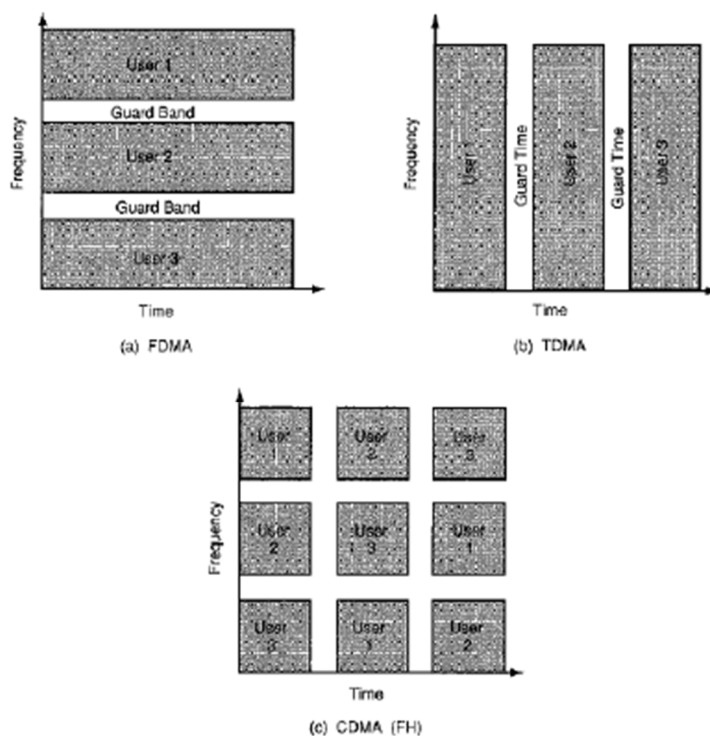


FIGURE 17.1 Multiple-access methods for wireless communication systems.

EX1008, 0314.

B. Orthogonal Frequency-Division Multiplexing

“Orthogonal frequency division multiplexing (OFDM) is a modulation technique” that “transmit[s] blocks of symbols in parallel employing a (large) number of orthogonal subcarriers.” EX1008, 0308. OFDM may also be considered a multiple access technique when employed in wireless communication systems where users share the OFDM frequency sub-carriers or sub-channels. EX1028, ¶50.

C. Guard Bands and Guard Periods

Inserting guard bands between frequency bands and guard periods between transmissions were well-known techniques used to reduce signal interference in cellular communication systems by 2004. EX1028, ¶51. For example, systems using FDMA routinely employed “guard bands between frequency bands to reduce adjacent channel interference, i.e., inference from signals transmitted in adjacent frequency bands; see also Fig. 17.1(a).” EX1008, 0315. Similarly, systems using TDMA routinely employed “[g]uard times” or periods between timeslots. EX1008, 0318. Figures 17.1(a) and (b) of Gibson, above, illustrate guard bands in FDMA and guard times/periods in TDMA, respectively. Notably, each of Kaiser, Gibson, and Frank discloses using guard periods. *See, e.g.*, EX1007, 0003 (explaining that “[e]ach ODFM-frame may start with a null symbol (without signal energy)” and referring to “guard-time Δ ”), 0004 (“guard time of about 20 μ s”); EX1008, 0318; EX1009, 6:6-10 (“A guard interval is preferably inserted in the preamble portion of the frame”).

D. Random Access Channel and Protocol

Random access channels and protocols were well-known technologies for dynamic channel (or subcarrier) assignment by 2004. EX1028, ¶52; EX1008, 0319-20, 0324. A random access channel was often “a separate uplink channel on which mobiles [could] notify the base station of their need for a traffic channel.”

EX1008, 0319. This channel was “shared by all users in range of the base station,” and thus “a random access protocol, like the ALOHA protocol, ha[d] to be employed to resolve possible collisions.” EX1008, 0319; *see* EX1028, ¶¶53-54 (describing ALOHA).

E. Standard Mobile Station Components

Mobile station components including transmitters, receivers, digital-to- analog converters, and analog-to-digital converters were well-known by January 2004. EX1028, ¶¶55-56; EX1019, 0037. Such components were basic and fundamental to a mobile station’s ability to operate in a cellular network. EX1028, ¶¶55-56.

VI. THE ’908 PATENT

A. Overview

The ’908 patent describes “[a] broadband wireless communication system where both the Multi-Carrier (MC) and direct Sequence Spread Spectrum (DSSS) signals are intentionally overlaid together in both time and frequency domains.” EX1001, 2:42-45. The “MC system can be ... [an] OFDM” system. EX1001, 3:9-11. The ’908 patent acknowledges that both DSSS and OFDM systems were known. EX1001, 1:32-58; *see id.*, 1:37-38 (“[DSSS] has been widely used in some existing wireless networks”).

The '908 patent explains that “[t]he MC signal is used to carry broadband data signal for its high spectral efficiency, while the DSSS signal is used for special purpose processing, such as initial random access” EX1001, 2:47-53. In one embodiment, the mobile station “sends an initial random access signal over the DSSS channel with a certain signature code or sequence that is designated to the corresponding base station and is broadcasted to all the mobile stations by each base station.” EX1001, 8:49-55. “A sufficient guard period is reserved in the DSSS signal to account for initial time alignment uncertainty.” EX1001, 8:60-62. “If the base station successfully detects the DSSS signal, it sends the acknowledgement (ACK) carrying information such as a signature or other unique mobile station identifier and power and time adjustments of the mobile on the downlink control channel in the next available timeslot.” EX1001, 8:63-67. “The mobile station whose transmission signature matches that of the acknowledgement then moves to the designated uplink MC control channel using the assigned time and power values and further completes the message transmission.” EX1001, 8:67-9:4. *See also* EX1028, ¶¶32-35.

B. Prosecution Summary

The application that issued as the '908 patent received only one office action on the merits, which included rejections under §112 but no art-based rejections.

EX1002, 0140-44. The applicant amended the claims seeking to address the §112 rejections, and the '908 patent issued thereafter. EX1002, 0173-92.

C. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSA”) would have a bachelor’s degree in electrical engineering, computer engineering, computer science, or an equivalent field, or an advanced degree in those fields, as well as at least 3-5 years of academic or industry experience in mobile wireless communications, or comparable industry experience. EX1028, ¶¶28-31, 40-41.

D. Claim Construction

No terms require express construction at this stage but Petitioner reserves the right to respond to any construction proposed by Patent Owner. EX1028, ¶¶42-43.

VII. GROUND 1: CLAIMS 1, 4, 6-11, 14, 16-21, 24, AND 26-30 WOULD HAVE BEEN OBVIOUS OVER KAISER, GIBSON, AND FRANK

Claims 1, 4, 6-11, 14, 16-21, 24, and 26-30 would have been obvious because the combination of Kaiser, Gibson, and Frank teaches, suggests, or renders obvious each and every claim element, and a POSA would have been motivated to combine the references and had a reasonable expectation of success in doing so. EX1028, ¶¶57-171.

A. Kaiser

Kaiser discloses a “system” and “multiple access scheme designed for mobile multi-media applications” that “is referred to as spread-spectrum multi-carrier multiple-access (SS-MC-MA) and exploits the advantages given by the combination of the spread-spectrum technique with multi-carrier modulation.” EX1007, 0001, Abstract. Kaiser explains that the system is “a good candidate for the future universal mobile telecommunications systems (UMTS),” which, in the 1997 timeframe, was a forthcoming “third-generation mobile radio communications system[.]” EX1007, 0001, Abstract.

Like the '908 patent, Kaiser's SS-MC-MA system and method employ multi-carrier (MC) modulation and spread-spectrum techniques in the uplink (from mobile station to base station) in a cellular communications system. *Compare, e.g.,* EX1007, 0001 (“The multiple access scheme is based on a combination of the spread-spectrum technique and orthogonal multi-carrier modulation.”), *with* EX1001, 2:42-45 (“A broadband wireless communication system where both the Multi-Carrier (MC) and direct Sequence Spread Spectrum (DSSS) signals are intentionally overlaid together in both time and frequency domains is described.”); *see also* EX1007, 0001 (the “SS-MC-MA scheme is investigated for the up-link of a mobile radio system”), 0003 (describing “adjacent cells operating in the same

frequency band,” i.e., a cellular system). A POSA would have understood that Kaiser discloses DSSS techniques. EX1028, ¶59.

Kaiser explains that “the SS-MC-MA separates the users’ signals according to an FDMA scheme on [the] sub-carrier level,” which advantageously “avoids multiple access interference (MAI) within a cell.” EX1007, 0001, Abstract; *see id.* (explaining the “SS-MC-MA scheme ... avoids MAI due to an FDMA scheme on [the] sub-carrier level by nevertheless exploiting the diversity gain offered by the spread-spectrum technique”). Kaiser’s “SS-MC-MA assigns each user exclusively its own sub-carriers according to an FDMA scheme,” EX1007, 0001, which, like the ’908 patent, is based on OFDM, EX1007, 0002-04, FIGs. 1, 2, 4; *see* EX1001, claim 1.

Figure 2 of Kaiser, below, shows an example of user-specific OFDM frequency mapping and de-mapping. EX1007, 0002. “Each user of a cell transmits on a sub-set of sub-carriers, where the sub-sets of sub-carriers of the users within a cell are disjunct.” EX1007, 0002. Figure 2 of Kaiser, for example, shows the sub- carrier (or sub-channel) assignment for users 1, 2, and Nu. Figure 4 of Kaiser, below, shows a single OFDM frame having “256 sub-channels” (on the frequency axis) and “31 OFDM-symbols” (on the time axis). EX1007, 0004.

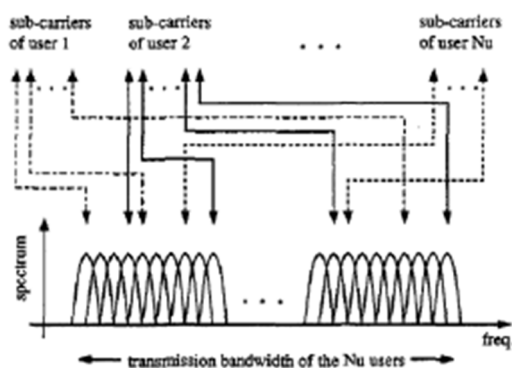


Figure 2: Pseudo-random user-specific frequency-mapping and -demapping.

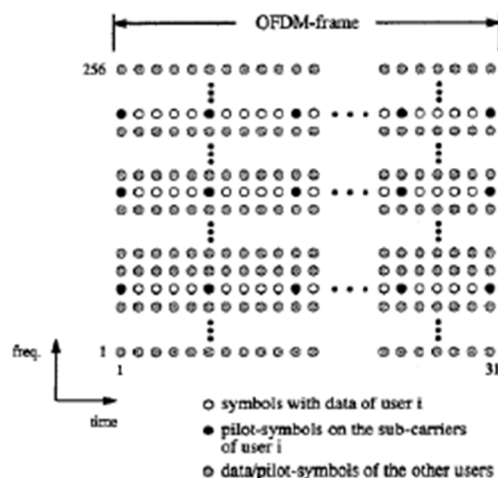


Figure 4: OFDM frame with 256 sub-carriers and 31 OFDM-symbols.

EX1007, 0002.

EX1007, 0004.

Kaiser describes an example implementation in which each OFDM frame can support “32 users.” EX1007, 0004. Kaiser further discloses that the SS-MC-MA system can have “a TDMA component, where, in a cycle of 4 [OFDM] frames ... each frame transmits the data of another group of 32 users” such that, in this implementation, Kaiser’s system can support up to “128 active users” (32 users per frame x four OFDM frames). EX1007, 0004.

Kaiser recognized that the “wide range of multi-media services” supported in 3G systems required “different data rates.” EX1007, 0003. “For instance, the transmission of low data rate services will need ... only one or few sub-carriers,” whereas “for the transmission of high data rate [services] ... the majority or all of the sub-carriers should be used.” EX1007, 0003. Kaiser thus discloses that a “base station ... allocates an appropriate set of sub-carriers” based on the “required data

rate” of the desired multi-media service. EX1007, 0003. Kaiser, however, does not describe the details of the sub-carrier (or sub-channel) assignment, which would have led a POSA to Gibson. EX1028, ¶¶58-65.

B. Gibson

Gibson is a comprehensive treatise on mobile communications that was published in 1999 and is titled *The Mobile Communications Handbook*. Gibson explains that the treatise “covers the entire field—from principles of analog and digital communications to cordless telephones, wireless local area networks (LANs), and international technology standards.” EX1008, 0003 (back cover).

Gibson discloses initial channel (or sub-carrier) assignment. EX1008, 0319. Specifically, Gibson teaches that “[i]n both FDMA and TDMA systems, channels should not be assigned to a mobile on a permanent basis” because such “[a] fixed assignment strategy would either be extremely wasteful of precious bandwidth or highly susceptible to cochannel interference.” *Id.* “Instead, channels must be assigned on demand.” *Id.* Gibson thus discloses using “a separate uplink channel on which mobiles can notify the base station of their need for a traffic channel. This uplink channel is referred to as the **random-access channel** because of the type of strategy used to regulate access to it.” *Id.*

Gibson discloses that because the random-access channel “is shared by all users in range of the base station, a random access protocol, like the ALOHA

protocol, has to be employed to resolve possible collisions.” EX1008, 0319.

Gibson explains, “A random access protocol is employed to arbitrate access to this channel.” EX1008, 0324.

Gibson further discloses a “procedure” for call establishment, illustrated in Figure 17.3 of Gibson (below). First, as Gibson explains, “[t]he mobile initiates the procedure by transmitting a request on the random-access channel.” EX1008, 0319. Second, “[o]nce the base station has received the mobile’s request, it responds with an immediate assignment message that directs the mobile to tune to a dedicated control channel for the ensuing call setup.” *Id.* Finally, “[u]pon completion of the call setup negotiation, a traffic channel, i.e., a frequency in FDMA systems or a time slot in TDMA systems, is assigned by the base station and all future communication takes place on that channel.” *Id.*

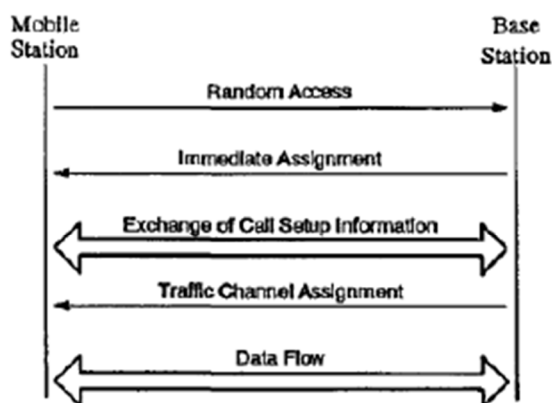


FIGURE 17.3 Mobile-originating call establishment.

EX1008, 0320.

Other than passing mention of the “ALOHA protocol,” Gibson does not expressly describe the details of the random access protocol, which would have led a POSA to Frank. EX1028, ¶¶66-70.

C. Frank

Like Kaiser, Frank is directed to “next generation mobile communications systems, such as ... Universal Mobile Telecommunications Systems (UMTS).” EX1009, 1:12-15; *compare id.*, with EX1007, 0001, Abstract; *see* EX1028, ¶¶71-73. Frank recognized that because of the “broad selection of telecommunications services” such systems would offer, “the number of calls being made is expected to increase significantly, which will result in much higher traffic density on random access channels (RACHs)” and “in increased collisions and access failures.” EX1009, 1:18-23. Frank further recognized that these “systems will have to use much faster and flexible random access procedures, in order to increase their access success rates and reduce their access request processing times.” EX1009, 1:23-26. Frank explains that “there will be a high demand for much faster and more efficient access in those systems due to the expected substantial increase in packet-switched traffic.” EX1009, 1:26-28.

To meet this demand, Frank describes a random-access technique that sought to improve upon then-existing approaches, such as ALOHA-type approaches. *See* EX1009, 2:9-5:31. Frank’s technique uses a random-access

“frame structure ... with a separate preamble and data portion.” EX1009, 8:14-16.

“The preamble is used by the based station to detect that a [mobile station (MS)] is attempting the random access request.” EX1009, 8:16-17. Frank discloses that “[a] guard interval is preferably inserted between the preamble and data portion of the frame, which enables detection of the preamble before the data arrives (requiring less buffering).” EX1009, 8:19-22.

In Frank’s system, a base station broadcasts “a known base station-unique spreading code ... via the base station’s broadcast channel,” EX1009, 9:6-9, and “can be continuously ‘listening’ for [a mobile station’s] transmitted preamble,” EX1009, 8:29-30. Frank discloses that “[i]n order to distinguish between simultaneous random access requests being transmitted by different MSs, each preamble of a random access request is modulated by a unique signature pattern,” which “is spread with [the] known base station-unique spreading code.” EX1009, 8:31-9:9. “[D]uring the guard time interval, T_G , the signature detection processing can be performed at the base station receiver ... and the base station can determine more quickly whether a random access request has been made.” EX1009, 9:24-27.

D. Motivation to Combine

The teachings of Kaiser, Gibson, and Frank “fit ... together like pieces of a puzzle.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007). The prior-art combination represents nothing more than “the predictable use of prior art

elements according to their established functions” and requires nothing more than “the inferences and creative steps that a ... [POSA] would employ.” *Id.* at 417-18.

1. Kaiser with Gibson

It would have been obvious to a POSA to combine Gibson’s teachings related to channel assignment with Kaiser’s system. EX1028, ¶74. For example, it would have been obvious to (i) include a “random-access channel” as “a separate uplink channel” and (ii) perform the channel-assignment “procedure,” as disclosed by Gibson, in Kaiser’s system. EX1008, 0319-20, FIG. 17.3; EX1028, ¶74. Doing so would have predictably resulted in a combined Kaiser-Gibson system in which: (i) the uplink includes Kaiser’s dedicated sub-channels and Gibson’s separate, shared random-access channel, and (ii) the system uses Gibson’s procedure shown in Figure 17.3 to assign channels (Kaiser’s sub-channels or sub-carriers). EX1028, ¶74.

Gibson’s express teachings would have motivated a POSA to make this combination. EX1028, ¶75. Kaiser discloses using both FDMA and TDMA, EX1007, 0003-04, but does not expressly describe the details of sub-channel (sub-carrier) assignment. Gibson teaches that “[i]n both FDMA and TDMA systems ... channels must be assigned on demand” because “[a] fixed assignment strategy would be either extremely wasteful of precious bandwidth or highly susceptible to cochannel interference.” EX1008, 0319. Gibson thus teaches

employing a “random-access channel” as “a separate uplink channel on which mobiles can notify the base station of their need for a traffic channel.” EX1008, 0319. Gibson also teaches that Figure 17.3 outlines a “successful procedure” showing the exchange between a mobile station seeking channel assignment and a base station performing channel assignment that uses the random-access channel. EX1008, 0319-20, FIG. 17.3.

Gibson’s teachings would have motivated a POSA to include a random-access channel as a separate uplink channel in Kaiser in order for Kaiser’s system to assign subcarriers according to the FDMA and TDMA schemes disclosed by Kaiser. EX1028, ¶76. A POSA would have been further motivated by Gibson’s teaching that Figure 17.3 outlines a “successful procedure” for channel assignment to use Gibson’s procedure in Kaiser’s system to assign subcarriers. EX1028, ¶76.

A POSA would have had a reasonable expectation of success in making this combination. EX1028, ¶77. Gibson’s techniques were well-known and commonly implemented in existing cellular systems by 2004. *Id.* A POSA would have reasonably expected that combining Gibson’s known and familiar techniques in Kaiser’s system would result in successful carrier assignment. *Id.*

Accordingly, the Kaiser-Gibson combination is nothing more than the combination of well-known, prior-art elements (e.g., Kaiser’s FDMA and TDMA

access methods and Gibson's random-access channel and channel-assignment procedure) according to their established functions, yielding predictable results (e.g., channel/carrier assignment in a system employing FDMA and/or TDMA). EX1028, ¶78; *see KSR*, 550 U.S. at 416-17.

2. Kaiser and Gibson with Frank

It would have been obvious to a POSA to combine Frank's random-access techniques with the combined Kaiser-Gibson system. EX1028, ¶79. For example, it would have been obvious to employ Frank's teachings related to the preamble and guard period in the Kaiser-Gibson system during the channel-assignment procedure. EX1028, ¶79. Doing so would have predictably resulted in a combined Kaiser-Gibson-Frank system in which: (i) the uplink includes Kaiser's dedicated sub-channels and Gibson's separate, shared random-access channel, (ii) Frank's random-access preamble is transmitted in the separate, shared random-access channel, and (iii) the system uses Gibson's procedure shown in Figure 17.3 to assign channels (Kaiser's sub-channels or sub-carriers). EX1028, ¶79.

The references' express teachings and suggestions, as well as the "design incentives and other market forces" driving the development of the next generation (3G) systems by January 2004, would have motivated a POSA to make this combination. *KSR*, 550 U.S. at 417; EX1028, ¶80.

Kaiser suggests using its system in 3G networks, such as UMTS, EX1007, 0001, and each of Kaiser, Gibson, and Frank teaches that a key objective of 3G networks was to support and contend with increased user traffic (among other constraints and objectives), *see, e.g.*, EX1007, 0001 (“user capacity”); EX1008, 0523 (“higher call capacities”); EX1009, 1:18-28 (“expected to increase significantly”). Gibson teaches that because the random-access “channel is shared by all users in range of the base station, a random access protocol, like the ALOHA protocol, has to be employed to resolve possible collisions,” EX1008, 0319, but does not expressly describe the details of such random-access protocols. EX1028, ¶81.

The design incentives and market forces (e.g., increased user traffic) driving 3G system development, as well as Gibson’s teaching that “a random access protocol ... has to be employed to resolve possible collisions,” would have motivated a POSA to seek random-access techniques designed for 3G systems, leading to Frank. EX1028, ¶82. And because Frank teaches random-access techniques designed to address the “much higher traffic density on random access channels (RACHs)” resulting in “increased collisions and access failures” in 3G systems, such as UMTS, *see* EX1009, 1:12-28, a POSA would have been motivated to combine Frank’s techniques in the Kaiser-Gibson system. EX1028, ¶82.

Frank's express teachings would have further motivated the combination and provide independent bases to support combining Frank with Kaiser and Gibson. EX1028, ¶83. Frank teaches its random-access technique, particularly using the preamble and guard period, confers numerous important technical advantages, such as "that each portion of the random access request has to fulfill only one function and can thus be optimally designed for that respective task," EX1009, 6:14-16; "that all necessary post-processing, such as for example, signature decoding, can be accomplished during the guard period," which simplifies "the hardware design for random access request detection" and minimizes "the random access request processing delay," EX1009, 6:20-24; "less buffering" as a result of the guard period, EX1009, 6:7-10, 8:19-22; "reduc[ing] the MS's transmitted power," EX1009, 9:19-23; that the "random access request can be aligned exactly to that of an existing system's frame slot scheme," EX1009, 9:22-23; and "the base station can determine more quickly whether a random access request has been made," EX1009, 9:24-27. These benefits would have motivated a POSA to use Frank's teachings related to the preamble (random-access signal) and guard period in the Kaiser-Gibson system. EX1028, ¶83.

A POSA would have had a reasonable expectation of success in making this combination. EX1028, ¶¶84-87. That Frank discloses its random-access techniques in the context of a CDMA system, EX1009, 1:6-9, would not have discouraged a

POSA from making the combination. EX1028, ¶84. First, it was well-known by January 2004 for systems to employ a combination of known multiple-access techniques, such as FDMA, TDMA, and CDMA. *See, e.g.*, EX1008, 0313 (“System designers have to decide in favor of one, or a combination, of the latter three domains to facilitate multiple access.”), 0435 (“There are also many hybrids of these systems.”). Indeed, Kaiser’s system employs all three: FDMA, TDMA, and DSSS (which was also commonly called CDMA), EX1007, 0001, 0003-04; EX1008, 0320, 0435, confirming that using CDMA with FDMA and/or TDMA was common and within the skill of a POSA, EX1028, ¶84. Further, by January 2004, mobile stations that supported TDMA, FDMA, and CDMA/WCDMA were also well known, further confirming that it would have been routine, predictable, and obvious to combine Frank’s random-access techniques in the Kaiser-Gibson system. EX1028, ¶85; EX1019, 0045 (describing “multi-mode” mobiles), 0050 (discussing “Type 2 dual-mode” mobiles that supported both WCDMA and GSM).

Second, relatedly, Kaiser and Frank describe similar spread-spectrum technologies, such as using similar spreading codes (e.g., Walsh-Hadamard). EX1007, 0002; EX1009, 9:26. A POSA would recognize these similarities and have understood that Kaiser and Frank disclose compatible technologies that, when combined, yield predictable results. EX1028, ¶86.

Finally, Frank identifies a number of ways in which Frank's random-access techniques improve CDMA-based systems. *See, e.g.*, EX1009, 6:1-7:11. A POSA would recognize that Frank's techniques would improve similar systems, such as Kaiser's system, in the same ways. EX1028, ¶87; *KSR*, 550 U.S. at 417 (explaining that "if a technique has been used to improve one device, and a [POSA] would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill"). A POSA would thus have reasonably expected that combining Frank's techniques with the Kaiser-Gibson system would result in successful random access and carrier assignment. EX1028, ¶87.

At bottom, the Kaiser-Gibson-Frank combination is nothing more than the combination of well-known, prior-art elements (e.g., Kaiser's FDMA and TDMA access methods, Gibson's random-access channel and channel-assignment procedure, and Frank's random-access techniques) according to their established functions, yielding predictable results (e.g., channel/carrier assignment in a system employing FDMA and/or TDMA). EX1028, ¶88; *see KSR*, 550 U.S. at 416-17.

E. Independent Claim 1

1. Preamble

Kaiser teaches or suggests a "*mobile station.*" EX1028, ¶¶90-91. *See In re Burckel*, 592 F.2d 1175, 1179 (C.C.P.A. 1979) ("Under 35 U.S.C. § 103, a

reference must be considered not only for what it expressly teaches, but also for what it fairly suggests.”). Kaiser’s system includes a “mobile station” that implements Kaiser’s SS-MC-MA scheme. EX1007, 0004 (describing “System Performance” and referencing “the mobile station”); *see also* EX1007, 0002 (showing in Figure 1 the “SS-MC-MA transmitter for the data of user i ”), 0004 (describing “mobile users”).

2. Limitation 1.1

Kaiser teaches or suggests “a transmitter.” EX1028, ¶92. In Section 2.1 and Figure 1, Kaiser discloses a transmitter, shown below. EX1007, 0002, FIG. 1.

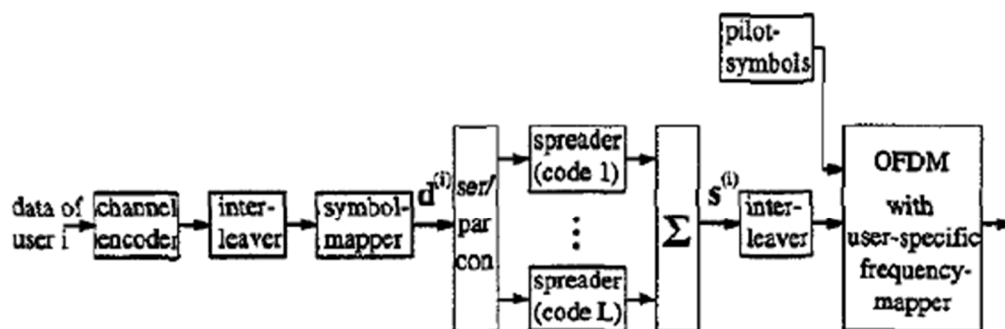


Figure 1: SS-MC-MA transmitter for the data of user i .

EX1007, 0002.

3. Limitation 1.2

Kaiser teaches or suggests that the transmitter is configured to “transmit, to a base station, a first uplink signal within a frequency band, wherein the first uplink signal is an orthogonal frequency division multiplexing (OFDM) signal and

utilizes a frame format comprising a plurality of timeslots, each timeslot comprising a plurality of OFDM symbols.” EX1028, ¶¶93-102.

Kaiser teaches “*a base station*”: “The required data rate is transmitted to the base station, which allocates an appropriate set of sub-carriers.” EX1007, 0003.

Kaiser teaches or suggests that the transmitter is configured to “*transmit, to [the] base station, a first uplink signal within a frequency band, wherein the first uplink signal is an orthogonal frequency division multiplexing (OFDM) signal.*”

EX1028, ¶95. Kaiser focuses on “the up-link of a mobile radio station,” but explains that “the same radio interface can be used for the up- and the down-link.” EX1007, 0001; *see also* EX1007, 0004 (“[T]he up-link of a SS-MC-MA system is considered.”). Kaiser discloses that “data transmission can be based on OFDM- frames, where each frame consists of a group of several OFDM-symbols.” EX1007, 0003. As shown in Figure 2 below, Kaiser discloses that “[e]ach user of a cell transmits on a sub-set of sub-carriers, where the sub-sets of sub-carriers of the users within a cell are disjunct.” EX1007, 0002, FIG. 2. Kaiser explains that “the OFDM unit” of the transmitter of Figure 1 “performs [the] user-specific frequency mapping, illustrated in Fig. 2.” EX1007, 0002.

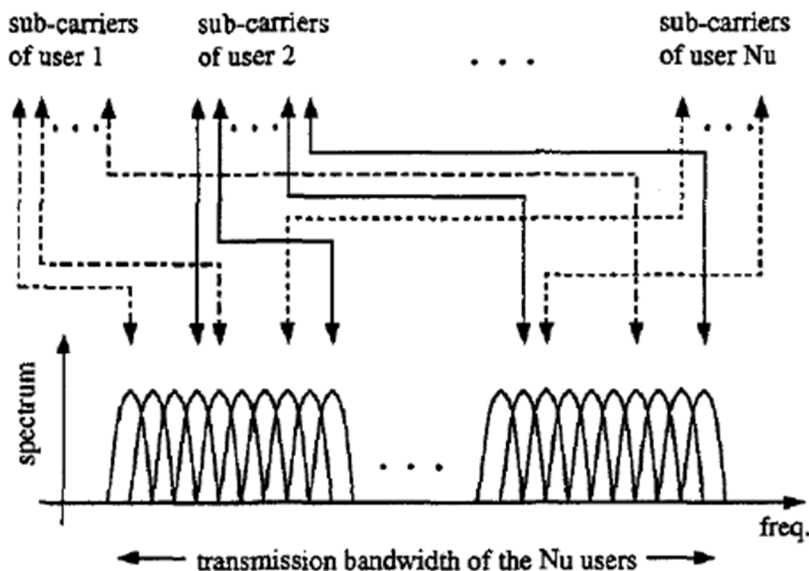


Figure 2: Pseudo-random user-specific frequency-mapping and -demapping.

EX1007, 0002.

Figure 4 of Kaiser (below) illustrates an “OFDM frame with 256 sub-carriers and 31 OFDM-symbols” and an example of the sub-carrier assignment for “user i.” EX1007, 0004, FIG. 4. As shown, user i’s mobile station transmits data and pilot symbols on a sub-set of the 256 sub-carriers in the OFDM-frame. *Id.* A POSA would have understood that, in Kaiser, a user’s mobile station transmits to the base station that performed the sub-carrier assignment. EX1028, ¶96; *see also* EX1007, 0003 (“the base station ... allocates an appropriate set of sub-carriers”).

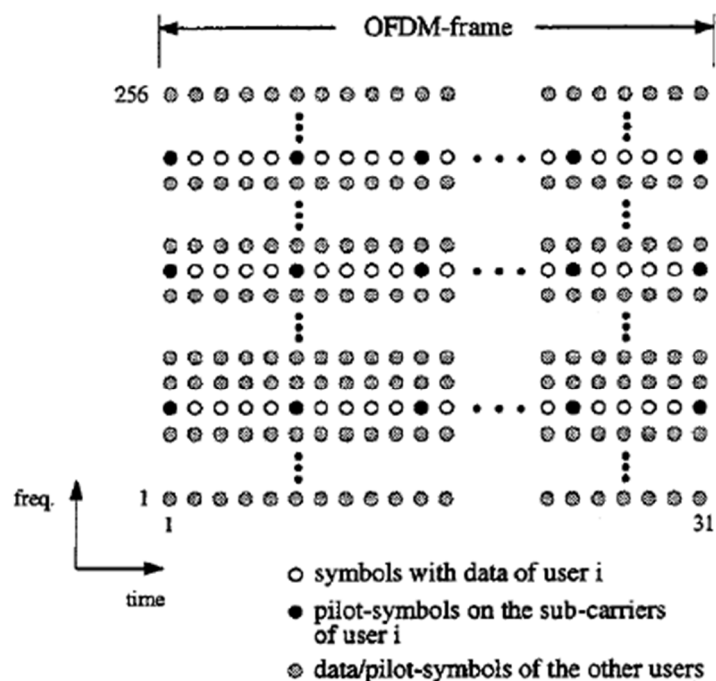


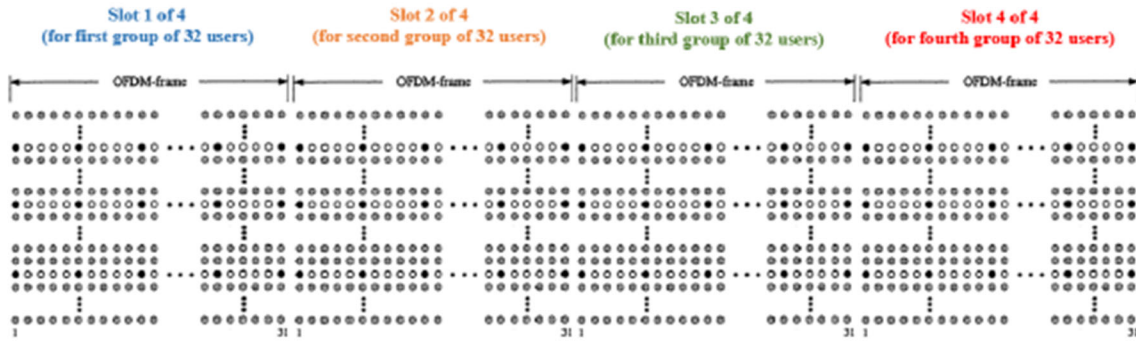
Figure 4: OFDM frame with 256 sub-carriers and 31 OFDM-symbols.

EX1007, 0004.

In Kaiser, the “*first uplink signal*” is “*within a frequency band.*” EX1028, ¶97. Kaiser discloses that the system operates in a “frequency band.” EX1007, 0003. A POSA would have understood that Kaiser’s “frequency band” includes the entire range of frequencies used for both up- and down-links, including frequencies used for the random-access channel discussed in Limitation 1.3 below. EX1028, ¶97. As an example, Figure 4 of Kaiser shows user i’s mobile device transmitting on the uplink an OFDM signal (the sub-carriers in the OFDM frame assigned to user i) within a frequency band (a band that includes, but is not limited to, the 256 sub-carriers shown in Figure 4 of Kaiser). EX1028, ¶97.

Kaiser teaches or suggests that “*the first uplink signal ... utilizes a frame format comprising a plurality of timeslots, each timeslot comprising a plurality of OFDM symbols.*” EX1028, ¶98. Kaiser discloses that the system can have a “time division multiple access (TDMA) component in the OFDM-frame structure” so that “different groups of users can be supplied in subsequent OFDM-frames, resulting in an increasing number of active users.” EX1007, 0003. Kaiser discloses an implementation where “[t]he SS-MC-MA system has a TDMA component, where, in a cycle of 4 [OFDM] frames (each frame consists of 31 OFDM-symbols, see Fig. 4), each frame transmits the data of another group of 32 users,” thus supporting “128 active users.” EX1007, 0004.

Kaiser’s disclosures directed to the “TDMA component” teach, or at least suggest to, a POSA a “*frame format comprising a plurality of timeslots.*” EX1028, ¶99 (discussing EX1008, 0456 (“TDMA (time-division multiple access): A form of multiple access giving each user a different time slot for transmission and reception of signals.”)). For example, Kaiser’s TDMA example supporting 128 active users “*utilizes a frame format*” (a cycle of four OFDM frames) “*comprising a plurality of timeslots*” (the duration of each OFDM frame being a timeslot supporting 32 active users, resulting in four timeslots). EX1028, ¶99. Modifying Figure 4 of Kaiser, the figure below illustrates Kaiser’s TDMA implementation having a cycle of four OFDM frames and four resulting timeslots:



EX1028, ¶99 (modifying and annotating Figure 4 of Kaiser).

Kaiser discloses that “each [OFDM] frame consists of 31 OFDM-symbols.”

EX1007, 0004. Kaiser thus teaches that “*each timeslot*” (the duration of an OFDM frame) comprises “*a plurality of OFDM symbols*” (e.g., 31 OFDM symbols).

EX1028, ¶100. Accordingly, Kaiser teaches or suggests that “*the first uplink signal*” (e.g., user *i*’s data and pilot OFDM symbols in the OFDM frame of Figure 4) “*utilizes a frame format comprising a plurality of timeslots*” (e.g., cycle of four OFDM frames), where “*each timeslot compris[es] a plurality of OFDM symbols*” (e.g., 31 OFDM symbols per timeslot). EX1028, ¶100.

The ’908 patent’s specification does not use, let alone define, the term “*frame format*.” Nor do the claims or specification limit “*frame format*” to a single frame, such as a single OFDM frame. EX1028, ¶101. Rather, the claims merely require that the “*frame format*” comprises “*a plurality of timeslots, each timeslot comprising a plurality of OFDM symbols,*” EX1001, 11:13-15, which, as discussed above, Kaiser’s cycle-of-four-OFDM-frames implementation satisfies.

However, to the extent the term “*frame format*” is interpreted as limited to a single OFDM frame—an interpretation Petitioner does not advance—Kaiser still teaches or suggests the claimed “*frame format*” commensurate with the ’908 patent’s disclosure. EX1028, ¶102. The ’908 patent describes a “slot structure of an OFDM system” where each timeslot “is comprised of 8 OFDM symbols.” EX1001, 4:19-23; *compare* EX1001, 4:32-33 (example “OFDM symbol duration” of “100 us”), *with* EX1007, 0004 (“OFDM-symbol duration is $T_s = 128\mu\text{s}$ ”). Kaiser discloses that “each [OFDM] frame consists of 31 OFDM-symbols.” EX1007, 0004. Accordingly, applying the ’908 patent’s example of 8 OFDM symbols/timeslot, each of Kaiser’s OFDM frames includes a plurality of timeslots (four), each of which includes a plurality of OFDM symbols (at least seven). EX1028, ¶102.

4. Limitation 1.3

The combination of Kaiser, Gibson, and Frank renders obvious that the transmitter is configured to “*transmit, to the base station, a random access signal followed by a guard period in only a portion of the frequency band, wherein the random access signal includes a sequence associated with the base station, wherein a time duration of a combination of the random access signal and the guard period is greater than a time duration of at least one of the plurality of OFDM symbols.*” EX1028, ¶¶103-114.

Kaiser discloses that the “SS-MC-MA [system] assigns each user exclusively its own sub-carriers according to an FDMA scheme,” EX1007, 0001, but does not describe the details of the sub-carrier (or sub-channel) assignment procedure. For these details, a POSA would have turned to Gibson. EX1028, ¶104.

Gibson teaches “*transmit[ting], to [a] base station, a random access signal.*” EX1028, ¶105. Gibson discloses channel assignment “[i]n both FDMA and TDMA systems” using “a separate uplink channel on which mobiles can notify the base station of their need for a traffic channel.” EX1008, 0319. Gibson explains that “[t]his uplink channel is” called “the **random-access channel.**” *Id.* Gibson discloses a random access “procedure” whereby “[t]he mobile initiates the procedure by transmitting a request on the random-access channel” to the base station, as shown in Figure 17.3 below. *Id.*

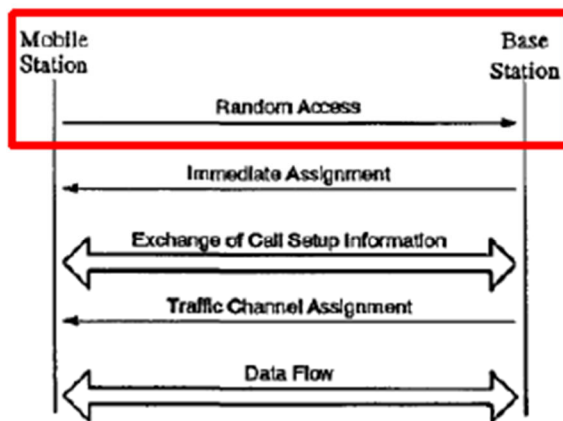


FIGURE 17.3 Mobile-originating call establishment.

EX1008, 0320 (annotated).

It would have been obvious to a POSA to combine Gibson's random-access channel and procedure with Kaiser's system. EX1028, ¶106. Specifically, it would have been obvious to include a random-access channel as a separate, shared uplink channel, as disclosed by Gibson, in Kaiser's system such that the uplink in the combined Kaiser-Gibson system includes Kaiser's dedicated sub-channels and Gibson's separate, shared random-access channel. EX1028, ¶106. It would have been further obvious to perform the channel-assignment procedure, as disclosed by Gibson, in Kaiser's system. EX1028, ¶106. Gibson's express teachings would have motivated a POSA to make this combination. *See* Section VII.D.1.

Because Gibson does not describe certain details of the random-access procedure, such as details of the initial random access request, a POSA would have turned to Frank. EX1028, ¶107.

Frank teaches or suggests “*transmit[ting], to the base station, a random access signal followed by a guard period in only a portion of the frequency band.*” EX1028, ¶108. Frank discloses transmitting, to a “base station,” a random-access “frame structure ... with a separate preamble and data portion” having a “guard interval ... inserted between the preamble and data portion of the frame.” EX1009, 8:14-23. A POSA would have understood that Frank's preamble is a “*random access signal.*” EX1028, ¶108. Frank thus teaches that the preamble (“*random*

access signal”) is “*followed by*” the guard interval (“*guard period*”). EX1028, ¶108.

Frank’s random access signal and guard period are “*in only a portion of the frequency band.*” EX1028, ¶109. In the combined Kaiser-Gibson system, the uplink includes Kaiser’s dedicated sub-channels and Gibson’s separate, shared random-access channel. EX1028, ¶109. Frank discloses transmitting the preamble and guard interval in “an uplink common physical channel (random access channel).” EX1009, 8:14-16. It thus would have been obvious to a POSA to transmit Frank’s preamble and guard interval in the separate, shared random-access portion of the Kaiser-Gibson uplink, which is “*only a portion of the frequency band.*” EX1028, ¶109.

Frank teaches or suggests that “*the random access signal includes a sequence associated with the base station.*” EX1028, ¶110. Frank discloses that a base station broadcasts “a known base station-unique spreading code ... via the base station’s broadcast channel,” EX1009, 9:6-9, and “can be continuously ‘listening’ for [a mobile station’s] transmitted preamble,” EX1009, 8:29-30. Frank discloses that “[i]n order to distinguish between simultaneous random access requests being transmitted by different MSs, each preamble of a random access request is modulated by a unique signature pattern,” which “is spread with [the] known base station-unique spreading code.” EX1009, 8:31-9:9. Frank’s “base

station-unique spreading code” is a “*sequence associated with the base station.*”

EX1028, ¶110.

Frank teaches or suggests that “*a time duration of a combination of the random access signal and the guard period is greater than a time duration of at least one of the plurality of OFDM symbols.*” EX1028, ¶111. Frank discloses an example “where a preamble is 16 symbols” or “1 ms long,” and the “guard time interval, T_G , ... could be 0.25 ms long.” EX1009, 10:1-5. Kaiser discloses an example where the duration of an OFDM symbol is “128 μ s.” EX1007, 0004. The combined duration of Frank’s preamble and guard period ($1\text{ms} + 0.25\text{ms} = 1.25\text{ms}$) is greater than the duration of at least one OFDM symbol (128 μ s).

As an additional, independent reason, Frank also discloses that because the duration of the preamble is typically “less than the length ... of N frame slots in existing systems,” the guard interval can extend “from the end of the preamble to the beginning of the next frame slot.” EX1009, 9:11-16. A POSA would have understood that even if the duration of Frank’s preamble and guard period was only one slot in the Kaiser-Gibson system (having 31 symbols, or alternatively, at least 7 symbols), it would be “*greater than a time duration of at least one of the plurality of OFDM symbols.*” EX1028, ¶112; see Section VII.E.3 (explaining for Limitation 1.2 that Kaiser teaches 31 (or, alternatively, at least seven) OFDM symbols per slot).

It would have been obvious to a POSA to combine Frank's random-access techniques with the Kaiser-Gibson system. EX1028, ¶113. Specifically, it would have been obvious to transmit Frank's preamble and guard period in the separate random-access channel of Kaiser-Gibson. EX1028, ¶¶79-88. As discussed above, the references' express teachings and the prevailing design incentives and other market forces would have motivated a POSA to make the combination.

Section VII.D.2.

It would have been obvious to a POSA that the same or a different “*transmitter*” that is configured to transmit the “*first uplink signal*” would transmit the “*random access signal*” and “*guard period*.” EX1028, ¶114. Again, Kaiser's system transmits spread-spectrum signals using similar spreading codes as Frank. EX1007, 0001-02; EX1009, 9:26. It would have been obvious to (1) use or modify Kaiser's transmitter to transmit Frank's preamble and guard period, or (2) modify Kaiser's mobile station to include a transmitter capable of transmitting Frank's preamble and guard period. EX1028, ¶114. The combination is nothing more than the combination or modification of well-known, prior-art elements (e.g., Kaiser's transmitter) according to their established functions, yielding predictable results (e.g., transmission of Frank's preamble and guard period). EX1028, ¶114. Regardless, obviousness does not require that the references are physically

combinable to render claims obvious. *See In re Mouttet*, 686 F.3d 1322, 1323 (Fed. Cir. 2012).

5. Limitation 1.4

The combination of Kaiser, Gibson, and Frank system renders obvious “*a receiver configured to receive, from the base station, a response message.*” EX1028, ¶¶115-118. Kaiser discloses a “mobile station” but does not expressly disclose “*a receiver*” of a mobile station. EX1007, 0004. A POSA would have understood, and it would have been obvious that, mobile stations include “*a receiver*” in order to communicate and consume services, such as those disclosed by Kaiser. EX1028, ¶115; EX1007, 0001.

Regardless, Gibson teaches or suggests “*a receiver configured to receive, from the base station, a response message.*” EX1028, ¶116. Gibson discloses that mobile stations have receivers, *see, e.g.*, EX1008, 0150-64 (describing optimum receiver design), 0414 (“mobile station receiver”), and, with respect to Figure 17.3, that the mobile station receives an “immediate assignment” message from the base station, EX1008, 0319-20; *id.*, 0319 (“Once the base station has received the mobile’s request, it responds with an immediate assignment message that directs the mobile to tune to a dedicated control channel for the ensuing call setup.”).

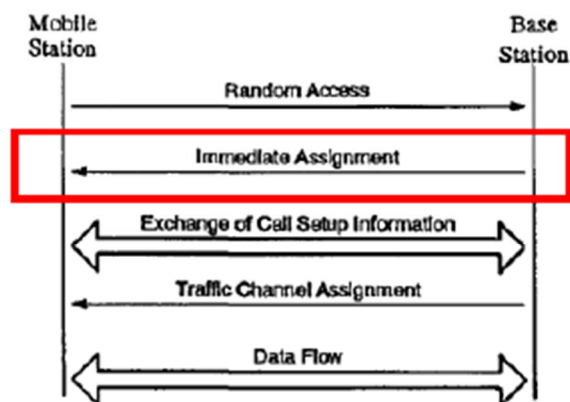


FIGURE 17.3 Mobile-originating call establishment.

EX1008, 0320 (annotated).

Again, a POSA would have been motivated to use Gibson’s “procedure” of Figure 17.3 for channel assignment in Kaiser’s system. Sections VII.D.1, VII.E.4; EX1028, ¶¶74-78, 117.

Frank also teaches or suggests the claimed “*receiver*.” EX1028, ¶118. Frank discloses mobile stations that receive (among other things) “a known base station-unique spreading code” that is provided “via the base station’s broadcast channel.” EX1009, 9:5-9. A POSA would have understood and found obvious that a mobile station includes “a *receiver*” in order to receive messages, such as broadcasts and other messages from the base station, as disclosed in Frank. EX1028, ¶118.

F. Independent Claim 11

Claim 11 is directed to a “*method performed by a mobile station*” and recites method steps that mirror the functions required by claim 1’s “*transmitter*” and

“receiver.” EX1028, ¶¶119-120. The prior art teaches “*method[s] performed by a mobile station,*” such as schemes, procedures, protocols, etc. *See, e.g.,* EX1007, 0001, Abstract (“scheme”); EX1008, 0319-20 (“procedure,” “protocol”). Claim 11 thus would have been obvious for the same reasons as claim 1. EX1028, ¶120; *see* Section VII.E.

G. Independent Claim 21

1. Preamble

Kaiser teaches or suggests a “*mobile station.*” EX1007, 0004; Section VII.E.1 (addressing Claim 1’s Preamble); EX1028, ¶122.

2. Limitation 21.1

Kaiser teaches or suggests “*a first type of transmitter signal processing circuit configured to: generate a first uplink signal, wherein the first uplink signal is an orthogonal frequency division multiplexing (OFDM) signal and utilizes a frame format comprising a plurality of timeslots, each timeslot comprising a plurality of OFDM symbols; [and] modulate the first uplink signal onto a first set of OFDM subcarriers.*” EX1028, ¶¶123-126.

As explained in Limitation 1.2, Kaiser teaches or suggests a transmitter configured to transmit “*a first uplink signal, wherein the first uplink signal is an orthogonal frequency division multiplexing (OFDM) signal and utilizes a frame*

format comprising a plurality of timeslots, each timeslot comprising a plurality of OFDM symbols.” Section VII.E.3; EX1028, ¶124.

Kaiser teaches or suggests “*a first type of transmitter signal processing circuit configured to: generate [the] first uplink signal.*” EX1028, ¶125. Kaiser discloses a “*transmitter*” (below) comprising several components, including a “*serial to parallel convert[er]*” and an “*OFDM unit.*” EX1007, 0002, FIG. 1 (“*ser/par con*” and “*ODFM with user-specific frequency-mapper*”). A POSA would have understood and found obvious that (at least) Kaiser’s serial-to-parallel converter and OFDM unit, together, satisfy “*a first type of transmitter signal processing circuit configured to: generate [the] first uplink signal.*” EX1028, ¶125. Claim 21 (and dependent claim 30) describes “*first type of transmitter signal processing circuit*” in terms of its functions, which are met by the Kaiser’s serial- to-parallel converter and OFDM unit. EX1028, ¶125.

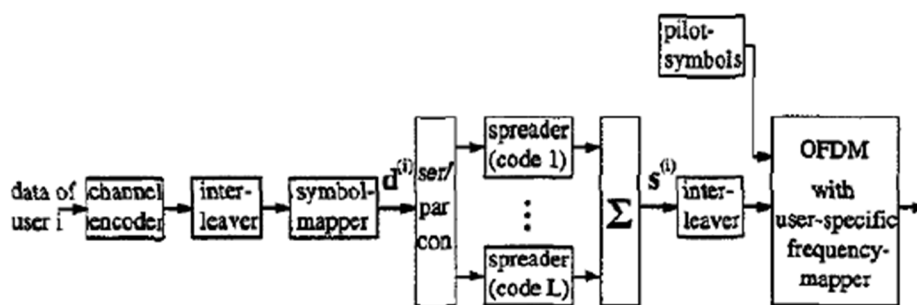


Figure 1: SS-MC-MA transmitter for the data of user i .

EX1007, 0002.

Kaiser teaches or suggests that the “*first type of transmitter signal processing circuit*” is also configured to “*modulate the first uplink signal onto a first set of OFDM subcarriers.*” EX1028, ¶126. Kaiser discloses that “the OFDM unit ... performs a user-specific frequency mapping, illustrated in Fig. 2,” and that “[e]ach user of a cell transmits on a sub-set of sub-carriers.” EX1007, 0002; *see also id.*, FIGS. 2, 4. Kaiser discloses that “[i]n the OFDM unit 8 chips are modulated on 8 sub-carriers per OFDM-symbol” EX1007, 0004.

3. Limitation 21.2

The combination of Kaiser, Gibson, and Frank renders obvious “*a second type of transmitter signal processing circuit configured to generate an random access signal followed by a guard period, wherein the random access signal includes a sequence associated with a base station, wherein a time duration of a combination of the random access signal and the guard period is greater than a time duration of at least one of the plurality of OFDM symbols.*” EX1028, ¶¶127- 131.

As explained in Limitation 1.3, the combination of Kaiser, Gibson, and Frank renders obvious transmitting a “*random access signal followed by a guard period, wherein the random access signal includes a sequence associated with a base station, wherein a time duration of a combination of the random access signal*

and the guard period is greater than a time duration of at least one of the plurality of OFDM symbols.” Section VII.E.4; EX1028, ¶128.

The combination of Kaiser, Gibson, and Frank further renders obvious “*a second type of transmitter signal processing circuit configured to generate*” the random-access signal and guard period. EX1028, ¶129. Although not required in claim 21, the ’908 patent describes the “*random access signal*” as a spread-spectrum signal. *See, e.g.*, EX1001, 2:49-50 (“the DSSS signal is used for ... initial random access”), claim 29. Both Kaiser and Frank teach or suggest a “*transmitter signal processing circuit configured to generate*” spread-spectrum signals. EX1028, ¶129. Kaiser’s transmitter of Figure 1 includes signal-processing circuitry to generate spread-spectrum signals, such as the circuitry that multiplies “[e]ach of the L data-symbols ... with an orthogonal spreading code (e.g., Walsh-Hadamard code []) of length L .” EX1007, 0002, FIG. 1 (“spreader (code 1) ... spreader (code L)”). EX1028, ¶129. A POSA would have understood and found obvious that Kaiser’s circuitry for generating spread-spectrum signals is a different type (“*second type*”) than Kaiser’s circuitry for generating the OFDM signal (“*first type*”), discussed in Limitation 21.1. EX1028, ¶129.

As explained in Limitation 1.3, Frank discloses that “each preamble of a random access request is modulated by a unique signature pattern,” which “is spread with a known base station-unique spreading code.” EX1009, 8:31-9:9; *see*

also Section VII.E.4. A POSA would have understood and found obvious that Frank's mobile stations include a "*transmitter signal processing circuit*" that generates spread-spectrum signals, such as Frank's preamble. EX1028, ¶130. A POSA would have also understood and found obvious that Frank's circuitry for generating spectrum-spectrum signals is different type ("*second type*") than Kaiser's circuitry for generating the OFDM signal ("*first type*"), discussed in Limitation 21.1. EX1028, ¶130.

As explained in Limitation 1.3, it would have been obvious to (1) use or modify Kaiser's transmitter to transmit Frank's preamble and guard period, or (2) modify Kaiser's mobile station to include a transmitter capable of transmitting Frank's preamble and guard period. Section VII.E.4. Either modification would result in the "*second type of transmitter signal processing circuit.*" EX1028, ¶131.

4. Limitation 21.3

Kaiser teaches or suggests "*a circuit configured to provide at least the first uplink signal or the random access signal to output a digital signal.*" EX1028, ¶¶132-135. Kaiser discloses that its system supports "the transmission of a wide range of multi-media services with different data rates," including "speech." EX1007, 0003. Kaiser discloses a "speech encoder of the mobile station" that "delivers a data rate of 10.46 kbit/s to the channel encoder." EX1007, 0004. Kaiser describes the data delivered to the channel encoder as "binary data." *Id.*

A POSA would have known that speech (e.g., human speech) is an analog signal. EX1028, ¶133; EX1008, 0032 (“To transmit analog message signals, such as speech signals or video signals, by digital means, the signal has to be converted into digital form. This process is known as analog-to-digital conversion.”). A POSA would have further understood and found obvious that Kaiser’s “speech encoder,” which delivers “binary data” to the “channel encoder,” converts analog speech signals into digital signals. EX1028, ¶133; EX1008, 0542 (“An input speech signal is processed by a speech encoder to generate a digital representation at a net bit rate of R_s bits per second.”). Accordingly, Kaiser teaches or suggests “a circuit” (e.g., speech encoder) “*configured to provide at least the first uplink signal*” (e.g., a speech signal captured by Kaiser’s mobile station) “*to output a digital signal*” (e.g., the binary data output from Kaiser’s speech encoder). EX1028, ¶133.

Alternatively, the combination of Kaiser and Gibson renders obvious Limitation 21.3. EX1028, ¶134. Again, Kaiser discloses a “speech encoder of the mobile station.” EX1007, 0004. Gibson discloses that “speech signals” are “analog message signals,” EX1008, 0032, and “a speech encoder” that “generate[s] a digital representation” of “[a]n input speech signal,” EX1008, 0542. It would have been obvious to use Gibson’s speech encoder to digitize analog speech signals in Kaiser’s system because the combination involves nothing “more than the simple

substitution of one known element [Kaiser’s speech encoder] for another [Gibson’s speech encoder],” and “the predictable use of prior art elements [e.g., Gibson’s speech encoder] according to their established functions.” *KSR*, 550 U.S. at 417; EX1028, ¶134. Accordingly, a POSA would have been both motivated to make the combination and reasonably expected success in doing so. EX1028, ¶134.

Additionally, a “*circuit configured to provide ... the random access signal to output a digital signal*” would also have been obvious as mobile stations in the January 2004 timeframe routinely included digital processing circuitry to process signals, such as Frank’s random-access preamble. EX1028, ¶135.

5. Limitation 21.4

The combination of Kaiser, Gibson, and Frank renders obvious “*a digital-to-analog (D/A) conversion circuit configured to convert the digital signal to an analog signal.*” EX1028, ¶¶136-137. Kaiser does not expressly disclose the claimed digital-to-analog conversion circuit. A POSA, however, would have known that in cellular systems, signals are transmitted through the air as analog, radio frequency (RF) waves, which Gibson confirms. EX1028, ¶136. Gibson explains that “radio channels[] accept a continuous-time waveform as input. Consequently, a sequence of source bits, representing data or a digitized analog

signal, must be converted to a continuous-time waveform at the transmitter.”¹

EX1008, 0055. It thus would have been obvious to a POSA to include a digital-to-analog conversation circuit in the combined Kaiser-Gibson-Frank system such that digital signals from the mobile station—including both the “*first uplink signal*” and the “*random access signal*”—would be converted to analog, RF waves before transmission. EX1028, ¶136.

A POSA would have also known the converse: upon receipt, analog RF signals would be converted to digital form (i.e., undergo analog-to-digital conversion) for digital signal processing. EX1028, ¶137.

6. Limitation 21.5

The combination of Kaiser, Gibson, and Frank renders obvious “*wherein the mobile station is configured to transmit, to the base station, the analog signal in a frequency band.*” EX1028, ¶¶138-139. As explained in Limitation 1.2, Kaiser teaches or suggests a mobile station comprising a transmitter configured to transmit, to a base station, an uplink signal in a frequency band. Section VII.E.3. As explained in Limitation 21.4, it would have been obvious that Kaiser’s uplink signal is converted to analog form before transmission. Section VII.G.5.

¹ A POSA would have known that by “continuous-time waveform,” Gibson is referring to analog signals. EX1028, ¶136.

A POSA would have further understood and found obvious that the mobile station in the combined Kaiser-Gibson-Frank system would be configured to transmit, to the base station, Frank's preamble ("*random access signal*") in analog form in the frequency band. EX1028, ¶139; *see* Section VII.G.5 (explaining it would have been obvious to convert the "*random access signal*" to analog before transmission); EX1028, ¶¶55-56.

7. Limitation 21.6

The combination of Kaiser, Gibson, and Frank renders obvious "*wherein the random access signal occupies in a frequency domain only a portion of the frequency band.*" EX1028, ¶140. As explained in Limitation 1.3, Frank's preamble is a "*random access signal*" that is transmitted in the separate, shared random-access channel of the combined Kaiser-Gibson system, and thus "*occupies in a frequency domain only a portion of the frequency band.*" Section VII.E.4.

8. Limitation 21.7

The combination of Kaiser, Gibson, and Frank renders obvious "*wherein the mobile station is further configured to receive, from the base station, a second analog signal.*" EX1028, ¶¶141-142. As explained in Limitation 1.4, the combination of Kaiser, Gibson, and Frank renders obvious a "*mobile station*" that

is “*configured to receive*” signals “*from the base station,*” including Gibson’s “Immediate Assignment” message of Figure 17.3. Section VII.E.5.

A POSA would have understood and found obvious that the received signal is “*a second analog signal*” because, as explained in Limitation 21.4, cellular systems transmit signals through the air as analog, radio frequency (RF) waves. Section VII.G.5. EX1028, ¶142.

9. Limitation 21.8

The combination of Kaiser, Gibson, and Frank renders obvious “*wherein the mobile station further comprises: an analog-to-digital (A/D) conversion circuit configured to convert the second analog signal to a second digital signal.*”

EX1028, ¶¶143-144. As explained in Limitation 21.4, Gibson explains that “radio channels[] accept a continuous-time waveform as input. Consequently, a sequence of source bits, representing data or a digitized analog signal, must be converted to a continuous-time waveform at the transmitter.” EX1008, 0055; see Section VII.G.5. A POSA would have understood Gibson’s teaching applies in both the uplink and downlink directions. EX1028, ¶143.

Accordingly, a POSA would have known and found obvious that mobile stations receive analog RF signals (e.g., transmitted from the base station) that need to be converted to digital form (i.e., undergo analog-to-digital conversion) for digital signal processing. EX1028, ¶144. It thus would have been obvious that the

mobile station in the combined Kaiser-Gibson-Frank system would include the claimed analog-to-digital conversion circuit. EX1028, ¶144.

10. Limitation 21.9

The combination of Kaiser, Gibson, and Frank renders obvious that “*the mobile station further comprises ... a receiver circuit configured to receive, based on the second digital signal, a response message.*” EX1028, ¶145. As explained in Limitation 1.4, the mobile station in the combined Kaiser-Gibson-Frank system comprises a receiver configured to receive a response message, such as including Gibson’s “Immediate Assignment” message of Figure 17.3. Section VII.E.5. As explained in Limitation 21.8, it would have been obvious that the response message is converted to digital form. Section VII.G.9.

H. Claims 4, 14, and 24

The combination of Kaiser, Gibson, and Frank renders obvious that “*the portion of the frequency band used for transmission of the random access signal does not include control channels.*” EX1028, ¶¶146-148.

In the combined Kaiser-Gibson-Frank system, (i) the uplink includes Kaiser’s dedicated sub-channels and Gibson’s separate, shared random-access channel, (ii) Frank’s random-access preamble (“*the random access signal*”) is transmitted in the separate, shared random-access channel, and (iii) the system uses Gibson’s procedure shown in Figure 17.3 to assign channels. See Section VII.E.4;

EX1028, ¶146. As shown in Figure 17.3 below, Gibson discloses that “[o]nce the base station has received the mobile’s request”—e.g., Frank’s preamble—“it responds with an immediate assignment message that directs the mobile to tune to a dedicated control channel for the ensuing call setup.” EX1008, 0319.

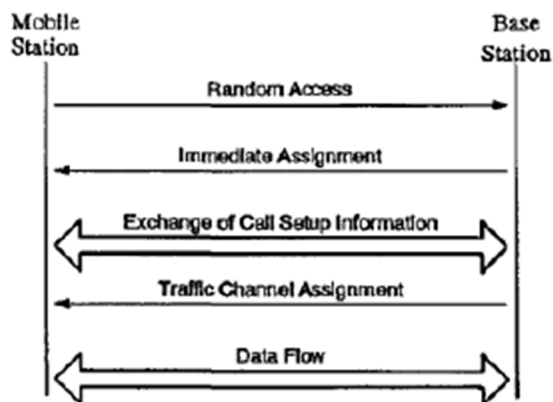


FIGURE 17.3 Mobile-originating call establishment.

EX1008, 0320.

A POSA would have understood and found obvious that Gibson’s shared random-access channel is wholly distinct from Gibson’s dedicated control channel (and any other control channels) in order decrease traffic on the shared random-access channel, resulting in fewer collisions. EX1028, ¶147; *see also* EX1009, 1:18-2:1 (explaining that because the expected “higher traffic density on random access channels” in 3G systems “will also result in increased collisions and access failures,” there was “high demand for faster and more efficient random access”). Further, there would be no need in Gibson for the base station to instruct the mobile to tune to a dedicated control channel if the random-access channel

itself included control channels. EX1028, ¶147. Accordingly, it would have been obvious to a POSA that, in the combined Kaiser-Gibson-Frank system, “*the portion of the frequency band used for transmission of the random access signal*” (the shared random-access channel used to transmits Frank’s preamble) “*does not include control channels.*” EX1028, ¶147.

Petitioner notes that the ’908 patent does not define or provide examples of “*control channels,*” and describes a channel-assignment procedure (similar to Gibson’s procedure) that uses designated control channels:

If the base station successfully detects the DSSS signal, it sends the acknowledgement (ACK) carrying information such as a signature or other unique mobile station identifier and power and time adjustments of the mobile on the downlink control channel in the next available timeslot. The mobile station whose transmission signature matches that of the acknowledgement then moves to the designated uplink MC control channel using the assigned time and power values and further completes the message transmission.

EX1001, 8:63-9:4. The prior-art combination’s use of control channels is commensurate with the ’908 patent’s description. EX1028, ¶148.

I. Claims 6, 16, and 26

Frank teaches or suggests that “*the time duration of the combination of the random access signal and the guard period is greater than a time duration of at least two of the plurality of OFDM symbols.*” EX1028, ¶¶149-150; see Section VII.E.4. As explained for Limitation 1.3, Frank discloses an example where the combined duration of Frank’s preamble and guard period is 1.25ms, and Kaiser discloses an example OFDM-symbol duration of 128μs. See Section VII.E.4; EX1009, 10:1-5; EX1007, 0004. Frank’s 1.25ms combined duration is “*greater than a time duration of two of the plurality of OFDM symbols*” (e.g., $128\mu\text{s} + 128\mu\text{s} = 246\mu\text{s}$). EX1028, ¶149.

As an additional, independent reason, as explained in Section VII.E.4, a POSA would have understood that even if the duration of Frank’s preamble and guard period was only one slot in the Kaiser-Gibson system (having 31 symbols, or alternatively, at least 7 symbols), it would be “*greater than a time duration of two of the plurality of OFDM symbols.*” EX1028, ¶150; see Section VII.E.3 (explaining for Limitation 1.2 that Kaiser teaches 31 (or, alternatively, at least seven) OFDM symbols per slot).

J. Claims 7, 17, and 27

The combination of Kaiser, Gibson, and Frank renders obvious that “*the frequency band includes an outer portion and a center portion, wherein the portion*

of the frequency band for the random access signal is in the center portion and uplink control signals are sent in the outer portion.” EX1028, ¶¶151-161.

As explained in Limitation 1.2, Kaiser discloses that its system operates in a “frequency band.” EX1007, 0003; Section VII.E.3. Although Kaiser mentions the “up-link” and the “down-link,” EX1007, 0003, Kaiser does not explain how the uplink and downlink are allocated or organized. EX1028, ¶152.

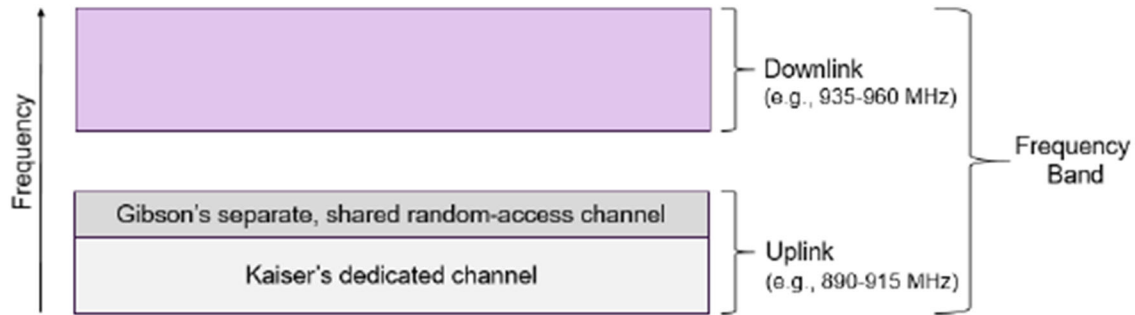
Gibson teaches that systems using TDMA or FDMA, like Kaiser’s system, routinely used “frequency-division duplexing (FDD)” as a “duplexing scheme.” EX1008, 0318. For example, Gibson explains that “GSM uses combined TDMA and FDMA with frequency-division duplex for access.” EX1008, 0319. Gibson further discloses that known cellular systems routinely used FDD. EX1008, 0473 (row: “Duplex mode”). In FDD, “separate frequency bands are provided for uplink and downlink communication.” EX1008, 0318. In GSM, for example, “the uplink frequency band 890-915 MHz is allocated, whereas the downlink uses the band 935-960 MHz.” EX1008, 0319. EX1028, ¶153.

It would have been obvious to use FDD, as disclosed in Gibson, in Kaiser’s system. EX1028, ¶154. A POSA would have been familiar with existing cellular systems, such as GSM, and Gibson’s disclosure that FDD was implemented in existing systems would have motivated a POSA to use FDD in Kaiser’s system. EX1028, ¶154. This combination represents nothing more than “the predictable use

of prior art elements [FDD] according to their established functions.” *KSR*, 550 U.S. at 417. Given FDD’s wide adoption and implementation, a POSA would have reasonably expected success in using FDD in Kaiser’s system. EX1028, ¶154.

As explained in Limitation 1.2, a POSA would have understood that Kaiser’s “frequency band” includes the entire range of frequencies used for both up- and down-links, including frequencies used for the random-access channel discussed in Limitation 1.3. Section VII.E.3. As explained in Limitation 1.3, in the combined Kaiser-Gibson-Frank system: (i) the uplink includes Kaiser’s dedicated sub-channels and Gibson’s separate, shared random-access channel, and (ii) Frank’s preamble (“*random access signal*”) is transmitted in the random-access channel. Section VII.E.4. Kaiser discloses that pilot symbols are transmitted in the dedicated channel. EX1007, 0003-04, FIG. 4. A POSA would have understood and found obvious that a pilot symbol is a type of control signal, and thus both data and control signals are transmitted in Kaiser’s dedicated channel. EX1028, ¶155.

The figure below shows, as an example, an obvious allocation of the combined system’s up- and down-links in a frequency band, such as the frequencies allocated for GSM. EX1028, ¶¶156-157.

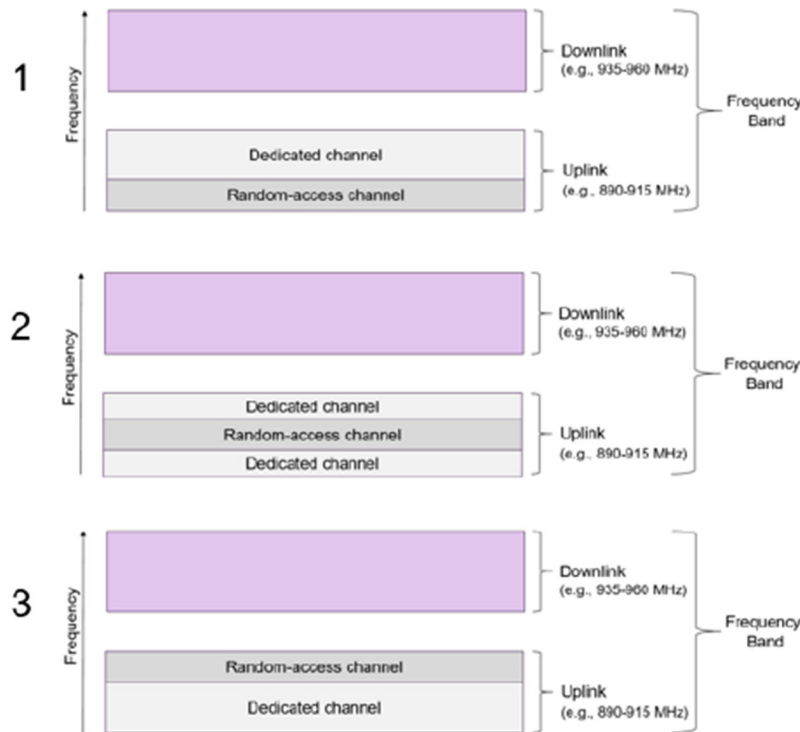


EX1028, ¶157.

As shown in the figure above, a POSA would have found it obvious to allocate “*the portion of the frequency band for the random access signal*” (Gibson’s separate, shared random-access channel) “*in the center portion*” (at higher frequencies in the uplink than Kaiser’s dedicated channel), “*and uplink control signals are sent in the outer portion*” (the lower frequencies allocated for Kaiser’s dedicated channel). EX1028, ¶158; *see KSR*, 550 U.S. at 421 (“When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.”).

A POSA would have understood that there was a design need to solve a problem: for FDMA and TDMA systems, frequencies in the uplink needed to be allocated for the separate, random-access channel. EX1028, ¶158; *see EX1008*, 0319. Once the frequency range for the uplink was defined, such as 890-915 MHz in GSM, a POSA would have understood there were a finite number of predictable solutions for where to place the random-access channel: (1) below the dedicated

channel(s) (in lower frequencies); (2) in between dedicated channels; or (3) above the dedicated channel(s) (in higher frequencies). EX1028, ¶158. These finite, predictable solutions are illustrated in the series of figures below.



EX1028, ¶158.

Each of these solutions would have been within a POSA's skill, requiring only routine configuration of standard equipment, and would have yielded predictable results. EX1028, ¶159.

A POSA also would have been motivated to use different frequency mappings for the random-access channels in different cells of a cellular network to avoid interference between the random-access channels of adjacent and nearby

cells. EX1028, ¶¶160-161; *see* EX1007, 0003 (“When considering inter cell interference, it is of advantage that adjacent cells operating in the same frequency band use[] different frequency mapping patterns”); EX1008, 0372 (describing cochannel interference), 0415-18 (explaining that avoiding interference was an important cell design principle and that cochannel interference is “[u]ndoubtedly the most critical of all interferences”), 0439 (describing fixed channel assignment in which “[e]ach cell is then assigned a fixed number of carriers, dependent on the traffic density and cell size”). For example, a POSA would have found it obvious to assign the random-access channel as shown in solution (3) in a first cell, and to assign the random-access channel as shown in solution (1) in an adjacent cell to reduce or avoid cochannel interference between the random-access channels of the adjacent cells. EX1028, ¶161. The cell applying solution (3) satisfies the limitations of claims 7, 17, and 27. EX1028, ¶161.

K. Claims 8, 18, and 28

Frank teaches or suggests that “*the random access signal is a spread spectrum signal.*” EX1028, ¶162. Frank discloses that “each preamble of a random access request is modulated by a unique signature pattern,” which “is spread with a known base station-unique spreading code.” EX1009, 8:31-9:9; *see id.*, 14:9-11 (referring to “the preamble’s spreading code (that had been provided to the MS by the base station)”). Frank discloses that a “random access detector unit 202” at the

base station “despread[s] the preamble part of the random access packet.” EX1009, 14:9-14. Accordingly, a POSA would have understood that Frank’s preamble (“*the random access signal*”) is a “*spread spectrum signal*.” EX1028, ¶162.

L. Claims 9, 19, and 29

Frank teaches or suggests that “*the receiver is further configured to receive broadcast information from the base station, the broadcast information indicating at least one sequence associated with the base station for use in producing the random access signal*.” EX1028, ¶¶163-165.

As explained in Limitation 1.3, a POSA would have understood and found obvious that Frank’s mobile station includes “*a receiver*.” Section VII.E.4. Frank discloses that mobile stations receive “a known base station-unique spreading code ... via the base station’s broadcast channel.” EX1009, 9:5-9; *see also id.*, 14:9-11 (discussing “the preamble spreading code []that had been provided to the [mobile station (MS)] by the base station[.]”). Frank thus teaches or suggests a receiver “*configured to receive broadcast information from the base station*.” EX1028, ¶164. As explained for Limitation 1.3, a POSA would have understood that Frank’s base station-unique spreading code is a “*sequence associated with the base station*.” Section VII.E.4. Frank thus teaches or suggests that “*the broadcast information indicat[es] at least one sequence associated with the base station*.” EX1028, ¶164.

Frank also discloses that “[i]n order to distinguish between simultaneous random access requests being transmitted by different [mobile stations], each preamble of a random access request is modulated by a unique signature pattern,” which “is spread with [the] known base station-unique spreading code.” EX1009, 8:31-9:9. As explained in Limitation 1.3, a POSA would have understood that Frank’s preamble is a “*random access signal*.” Section VII.E.4. Frank thus teaches or suggests that the “*at least one sequence associated with the base station*” (e.g., Frank’s base station-unique spreading code) is “*for use in producing the random access signal*” (e.g., Frank’s preamble). EX1028, ¶165.

M. Claims 10, 20, and 30

Kaiser teaches or suggests that “*the transmitter includes [the first type of transmitter signal processing circuit is] an OFDM transmitter signal processing circuit comprising: a serial to parallel converter, an inverse Fourier transform, and a cyclic prefix addition circuit; and the OFDM transmitter signal processing circuit outputs the first uplink signal.*” EX1028, ¶¶166-171.

Kaiser discloses a “*transmitter*” (below) comprising several components, including a “serial to parallel convert[er]” and an “OFDM unit.” EX1007, 0002, FIG. 1 (“ser/par con” and “OFDM with user-specific frequency-mapper”). A POSA would have understood and found obvious that (at least) Kaiser’s

serial-to-parallel converter and OFDM unit satisfy the “*OFDM transmitter signal processing circuit*” of claims 10, 20, and 30. EX1028, ¶167.

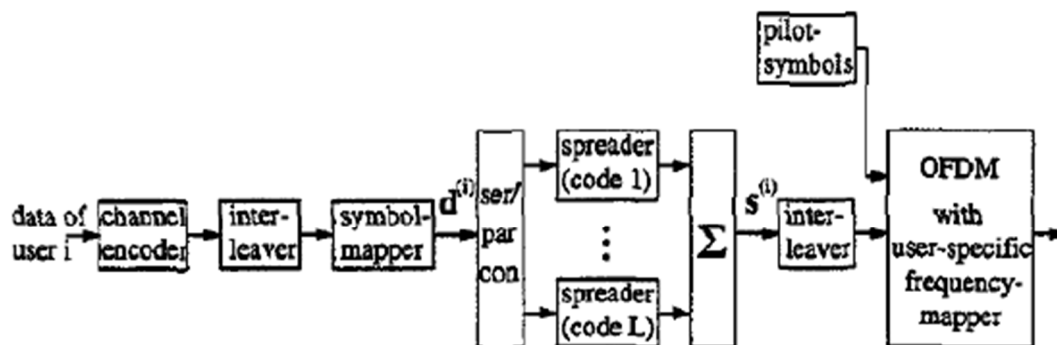


Figure 1: SS-MC-MA transmitter for the data of user i .

EX1007, 0002.

Kaiser teaches or suggests that the “*OFDM transmitter signal processing circuit*” comprises “*a serial to parallel converter.*” EX1028, ¶168. Kaiser discloses a “serial to parallel convert[er].” EX1007, 0002, FIG. 1 (“ser/par con”).

Kaiser teaches or suggests that the “*OFDM transmitter signal processing circuit*” comprises “*an inverse Fourier transform.*” EX1028, ¶169. Kaiser discloses that “the OFDM unit ... performs a user-specific frequency mapping, illustrated in Fig. 2.” EX1007, 0002, FIG. 2. Kaiser further discloses that “[t]he OFDM and inverse OFDM is realized by an IFFT and a FFT, respectively.” EX1007, 0004. A POSA would have understood that “IFFT” is an acronym for “inverse fast Fourier transform.” EX1028, ¶169; *see* EX1008, 0309 (“inverse fast Fourier transform (IFFT)”).

Kaiser teaches or suggests that the “*OFDM transmitter signal processing circuit*” comprises “*a cyclic prefix addition circuit.*” EX1028, ¶170. Kaiser discloses that “each OFDM-symbol of duration T_s is cyclic extended by a guard interval Δ in the OFDM unit to prevent inter symbol interference (ISI) in multipath channels.” EX1007, 0002. Accordingly, a POSA would have understood and found obvious that Kaiser’s OFDM unit includes “*a cyclic prefix addition circuit.*” EX1028, ¶170; *see also* EX1008, 0133 (“After modulation, each block of M signals is cyclically extended by copying the last L signals in front of the block”).

Kaiser teaches or suggests that “*the OFDM transmitter signal processing circuit outputs the first uplink signal.*” EX1028, ¶171; *see* Section VII.E.3 (addressing Limitation 1.2); *see also* EX1007, 0002 (“the OFDM unit ... performs a user-specific frequency mapping”; “Each user of a cell transmits on a sub-set of sub-carriers”), 0003 (“The data transmission can be based on OFDM-frames”), 0004 (“In the OFDM unit 8 chips are modulated on 8 sub-carriers per OFDM-symbol”).

VIII. GROUND 2: CLAIMS 2-3, 5, 12-13, 15, 22-23, AND 25 WOULD HAVE BEEN OBVIOUS OVER KAISER, GIBSON, FRANK, AND KANTERAKIS.

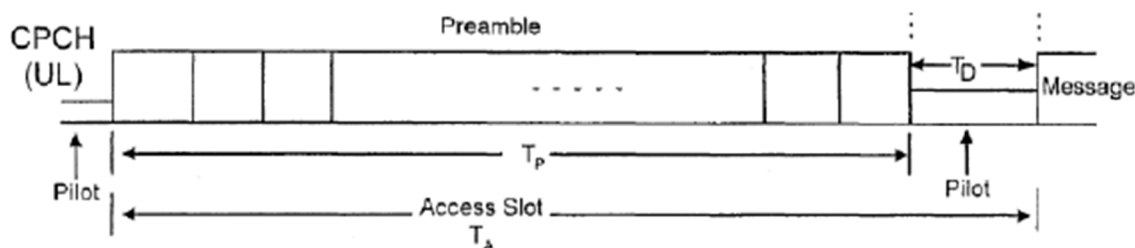
Dependent claims 2-3, 5, 12-13, 15, 22-23, and 25 recite additional limitations with regard to “*the response message.*” In the combined

Kaiser-Gibson-Frank system, the “*response message*” corresponds to a message provided by the base station in immediate response to Frank’s preamble (“*random access signal*”) sent by the mobile station. *See* Section VII.E.5. Frank’s preamble contains a sequence that incorporates two codes: (1) a “unique signature pattern” that is selected by the mobile station and allows the base station to identify the mobile station’s request from among multiple potential requests made simultaneously, EX1009, 8:31-9:6, 14:16-18; and (2) a “base station-unique spreading code,” used to spread the mobile station-specific signature prior to transmission, which allows the base station to detect that a random access request specifically intended for it (as opposed to a neighboring base station) has been received, EX1009, 9:6-9, 14:9-14. Under the further combination with Kanterakis, the entire data sequence contained in the preamble received by the base station, which includes identifiers of *both* the mobile station and the base station, would be incorporated as part of the base station’s response message sent back to the mobile station. EX1028, ¶172.

A. Kanterakis

Similar to the combined Kaiser-Gibson-Frank system, Kanterakis teaches a random-access preamble followed by a guard period that is used in a channel allocation procedure based on the ALOHA protocol. EX1028, ¶173; EX1010,

1:12-21, 2:47-54, 7:24-26, 7:56-57, 8:53-65, FIG. 10. Kanterakis's random-access frame format is shown below:



EX1010, FIG. 10 (reproduced in-part).

Kanterakis's random-access frame format includes a preamble, followed by a time interval T_D , followed by a message data portion. EX1010, FIG. 10.

Kanterakis teaches that “[t]he pilot signal could be eliminated by setting it to a zero power level,” EX1010, 7:56-57, thus creating a guard interval, like in Frank, following the preamble. *Compare* EX1010, 7:56-57, *with*, EX1009, FIG. 4; EX1028, ¶174. Kanterakis also teaches, like Frank, that the mobile station's random access preamble can be a spread-spectrum signal obtained by “spreading an access preamble selected from a set of predefined preambles.” EX1010, 17:28-29, 18:22-23; *compare* EX1010, 8:20-22 (“orthogonal Gold codes”), *with* EX1009, 10:1-5 (same).

Kanterakis describes the format of the base station's response, which, like Gibson, contains an “acknowledgement” (“ACK”) signal:

After the last transmitted preamble, the base station has successfully detected the transmission of the last transmitted preamble and

transmits back the acknowledgment signal. During the same time, the remote station is tuned to receive the ACK signal. *The ACK signal transmitted corresponds to the specific preamble structure transmitted on the uplink.* Once the remote station detects the ACK signal corresponding to transmitted preamble by the remote station, the remote station begins transmission of its data.

EX1010, 8:54-62; *see also id.*, 6:11-15, 10:61-11:4, 18:1-4, 18:31-35. Kaiser explains that “[t]here is one acknowledgment message corresponding to each possible preamble signal.” EX1010, 10:63-64. Kanterakis also discloses that the ACK signal includes “power control information” that the mobile station uses to “adjust its transmitted power.” EX1010, 8:63-9:3. EX1028, ¶175.

B. Motivation to combine

It would have been obvious to combine Kanterakis with Kaiser, Gibson, and Frank. EX1028, ¶¶176-178. As explained for claim 1, the combined Kaiser-Gibson-Frank system uses Gibson’s access procedure, shown in Figure 17.3 of Gibson, for channel assignment. *See* Section VII.E Gibson discloses that “[o]nce the base station has received the mobile’s request, it responds with an immediate assignment message that directs the mobile to tune to a dedicated control channel for the ensuing call setup.” EX1008, 0319. Gibson, however, does not describe

further details of the immediate assignment message (“*response message*”), which would have led a POSA to Kanterakis.

A POSA would have been motivated to include, in the base station’s response message, the additional data suggested by Kanterakis because they provide the mobile station with useful information that facilitates progression into subsequent steps of Gibson’s access procedure. EX1028, ¶177. As a POSA would have appreciated, including the full data sequence corresponding to the original preamble would allow a mobile station to recognize the response as a message that (1) originated from the same base station to which the random-access preamble was sent (as opposed to a base station of another cell), and (2) was specifically intended for the mobile station (as opposed to a different mobile station from the same cell). EX1028, ¶177. The power control information, in turn, allows the mobile station “to increase or decrease the transmitted power accordingly,” EX1010, 8:63-9:3, further motivating the combination, EX1028, ¶177.

The combined system would have predictably resulted in a base station’s response message to the mobile station’s random access preamble signal that includes: (1) assignment information for a dedicated control channel, as disclosed by Gibson, *see* EX1008, 0319; and (2) the full data sequence contained in the original preamble as well as power control information, as disclosed by Kanterakis, EX1010, 8:54-9:3, 10:63-66, 18:1-4, 18:31-35, 8:63-9:3. And because this

combination requires nothing “more than the predictable use of prior art elements [e.g., certain data in Kanterakis’ ACK message] according to their established functions,” *KSR*, 550 U.S. at 417, a POSA would have reasonably expected that the combination would succeed. EX1028, ¶178.

C. Claims 2, 12, and 22

The Kaiser-Gibson-Frank-Kanterakis combination renders obvious that “*the receiver is configured to determine if the response message identifies the sequence associated with the base station in the random access signal; and on a condition that the response message identifies the sequence associated with the base station in the random access signal, the transmitter is configured to transmit a second uplink signal.*” EX1028, ¶¶179-181.

As taught by Kanterakis, detection by the mobile station of an acknowledgement “corresponding to transmitted preamble” triggers its subsequent transmission of additional data. EX1010, 8:54-62; *see also id.*, 10:61-11:4, 18:1-4, 18:31-35. A POSA would have found it obvious that this would involve analysis of the full data sequence of the received acknowledgement for correspondence with the original preamble. EX1028, ¶180. In Kanterakis, there is a one-to-one match between a given acknowledgement and original preamble. EX1010, 10:63-66.

Because in the combined system, the original preamble would include a “*sequence associated with the base station,*” EX1009, 9:6-9, 14:9-14, the further

combination with Kanterakis renders obvious that “*the receiver is configured to determine if the response message identifies the sequence associated with the base station in the random access signal.*” EX1028, ¶181. Again, in Kanterakis it would have been obvious that the mobile station would analyze the full data sequence of the received acknowledgement for correspondence with the original preamble, EX1010, 8:54-62, 18:1-4, 18:31-35, which would include identifying the same “*sequence associated with the base station,*” originally sent with the preamble (as taught by Frank), within the received acknowledgement. EX1028, ¶181. And “*on [the] condition that the response message identifies*” the full data sequence originally sent with the preamble—including “*the sequence associated with the base station*”—transmission of additional data by the mobile station is triggered. EX1010, 8:54-62, 18:1-4, 18:31-35. In the context of the underlying Ground 1 combination, the additional data transmitted by the mobile station (“*second uplink signal*”) takes the form of setup information communicated over a dedicated control channel. EX1008, 0319-20, FIG. 17.3.

D. Claims 3, 13, and 23

The Kaiser-Gibson-Frank-Kanterakis combination renders obvious “*wherein the response message includes power adjustment information and wherein the transmitter is configured to transmit the second uplink signal according to the power adjustment information.*” EX1028, ¶¶182-183.

Kanterakis teaches or suggests that, in addition to incorporating an ACK signal, the base station's response message can also include associated power control information, which is then used by the mobile station to adjust its transmission power upon restarting data transmission after time interval T_D :

Corresponding with the preamble structure in the uplink there is a corresponding in time power control information symbol *Upon start of data transmission the remote station uses the downlink transmitted power control information to adjust its transmitted power.* The power control symbols are decoded to derive binary decision data, which is then used to increase or decrease the transmitted power accordingly.

EX1010, 8:63-9:3; *see also id.*, FIG. 10 (showing "PC1, PN2... PCN" being sent in the same down-link timeslot as "ACK"); EX1028, ¶183.

E. Claims 5, 15, and 25

The Kaiser-Gibson-Frank-Kanterakis combination renders obvious "*wherein the response message includes a mobile station identifier assigned to the mobile station.*" EX1028, ¶¶184-185. Because Kanterakis's "ACK" signal "corresponds to the specific preamble structure" originally sent by the mobile station, and which is then capable of being detected by the mobile station as a signal "corresponding to [the] transmitted preamble," EX1010, 8:58-62, a POSA would have found it

obvious that the “ACK” signal would include the same data sequence originally transmitted in the preamble. EX1028, ¶184. Kanterakis teaches or suggests there should be a precise one-to-one correspondence between the acknowledgement message and original preamble. EX1010, 10:63-66; *see also id.*, 18:1-4, 18:31-35. Accordingly, because the originally transmitted preamble would “*include[] a mobile station identifier assigned to the mobile station*” based on the preamble structure from Frank, EX1009, 8:31-9:2, 9:5-6, 14:16-18, it would have been obvious that the response message (as modified by Kanterakis) would likewise “*include[] a mobile station identifier assigned to the mobile station.*” EX1028, ¶184. A POSA would have understood and found obvious that when Frank’s mobile station selects a unique signature pattern, the mobile station assigns to itself, at least temporarily, a unique signature pattern that identifies the mobile station. EX1028, ¶184.

Alternatively, it would have been obvious to a POSA to include in the base station’s response message a mobile station identifier of the mobile station to which the base station transmitted the response message so that the mobile station could identify the acknowledgement message intended for it and successfully continue the channel allocation procedure. EX1028, ¶185.

IX. DISCRETIONARY CONSIDERATIONS UNDER SECTIONS 314(a) AND 325(d) STRONGLY FAVOR INSTITUTION.

A. The *Fintiv* factors strongly favor institution.

Should Patent Owner seek denial under *Fintiv*, Ford will seek permission to reply to address the facts and law as they stand at that time. Under the current facts, *Fintiv* is not applicable. There is no trial scheduled. In fact, there is not even a scheduled date for remand from the MDL court to Ford's trial court (in the Western District of Missouri) that will, upon that remand, schedule a trial date. And the median time to trial for civil actions in the Eastern District of Michigan (where the nine parties' cases have been consolidated for pretrial proceedings) is nearly four years. Ex. 1026 at 40.

B. *General Plastic* and *Valve Corp.* strongly favor institution.

Serial petitioning concerns addressed in *General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (P.T.A.B. Sept. 6, 2017) (§ II.B.4.i precedential), and *Valve Corp. v. Electronic Scripting Products, Inc.*, IPR2019-00062, Paper 11 (P.T.A.B. April 2, 2019) (precedential), are not at play here. Petitioner has not previously petitioned for IPR of the '908 patent.

Non-parties Dell Inc. and Dell Technologies Inc. ("Dell") previously sought IPR of the '908 patent in IPR2022-00277 based on different prior art and arguments, and a different technical expert. *See* EX1020, 7. Petitioner has not

coordinated with and has no relationship with Dell, who is not a co-defendant in the MDL centralized in EDMI. EX1024. Nor has Petitioner used the Dell IPR as a “roadmap” to craft invalidity positions. Rather, Petitioner’s review and consideration of the record in IPR2022-00277 is no different than review of the ’908 patent’s file history—routine diligence to understand the patent’s history before the Office. Moreover, the deficiencies in Dell’s prior-art combinations that led the Board to deny Dell’s petition are not present here. EX1028, ¶¶37-39.

Finally, the concerns for fundamental fairness undergirding *General Plastic* and *Valve Corp.* confirm that institution is warranted here. Patent Owner sued Dell in January 2021, more than a year before filing suit against Petitioner. That the Petition here comes after the Dell IPR is the result of Patent Owner’s own actions, not any nefarious serial-petitioning strategy to harass Patent Owner.

C. The *Advanced Bionics* two-part framework strongly favors institution.

Applying the two-part framework from *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8-9 (P.T.A.B. February 13, 2020) (precedential), demonstrates that denial under § 325(d) is not appropriate. Under part one, the same or substantially the same art or arguments were *not* previously presented to the Office, ending the inquiry in favor of institution. The “new, noncumulative prior art asserted in the Petition”

strongly favors IPR. *Oticon Medical AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (P.T.A.B. October 16, 2019) (§§ II.B and II.C precedential).

X. CONCLUSION

The Board should grant IPR and cancel claims 1-30.

Respectfully submitted,

Dated: March 28, 2023

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Petition complies with the word count limitation of 37 C.F.R. § 42.24(a)(1)(i) because the Petition contains a total of 13,733 words as calculated by Microsoft Word's word-count feature. This total excludes the cover page, signature block, and the parts of the Petition exempted by 37 C.F.R. § 42.24(a)(1).

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CERTIFICATE OF SERVICE

The undersigned certifies that a complete copy of this Petition for *Inter Partes* Review of U.S. Patent No. 10,833,908 and all Exhibits and other documents filed together with this Petition were served on the official correspondence address for the patent shown in Patent Center:

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