IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Xiaobo Zhang	
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Issue Date:	June 28, 2022	
Appl. Serial No.:	17/095,767	
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Title:	METHOD AND DEVICE FOR WIRELESS COMMUNICATION	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 11,374,721 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42

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LISTING OF CLAIMS

Claim 1	
[1.pre]	A method for wireless communication in a user equipment (UE), comprising:
[1.1]	transmitting a first wireless signal; and
[1.2]	transmitting a second wireless signal;
[1.3]	wherein the first wireless signal is generated by a first sequence;
[1.4]	the first wireless signal is used to determine a first time interval; the first time interval is a time interval between a first time instant and a second time instant; the first time instant is a starting time instant at which a transmitter of the first wireless signal transmits the first wireless signal; the second time instant is a starting time instant at which a transmitter of the second wireless signal transmits the second wireless signal; the first time instant is earlier than the second time instant;
[1.5]	the second wireless signal occupies a first wireless resource; the first wireless resource is one of J candidate wireless resources; the J is a positive integer;
[1.6]	the first time interval is used to determine the first wireless resource out of the J candidate wireless resources;
[1.7]	the first sequence is a Zadoff-Chu (ZC) sequence,
[1.8]	a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH), a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH);
[1.9]	the first wireless signal is used to determine whether the second wireless signal is transmitted or not.

Claim 2	
[2.1]	The method of claim 1, wherein the J candidate wireless resources correspond to P time interval ranges; any two time interval ranges of the P time interval ranges do not overlap; the P is a positive integer greater than 1;
[2.2]	the first time interval belongs to a target time interval range; the target time interval range is a time interval range of the P time interval ranges;
[2.3]	the target time interval range corresponds to K candidate wireless resource(s) out of the J candidate wireless resources; the first wireless resource is one of the K candidate wireless resource(s); the K is a positive integer smaller than or equal to the J;
[2.4]	P is configured by network.
Claim 3	
[3.1]	The method of claim 2, further comprising: receiving a first signaling; wherein the first wireless signaling is used to determine Q wireless resource pool(s); the Q is a positive integer;
[3.2]	each candidate wireless resource of the J candidate wireless resources belongs to one of the Q wireless resource pool(s);
[3.3]	the K candidate wireless resource(s) belongs (belong) to a first wireless resource pool; the first wireless resource pool is one of the Q wireless resource pool(s);
[3.4]	the first time interval is used to determine the first wireless resource pool out of the Q wireless resource pool(s).
Claim 4	
[4]	The method of claim 1, further comprising: receiving a second wireless signaling; wherein the second wireless signaling is used to determine the first time interval; the second wireless signaling indicates a portion of the first time interval, the second wireless signaling is a Radio Resource Control (RRC) signaling.

Claim 5	
[5.1]	The method of claim 1, wherein the first sequence belongs to a target sequence set;
[5.2]	the first wireless signal occupies a target time-frequency resource;
[5.3]	at least one of an index of the first sequence in the target sequence set, a location of the target time-frequency resource in time domain, a location of the target time-frequency resource in frequency domain, or a correspondence relationship between the location of the target time-frequency resource in time domain and the location of the target time-frequency resource in frequency domain is used to determine the first wireless resource out of the J candidate wireless resources through a pre-defined mapping relationship;
[5.4]	the index of the first sequence in the target sequence set is an index for which the sequence in the target sequence set are sorted by a specific order.
Claim 6	
[6.pre]	A method for wireless communication in a base station, comprising:
[6.1]	receiving a first wireless signal; and
[6.2]	receiving a second wireless signal;
[6.3]	wherein the first wireless signal is generated by a first sequence;
[6.4]	the first wireless signal is used to determine a first time interval; the first time interval is a time interval between a first time instant and a second time instant; the first time instant is a starting time instant at which a transmitter of the first wireless signal transmits the first wireless signal; the second time instant is a starting time instant at which a transmitter of the second wireless signal transmits the second wireless signal; the first time instant is earlier than the second time instant;

[6.5]	the second wireless signal occupies a first wireless resource; the first wireless resource is one of J candidate wireless resources; the J is a positive integer;
[6.6]	the first time interval is used to determine the first wireless resource out of the J candidate wireless resources;
[6.7]	the first sequence is a Zadoff-Chu (ZC) sequence,
[6.8]	a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH), a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH);
[6.9]	the first wireless signal is used to determine whether the second wireless signal is transmitted or not.
Claim 7	
[7.1]	The method of claim 6, wherein the J candidate wireless resources correspond to P time interval ranges; any two time interval ranges of the P time interval ranges do not overlap; the P is a positive integer greater than 1;
[7.2]	the first time interval belongs to a target time interval range; the target time interval range is a time interval range of the P time interval ranges;
[7.3]	the target time interval range corresponds to K candidate wireless resource(s) out of the J candidate wireless resources; the first wireless resource is one of the K candidate wireless resource(s); the K is a positive integer smaller than or equal to the J;
[7.4]	P is configured by network.
Claim 8	
[8.1]	The method of claim 7, further comprising: transmitting a first signaling; wherein the first wireless signaling is used to determine Q wireless resource pool(s); the Q is a positive integer;

[8.2]	each candidate wireless resource of the J candidate wireless resources belongs to one of the Q wireless resource pool(s);
[8.3]	the K candidate wireless resource(s) belongs (belong) to a first wireless resource pool; the first wireless resource pool is one of the Q wireless resource pool(s);
[8.4]	the first time interval is used to determine the first wireless resource pool out of the Q wireless resource pool(s).
Claim 9	
[9]	The method of claim 6, further comprising: transmitting a second wireless signaling; wherein the second wireless signaling is used to determine the first time interval; the second wireless signaling indicates a portion of the first time interval, the second wireless signaling is a Radio Resource Control (RRC) signaling.
Claim 10	
[10.1]	The method of claim 6, wherein the first sequence belongs to a target sequence set;
[10.2]	the first wireless signal occupies a target time-frequency resource;
[10.3]	at least one of an index of the first sequence in the target sequence set, a location of the target time-frequency resource in time domain, a location of the target time-frequency resource in frequency domain, or a correspondence relationship between the location of the target time-frequency resource in time domain and the location of the target time-frequency resource in frequency domain is used to determine the first wireless resource out of the J candidate wireless resources through a pre-defined mapping relationship;
[10.4]	the index of the first sequence in the target sequence set is an index for which the sequence in the target sequence set are sorted by a specific order.

Claim 11	
[11.pre]	A user equipment for wireless communication, comprising:
[11.1]	a first processor transmitting a first wireless signal; and
[11.2]	a first transmitter transmitting a second wireless signal;
[11.3]	wherein the first wireless signal is generated by a first sequence;
[11.4]	the first wireless signal is used to determine a first time interval; the first time interval is a time interval between a first time instant and a second time instant; the first time instant is a starting time instant at which a transmitter of the first wireless signal transmits the first wireless signal; the second time instant is a starting time instant at which a transmitter of the second wireless signal transmits the second wireless signal; the first time instant is earlier than the second time instant;
[11.5]	the second wireless signal occupies a first wireless resource; the first wireless resource is one of J candidate wireless resources; the J is a positive integer;
[11.6]	the first time interval is used to determine the first wireless resource out of the J candidate wireless resources;
[11.7]	the first sequence is a Zadoff-Chu (ZC) sequence,
[11.8]	a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH), a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH);
[11.9]	the first wireless signal is used to determine whether the second wireless signal is transmitted or not.

Claim 12	
[12.1]	The user equipment of claim 11, wherein the J candidate wireless resources correspond to P time interval ranges; any two time interval ranges of the P time interval ranges do not overlap; the P is a positive integer greater than 1;
[12.2]	the first time interval belongs to a target time interval range; the target time interval range is a time interval range of the P time interval ranges;
[12.3]	the target time interval range corresponds to K candidate wireless resource(s) out of the J candidate wireless resources; the first wireless resource is one of the K candidate wireless resource(s); the K is a positive integer smaller than or equal to the J;
[12.4]	P is configured by network.
Claim 13	
[13.1]	The user equipment of claim 12, wherein the first processor receives a first signaling; wherein the first wireless signaling is used to determine Q wireless resource pool(s); the Q is a positive integer;
[13.2]	each candidate wireless resource of the J candidate wireless resources belongs to one of the Q wireless resource pool(s);
[13.3]	the K candidate wireless resource(s) belongs (belong) to a first wireless resource pool; the first wireless resource pool is one of the Q wireless resource pool(s);
[13.4]	the first time interval is used to determine the first wireless resource pool out of the Q wireless resource pool(s).
Claim 14	
[14]	The user equipment of claim 11, wherein the first processor receives a second wireless signaling; wherein the second wireless signaling is used to determine the first time interval; the second wireless signaling indicates a portion of the first time interval, the second wireless signaling is a Radio Resource Control (RRC) signaling.

Claim 15	
[15.1]	The user equipment of claim 11, wherein the first sequence belongs to a target sequence set;
[15.2]	the first wireless signal occupies a target time-frequency resource;
[15.3]	at least one of an index of the first sequence in the target sequence set, a location of the target time-frequency resource in time domain, a location of the target time-frequency resource in frequency domain, or a correspondence relationship between the location of the target time-frequency resource in time domain and the location of the target time-frequency resource in frequency domain is used to determine the first wireless resource out of the J candidate wireless resources through a pre-defined mapping relationship;
[15.4]	the index of the first sequence in the target sequence set is an index for which the sequence in the target sequence set are sorted by a specific order.
Claim 16	
[16.pre]	A base station for wireless communication, comprising:
[16.1]	a second processor transmitting a first wireless signal; and
[16.2]	a first receiver transmitting a second wireless signal;
[16.3]	wherein the first wireless signal is generated by a first sequence;
[16.4]	the first wireless signal is used to determine a first time interval; the first time interval is a time interval between a first time instant and a second time instant; the first time instant is a starting time instant at which a transmitter of the first wireless signal transmits the first wireless signal; the second time instant is a starting time instant at which a transmitter of the second wireless signal transmits the second wireless signal; the first time instant is earlier than the second time instant;

[16.5]	the second wireless signal occupies a first wireless resource; the first wireless resource is one of J candidate wireless resources; the J is a positive integer;
[16.6]	the first time interval is used to determine the first wireless resource out of the J candidate wireless resources;
[16.7]	the first sequence is a Zadoff-Chu (ZC) sequence,
[16.8]	a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH), a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH);
[16.9]	the first wireless signal is used to determine whether the second wireless signal is transmitted or not.
Claim 17	
[17.1]	The base station of claim 16, wherein the J candidate wireless resources correspond to P time interval ranges; any two time interval ranges of the P time interval ranges do not overlap; the P is a positive integer greater than 1;
[17.2]	the first time interval belongs to a target time interval range; the target time interval range is a time interval range of the P time interval ranges;
[17.3]	the target time interval range corresponds to K candidate wireless resource(s) out of the J candidate wireless resources; the first wireless resource is one of the K candidate wireless resource(s); the K is a positive integer smaller than or equal to the J;
[17.4]	P is configured by network.
Claim 18	
[18.1]	The base station of claim 17, wherein the second processor transmits a first signaling; wherein the first wireless signaling is used to determine Q wireless resource pool(s); the Q is a positive integer;

[18.2]	each candidate wireless resource of the J candidate wireless resources belongs to one of the Q wireless resource pool(s);
[18.3]	the K candidate wireless resource(s) belongs (belong) to a first wireless resource pool; the first wireless resource pool is one of the Q wireless resource pool(s);
[18.4]	the first time interval is used to determine the first wireless resource pool out of the Q wireless resource pool(s).
Claim 19	
[19]	The base station of claim 16, wherein the second processor transmits a second wireless signaling; wherein the second wireless signaling is used to determine the first time interval; the second wireless signaling indicates a portion of the first time interval, the second wireless signaling is a Radio Resource Control (RRC) signaling.
Claim 20	
[20.1]	The base station of claim 16, wherein the first sequence belongs to a target sequence set;
[20.2]	the first wireless signal occupies a target time-frequency resource;
[20.3]	at least one of an index of the first sequence in the target sequence set, a location of the target time-frequency resource in time domain, a location of the target time-frequency resource in frequency domain, or a correspondence relationship between the location of the target time-frequency resource in time domain and the location of the target time-frequency resource in frequency domain is used to determine the first wireless resource out of the J candidate wireless resources through a pre-defined mapping relationship;
[20.4]	the index of the first sequence in the target sequence set is an index for which the sequence in the target sequence set are sorted by a specific order.

I. INTRODUCTION

Apple Inc. ("Apple" or "Petitioner") petitions for *Inter Partes Review* ("IPR") of claims 1-20 ("the Challenged Claims") of U.S. Patent No. 11,374,721 ("the '721 patent"). Compelling evidence presented in this Petition demonstrates that the Challenged Claims are unpatentable.

II. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Apple Inc. certifies that the '721 patent is available for IPR. The present petition is being filed within one year of service of a complaint against Apple. Apple is not barred or estopped from requesting this review.

B. Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

Petitioner requests institution of IPR and cancellation of the Challenged Claims based on the following grounds:

Ground	'721 Patent Claims	Basis for Rejection
Ground 1	1-20	§103 – **Lee** (APPLE-1005) in view of **Freda** (APPLE-1006) and **Ly** (APPLE-1007)

The grounds of this petition are further supported by the expert testimony of Dr. Robert Akl. APPLE-1003 ("Expert Declaration").

The '721 patent is a continuation of an application filed July 22, 2019, which in turn is a continuation of an application filed January 22, 2017. APPLE-1001, 1:7-11. The '721 patent's earliest proclaimed priority date is **January 22, 2017** ("Critical Date"), which Petitioner does not concede.

As shown below, each prior art reference that forms the basis of Ground 1 of this Petition qualifies as prior art with respect to the Critical Date.

Reference	Date	Sections
Lee	• January 19, 2017 (published) • March 12, 2015 (filed, PCT application) • March 11, 2014 (filed, provisional application)	§102(a)(1) §102(a)(2)
Freda	• September 28, 2016 (filed, first provisional application); • November 2, 2016 (filed, second provisional application)	§102(a)(2)
Ly	• September 30, 2016 (filed, provisional ap-plication)	§102(a)(2)

Lee was published on January 19, 2017 as a national phase application of PCT/KR2015/001416 filed February 12, 2015 ("Lee PCT" the contents of which are substantially identical to Lee), and claims priority to U.S. Prov. 61/951,477 filed March 11, 2014 ("Lee Provisional"). APPLE-1005, Cover. Lee qualifies as prior art at least because its publication date and the filing date of its PCT application both predate the Critical Date.

Freda claims priority to U.S. Provs. 62/401,082 filed September 28, 2016 ("Freda Provisional 1") and 62/474,762 filed November 2, 2016 ("Freda Provisional 2"). APPLE-1006, Cover. Freda Provisional 1 and Freda Provisional 2 are incorporated in their entirety in/by Freda. APPLE-1006, [0001]. Freda qualifies as prior art because the filing dates of these two provisional applications (September 28, 2016 and November 2, 2016) each predate the Critical Date, these two provisional applications were co-pending when Freda was filed, and share the same inventors as Freda. As parallel citations in this Petition illustrate, the two Freda Provisionals fully describe the disclosures of Freda relied on in this Petition.

Ly claims priority to U.S. Prov. 62/402,956 filed September 30, 2016 ("Ly Provisional"). APPLE-1007, Cover. The Ly Provisional is incorporated in its entirety in Ly. APPLE-1007, [0001]. Ly qualifies as prior art because the filing date of its provisional application (September 30, 2016) predates the Critical Date, its provisional application was co-pending when Ly was filed, and shares the same inventors as Ly. As citations in this Petition illustrate, the Ly provisional fully describes the disclosures of Ly relied on in this Petition.

While there is no need to evaluate whether any claim of Freda or Ly is actually entitled to priority of their respective provisionals (*Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 (March 10, 2023)), the provisionals readily support respective claims of Freda and Ly. APPLE-1003, Sections VII.D.1 and D.1 (mapping exemplary support).

C. Claim Construction

All claim terms should be construed according to the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. §42.100. Petitioner submits that no claim terms need be construed to resolve issues of controversy in the present Petition. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); APPLE-1003, ¶25. Petitioner reserves the right to respond to any constructions offered by Patent Owner or adopted by the Board. Petitioner is not conceding that each challenged claim satisfies all statutory requirements, nor is Petitioner waiving any arguments concerning claim scope or grounds that can only be raised in district court.

D. Level of Ordinary Skill in the Art

A person of ordinary skill in the art ("POSITA") relating to the subject matter of the '721 Patent as of the Critical Date would have a bachelor's degree in electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks, including long-term evolution LTE/4G and 5G new radio (NR) cellular technology. APPLE-1003, ¶¶31-34. Additional education might substitute for some of the experience, and additional substantial experience might substitute for some of the educational background. *Id*.

III. SUMMARY OF THE ’721 PATENT

A. Brief Description

The ’721 patent is directed to “a transmission scheme in a wireless communication system, and in particular to … uplink transmission.” APPLE-1001, 1:18-20; APPLE-1003, ¶¶35-40. As shown in FIG. 1 (reproduced below), a user equipment (UE) transmits two different signals to a base station: (i) a “first wireless signal” over a Random Access Channel (RACH) and (ii) a “second wireless signal” over a Physical Uplink Shared Channel (PUSCH). APPLE-1001, FIG. 1 (S21), (S24).

The ’721 patent describes “grant-free uplink transmission” where a “lack of centralized dynamic scheduling and resource coordination” can result in collisions between uplink transmissions of different UEs. *Id*., 2:6-18. The ’721 patent seeks to reduce “the possibility of collision of the second wireless signals” and “ambiguity of uplink transmission between multiple uplink receiving nodes.” *Id.*, 2:64-67, 11:27-28. To achieve this, the ’721 patent describes adjusting various transmission properties of the second wireless signal, such as (i) the timing of the second wireless signal, (ii) the resource occupied by the second wireless signal, and (iii) whether the second wireless signal is transmitted or not. *Id*., claim 1.

For example, the ’721 patent describes adjusting the time interval (“first time interval") between the start of the first wireless signal transmission ("first time instant") and the start of the second wireless signal transmission ("second time instant"). *Id.,* 12:30-39, 49-67. Notably, the first wireless signal is used to determine the first time interval. *Id.*, 2:31-34.

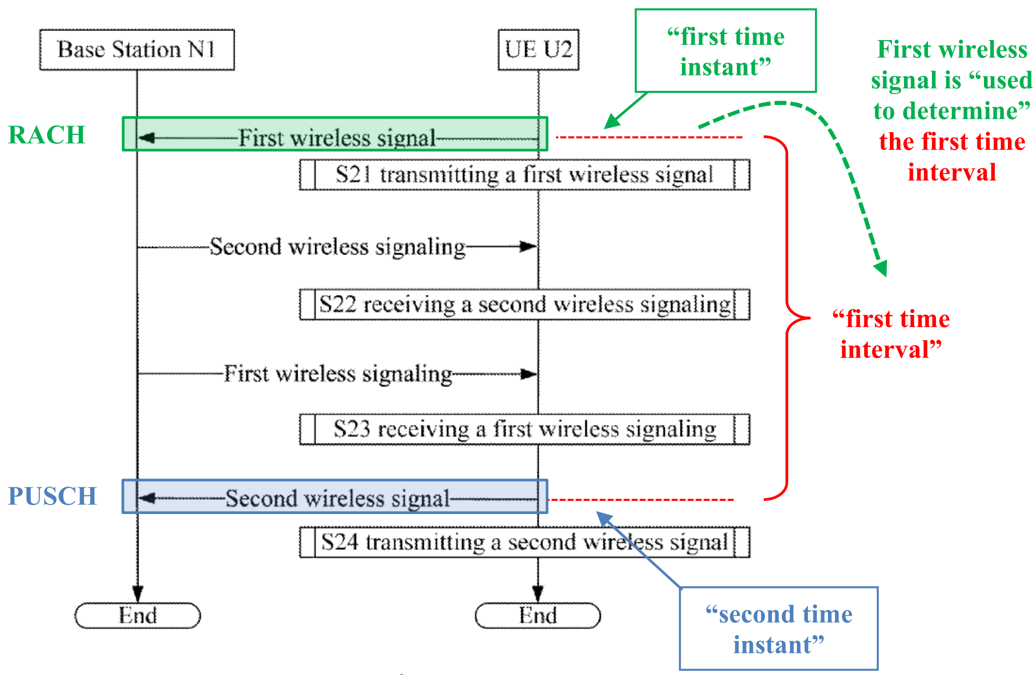
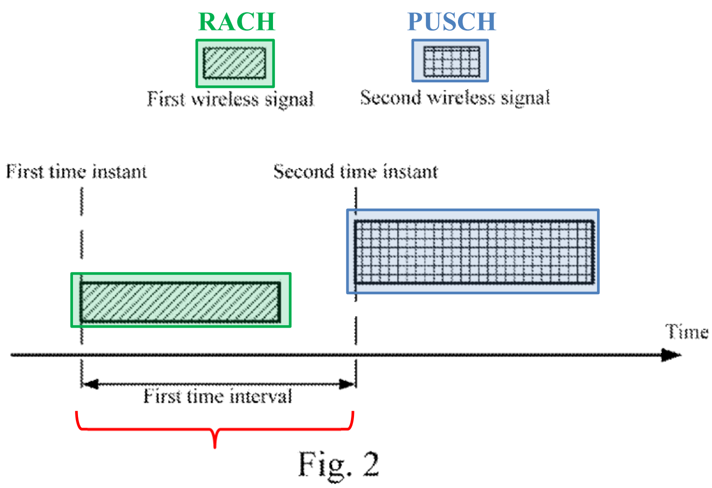


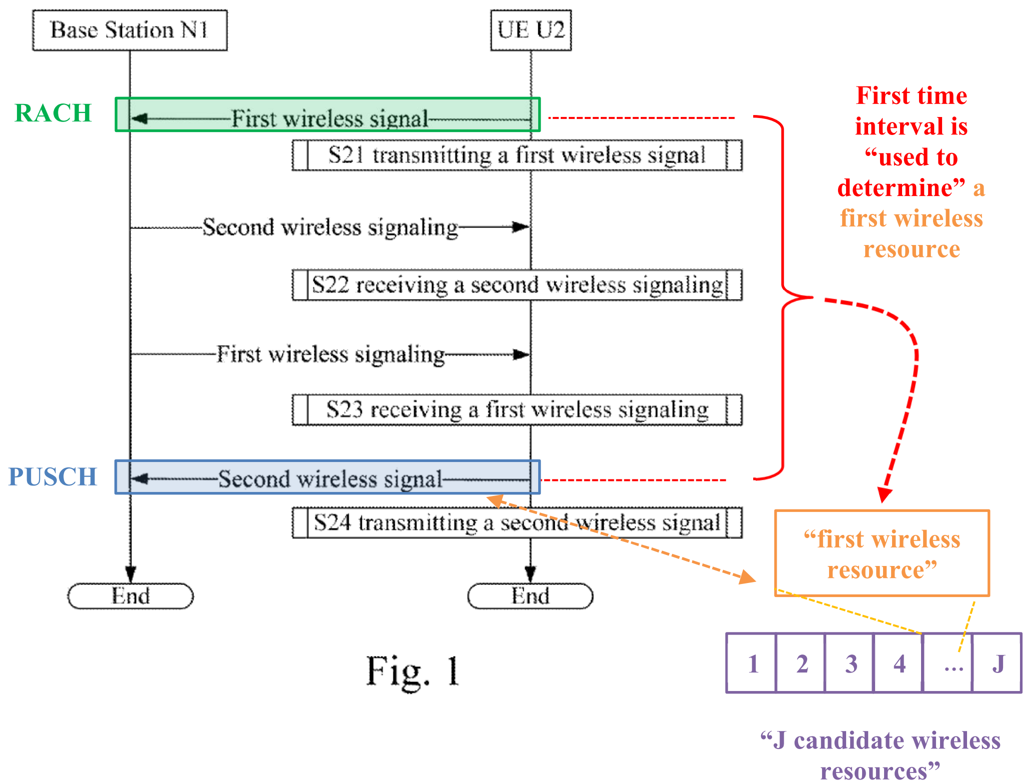
Fig. 1

<u>APPLE-1001, FIG. 1 (annotated)</u>

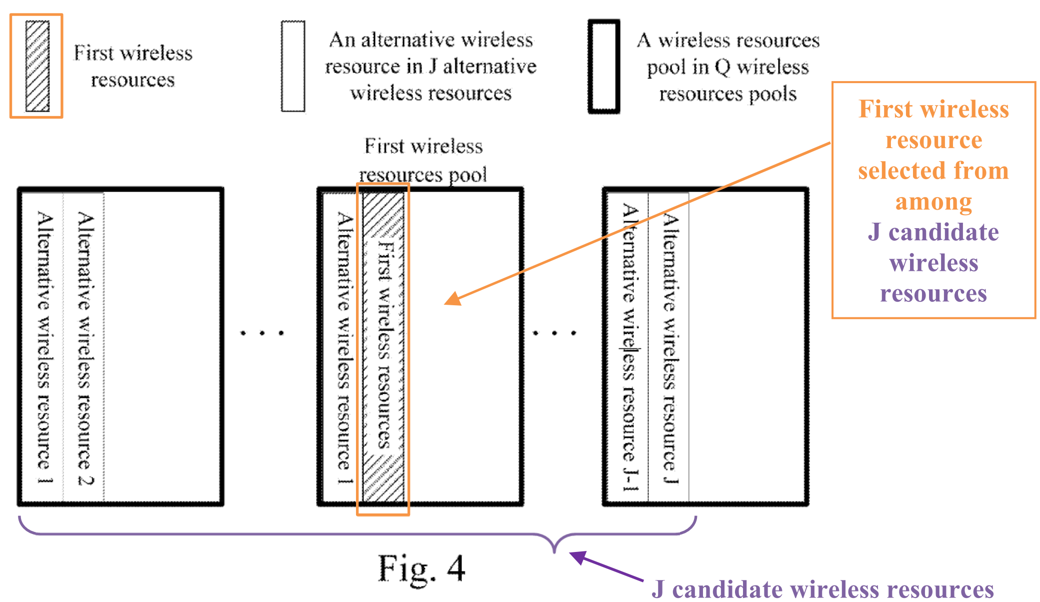


APPLE-1001, FIG. 2 (annotated)

The "second wireless signal" occupies a wireless resource ("first wireless resource") which can be a "time-frequency resource" occupying "one subcarrier in frequency domain" and "one OFDM symbol in time domain" (i.e., a "resource block"). *Id.*, 4:3-6, 4:15-19, 12:39-45, 14:64-19:20. 21:21-24. The first wireless resource is selected from "J candidate wireless resources." *Id.*, 12:39-45, 14:64-19:20. Notably, the first wireless resource is determined by using the first time interval. *Id.* As such, the '721 patent describes the ability to adjust the time-frequency resource in which the second wireless signal is transmitted, to help avoid collisions. *Id.*, 2:31-34.

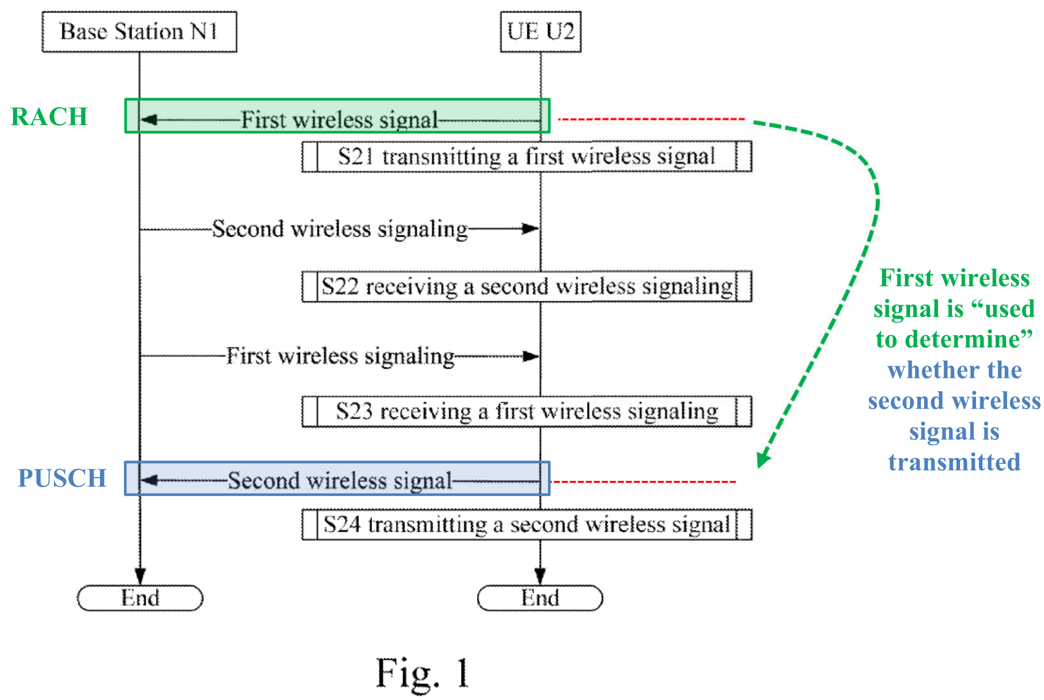


APPLE-1001, FIG. 1 (annotated)



APPLE-1001, FIG. 4 (annotated)

Further, the '721 patent describes the first wireless signal is also used to determine whether the second wireless signal is transmitted or not. *Id.*, 10:9-11,13:4-6.



APPLE-1001, FIG. 1 (annotated)

B. Prosecution History

The Examiner for the '721 patent did not issue any prior art rejections and there is no indication that the Examiner considered Lee, Freda, or Ly, which render the Challenged Claims obvious, as discussed below. *See generally*, APPLE-1002; APPLE-1003, ¶¶41-42.

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1] – CLAIMS 1-20 ARE RENDERED OBVIOUS BY LEE, FREDA, AND LY

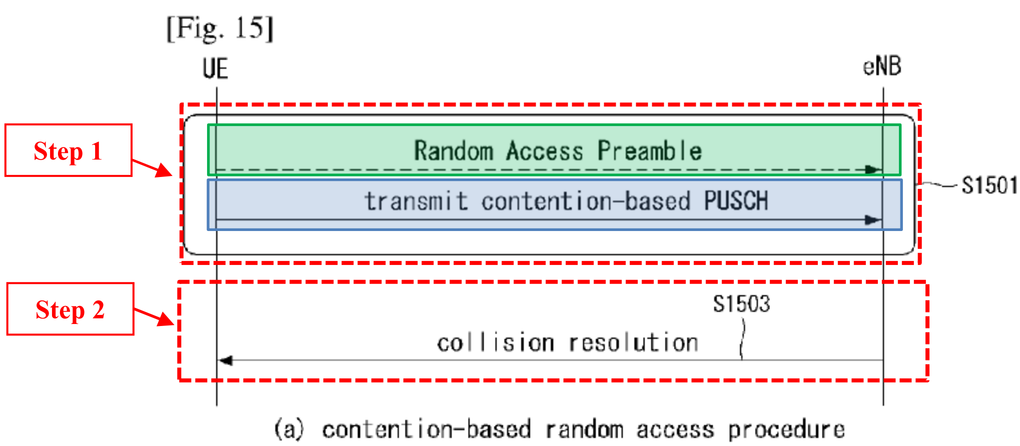
Below, the Petition relies on the disclosure of Lee, Freda, and Ly and explains why this disclosure, when interpreted in view of the general knowledge of a POSITA, renders obvious claims 1-20. APPLE-1003, ¶¶43-279.

Lee provides a foundational teaching for many of the claim features of the ’721 patent with the goal of addressing the same technical problems as the ’721 patent, namely adaptively adjusting when, where, and whether a UE transmits its PUSCH (second wireless signal) to reduce collisions with PUSCH transmissions of other UEs. APPLE-1003, ¶91. Freda provides additional details for implementing the type of adaptive allocation of PUSCH resources as described in Lee. Ly merely provides disclosure of the notoriously well-known feature that the RACH (first wireless signal) is a Zadoff-Chu (ZC) sequence. APPLE-1003, ¶91.

1. Overview of Lee

Lee is analogous art to the ’721 patent because, like the ’721 patent, Lee is directed to a random-access procedure in a wireless communication system with a goal of reducing collisions in unscheduled uplink transmissions. APPLE-1005, Abstract, [0041]-[0045]; APPLE-1001, 2:6-18, 2:64-67, 3:22-30, 11:27-28; APPLE-1003, ¶¶44-52.

Lee describes a “2-step random access procedure” (“2-step RACH”). APPLE-1005, [0009]-[0011], [0019]-[0020], [0237]-[0241], [0315]-[0383], FIGS. 15(a), 22-27. In the first step (S1501 in FIG. 15(a), annotated “Step 1”), Lee’s UE transmits two signals, (i) "a RACH preamble sequence through the PRACH" (annotated in green below) and (ii) "an RRC message" through the "PUSCH" (annotated in blue). *Id.* In response, in the second step (step S1503, annotated "Step 2"), "[t]he eNB transmits a contention resolution" to the UE. *Id.*

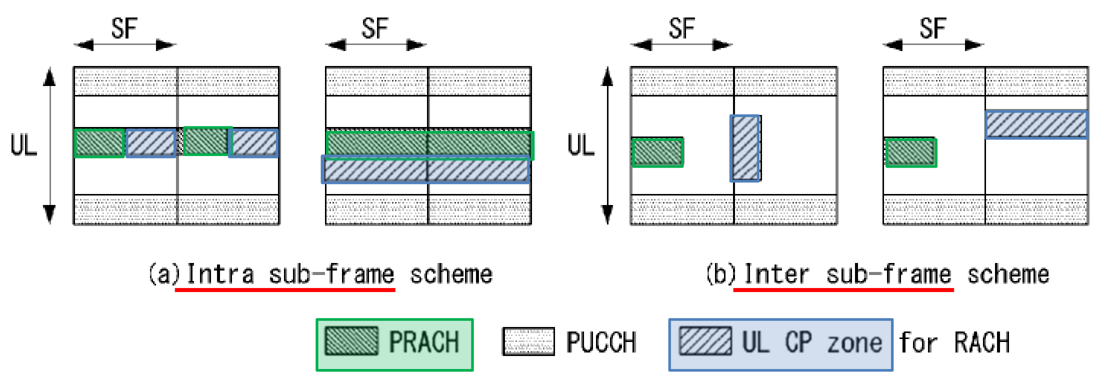


APPLE-1005, Lee FIG. 15(a) (annotated)

In Lee's first step (S1501, "Step 1") the UE transmits the RRC message "without separate UL grant" which "shorten[s] the time for transmitting the RRC message" as compared to a lengthier 4-step RACH procedure. *Id.* [0241], [0123], FIG. 8 (describing the lengthier 4-Step RACH).

In this first step (S1501) of the 2-step RACH, Lee's UE adjusts the timing between the RACH preamble transmission and the RRC message (PUSCH) transmission. APPLE-1003, ¶47. For example, in FIG. 14(a), below, Lee discloses an "**intra** sub-frame scheme" and an "**inter** sub-frame scheme" in which a resource for the RACH preamble ("PRACH," annotated green) is allocated in the

same subframe ("SF") and in a **different** subframe as the resource for the RRC message ("UL CP zone," annotated blue), respectively. APPLE-1005, [0203]-[0216]. "CP zone" is an acronym for "contention-based PUSCH zone" which "signify resource regions in which a contention-based UL **data** transmission allocated within a subframe is available." *Id.*, [0204].



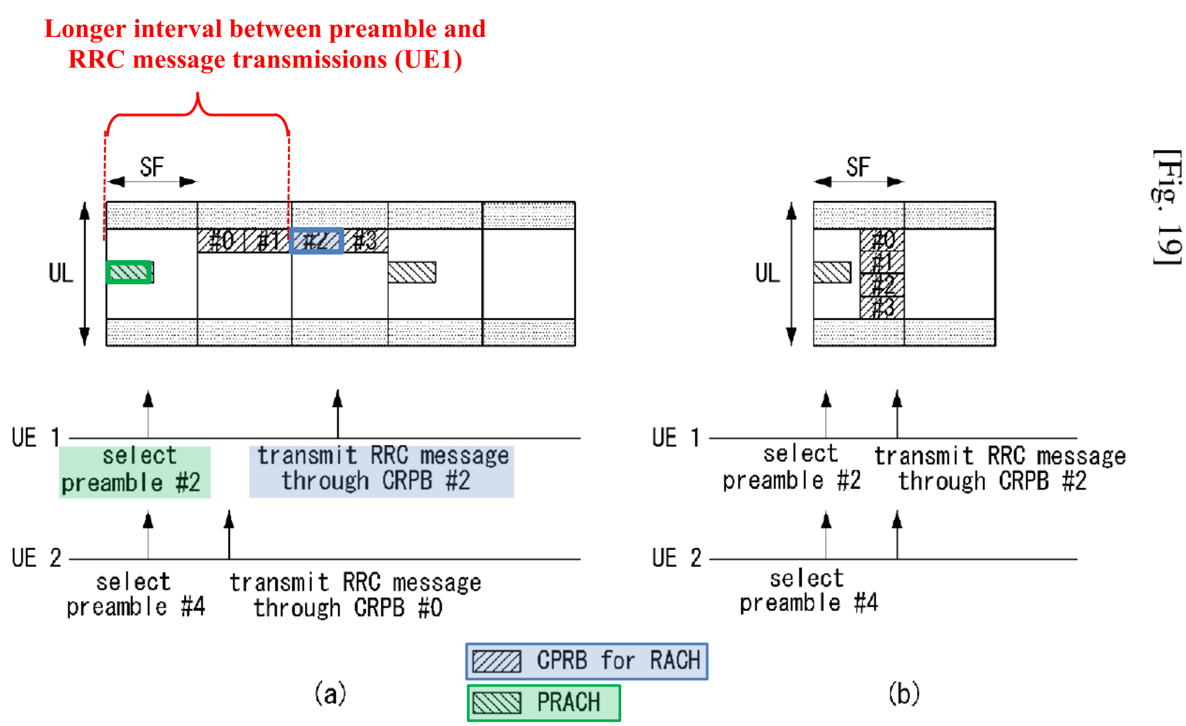
APPLE-1005, Lee FIG. 14 (annotated)

The configuration of an intra- or inter-subframe scheme is "predefined in a specific cell" and is informed to a UE via "configuration information" which "signifies the information for time/frequency resource domain in which the CP zone is configured" in relation to a PRACH region where the RACH preamble is transmitted APPLE-1005, [0213], [0218], [0220], [0222].

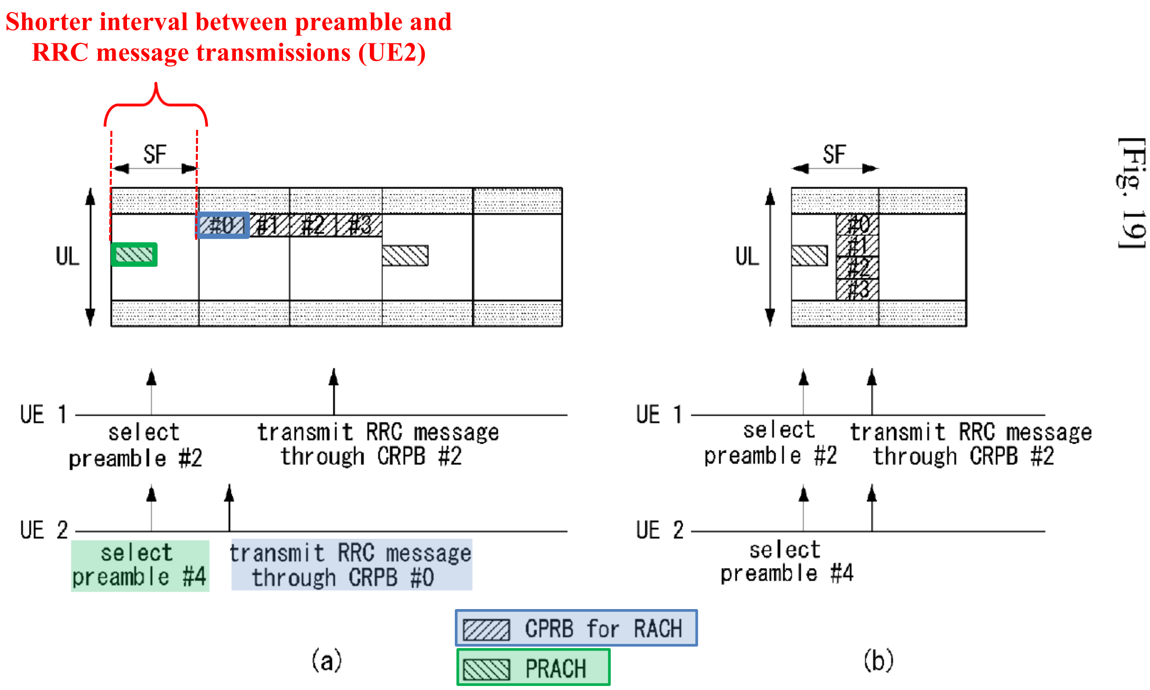
Each CP zone consists of multiple "contention-based PUSCH resource blocks" (CPRBs), where each CPRB is "a UL resource region that a UE may occupy (e.g., use) for a specific procedure within the CP zone." *Id.*, [0205]. For a given CP zone (configured as intra- or -inter-subframe), the UE uses "one or more

CPRB[s]" within that CP zone to transmit an RRC message. *Id*., [0206], [0237].

If multiple UEs share the same CP zone for their RRC message transmissions, Lee ensures the UEs use different CPRBs within the CP zone, by adaptively selecting a CPRB within the CP zone based on the RACH preamble. APPLE-1005, [0282]-[0287]. Lee's FIG. 19(a) illustrates an example of an inter-subframe scheme, where the CP zone includes 4 CPRBs (#0 – #3) in which two UEs transmit RRC messages in different CPRBs, based on their different respective preambles. APPLE-1005, [0281]-[0290].



APPLE-1005, Lee FIG. 19 (annotated)



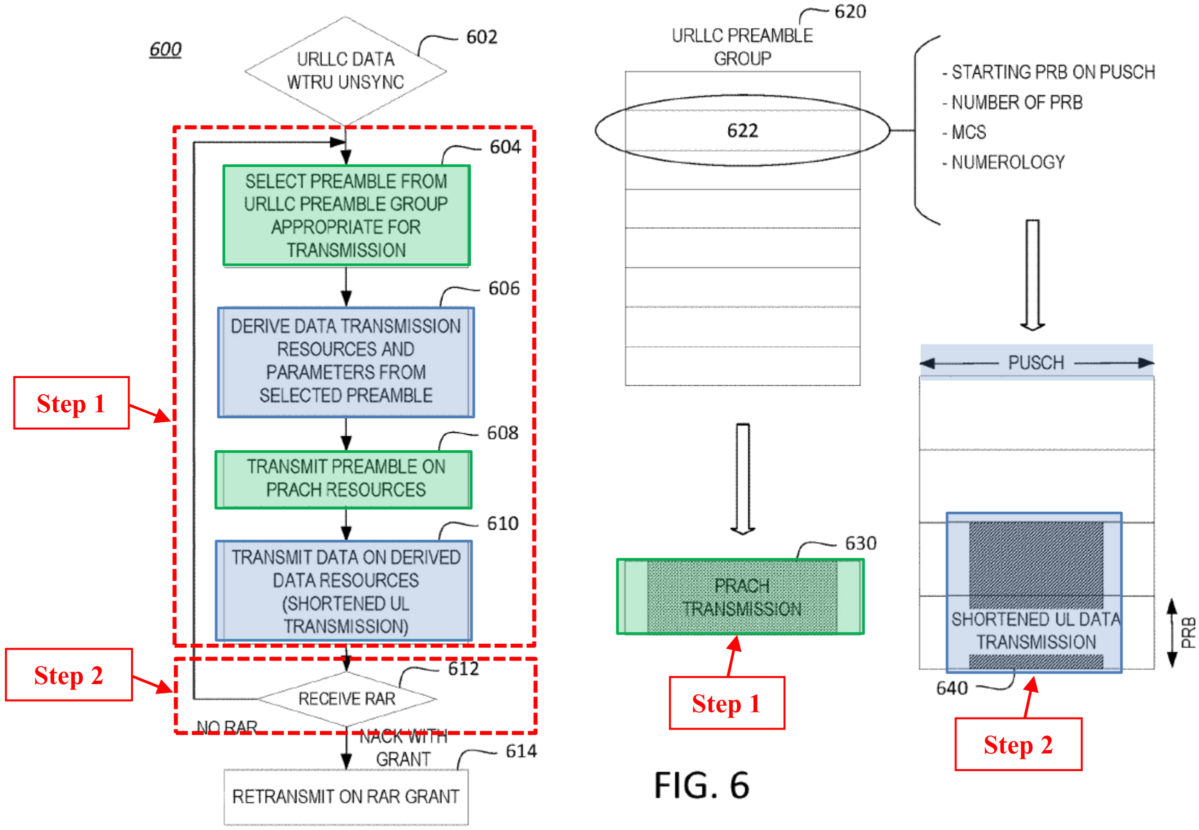
APPLE-1005, Lee FIG. 19 (annotated)

Lee's UE can also abandon its RRC message transmission when too many UEs attempt to utilize a CP zone. APPLE-1005, [0305]-[0311], FIG. 21. For example, in scenarios of full-duplex relay (FDR) where a UE is able to simultaneously transmit its own RACH preamble while also recognizing which RACH preamble a neighbor UE has selected, Lee ensures the simultaneously transmitting UEs do not collide in a CP zone. *Id*. Specifically, *e.g.*, preamble sequences can be ordered numerically such that a UE selecting a preamble sequence with higher-valued preamble sequence number "abandons RRC message transmission to the eNB" if "there is no available CPRB." *Id*., [0306], [0309], [0310].

2. Overview of Freda

Freda is analogous art to the ’721 patent because, like the ’721 patent, Freda is directed to a wireless communication system having a random-access procedure for reducing collisions in scenarios where uplink transmissions are performed without receiving a grant from the network. APPLE-1006, Title, Abstract, [0128], [0280], [0364]; APPLE-1008, Title, Abstract, [0113], [0240], [0296]; APPLE-1009, Title, Abstract, [0113], [0263], [0321]; APPLE-1001, 2:6-18, 2:64-67, 3:22-30, 11:27-28; APPLE-1003, ¶¶53-56.

Specifically, Freda describes an “enhanced random access procedure” (“2-step RACH”). APPLE-1006, [0127]; APPLE-1008, [0112]; APPLE-1009, [0112]. In the first step (604-610 in FIG. 6, “Step 1”) of Freda’s 2-step RACH procedure, its UE (also referred to as a “WTRU”) transmits, to a base station, a “first message (e.g., eMSG1)” which “may include a transmission of data combined with a preamble sequence.” APPLE-1006, [0129]; APPLE-1008, [0114]; APPLE-1009, [0114]. In response, in the second step (612, “Step 2”), the UE receives a “second message (e.g., eMSG2)” which may include “contention resolution information.” APPLE-1006, [0290], [0335]; APPLE-1008, [0249], [0294]; APPLE-1009, [0273], [0318].



APPLE-1006, Freda FIG. 6 (annotated)

Focusing on Freda's first step (annotated "Step 1" above), as with Lee, the UE transmits two signals, namely (i) a preamble transmitted through a "PRACH" and (ii) data transmitted through a "PUSCH." APPLE-1006, FIG. 6, [0132]; APPLE-1008, FIG. 6, [0117]; APPLE-1009, FIG. 6, [0117]. The 2-step RACH "enable[s] a WTRU to send data before receiving a grant from the network," which can "reduce latency for an initial transmission of a data burst." APPLE-1006, [0128]; APPLE-1008, [0113]; APPLE-1009, [0113].

In this first step (Step 1) of the 2-step RACH, the UE's preamble transmission resources and the UE's data transmission resources can be related through "association rules" such as "a time and/or frequency offset between them." APPLE-1006, [0206]; APPLE-1008, [0181]; APPLE-1009, [0189]. For example, "[a] relationship between preamble and data may be in a **time domain**" such that "a start time of a transmission of a preamble and a start time of a transmission of a data portion may be offset from each other by a specific amount of time." APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0192]. The "start time may correspond to … [a] first symbol of a corresponding PRB region." APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0192]. As another example, "[a] relationship between preamble and data may be in a **frequency domain**" such that "a first PRB of a transmission of a preamble and a first PRB of a transmission of a data portion may be offset from each other by a specific amount of PRBs." APPLE-1006, [0210]; APPLE-1008, [0185]; APPLE-1009, [0193]. Notably, both the time-domain offset and frequency-domain offset can be determined based on the selected RACH preamble (e.g., "a preamble may be associated with a specific offset to be used"). APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194].

3. Combination of Lee and Freda

As discussed above, both Lee and Freda describe 2-step random access procedures for reducing collisions in unscheduled uplink transmissions, where each has a first step (Step 1) in which a UE transmits both a RACH preamble and PUSCH data to a base station. APPLE-1005, [0009]-[0011], [0041]-[0045], [0019]-[0020], [0237]-[0241], [0315]-[0383], FIGS. 15(a) and 22-27; APPLE-1006, FIG. 6, [0128], [0132], [0238], [364]; APPLE-1008, FIG. 6, [0113], [0117], [0240], [0296]; APPLE-1009, FIG. 6, [0113], [0117], [0263], [0321]; APPLE-1003, ¶66. And, Lee and Freda both disclose a scenario where the PUSCH data is transmitted without a separate grant/scheduling from the base station, which can result in collisions of PUSCH data transmissions between different UEs. APPLE-1005, [0241], [0123], FIG. 8; APPLE-1006, [0128]; APPLE-1008, [0113]; APPLE-1009, [0113]; APPLE-1003, ¶66. Both recognize and offer suggestions for processes designed to avoid this potential issue. APPLE-1003, ¶66. For instance, to avoid such collisions, broadly speaking, Lee discloses adaptively allocating resources for a UE's PUSCH data depending on the UE's selection/assignment of the RACH preamble. APPLE-1005, [0281]-[0290], FIG. 19. Freda complements this broad disclosure with details that inform implementation of an adaptive resource allocation scheme having a 2-step random access procedure, notably suggesting the use of time and/or frequency offsets between the RACH preamble and PUSCH data, where the offsets depend on the selection of the RACH preamble. APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194].

As discussed above, Lee discloses a collision-avoidance resource allocation in which (i) a CP zone for PUSCH data can be configured in either the same subframe or a different subframe relative to the RACH preamble ("intra-subframe" or "inter-subframe"), and (ii) within that CP zone, a particular "resource block" can be selected, depending on the UE's RACH preamble. APPLE-1005, [0203]-[0213], [0281]-[0290], FIGS. 13-14, 19.

A POSITA would have naturally looked to Freda and its "association rules between preamble resources and data resources, such as … a time and/or frequency offset between them" for further details of how to implement collision-avoidance resource allocation as described in Lee. APPLE-1005, [0282]; APPLE-1006, [0206]; APPLE-1008, [0181]; APPLE-1009, [0189]; APPLE-1003, ¶68. A POSITA implementing the supplemental teachings of Freda into the existing disclosure of Lee would have created the Lee-Freda combination. APPLE-1003, ¶67-68.

In the Lee-Freda combination, Lee's UE device would implement collision-avoidance resource allocation for PUSCH data by using dynamically configurable time and frequency "offsets" between PRACH preamble and PUSCH data resources, as taught by Freda. APPLE-1003, ¶69. Specifically, the Lee-Freda device would determine both (i) a configurable offset "in a time domain" between the starting time of Lee's RACH preamble transmission and the starting time of

Lee's PUSCH data transmission, and (ii) a configurable offset "in a frequency domain" between a first CPRB of Lee's RACH preamble transmission and a first CPRB of Lee's PUSCH data transmission. APPLE-1003, ¶69. These time-domain and frequency-domain offsets would indicate a specific PUSCH resource (e.g., Lee's CPRB) in which the Lee-Freda device would transmit the RRC (PUSCH data) message. APPLE-1003, ¶69.

Diagrams A and B, below, which are annotated versions of Lee's FIG. 19(a), illustrates at a high-level an example of how a POSITA would implement a Lee-Freda combination. APPLE-1005, FIG. 19(a); APPLE-1003, ¶69. As shown, the modification simply applies Freda's time-domain offset and frequency-domain offset to enable an indication of which of Lee's CPRBs should be used for PUSCH data transmission (RRC message). APPLE-1003, ¶69.

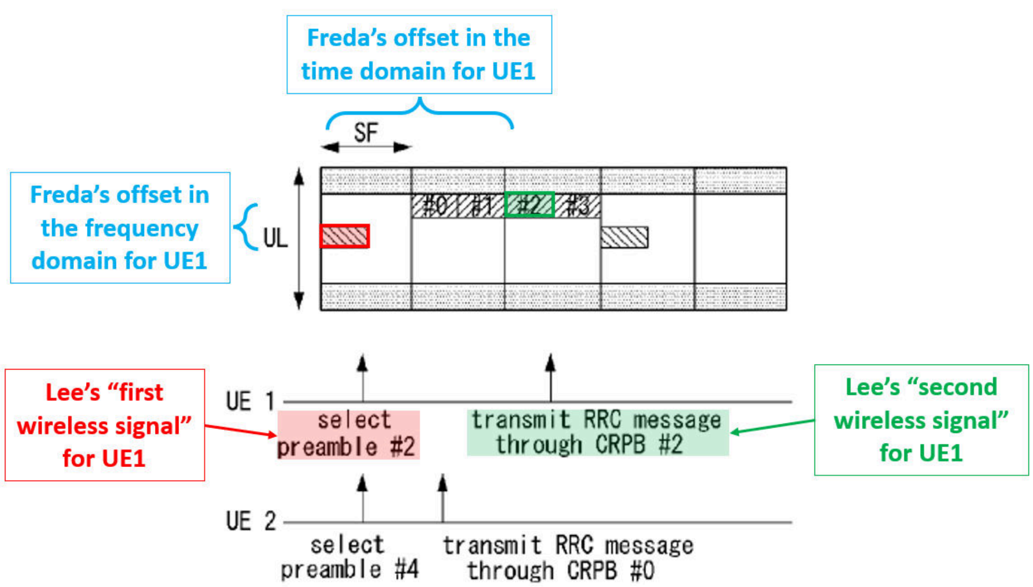


Diagram A (Determining an Offset for UE1)

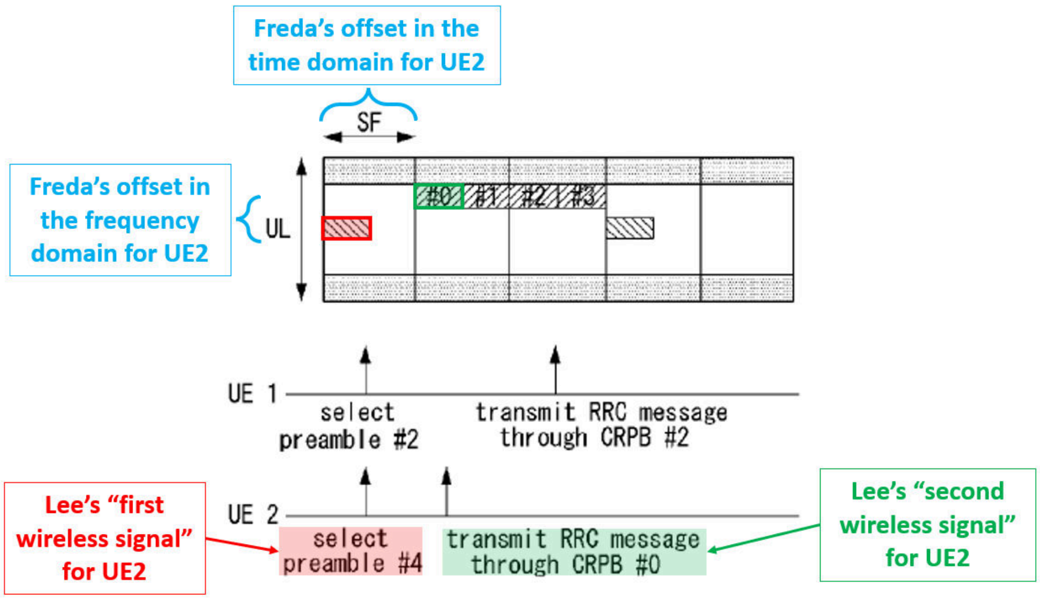


Diagram B (Determining an Offset for UE2)

Further, as taught by Freda, the Lee-Freda device would determine both the time-domain offset and frequency-domain offset, at least in part, based on the RACH preamble. APPLE-1003, ¶70. For example, the Lee-Freda device would determine that the RACH preamble indicates that a particular time-frequency "offset" should be used (e.g., based on an association that is "fixed or configured by a network"). APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194]; APPLE-1003, ¶70.

A POSITA would have understood that the Lee-Freda system would implement Lee's intra-subframe and inter-subframe scheme by setting appropriate values of a time-domain offset, as taught by Freda. APPLE-1003, ¶71. In one example, the Lee-Freda system would involve implementing Lee's *intra*-subframe scheme by setting Freda's time-domain offset equal to zero. APPLE-1006, [0209] (the time-domain offset "may be equal to zero, for example, when transmission of a preamble and a data portion may be continuous in time"); [0211] (an "association may be valid for a given transmission time duration … for example, for a given slot, mini-slot, subframe"); APPLE-1008, [0184]; APPLE-1009, [0192]; APPLE-1003, ¶71. As another example, the Lee-Freda system would implement Lee's *inter*-subframe scheme by controlling Freda's time-domain offset so that the RACH preamble and PUSCH data are transmitted in different subframes. APPLE-1006, [0210] (the "association may (e.g. alternatively) be applicable over non-overlapping (e.g. disjointed in time) time intervals"); APPLE-1008 [0185], APPLE-1009, [0193]; APPLE-1003, ¶71.

In addition, a POSITA would have understood Lee's collision-avoidance techniques can be implemented using Freda's configurable time-frequency offset. APPLE-1003, ¶72. For example, Lee avoids CPRB collisions by "implicitly selecting a CPRB on the basis of a randomly selected preamble." APPLE-1005, [0282]. Freda discloses details of how this would be implemented, explaining that "resources used for a preamble and the resources used for data may have some association, such as an implicit association" and that these association rules can be a "time and/or frequency offset" between preamble resources and data resources. APPLE-1006, [0147], [0206]; APPLE-1008, [0132], [0181], APPLE-1009, [0132],

[0189]. In particular, Freda explains that the time/frequency offset can be determined "based on explicit indication (e.g. explicitly indicated in DCI, or in a downlink control message)" or "based on a selected preamble (e.g. a preamble may be associated with a specific offset to be used, where an association may be fixed or configured by a network)." APPLE-1006, [0211]; APPLE-1008, [0186]; APPLE-1009, [0194].

As explained below in more detail, combining Lee and Freda would have been obvious at least because such a combination would have merely involved (1) combining prior art elements according to known methods to yield predictable results; and (2) use of a known technique to improve similar devices (methods, or products) in the same way. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395-97 (2007); MPEP 2143; APPLE-1003, ¶73.

Lee describes a similar 2-step random access procedure as Freda, and the combination would have simply involved adding Freda's teachings into the compatible teachings of Lee, thus, for at least this reason, making the Lee-Freda combination predictable and foreseeable with a reasonable expectation of success. APPLE-1005, [0237]-[0241]; APPLE-1006, [0127], [0290]; APPLE-1008, [0112], [0114], [0249], [0249]; APPLE-1009, [0112], [0114], [0273], [0318]; APPLE-1003, ¶74. Specifically, a POSITA would have recognized that, as with Lee, Freda describes a random access procedure in which a wireless communications device can communicate with a base station without first receiving a separate uplink grant from the base station. APPLE-1005, Abstract ("As such, the UE transmits the RRC message from the eNB through the CP zone without separate UL grant"); APPLE-1006, [0128] ("an enhanced random access procedure may enable a WTRU to send data before receiving a grant from the network"); APPLE-1008, [0113]; APPLE-1009, [0113]; APPLE-1003, ¶74.

In both Lee and Freda, a UE's RACH preamble can be either assigned by the base station or self-selected by the UE. APPLE-1005, [0242], [0283]; APPLE-1006, [0116], [0132], [0138]-[0139], [0141], [0145], [0228], [0383]; APPLE-1008, [0101], [0117], [0123]-[0124], [0126], [0130], [0193], [0337]; APPLE-1009, [0101], [0117], [0123]-[0124], [0126], [0130], [0203], [0211], [0366]; APPLE-1003, ¶75. In both Lee and Freda, the selected/assigned RACH preamble is then used to determine resources for subsequently transmitting the PUSCH data. APPLE-1005, [0282]-[0287] ("implicitly selecting a CPRB on the basis of a randomly selected preamble when a RACH procedure is performed using a CP zone"); APPLE-1006, [0209], [0211] ("determine an offset in time [between a start time of a transmission of a preamble and a start time of a transmission of a data portion] based on a selected PRACH resource"); APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194]; APPLE-1003, ¶75. Both Lee and Freda disclose that one or multiple resource blocks can be assigned to the PUSCH data. APPLE-

1005, [0206]; APPLE-1006, [0213]; APPLE-1008, [0189]; APPLE-1009, [0196].

Both Lee and Freda are also compatible in duplexing and relaying capabilities of their devices. APPLE-1003, ¶76. For example, Lee describes an example involving "full duplex relay (FDR) UEs." APPLE-1005, [0305] (referring to FIG. 21 of Lee). Likewise, Freda discloses that its techniques are applicable to "relay" devices and devices that "include a full duplex radio." APPLE-1006, [0021], [0041]; APPLE-1008, [0018]; APPLE-1009, [0018].

A POSITA would have also recognized that Freda improves upon Lee's system in several ways, providing further motivation to combine. APPLE-1003, ¶77. For example, Freda's teachings allow the base station to dynamically configure the resource allocation for PUSCH data, by using "DCI [downlink control information] that may include dynamically scheduled system-specific ePRACH parameters." APPLE-1006, [0144]; APPLE-1008, [0129]; APPLE-1009, [0129]; APPLE-1003, ¶77. Freda's explains that the DCI can include "association rules between preamble resources and data resources … such as a time and/or frequency offset between them." APPLE-1006, [0144]; APPLE-1008, [0181]; APPLE-1009, [0189]. A POSITA would have understood that implementing Freda's DCI-based configuration would have been straightforward in Lee's system. APPLE-1003, ¶77. Indeed, both Lee and Freda disclose that the UE receives a DCI signal prior to initiating the random access procedure. APPLE-

1006, [0135] ("initiate an eRACH procedure, for example, … upon reception of downlink control signaling (e.g., a DCI on NR-PDCCH)"); APPLE-1005, [0092] (the UE can "receive a Physical Downlink Control Channel (PDCCH) … and acquire more detailed system information … Thereafter, the UE may perform a random access procedure"); APPLE-1008, [0120]; APPLE-1009, [0120]. Lee further explains that resource allocation information can be conveyed to a UE via "configuration information" such as "a broadcasting message" or using "a unicast scheme through a new control message." APPLE-1005, [0225], [0229].

Furthermore, Freda's teachings allow both the UE and base station to identify the specific time and specific frequency (resource block) at which the UE transmits data to the base station (e.g., by determining "offsets" in both time and frequency between the transmission of the preamble and the transmission of the data, based on the preamble). APPLE-1003, ¶78. Through such techniques, Freda discloses that a UE can use the time-domain offset and the frequency-domain offset in order to "facilitate blind decoding of data" by the receiving node (e.g., base station) by using "a priori knowledge" of the start time and the first PRB of the transmission of a data portion, e.g., "as may be indicated by a preamble." APPLE-1006, [0207]-[0210]; APPLE-1008, [0182]-[0185]; APPLE-1009, [0190]-[0193]; APPLE-1003, ¶78.

Further, Freda provides more flexibility by allowing the time offset and/or frequency offset to implement a range of offset values including being "equal to zero" (to provide joint transmission) and by allowing the "start time" of data transmission to be first symbol of subframe or any "specific symbol thereof." APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0192]; APPLE-1003, ¶79.

4. Overview of Ly

Ly is analogous art to the '721 patent because, like the '721 patent, Ly is directed to a random-access procedure in a wireless communication system. APPLE-1007, Abstract, [0030]; APPLE-1010, Abstract, [0026]; APPLE-1001, 3:22-30; APPLE-1003, ¶¶80-82. Indeed, Ly is directed to "[w]ireless communications systems and methods related to random access and uplink (UL)-based mobility." APPLE-1007, Abstract; APPLE-1010, Abstract. And like Lee, Freda and the '721 patent, Ly describes "2-step random access mechanisms," which it offers to facilitate communications between a UE and a base station, including (i) transmitting "a random access preamble" over a PRACH and (ii) transmitting additional data over a PUSCH. APPLE-1007, [0069], [0083], FIG. 9; APPLE-1010, [0065], [0079], FIG. 9.

Specifically, Ly describes that a network utilizes a set of "random access preamble sequences with cyclic shifts" for "random access procedure," where the set "may include 64 Zadoff-Chu sequences." APPLE-1007, [0083]-[0085];

APPLE-1010, [0079]-[0081]. Ly explains this configuration "may be suitable for use is in large-cell deployment." APPLE-1007, [0085]; APPLE-1010, [0081]. In particular, "Zadoff-Chu [sequences] with cyclic shifts" can be used as "preamble sequences," and the "cyclic shifts [can be dimensioned] such that delay spread and/or Doppler shift have minimal impacts on the RACH sequence cross-correlation." APPLE-1007, [0085]; APPLE-1010, [0081].

5. Combination of Lee, Freda, and Ly

In view of Ly, a POSITA would have found it obvious to implement the RACH preamble sequence of the Lee-Freda system using a well-known ZC sequence, as taught by Ly. APPLE-1003, ¶¶88-90. Combining Lee-Freda and Ly would have been obvious at least because such a combination would have merely involved (1) combining prior art elements according to known methods to yield predictable results; and (2) use of a known technique to improve similar devices (methods, or products) in the same way. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395-97 (2007); MPEP 2143. Further, a POSITA would have had a reasonable expectation of success in making such a combination. *Endo Pharm., Inc. v. Actavis LLC*, 922 F.3d 1365, 1373 (Fed. Cir. 2019); MPEP 2143.02.

In particular, a POSITA would have recognized that Ly, like Lee and Freda, describes "2-step random access mechanisms" for facilitating communications between a UE and a base station, including (i) transmitting "a random access preamble" over a PRACH and (ii) transmitting additional data over a PUSCH. APPLE-1005, [0237]-[0241], [0315]-[0383], FIG. 15(a); APPLE-1007, [0069], [0083], FIG. 9; APPLE-1010, [0065], [0079], FIG. 9; APPLE-1003, ¶89. Further, in view of Ly, a POSITA would have understood that a network can utilize a set of preamble sequences for random access, for example, by employing "sets of random access preamble sequences with cyclic shifts" where "each set may include 64 Zadoff-Chu sequences." APPLE-1007, [0083]-[0085]; APPLE-1010, [0079]-[0081]; APPLE-1003, ¶89.

In view of Ly, a POSITA would have found it obvious to configure Lee's system that such that the "RACH preamble sequence" is implemented using a "Zadoff-Chu [sequence]" such that "delay spread and/or Doppler shift have minimal impacts on the RACH sequence cross-correlation," thereby improving the reliability of the communications. APPLE-1007, [0085]; APPLE-1010, [0081]; APPLE-1003, ¶90. The resulting modification ("Lee-Freda-Ly") would have been predictable and within an ordinary artisan's skill without undue experimentation and would have been one known option that would lead to predictable results. APPLE-1003, ¶90.

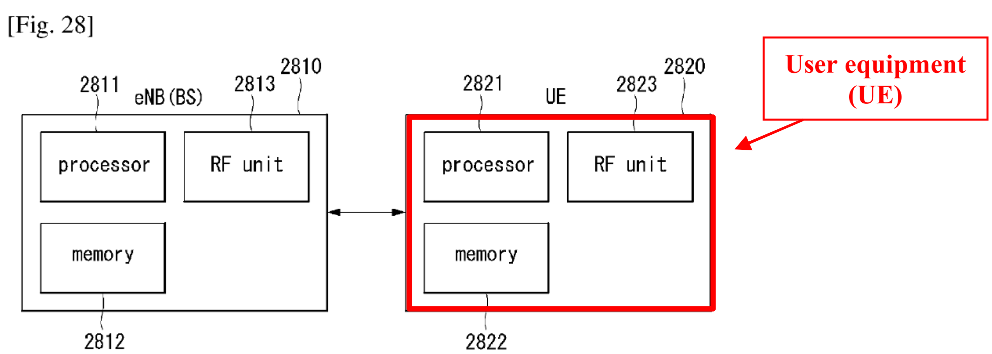
6. Analysis

(a) Claim 1

[1.pre]

To the extent that the preamble is limiting, Lee discloses or renders obvious [1.pre]. APPLE-1003, ¶¶92-95.

Lee describes "***user equipment (UE)***" for communicating in a "wireless communications system" ***(… for wireless communication)***. APPLE-1005, Abstract, [0385]-[0389], FIG. 28 (2820).

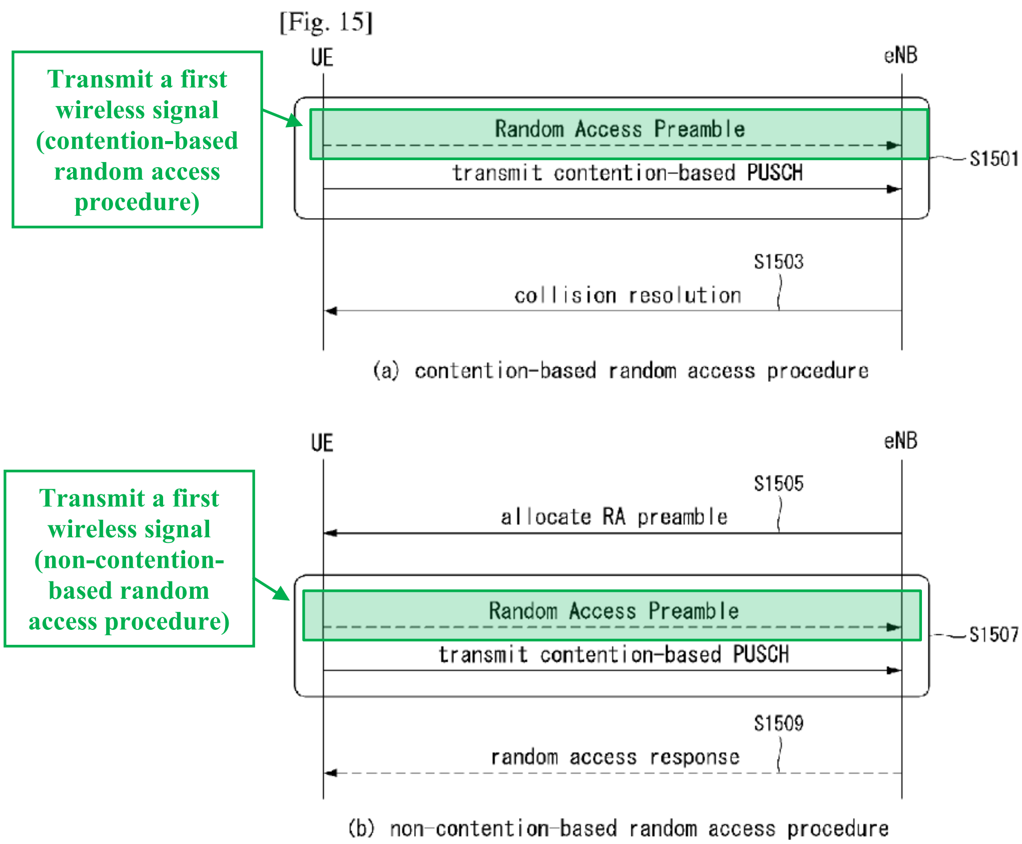


APPLE-1005, FIG. 28 (annotated)

Further, in view of Lee, Freda, and Ly, it would have been obvious to configure Lee's UE to perform ***a method for wireless communication*** including each of the operations recited in claim 1, as discussed in further detail below. APPLE-1003, ¶¶96-151. Therefore, a POSITA would have understood the combination of Lee-Freda-Ly to render obvious [1.pre].

[1.1]

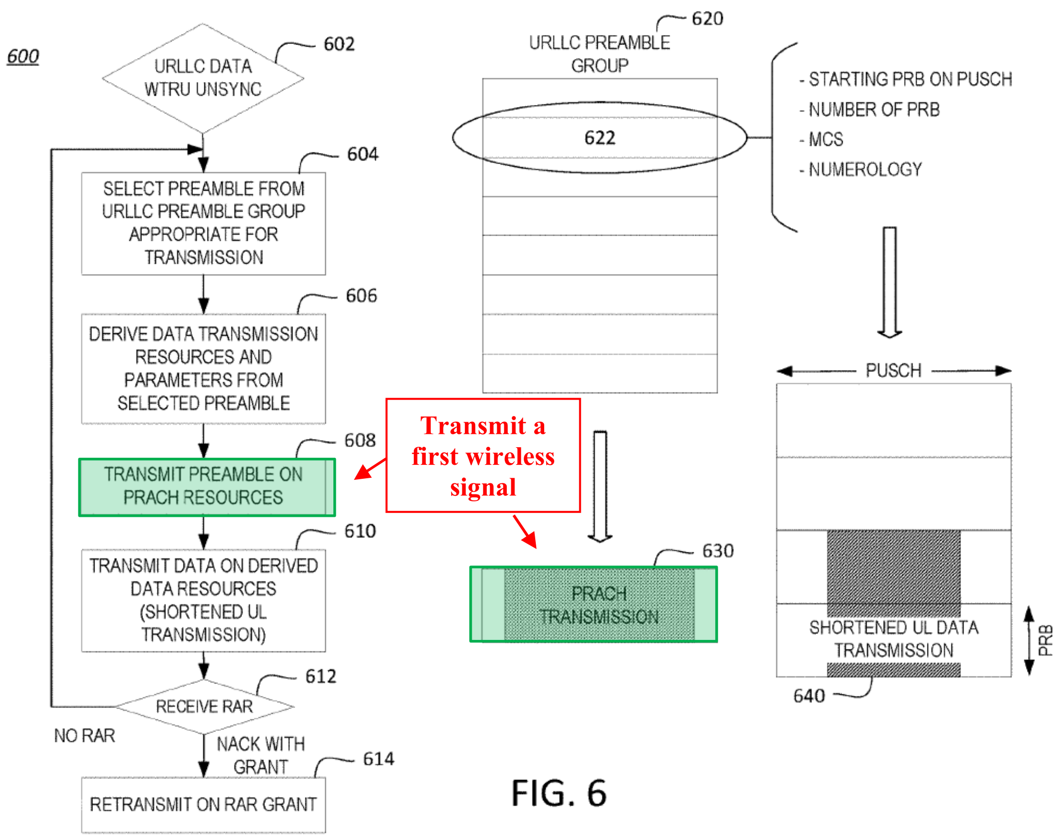
Lee describes a 2-step random access procedure where, in the first step (Step 1 as described in section IV.A.1), a UE "transmit[s] … a ***random access preamble*** to a base station (BS)" ***(transmitting a first wireless signal)***. APPLE-1005, Abstract; APPLE-1003, ¶96-98. Specifically, in both a "contention-based random access procedure" (where the UE self-selects its RACH preamble sequence) and a "non-contention-based random access procedure" (where the UE is allocated with a RACH preamble sequence from the base station), Lee's UE "***transmits a RACH preamble*** sequence through the PRACH" to an "eNode B" (eNB). APPLE-1005, [0242]-[0244], [0237]-[0241], FIG. 15(a) (S1501, top), FIG. 15(b) (S1507, top), [0266]-[0276], FIG. 17; APPLE-1003, ¶98.



APPLE-1005, FIG. 15 (annotated)

Lee's RACH preamble is transmitted by the UE's "radio frequency (RF) unit" through a "radio signal" (***transmitting a first wireless signal***) APPLE-1005, [0010], [0388]; APPLE-1003, ¶99.

Similarly, Freda discloses a 2-step RACH procedure. In Freda's first step, as with Lee, the UE transmits a preamble transmitted through a "PRACH" ***(transmitting a first wireless signal)***. APPLE-1006, FIG. 6, [0132]; APPLE-1008, FIG. 6, [0117]; APPLE-1009, FIG. 6, [0117]; APPLE-1003, ¶100.



APPLE-1006, FIG. 6 (annotated)

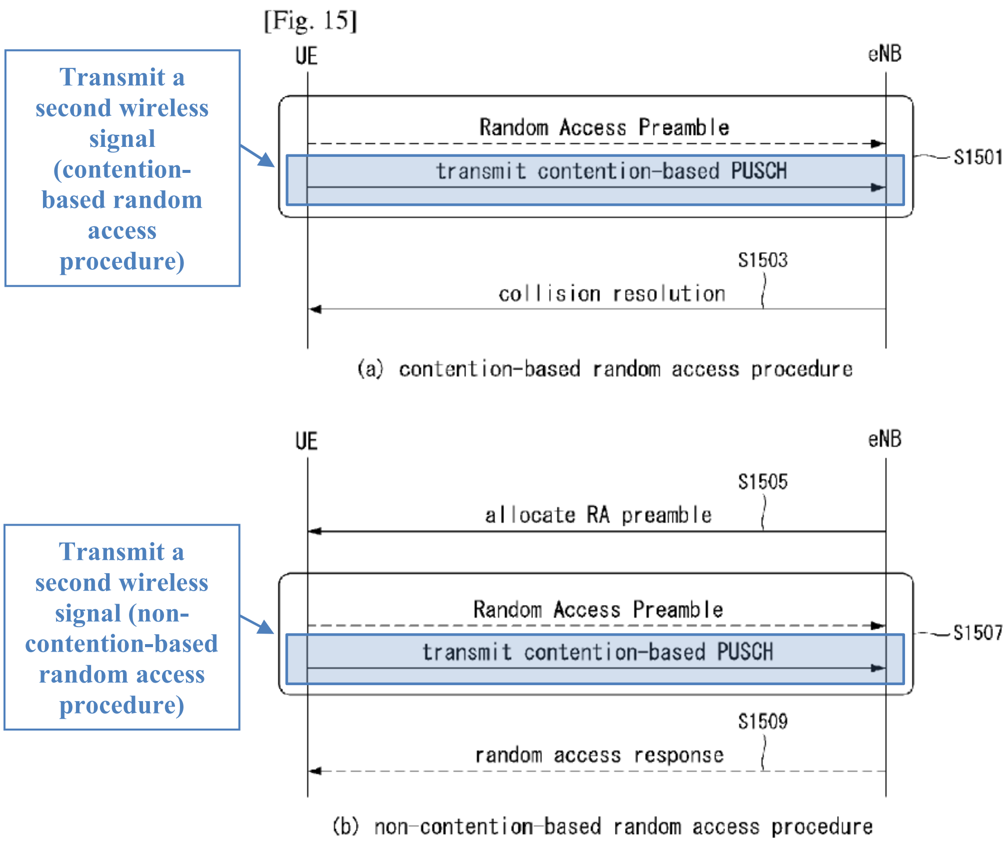
Therefore, a POSITA would have understood Lee-Freda-Ly to render

obvious [1.1]. APPLE-1003, ¶¶96-101.

[1.2]

In the first step (Step 1) of Lee's 2-step random access procedure, the UE additionally "***transmit[s] … a radio resource control (RRC) request message*** to the BS through a contention-based physical uplink shared channel (PUSCH)" ***(transmitting a second wireless signal)***. APPLE-1005, Abstract.

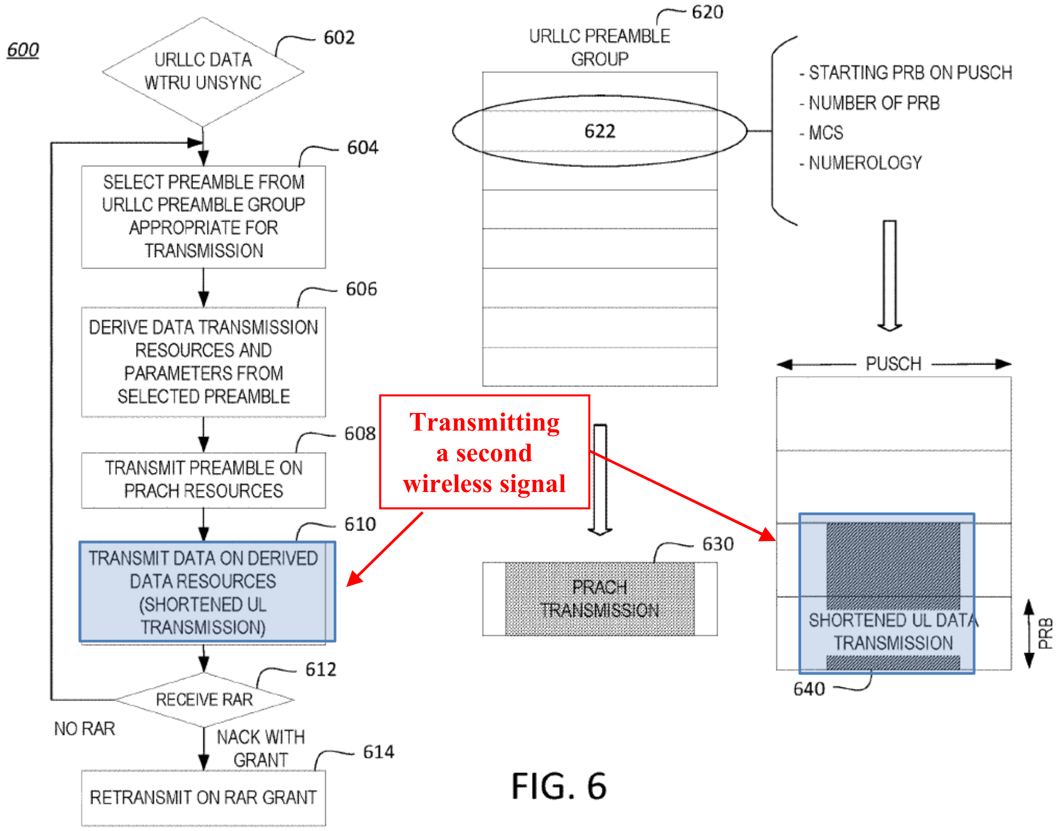
Specifically, in both the "contention-based random access procedure" and the "non-contention-based random access procedure," Lee's UE "***transmits an RRC message*** to an eNB through the CP zone" (e.g., either simultaneously with or sequentially after transmits a RACH preamble sequence through the PRACH). APPLE-1005, [0242]-[0244], [0237]-[0241], FIG. 15(a) (S1501, bottom), FIG. 15(b) (S1507, top), [0266]-[0276], FIG. 17.



<u>APPLE-1005, FIG. 15 (annotated)</u>

Lee's RRC message (PUSCH) is transmitted by the UE's "radio frequency (RF) unit" through a "radio signal" (***transmitting a second wireless signal***). APPLE-1005, [0010], [0388]; APPLE-1003, ¶105.

Similarly, Freda discloses a 2-step RACH procedure. In Freda's first step, as with Lee, the UE additionally transmits) data through a "PUSCH" ***(transmitting a second wireless signal)***. APPLE-1006, FIG. 6, [0132]; APPLE-1008, FIG. 6, [0117]; APPLE-1009, FIG. 6, [0117].



APPLE-1006, FIG. 6 (annotated)

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [1.2]; APPLE-1003, ¶¶102-106.

[1.3]

As discussed for [1.1], above, Lee's UE transmits, via a radio signal, "a ***random access preamble*** to a base station (BS)" ***(the first wireless signal)***. APPLE-1005, Abstract, [0010]. The transmitted "random access preamble" includes, and thus is generated at least in part by, a "***RACH preamble sequence***" determined by the UE ***(…is generated by a first sequence)***. APPLE-1005, [0211]-

[0214]; APPLE-1003, ¶108.

Specifically, each of Lee's UEs determines a different respective "RACH preamble sequence" ***(first sequence)*** and transmits a wireless signal including that RACH preamble sequence ***(first wireless signal)*** to the eNB. APPLE-1005, [0277] ("the UE 1 and the UE 2 transmit different RACH preamble sequences to the BS through the PRACH region allocated to the first subframe"), [0288], [0307], FIGS. 17, 19, 21.

Lee describes that, in some cases, the UE selects the RACH preamble sequence ***(first sequence)*** itself, such as by randomly selecting a RACH preamble or monitoring the RACH preamble sequences selected by neighboring UEs and selecting a RACH preamble to avoid collisions. APPLE-1005, [0283], [0304]-[0311], FIG. 21. In other cases, the UE "is allocated with the RACH preamble sequence from an eNB." APPLE-1005, [0242]-[0244], [0266]-[0276], [0286], [0300]. In either scenario, a POSITA would have found obvious that Lee's radio signal carrying the RACH preamble is generated by a RACH preamble sequence. APPLE-1003, ¶¶109-110.

Similarly, Freda discloses a 2-step RACH procedure. In Freda's first step, as with Lee, the UE transmits a preamble transmitted through a "PRACH." APPLE-1006, FIG. 6, [0132]; APPLE-1008, FIG. 6, [0117]; APPLE-1009, FIG. 6, [0117]. Further, Freda discloses the use of "[a] Preamble index (e.g., in a DCI and/or an RRC message)" to "indicate a specific preamble sequence (e.g., for dedicated signaling)" and/or to "indicate a specific preamble group and/or range (e.g., for shared signaling)." APPLE-1006, [0141]; APPLE-1008, [0126]; APPLE-1009, [0126]. The transmitted "preamble" ***(the first wireless signal)*** is thus generated at least in part by, a "preamble sequence" indicated by a "preamble index." ***(…is generated by a first sequence)***. APPLE-1003, ¶107-112.

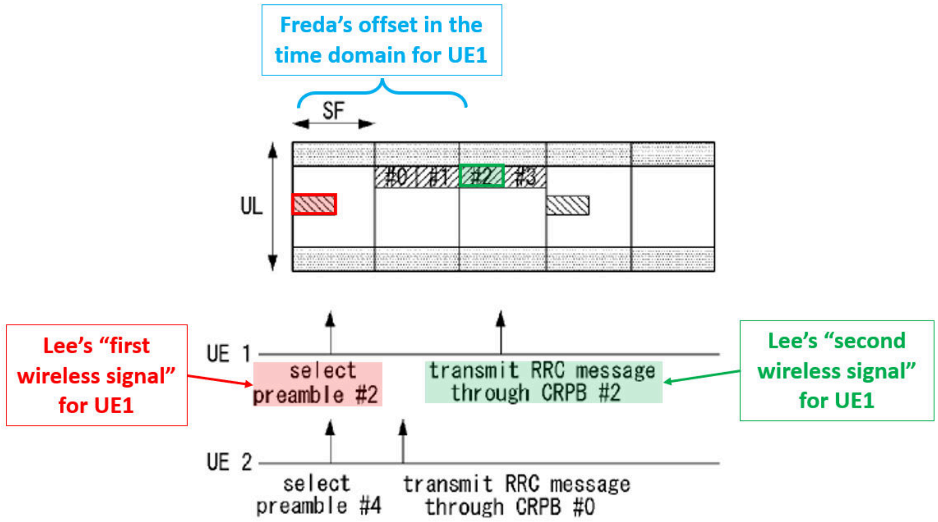
[1.4]

As discussed for [1.1] and [1.2], in the first step (Step 1) of Lee's 2-step random access procedure, the UE transmits two signals, (i) "a random access preamble" through the PRACH ***(the first wireless signal)*** and (ii) an "RRC request message" through the PUSCH ***(the second wireless signal)***. APPLE-1005, Abstract.

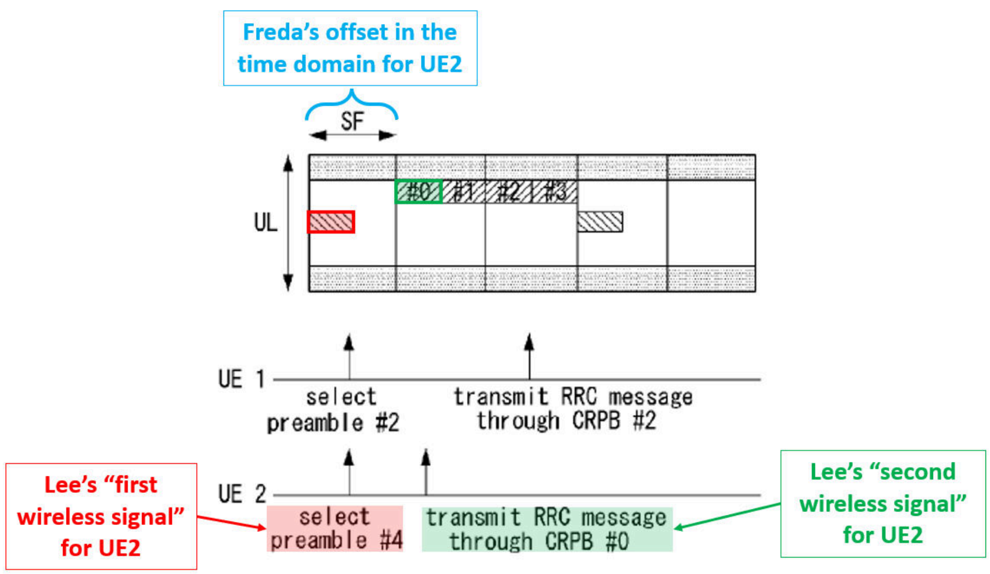
Freda provides details that inform designation of the time interval between (i) the starting time instant of the transmission of the RACH preamble and (ii) the starting time instant of the transmission of the RRC message. APPLE-1003, ¶117. Specifically, as discussed in section IV.A.3, the Lee-Freda system would implement Lee's adaptive PUSCH resource allocation using Freda's time-domain offset, which is determined using the PRACH preamble as taught by Freda. APPLE-1003, ¶117.

For example, as discussed in sections IV.A.2 and 3, *supra*, Freda defines an "offset" ***(first time interval)*** between "start times" of transmissions of the RACH preamble and the RRC message (PUSCH), and Freda further discloses that the UE can determine this offset using the selected RACH preamble ***(first wireless signal)***. The Lee-Freda device would implement Freda's teaching of "[a] relationship between preamble and data … in a time domain," and specifically, "a start time of a transmission of a preamble and a start time of a transmission of a data portion may be ***offset*** from each other by a specific amount of time" ***(a first time interval between the first time instant and the second time instant)***. APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0192]. Further, as taught by Freda, this "offset" can be "indicated by a preamble." APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0193]. For instance, the Lee-Freda system "may determine an ***offset in time*** … based on a selected preamble (e.g. a preamble may be associated with a specific offset to be used, where an association may be fixed or configured by a network)" as taught by Freda (***the first wireless signal is used to determine a first time interval***). APPLE-1006, [0211]; APPLE-1008, [0186]; APPLE-1009, [0194].

An example of this is shown in Diagrams C and D, below, which are annotated versions of Lee's FIG. 19(a) showing two different UEs using two different time-domain offsets (as taught by Freda) based on the UE's selection of its preamble. APPLE-1005, FIG. 19(a); APPLE-1003, ¶¶118-119.



<u>Diagram C</u>

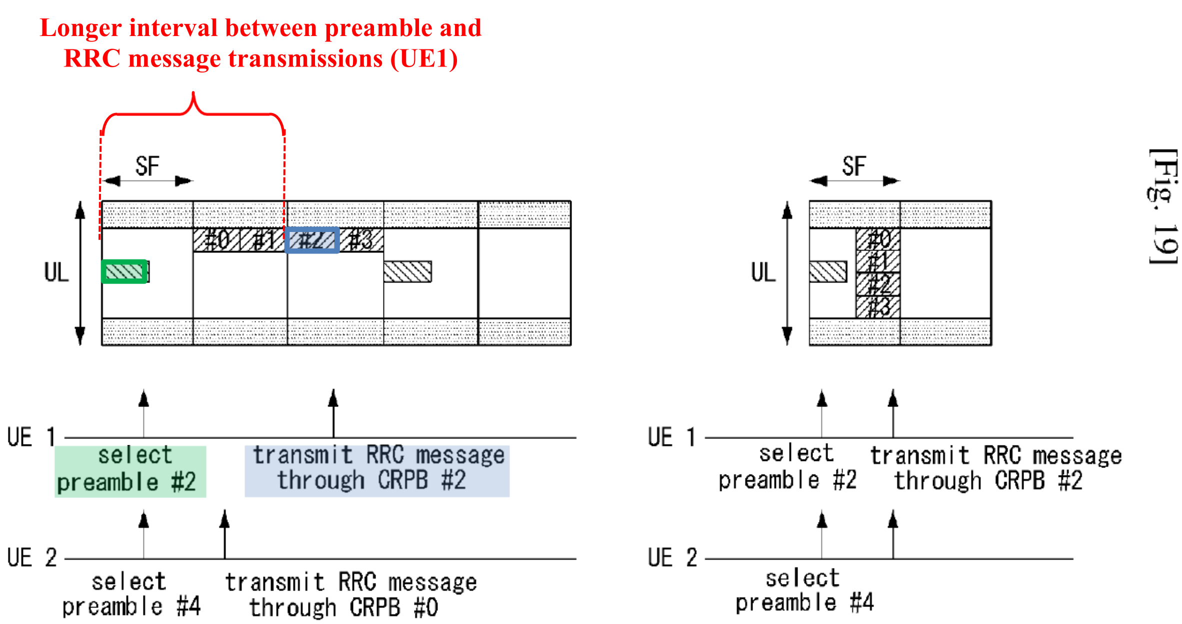


<u>Diagram D</u>

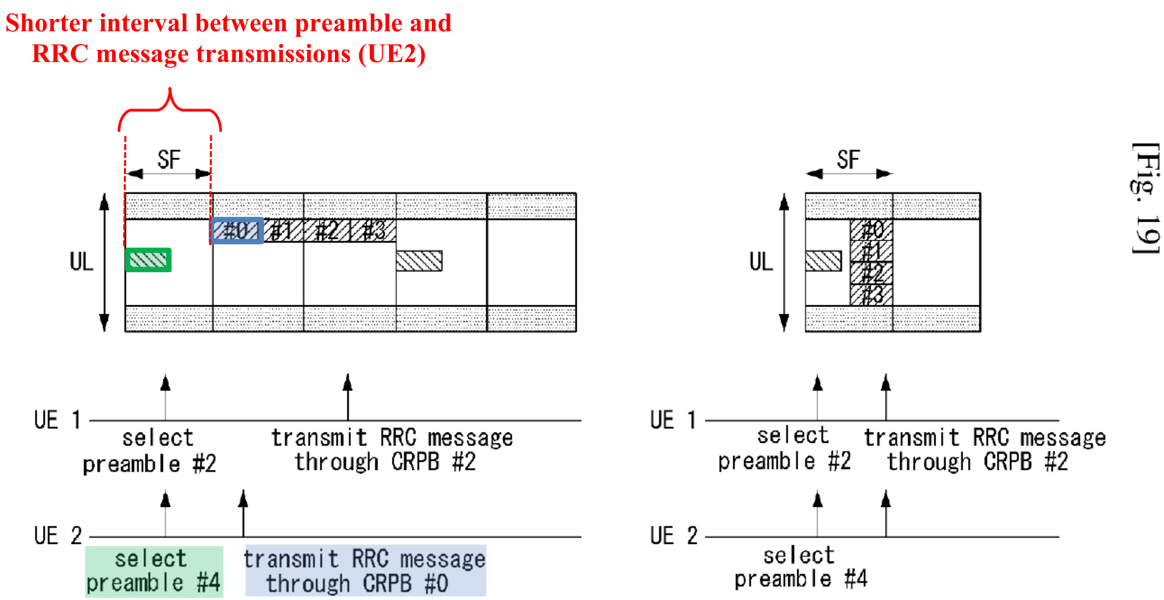
Furthermore, the starting time instant at which the Lee-Freda UE transmits the random access preamble ***(the first time instant…)*** occurs prior to ***(…is earlier than…)*** the starting time instant at which the UE transmits the RRC request message ***(… the second time instant)***. APPLE-1005, Abstract; [0237]-[0244],

FIGS. 15, 17, 19; APPLE-1003, ¶120.

In addition to Freda's explicit designation of a time-domain "offset" discussed above, Lee itself also teaches that the UE adjusts the timing between the PRACH preamble transmission and the RRC message (PUSCH) transmission. APPLE-1003, ¶121. For example, Lee discloses allocating a CP zone for the RRC PUSCH transmission either in the same subframe or in different subframes (intra-subframe or inter-subframe) as the PRACH preamble, and then selecting a particular CPRB for the RRC PUSCH transmission within the CP zone depending on the PRACH preamble. APPLE-1005, [0206], [0213], [0218], [0220], [0222], [0237], [0282]-[0287], FIG. 19(a) (reproduced below, annotated).



APPLE-1005, FIG. 19(a) (annotated, showing the time interval for UE1)



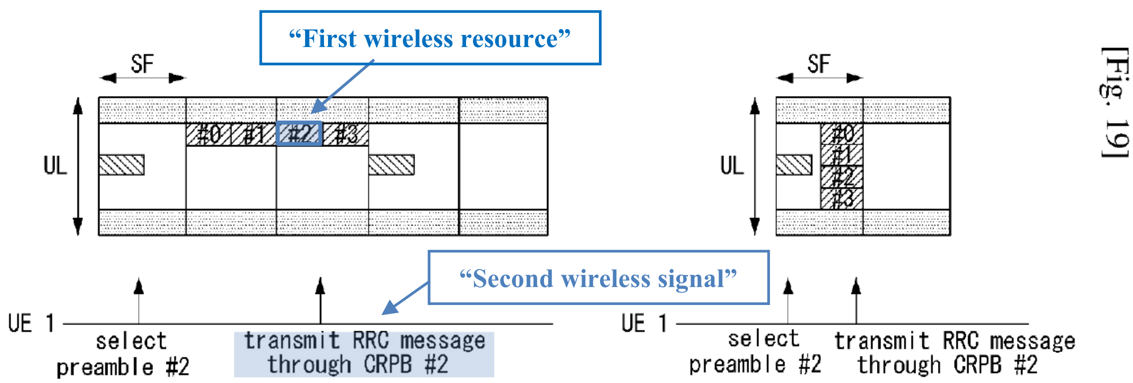
APPLE-1005, FIG. 19 (annotated, showing the time interval for UE2)

Therefore, Lee itself dictates the ***first time interval*** by establishing when the RRC (PUSCH) message (***second wireless signal***) will be transmitted relative to the PRACH preamble (***first wireless signal***). APPLE-1003, ¶122. In particular, Lee's designation of a resource block (CPRB) for the RRC message (*second wireless signal*) depends on the selection of the PRACH preamble (*first wireless signal*), and this renders obvious a determination of the time interval between the PRACH preamble and the RRC message, by using the PRACH preamble ("***the first wireless signal is used to determine a first time interval***"). APPLE-1003, ¶113-123.

[1.5]

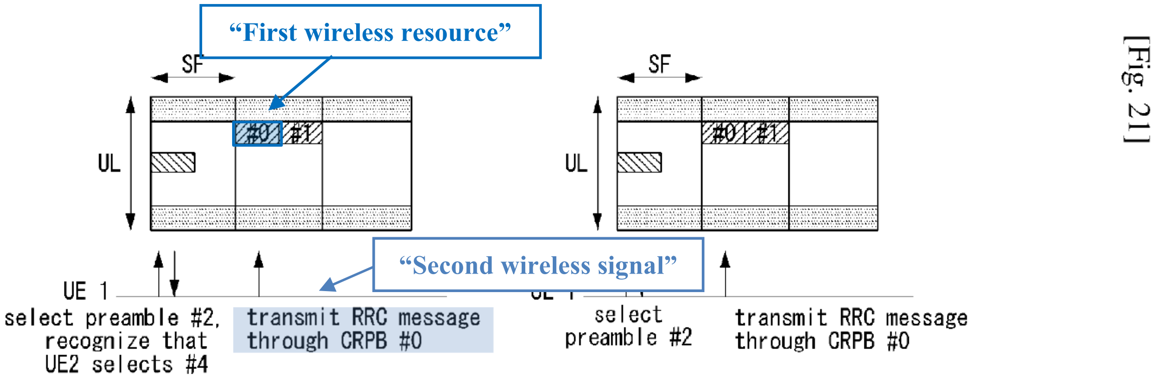
As discussed in sections IV.A.1 and 3, *supra*, Lee's UE transmits the RRC message ***(second wireless signal)*** using a "contention-based PUSCH resource block" ("CPRB") ***(…occupies a first wireless resource)***[1] that is selected based the RACH preamble. APPLE-1005, [0282]-[0287], [0203].

For example, in Lee's FIG. 19(a), below, the RRC message of UE1 ***(second wireless signal)*** occupies "CPRB #2" ***(…occupies a first wireless resource)***. APPLE-1005, [0281]-[0290]. As another example, in Lee's FIG. 21(a), below, the RRC message of UE1 ***(second wireless signal)*** occupies "CPRB #0" ***(…occupies a first wireless source)***. *Id.*, [0304]-[0311].



APPLE-1005, FIG. 19(a) (annotated)

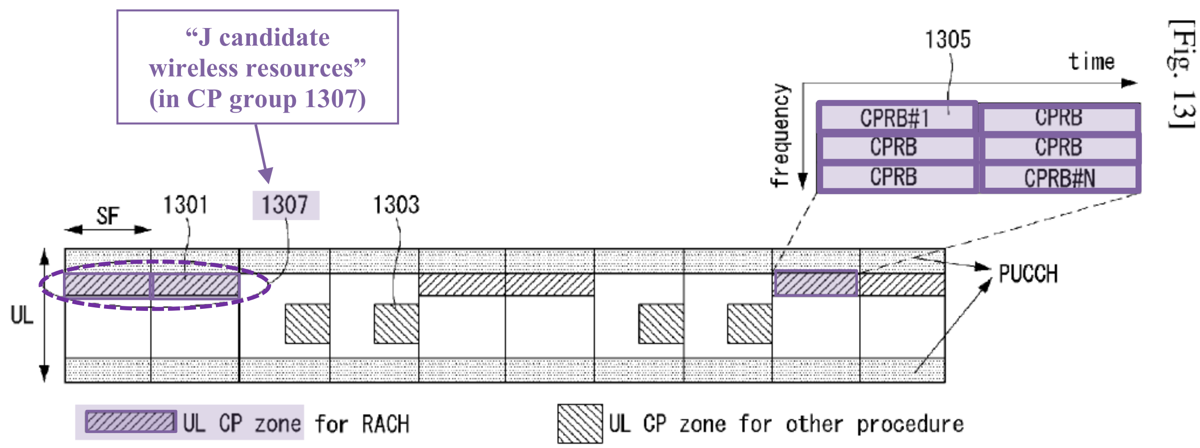
[1] The word "*first*" here is used in the '721 patent merely as a label, rather than a limiting expression. *See, e.g.*, APPLE-1001, FIGS. 4 and 5 (showing the "first wireless resource" as an arbitrary resource among the J wireless resources).



APPLE-1005, FIG. 21(a) (annotated)

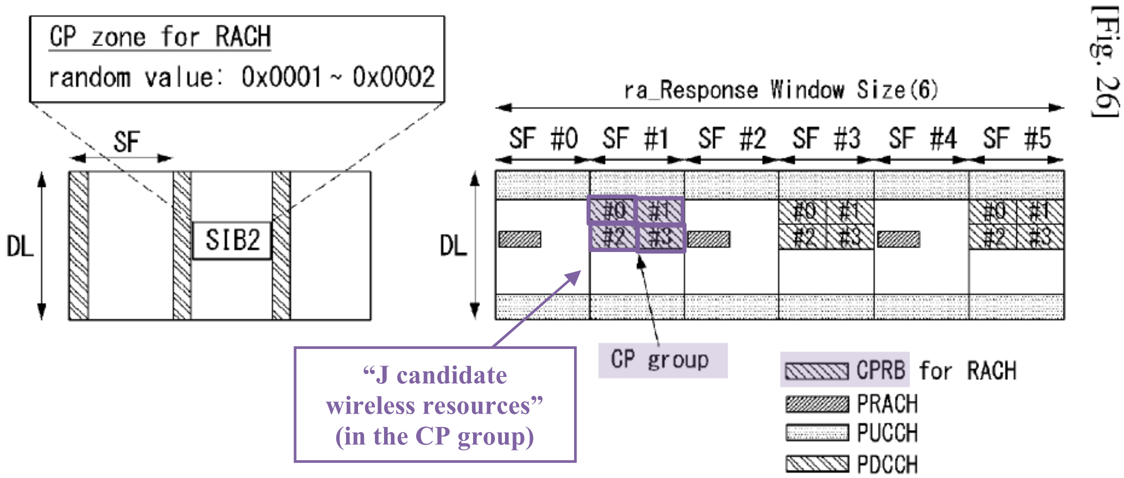
Further, Lee defines a "contention-based PUSCH group" ("CP group") as "comprised of one or more CP zone(s)" where the CP group is "a set of candidate CPRB(s) that an arbitrary UE may occupy." APPLE-1005, [0209]. Lee describes a CP group including "M" CP zones, with each CP zone including "N" CPRBs. APPLE-1005, [0223]. Thus, Lee's CPRB ***(first wireless resource)*** <u>is selected</u> from N*M individual CPRBs ***(…is one of J candidate wireless resources)*** in the "CP group." APPLE-1005, [0223]; APPLE-1003, ¶128. For example, Lee explains "in case that one CP zone is comprised of four CPRBs, and one CP group is comprised of two CP zones, a UE has candidate CPRBs as many as N*M=8" ***(J candidate wireless resources)***. APPLE-1005, [0223], [0355], [0365], [0367], [0376], FIGS. 22, 23, 25-27.

FIG. 13 shows an example of Lee's hierarchical resource structure for RRC message transmission, where CP group 1307 includes two CP zones 1301, and each CP zone 1301 includes N CPRBs 1305, such that the CP group 1307 has a total of 2*N CPRBs (thus, J=2*N for this example's ***J candidate wireless resources)***. APPLE-1005, [0203]-[0212]. Lee explains that the example of FIG. 13 can be used with either the intra- or inter-subframe scheme, and is thus compatible with FIG. 14. APPLE-1005, [0209]-[0213]; APPLE-1003, ¶129.



APPLE-1005, FIG. 13 (annotated)

FIG. 26 (reproduced below, annotated) shows another example of Lee's hierarchical resource structure, where the "CP group" includes four CPRBs (thus, J=4 for this example's ***J candidate wireless resources***). APPLE-1005, [0351]-[0361]. The example of FIG. 26 shows an inter-subframe scheme, and is thus compatible with FIG. 14. APPLE-1003, 130.



APPLE-1005, FIG. 26 (annotated)

Here and elsewhere, Lee contemplates an RRC message ***(the second wireless signal)*** occupying a CPRB ***(a first wireless resource)***, which is one of N*M CPRBs ***(one of J candidate wireless resources)*** in a CP group, where N*M can be, for example, equal to 4 ***(the J is a positive integer)***, as taught by Lee. APPLE-1003, ¶131. Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [1.5]; APPLE-1003, ¶¶124-131.

[1.6]

As discussed for [1.4], Lee and Freda render obvious determining the time interval between (i) the starting time instant of the transmission of the random access preamble through the PRACH and (ii) the start time instant of the transmission of the RRC request message through the PUSCH ***(the first time interval)***. APPLE-1003, ¶133. Further, as discussed for [1.5], Lee's RRC request message is transmitted using a corresponding CPRB ***(the first wireless resource)*** that is selected from a set of M*N CPRBs ***(J candidate wireless resources)*** in a CP group. APPLE-1003, ¶134.

Lee-Freda further renders obvious using the time interval to determine the CPRB for transmitting the RRC request message from among the set of M*N CPRBs. APPLE-1003, ¶135. As discussed in sections IV.A.2 and 3, above, the Lee-Freda system uses a time-domain "offset" ***(first time interval)*** and frequency-domain offset to select a time-frequency resource block ***(first wireless resource)*** for the PUSCH data ***(second wireless signal)***, as taught by Freda. In the Lee-Freda system, "resources used for a preamble and the resources used for data may have some association, such as an implicit association" and that these association rules can be a "time and/or frequency offset" between preamble resources and data resources, as taught by Freda. APPLE-1006, [0147], [0209]; APPLE-1008, [0132], [0184]; APPLE-1009, [0132], [0192]; APPLE-1003, ¶135.

Specifically, in a Lee-Freda system, a time-domain offset would be used with respect to a "start time" that "may correspond to … [a] first symbol of a corresponding PRB region" of the PUSCH data (Lee's RRC message). APPLE-1006, [0209]; APPLE-1008, [0184]; APPLE-1009, [0192]; APPLE-1003, ¶136. In addition, the Lee-Freda system would use a frequency-domain offset in which "a first PRB of a transmission of a preamble and a ***first PRB of a transmission of a***

data portion may be offset from each other by a specific amount of PRBs," as taught by Freda. APPLE-1006, [0210]; APPLE-1008, [0185]; APPLE-1009, [0193]; APPLE-1003, ¶136. As such, the Lee-Freda system uses Freda's time-domain offset (***first time interval***) to determine a "PRB region" for transmitting the PUSCH data (Lee's RRC message), and further uses Freda's frequency-domain offset to determine a specific PRB (***the first wireless resource***) within the PRB region for transmitting the PUSCH data. APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194]; APPLE-1003, ¶136.

Therefore, in view of Freda, a POSITA would have found it obvious to use Freda's time-domain offset ***(first time interval)*** and Freda's frequency-domain offset to determine a CPRB ***(the first wireless resource)*** out of Lee's M*N CPRBs in a CP group ***(out of the J candidate wireless resources)***. APPLE-1003, ¶138.

Accordingly, a POSITA would have understood Lee-Freda-Ly to render obvious [1.6]; APPLE-1003, ¶¶132-138.

[1.7]

A POSITA would have understood, as of the Critical Date, that it was notoriously well-known to generate a RACH preamble ***(the first sequence)*** using a Zadoff-Chu sequence. APPLE-1003, ¶¶139-141. Indeed, such knowledge is evidenced by Ly, as discussed in sections IV.A.4 and 5, above. A POSITA would have found to obvious to implement Lee's "RACH preamble sequence" ***(the first***

sequence) using ***a Zadoff-Chu (ZC) sequence*** as taught by Ly. APPLE-1003, ¶140. In view of Ly, a POSITA would have understood that a network can employ a set of "random access preamble sequences with cyclic shifts" for a "random access procedure," and that this set "may include 64 Zadoff-Chu sequences." APPLE-1007, [0083]-[0085]; APPLE-1010, [0079]-[0081]; APPLE-1003, ¶140-141.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [1.7]; APPLE-1003, ¶¶139-141.

[1.8]

As discussed in section IV.A.1 and for [1.1], Lee describes that the UE "transmit[s] … a random access preamble to a base station (BS)" ***(first wireless signal)***. APPLE-1005, Abstract. Specifically, in a "contention-based random access procedure," Lee's UE "transmits a RACH preamble sequence through the PRACH" ***(a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH)).*** APPLE-1005, [0237]-[0241], FIG. 15(a) (S1501, top)). Alternatively, in a "non-contention-based random access procedure," Lee's UE "transmits a RACH preamble sequence through the PRACH" after the UE has been "allocated with the RACH preamble sequence from [the] eNB" ***(a transport channel corresponding to the first wireless signal is a Random Access Channel (RACH))***. APPLE-1005, [0242]-[0244], FIG. 15(b)

(S1507, top)), [0266]-[0276], FIG. 17.

Further, as discussed in section IV.A.1 and for [1.2], Lee describes that the UE "transmit[s] … a radio resource control (RRC) request message" ***(second wireless signal)*** through a "contention-based physical uplink shared channel (PUSCH) resource block" ***(a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH)***). APPLE-1005, Abstract. Specifically, in both of Lee's "contention-based random access procedure" and in Lee's "non-contention-based random access procedure," Lee's UE transmits a "contention-based PUSCH" ***(a physical channel corresponding to the second wireless signal is a Physical Uplink Shared Channel (PUSCH)).*** APPLE-1005, [0237], [0241]-[0244], FIG. 15(a) (S1501, bottom), FIG. 15(b) (S1507, bottom)), [0266]-[0276], FIG. 17. Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [1.8]; APPLE-1003, ¶¶142-144.

[1.9]

As discussed in section IV.A.1 and explained below, Lee's UE uses its RACH preamble ***(first wireless signal)*** to determine whether resources are available for Lee's RRC message ***(second wireless signal)***, and if no resources are available then the UE abandons the RRC message. APPLE-1003, ¶146.

Thus, Lee resolves to abandon some instances of RRC message (***second wireless signal***) transmission, particularly when a relatively high number of RRC messages compete for a relatively limited number of CPRBs. APPLE-1003, ¶147. In so abandoning, Lee determines that the implicated RRC messages (***second wireless signals***) are **not** transmitted, and by implication, those RRC message not abandoned have been determined by Lee to be transmitted. APPLE-1003, ¶147.

In particular, as discussed with respect to [1.4], Lee's UE minimizes failure and/or collision of the RRC message ***(second wireless signal)*** transmission by selecting a "contention-based PUSCH resource block" ("CPRB") for the RRC message based on the RACH preamble ***(first wireless signal)***. APPLE-1005, [0282]-[0287].

Further, Lee's describes implementations of "full duplex relay (FDR) UEs" in which CPRBs are allocated to each of several UEs "in order of preamble sequences" (e.g., "according to descending order or ascending order of the transmitted RACH preamble sequence number"). APPLE-1005, [0306]. Further, if there are an insufficient number of CPRBs to allocate to all of the UEs, then UEs with larger-valued RACH preamble sequence numbers are configured to "abandon[] RRC message transmission to the eNB at the corresponding point in time (subframe). APPLE-1005, [0307]-[0310].

For example, referring to FIG. 21, Lee describes a scenario in which three UEs compete for allocation of two CPRBs based on their transmitted preamble sequences. APPLE-1005, [0304]-[0311]. As only two CPRBs are available for allocation, there are no CPRBs available for allocation of the UE having the highest-valued RACH preamble sequence number (UE 3 which selected "preamble sequence #8"), and that UE "abandons RRC message transmission to the eNB at the corresponding point in time." APPLE-1005, [0309]-[0310].

Therefore, Lee's discloses that the RACH preamble sequence ***(first wireless signal)*** is used to determine whether to transmit the RRC (PUSCH) message ***(…is used to determine whether the second wireless signal is transmitted or not)***. Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [1.9]; APPLE-1003, ¶¶145-151.

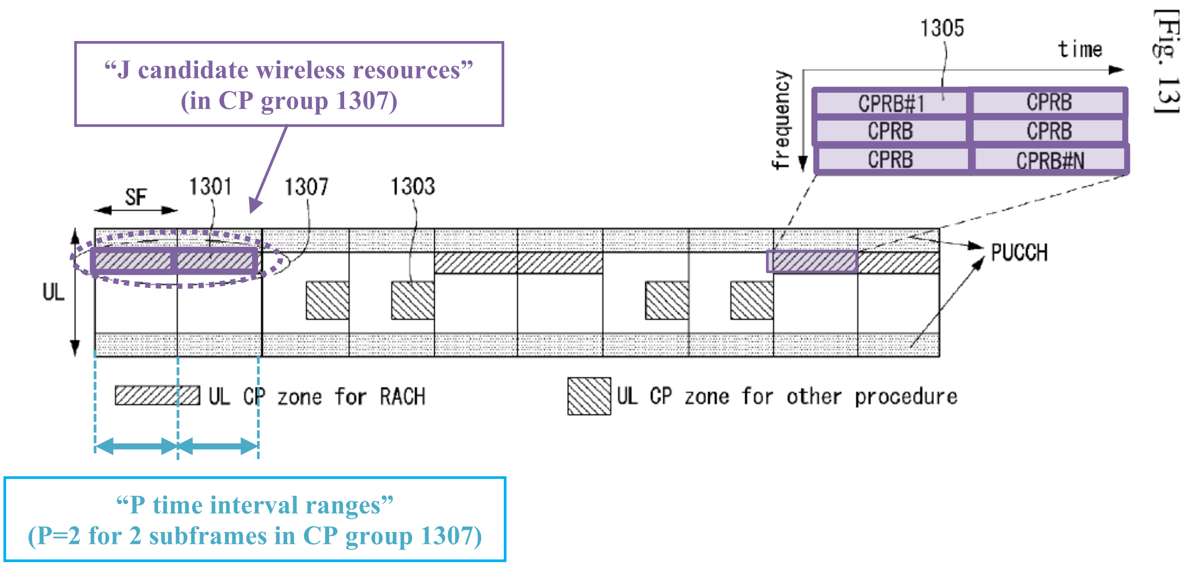
(b) **Claim 2**

[2.1]

As discussed for [1.5], Lee's CPRB ***(first wireless resource)*** is selected from among M*N individual CPRBs ***(J candidate wireless resources)*** in the "CP group" (where each CP group has M CP zones, and each CP zone has N CPRBs). "For example, in case that one CP zone is comprised of four CPRBs, and one CP group is comprised of two CP zones, a UE has candidate CPRBs as many as N*M=8." APPLE-1005, [0223], [0355], [0365], [0367], [0376], FIGS. 22, 23, 25-27.

FIG. 13 shows an example of Lee's hierarchical resource structure. In this example, CP group 1307 includes two CP zones (including CP zone 1301), and each CP zone includes N CPRBs (including CPRB 1305). APPLE-1005, [0203]-

[0212]. The time duration of each CP zone can be configured to span "n (n>=1) subframes." APPLE-1005, [0204]. In the example of FIG. 13, shown below, CP group 1307 (including the claimed "***J candidate wireless resources***") corresponds to 2 subframes (***P time interval range***). APPLE-1005, FIG. 13; APPLE-1003, ¶¶154-155.



APPLE-1005, FIG. 13 (annotated)

In general, according to Lee, each "CP group" (e.g., CP group 1307) having M*N individual CPRBs ***(J candidate wireless resources)*** includes an integer number (M) of "CP zones" (e.g., M=2 CP zones in CP group 1307) where each CP zone can include "n >= 1" subframes (***time interval ranges***). APPLE-1005, FIG. 13, [0204]; APPLE-1003, ¶156. Furthermore, as shown in FIG. 13, the subframes ("SF") do not overlap with each other. APPLE-1005, FIG. 4, 13, 14, 17-19, 21-24. The M*N CPRBs ***(J candidate wireless resources)*** in a CP group correspond to n*M non-overlapping subframes, where n>=1 and M can be, for example, equal to 2 ***(…correspond to P time interval ranges, where any two time interval ranges of the P time interval ranges do not overlap, and where the P is a positive integer greater than 1)***. Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [2.1]; APPLE-1003, ¶¶153-156.

[2.2]

In explaining the claim language "*the first time interval* ***belongs to*** *a target time interval range*" of [2.2], the '721 patent describes the ending point of the first time interval falling within the target time interval range. The '721 patent shows an example of "a relationship between the first time interval and the target time interval" in FIG. 3, where "the unfilled rectangle represents one time interval range in P time interval ranges, and the rectangle filled by slashes represents the target interval range." APPLE-1001, 14:30-35.

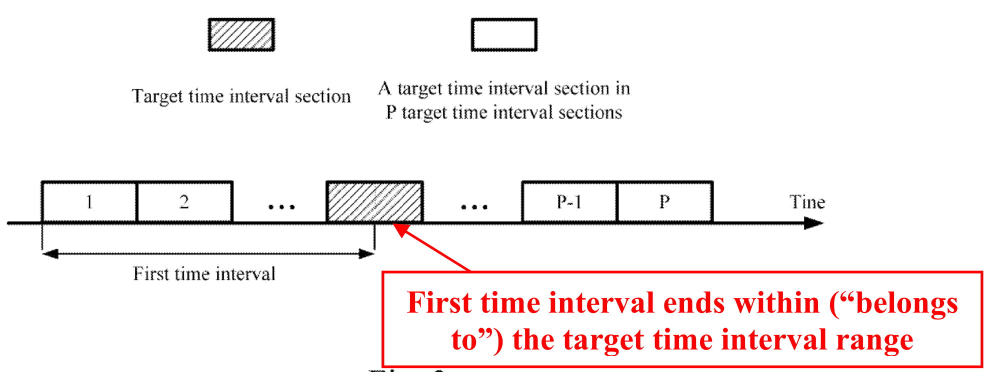


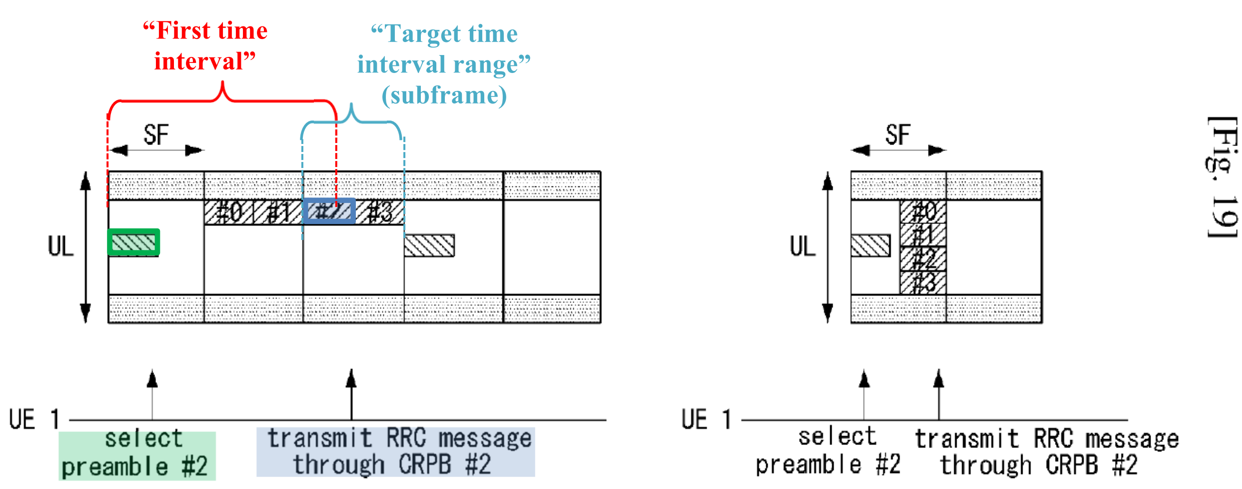
Fig. 3

APPLE-1001, FIG. 3 (annotated)

The ’721 patent characterizes FIG. 3 as showing “[t]he first time interval **belongs to** a target time interval range.” APPLE-1001, 14:38-39. Given this description, a POSITA would have understood that according to the ’721 patent, the first time interval “belongs to” the target time interval range if the first time interval ends within the target time interval range. APPLE-1001, 14:35-40, 14:41-42 (“one time interval range refers to a continuous range of one time interval”), FIG. 3; APPLE-1003, ¶¶158-159. As such, a POSITA would have understood the ’721 describes a “*time interval **range***” as a continuous range of possible end points of a time interval. APPLE-1003, ¶159.

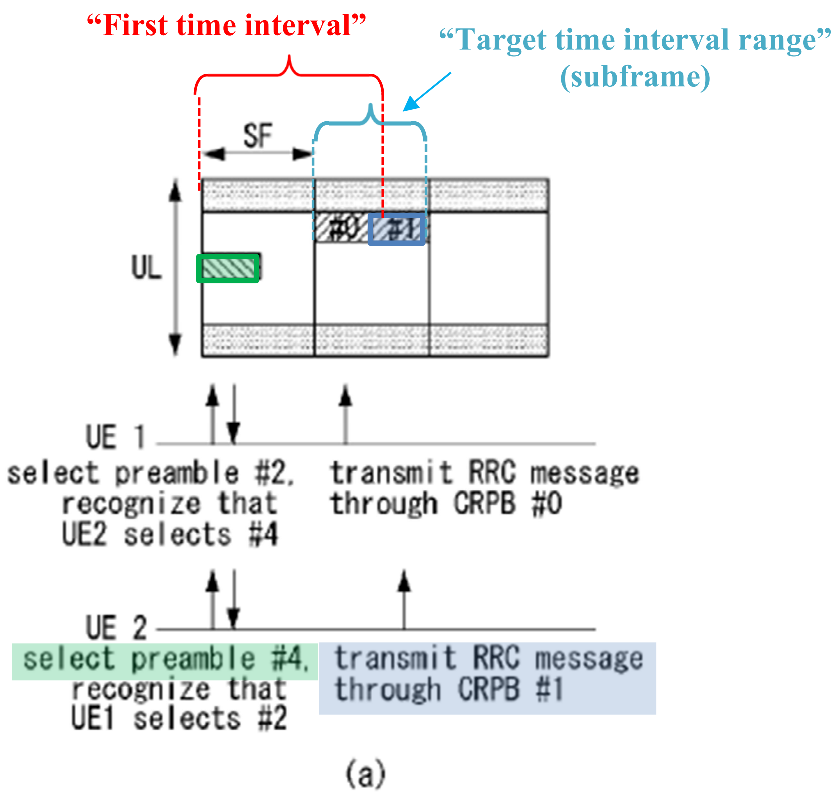
Lee in combination with Freda discloses a relationship between a *first time interval* and a *target time interval range*. APPLE-1003, ¶160. As discussed for [1.4], Lee-Freda renders obvious determining the time interval between (i) the starting time instant of the transmission of the random access preamble through the PRACH and (ii) the start time instant of the transmission of the RRC request message through the PUSCH ***(the first time interval).*** Further, in view of the discussion in [2.1], a POSITA would have understood that this first time interval “belongs to” (i.e., ends within) one of the n*M subframes (***P time interval ranges***) in Lee’s CP group ***(…belongs to a target time interval range, where the target time interval range is a time interval range of the P time interval ranges***). APPLE-1003, ¶161. In particular, when the UE transmits an RRC message over the PUSCH, Lee discloses that the transmission is performed using a particular subframe ***(target time interval range)*** within a CP zone from among the CP group.

For example, FIG. 19(a) shows a CP zone with four CPRBs (#0 – #3) spanning two subframes. "UE 1" transmits a RRC message using "CPRB #2" in the second subframe (spanning CPRBs #2 and #3) of the CP zone. APPLE-1005, [0287]-[0291]. Because the RRC message is transmitted in CPRB #2, a POSITA would have understood that in the Lee-Freda combination, the time interval between the starting time of the PRACH preamble transmission and the starting time of the RRC message transmission (***first time interval***) ends in the second subframe (***belongs to a target time interval range***) of Lee's CP zone. APPLE-1003, ¶¶162-162.



APPLE-1005, FIG. 19(a) (annotated)

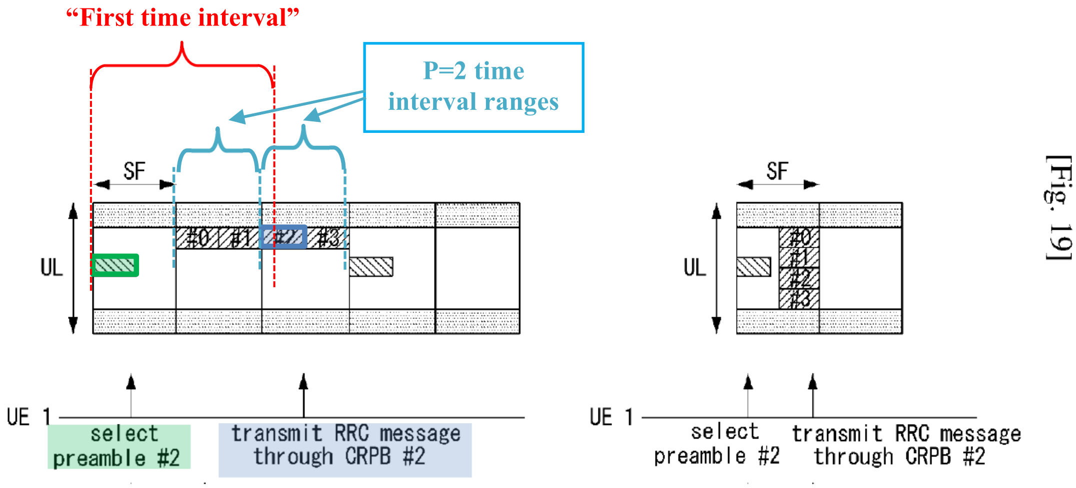
As another example, FIG. 21(a) shows a CP zone with two CPRBs (#0 and #1) in a single subframe. "UE 2" transmits a RRC message using "CPRB #1" which is the second CPRB in this single subframe of the CP zone. APPLE-1005, [0309]. Therefore, because the RRC message is transmitted in CPRB #1, a POSITA would have understood that in the Lee-Freda combination, the time interval between the starting time of the PRACH preamble transmission and the starting time of the RRC message transmission (***first time interval***) ends in the single subframe (***belongs to a target time interval range***) of the CP zone. APPLE-1003, ¶163. The example of FIG. 21(a) shows an inter-subframe scheme, details of which are provided with respect to Lee's FIG. 14. APPLE-1003, ¶163.



APPLE-1005, FIG. 21(a) (annotated)

That is, each of Lee's CP zones in the Lee-Freda combination has a particular subframe corresponding to a range of possible times where the time interval between the starting time instant of the PRACH preamble transmission and starting time instant of the RRC message transmission (***first time interval***) can end, and this time interval "belongs to" a particular subframe (***target time interval range***) within the CP zone by virtue of the time interval ending within that subframe. APPLE-1003, ¶164.

Further, a POSITA would have understood that the particular subframe in which the RRC message is transmitted ***(target time interval range)*** is one of the time interval ranges from among multiple subframes ***(… is a time interval range of the P time interval ranges***) corresponding to a CP group. APPLE-1003, ¶165. For example, Lee's FIG. 19 depicts a CP group have a single CP zone spanning 2 subframes (***P time interval ranges***), where each subframe has two CPRBs and CPRB #2 (in the second subframe) is used for transmitting the RRC message.



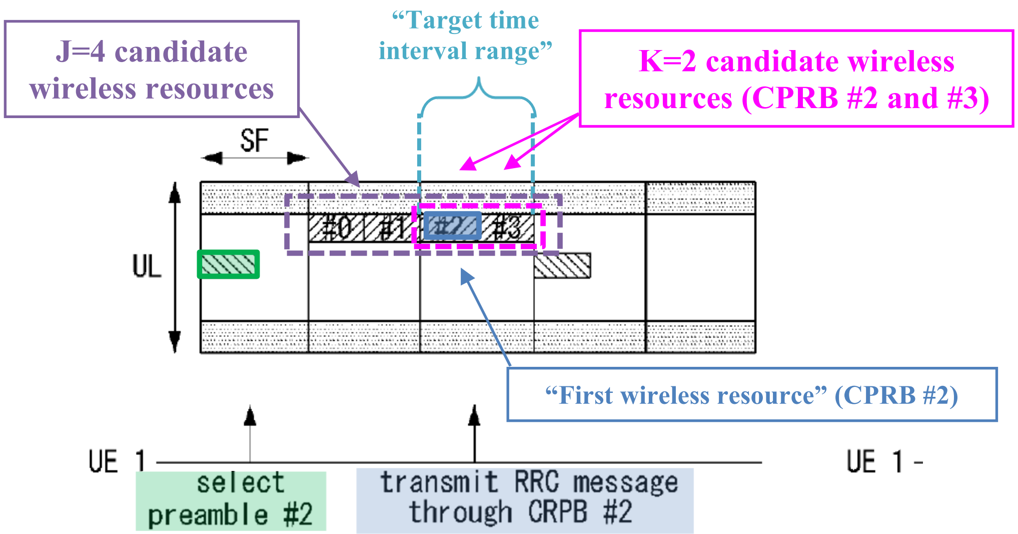
APPLE-1005, FIG. 19 (annotated)

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [2.2]; APPLE-1003, ¶¶157-166.

[2.3]

As discussed for [2.2], a POSITA would have understood or found obvious that Lee's ***first time interval*** "belongs to" one of the subframes ***(target time interval range)*** in Lee's CP group. APPLE-1003, ¶¶167-168.

For instance, in Lee's FIG. 19(a), "UE1" transmits a RRC message using "CPRB #2," which falls within the second "CP zone" or subframe spanning "CPRB #2" and "CPRB #3." APPLE-1005, [0287]-[0291], FIG. 13 (depicting each "CP group" as having two "CP zones" or subframes).



APPLE-1005, FIG. 19(a) (annotated)

In this example, Lee's second subframe ***(the target time interval range)*** in the CP zone corresponds to two CPRBs (#2, #3) ***(…corresponds to K candidate wireless resource(s))*** from among the four CPRBs, (#0, #1, #2, #3) in the CP group ***(…out of the J candidate wireless resources)*** and the number of CPRBs in the second subframe (K=2) of the CP group is a positive integer smaller than or equal to the total number of CPRBs in the CP group (J=4) ***(the K is a positive integer smaller than or equal to the J)***. APPLE-1005, FIG. 19(a); APPLE-1003, ¶¶169-170. Further, CPRB #2 in which the RRC message is transmitted ***(the first wireless resource)*** is one of the two CPRBs of the second subframe ***(…is one of the K candidate wireless resource(s))*** of the CP zone in the CP group. APPLE-1005, FIG. 19(a); APPLE-1003, ¶170.

Therefore, a POSITA would have understood Lee-Freda-Ly to render

obvious [2.3]; APPLE-1003, ¶¶167-171.

[2.4]

As discussed for [2.1], a POSITA would have understood that Lee's RRC message is transmitted within a particular subframe ***(target time interval range)*** which is one of multiple subframes corresponding to a CP group ***(… is a time interval range of the P time interval ranges)***; APPLE-1003, ¶172-173.

Further, as explained below, Lee discloses that each of the "CP zones" and "CP groups" is configured by the eNB. APPLE-1003, ¶174. Thus, it would have been obvious to a POSITA that Lee specifically configures the number of subframes (time interval ranges) spanned by a CP group ***(<u>P is configured by network</u>)***. APPLE-1003, ¶174. Specifically, Lee discloses that "[t]he CP zone, the CPRB and the CP group described above are predefined in a specific cell" and that "an **eNB** of the corresponding cell **transmits** the **configuration information** for the contention-based radio resource to a UE in order to notify that the contention-based radio resource is **configured**." APPLE-1005, [0220]. This configuration information can include "the UL resource information in which the CP zone is configured," "information for time/frequency resource domain in which the CP zone is configured," "the number (N) of CPRBs constructing one CP zone," and "the number (M) of CP zones that attempt to occupy resources by an arbitrary UE." APPLE-1005, [0220]-[0223]. Lee explains that "CP zones (1301, 1303) may be **configured** to be comprised of the same pattern **within n (n>=1) subframes** (or m (m>=1) radio frames)." APPLE-1005, [0204]; APPLE-1003, ¶174.

In view of Lee, a POSITA would have understood or found obvious that a network can provide "predefined" configurations to a UE regarding each of the CP groups, CP zones, and subframes for the CP zones, and that such configuration can signal at least "information for time/frequency resource domain in which the CP zone is configured (e.g., the number of "CP zones" or subframes in each "CP group") ***(P is configured by network)***. APPLE-1003, ¶175. Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [2.4]; APPLE-1003, ¶¶172-175.

(c) **Claim 3**

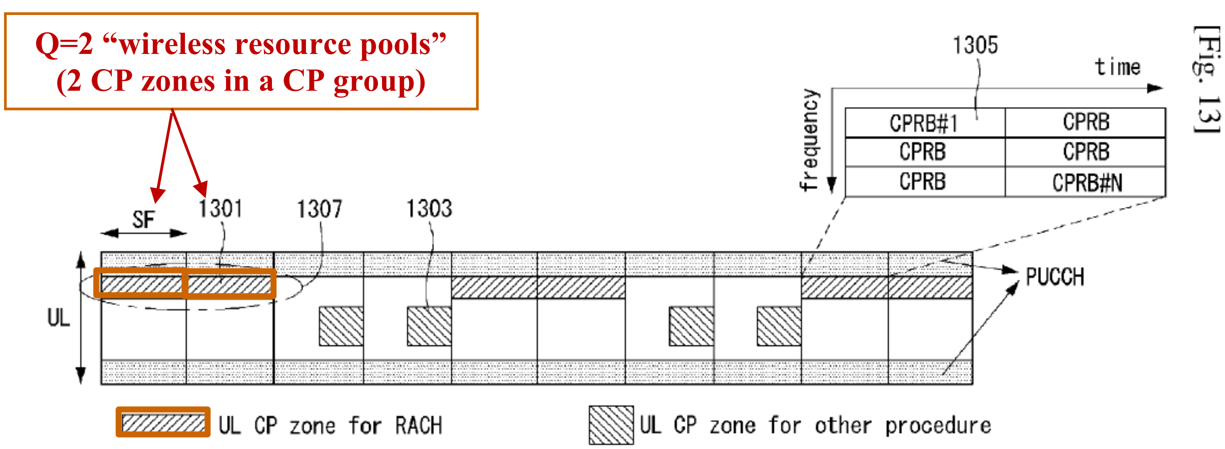
[3.1]

Lee's UE receives, from the base station, "configuration information" ***(receiving a first signaling)*** for a "contention-based radio resource," such as configuration information regarding "[t]he CP zone, the CPRB and the CP group." APPLE-1005, [0220]. Lee's UE can receive this configuration information through various types of signaling, such as "a broadcasting message, transmitted with a unicast message for a specific UE, or transmitted with a multicast message" (APPLE-1005, [0225]) or "through a master information block (MIB)" (APPLE-

1005, [0226]) or "through the existing system information block (SIB)-x" (APPLE-1005, [0227]) or "using a unicast scheme through a new control message" (APPLE-1005, [0228]). APPLE-1003, ¶178.

This configuration information ***(the first signaling)*** can include "the UL resource information in which the CP zone is configured," "information for time/frequency resource domain in which the CP zone is configured," "the number (N) of CPRBs constructing one CP zone," and "the number (M) of CP zones that attempt to occupy resources by an arbitrary UE" ***(… is used to determine Q wireless resource pool(s), where the Q is a positive integer***). APPLE-1005, [0220]-[0223], [0226]-[0229]. APPLE-1003, ¶179.

For instance, in Lee's FIG. 13, a "CP group" has two "CP zones" ***(Q=2 wireless resource pools)*** in a CP group, each CP zone having respective frequency and time components. APPLE-1005, [0203]-[0212].



APPLE-1005, FIG. 13 (annotated)

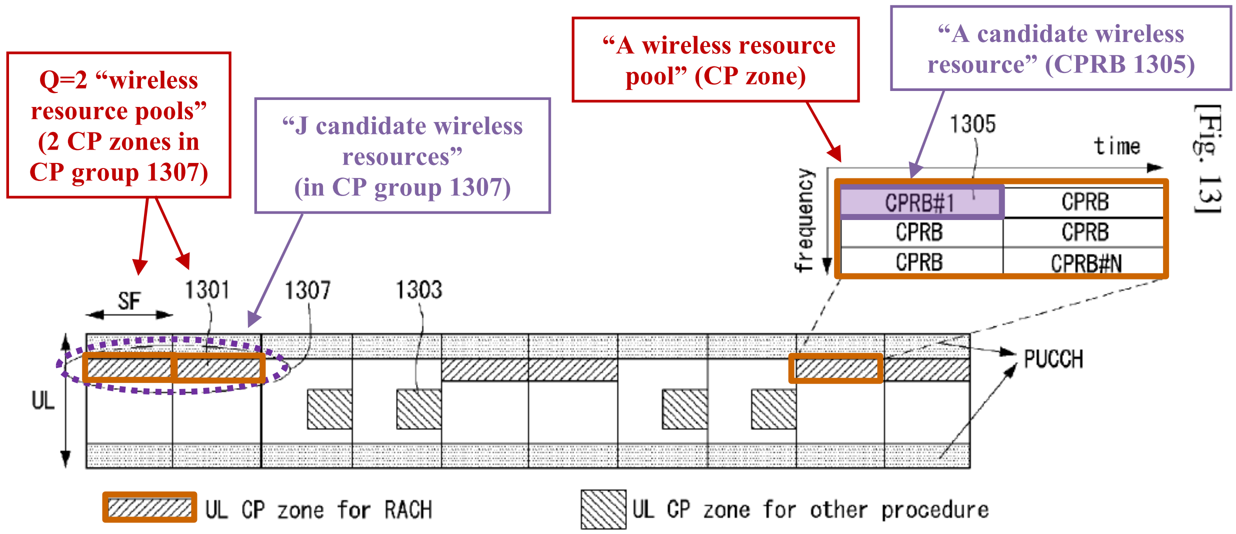
Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [3.1]; APPLE-1003, ¶¶176-181.

[3.2]

As described for [3.1], Lee's UE device receives configuration information ***(the first signaling)*** which includes "the number (M) of CP zones that attempt to occupy resources by an arbitrary UE" ***(… is used to determine Q wireless resource pool(s))***.

Further, a POSITA would have understood each of Lee's M*N CPRBs ***(each candidate wireless resource of the J candidate wireless resources)*** belongs to one of the "CP zones" ***(…belongs to one of the Q wireless resource pool(s))***. APPLE-1003, ¶¶184-187.

For instance, in Lee's FIG. 13, CP group 1307 has two CP zones ***(Q=2 wireless resource pools)***, and each CP zone includes one or more respective CPRBs, e.g., CPRBs #1 through #N ***(candidate wireless resources).*** APPLE-1005, [0203]-[0212].



APPLE-1005, FIG. 13 (annotated)

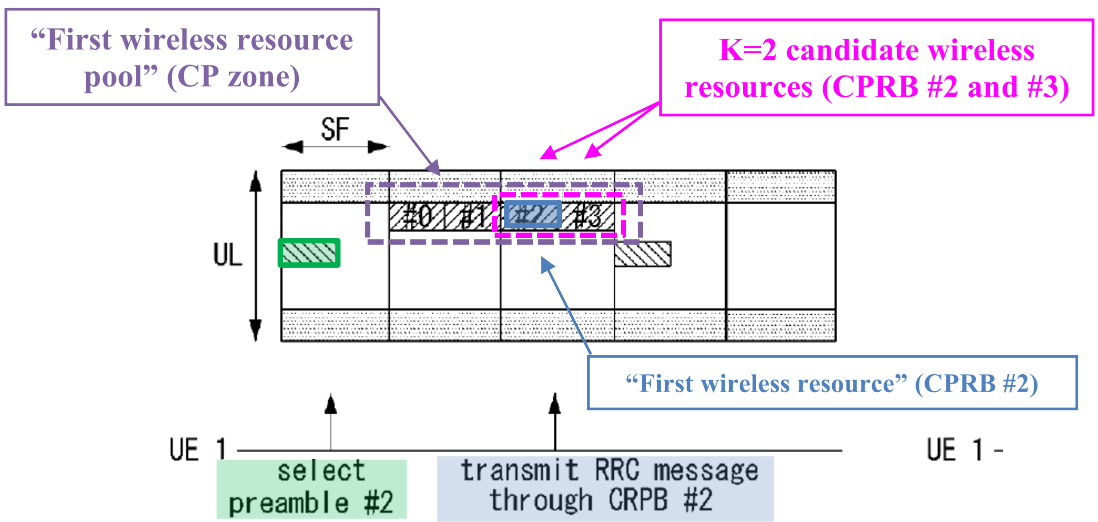
In general, Lee describes a CP group having "M" CP zones where each CP zone has "N" CPRBs, such that the CP group has a total of N*M CPRBs. APPLE-1005, [0223]; APPLE-1003, ¶186. In this case, each CPRB ***(each candidate wireless resource)*** of the total M*N CPRBs ***(of the J candidate wireless resources)*** in the CP group belongs to one of the M CP zones ***(…belongs to one of the Q wireless resource pool(s))*** in the CP group. APPLE-1003, ¶186.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [3.2]; APPLE-1003, ¶¶183-187.

[3.3]

As discussed for [2.3], a POSITA would have understood or found obvious that Lee's ***first time interval*** "belongs to" a particular subframe ***(the target time interval range)*** within a CP group, in a manner consistent with the '721 patent's description of the term "belongs to." APPLE-1003, ¶¶188-189.

For instance, in Lee's FIG. 19(a), two CPRBs (#2, #3) ***(K candidate wireless resource(s))*** in the second subframe belong to a CP zone ***(a first wireless resource pool)*** consisting of four CPRBs #0, #1, #2, #3. APPLE-1005, [0288]; APPLE-1003, ¶190. "UE1" transmits a RRC message using "CPRB #2" of the CP zone including CPRBs #0 – #3. APPLE-1005, [0287]-[0291], FIG. 13 (depicting CP group 1307 as having two CP zones).



APPLE-1005, FIG. 19(a) (annotated)

That is, the RRC message is transmitted in CPRB #2 ***(the first wireless resource)*** which is one of two CPRBs, i.e., CPRBs #2 and #3 ***(…is one of the K candidate wireless resource(s))*** in the second subframe which belongs to the CP zone ***(…belong to a first wireless resource pool)***. APPLE-1005, [0287]-[0291]; APPLE-1003, ¶¶190-191.

Further, in FIG. 19(a), the CP zone ***(the first wireless resource)*** consisting of CPRBs #0 – #3 is the only CP zone ***(…is one of the Q wireless resource pool(s)*** in the singular***)*** in the CP group. APPLE-1005, [0287]-[0291]. In general, Lee discloses that a CP group can include "M" CP zones, e.g., M=2 as in FIG. 13, (***…is one of the Q wireless resource pool(s)*** in the plural). APPLE-1005, [0223], FIG. 13; APPLE-1003, APPLE-1003, ¶192.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [3.3]; APPLE-1003, ¶¶188-193.

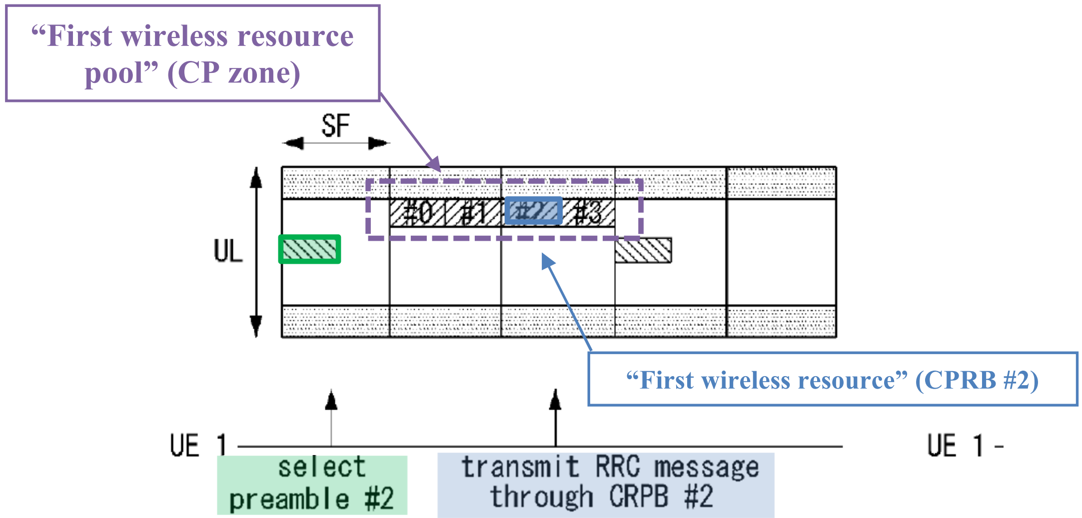
[3.4]

As discussed for [1.4], Lee-Freda uses a time-domain "offset" ***(the first time interval)*** and a frequency-domain offset, as taught by Freda, to determine a resource block (i.e., Lee's CPRB) for Lee's RRC message transmission. APPLE-1003, ¶195. As explained below, a POSITA would have understood or found obvious that Lee-Freda would also determine the particular CP zone ***(the first wireless resource pool out of the Q wireless resource pool(s))*** in which the CPRB is allocated for the RRC message (PUSCH) transmission. APPLE-1003, ¶195.

Lee explains that "zones signify a region in which a UE may transmit UL data competitively without UL resource allocation scheduling" and a "CPRB … signifies a UL resource region that a UE may occupy (e.g., use) for a specific procedure within the CP zone." APPLE-1005, [0204], [0205]. In particular, "[e]ach of the CPRBs that constructs the CP zone has its own unique index (e.g., CPRB #1, CPRB #2, etc.)." *Id*. Furthermore, "UL resource information in which the CP zone is configured signifies the information for time/frequency resource domain in which the CP zone is configured." *Id*., [0222].

A POSITA also would have found it obvious to determine a particular CP zone out of Lee's "M" CP zones ***(the first wireless resource pool out of the Q wireless resource pool(s))*** in a CP group to transmit the RRC message. APPLE-1005, [0223]; APPLE-1003, ¶¶196-197. For example, a POSITA would have recognized or found obvious that upon determining that the RRC message is to be transmitted at a particular time (e.g., based on Freda's teaching regarding an "offset" in time), the UE would determine that the transmission time falls within a particular one of Lee's "CP zones." APPLE-1003, ¶197. Accordingly, a POSITA would have found to obvious to select that "CP zone" to transmit the RRC message. APPLE-1003, ¶197.

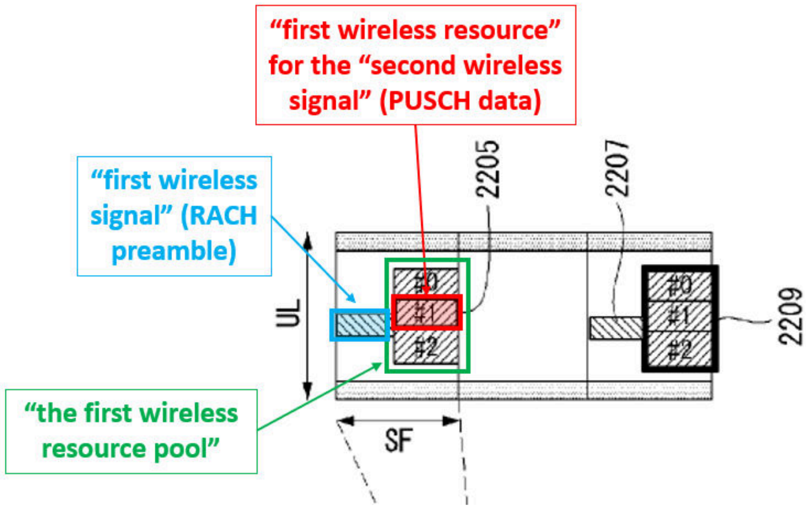
For instance, in Lee's FIG. 19(a), the RRC message is transmitted in CPRB #2 within the CP zone ***(Q=1 wireless resource pool)*** which includes four CPRBs #0, #1, #2, and #3. APPLE-10065, [0203]-[0212]; APPLE-1003, ¶198. Upon determining that the "offset" in time (as taught by Freda) for transmitting the RRC message points to CPRB #2, the UE would determine that the CP zone ***(the first wireless pool)*** including CPRB #2 should be used for transmitting the RRC message. APPLE-10065, [0203]-[0212]; APPLE-1003, ¶198.



APPLE-1005, FIG. 19(a) (annotated)

As another example, a POSITA would have found it obvious to use Freda's time-domain offset ***(the first time interval)*** to determine one of Lee's CP zones and further use Freda's frequency-domain offset to determine one of Lee's CPRB ***(the first wireless resource)*** within the CP zone for transmitting Lee's RRC message. APPLE-1003, ¶199. As discussed in sections IV.A.2 and IV.A.3 and for [1.6], the Lee-Freda system uses Freda's time-domain offset ***(the first time interval)*** to determine a "PRB region" for transmitting the PUSCH data, and further uses Freda's frequency-domain offset to determine a specific PRB ***(the first wireless resource)*** within the PRB region for transmitting the PUSCH data. APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194]. Based on this teaching, a POSITA would have found it obvious that the Lee-Freda system would use Freda's time-domain offset ***(the first time interval)*** to determine one of Lee's "M" CP zones ***(the first wireless resource pool out of the Q wireless resource pool(s))*** in a CP group and further use Freda's frequency-domain offset to determine one of Lee's CPRBs ***(the first wireless resource)*** within the CP zone for transmitting Lee's RRC message. APPLE-1005, [0223]; APPLE-1003, ¶199.

An illustration of this is shown below with reference to Lee's FIG. 22. In this example, the Lee-Freda system would use Freda's time-domain offset ***(first time interval)*** between the RACH preamble transmission ("*first wireless signal*") and RRC message (PUSCH) transmission ("*second wireless signal*") (along the horizontal distance in the figure below) to determine the CP zone ("*the first wireless resource pool*" annotated in green) in which to transmit the PUSCH data. The Lee-Freda system would then use Freda's frequency-domain offset (along the vertical direction in the figure below) to determine CPRB #1 (***the first wireless resource***, red box) within the CP zone (along the vertical axis) for transmitting Lee's RRC message. APPLE-1003, ¶200. Lee explains that the example of FIG. 22 is an example of an intra-subframe scheme, and is thus compatible with FIG. 14. APPLE-1005, [0317]; APPLE-1003, ¶200.



APPLE-1005, FIG. 22 (annotated)

Therefore, as shown in this example, a POSITA would have found it obvious that the Lee-Freda system could use Freda's time-domain offset ***(the first time interval)*** to determine one of Lee's CP zones ***(the first wireless resource pool out of the Q wireless resource pool(s))*** for transmitting Lee's RRC message. APPLE-1003, ¶201.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [3.4]; APPLE-1003, ¶¶194-202.

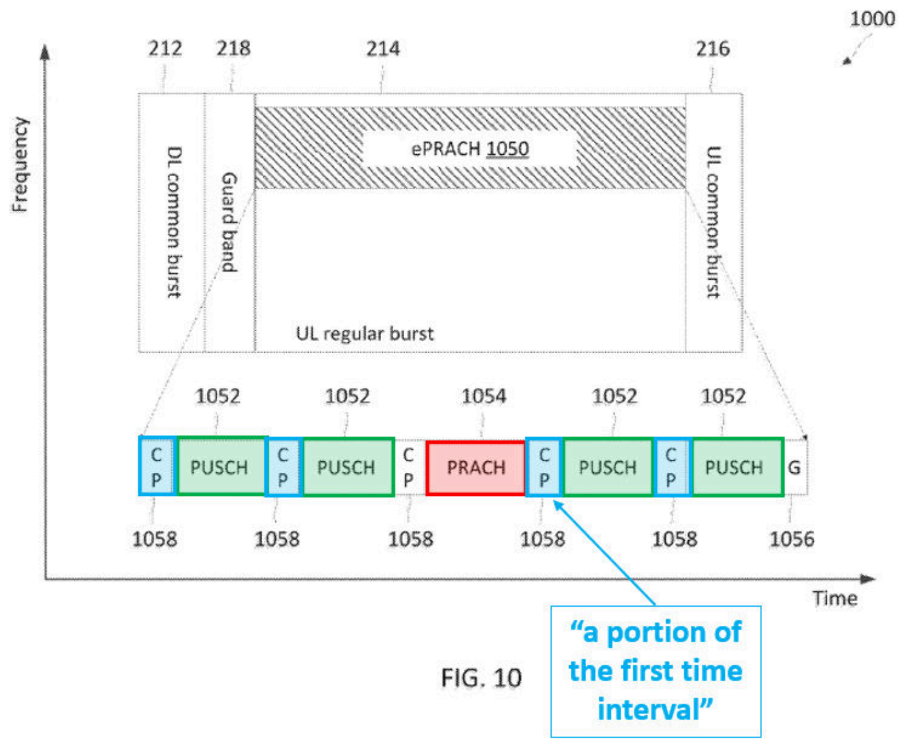
(d) **Claim 4**

As discussed for [1.4], the Lee-Freda system would use the RACH preamble to determine Freda's time-domain offset ***(the first time interval)*** between (i) the starting time instant of the transmission of the RACH preamble and (ii) the starting time instant of the transmission of the PUSCH data. APPLE-1003, ¶¶204-205.

Furthermore, as explained below, Freda also discloses that a "guard period" ***(a portion of the first time interval)*** can be configured prior to the data transmission, and that the UE can receive its guard period configuration from the network ***(receiving a second wireless signaling, … the second wireless signaling indicates a portion of the first time interval)***. APPLE-1003, ¶206.

Freda discloses a "guard period" ***(a portion of the first time interval)*** may be used "***prior*** and/or after ***data transmission.***" APPLE-1006, [0275]; APPLE-1008, [0235]; APPLE-1009, [0258]. In particular, there may be "a known sequence within a portion of a guard period" where the "sequence may consist of a cyclic prefix." APPLE-1006, [0277]; APPLE-1008, [0237]; APPLE-1009, [0260]. As such, Freda discloses that a guard period (including a cyclic prefix) can be implemented prior to the data transmission (i.e., as part of the ***first time interval*** between the RACH preamble and the data transmission).

An example of such a guard period including a cyclic prefix is shown in Ly, where FIG. 10 illustrates cyclic prefix 1058 (annotated in blue) prior to each PUSCH transmission. APPLE-1007, FIG. 10, [0073]; APPLE-1010, FIG. 10, [0069].



APPLE-1007, FIG. 10 (annotated)

Therefore, a POSITA would have understood or found obvious that the Lee-Freda-Ly system would implement a guard period (including a cyclic prefix) prior to each PUSCH data transmission, *i.e.*, in a portion of Freda's time-domain offset between the PRACH and the PUSCH. APPLE-1003, ¶¶207-209.

Furthermore, Freda discloses that the UE can "receive its guard period configuration from the network" ***(receiving a second wireless signaling, … the second wireless signaling indicates a portion of the first time interval)***. APPLE-1006, [0276], [0287] (the UE "may (e.g. further) modify a guard interval configuration for retransmission of preamble+data"). Furthermore, a POSITA would have found it obvious that the UE would receive this guard period configuration through RRC signaling ***(the second wireless signaling is a Radio Resource Control (RRC) signaling)***. APPLE-1008, [0236], [0246]; APPLE-1009, [0259], [0270]; APPLE-1003, ¶210. For example, both Lee and Freda disclose using RRC signaling to configure various aspects of the network, and using RRC signaling would have been one of a finite number of predictable solutions to receive a guard period configuration. APPLE-1005, [0073] ("Radio Resource Control (RRC) layer …is responsible for control of logical, transport, and physical channels in association with configuration, reconfiguration, and release of Radio Bearers (RBs)"); APPLE-1006, [0101], [0137]-[0143], [0205], [0211]; APPLE-1008, [0086], [0122]-[0128], [0180], [0186]; APPLE-1009, [0086], [0122]-[0128], [0188], [0194].

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious claim 4; APPLE-1003, ¶¶204-211.

(e) **Claim 5**

[5.1]

As discussed for [1.3], Lee's "random access preamble" ***(the first wireless signal)*** is generated by a "RACH preamble sequence" ***(the first sequence)***. APPLE-1003, ¶¶213-214.

Further, Lee discloses that the "RACH preamble sequence" ***(the first***

wireless signal) can be identified by a "preamble sequence number," which implies that the "RACH preamble sequence" is selected from a finite set of enumerated preamble sequences ***(…belongs to a target sequence set)***. APPLE-1005, [0301], [0306], [0311], [0156] (referring to a "preamble index/identifier" that can be the "same as the random access preamble"), [0367] (referring to a "preamble index," such as "preamble index #1").

Nevertheless, to the extent that Lee does not expressly disclose or render obvious the "RACH preamble sequence" is selected from among a particular set, a POSITA would have found it obvious to configure Lee's system to do so in view of Freda. APPLE-1003, ¶¶216-218.

Freda describes that a wireless communications device "may select a preamble 622 from a group 620 of preambles." APPLE-1006, [0132]; APPLE-1008, [0194]; APPLE-1009, [0212]. Further, Freda describes that "[a] set of eRACH resource(s) may include one or more of a set of preambles." APPLE-1006, [0164], [0229] ("selection of one or more preambles from a set of configured preambles"), [0239] ("random selection of a preamble from a configured set of preambles), [0248] ("receiv[ing] multiple preambles from a network (e.g. through RRC signaling) and … select[ing] a provided preamble"), [0251]; APPLE-1008, [0149], [0194], [0204], [0208], [0211]; APPLE-1009, [0149], [0212], [0222], [0231], [0234].

Further, Ly also discloses that a "network … may employ two sets of random access preamble sequences," and that "each set may include 64 Zadoff-Chu sequences" ***(a target sequence set)***. APPLE-1007, [0083]; APPLE-1010, [0079].

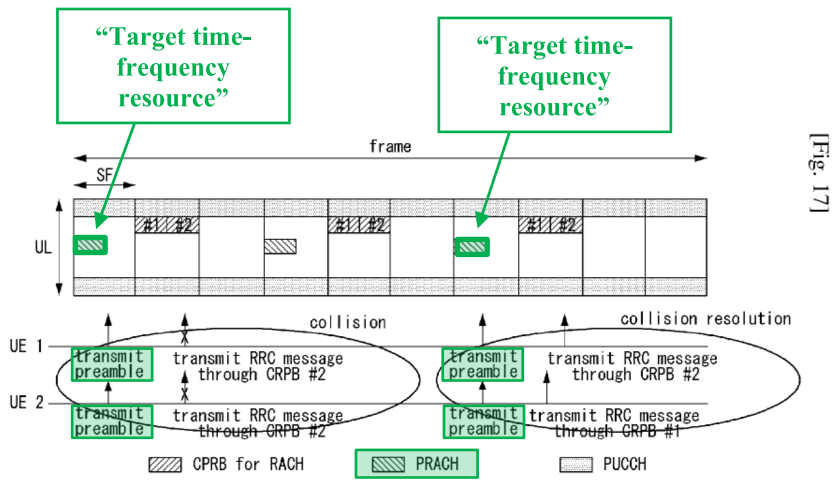
In view of Freda and Ly, a POSITA would have understood that Lee's random access preamble sequence ***(the first wireless signal)*** can be selected from a specific set of preambles ***(…belongs to a target sequence set)***, such as a set of configured preambles (e.g., as expressly described by Freda and Ly). This selection process would allow a UE and a base station to select and use random access preamble sequences in a more consistent and predictable manner (e.g., by limiting random access preamble sequences to a known set of sequences), thereby improving the reliability of communications between them. APPLE-1003, ¶¶218-219.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [5.1]; APPLE-1003, ¶¶213-220.

[5.2]

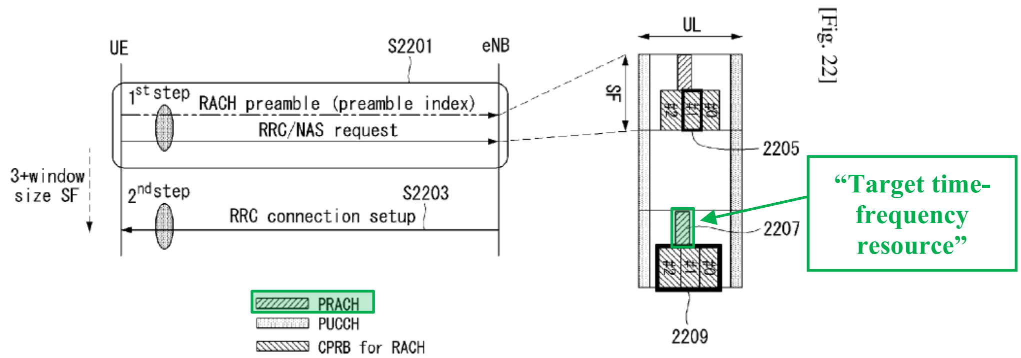
As discussed for [1.1], Lee's UE "transmit[s] … a random access preamble" ***(the first wireless signal)*** that occupies a particular PRACH region ***(…occupies a target time-frequency resource)***. APPLE-1003, ¶¶221-223.

For example, in Lee's FIG. 17, "UE 1 and UE 2 transmit different RACH preamble sequences in a PRACH region of a first subframe," which includes a frequency component (vertical axis) and a time-component (horizontal axis). The example of FIG. 13 shows an inter-subframe scheme, details of which are described with reference to FIG. 14. APPLE-1003, ¶224.



APPLE-1005, FIG. 17 (annotated)

Further, Lee's FIG. 22 depicts a "PRACH region 2207 in which a preamble is transmitted," which includes a frequency component (horizontal axis) and a time-component (vertical axis.) APPLE-1005, [0317]. Lee explains that the example of FIG. 22 is an example of an intra-subframe scheme, and is thus compatible with FIG. 14. APPLE-1005, [0317]; APPLE-1003, ¶225.



APPLE-1005, FIG. 22 (annotated)

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [5.2]; APPLE-1003, ¶¶221-226.

[5.3]

As discussed for [1.3], Lee's "random access preamble" ***(the first wireless signal)*** is generated by a "RACH preamble sequence" ***(the first sequence)***. APPLE-1003, ¶¶227-228.

Further, Lee discloses that an "index" of the RACH preamble sequence ***(index of the first sequence in the target sequence set)*** can be used to determine the CPRB ***(first wireless resource)*** from among M*N individual CPRBs in the "CP group" ***(…is used to determine the first wireless resource out of the J candidate wireless re-sources through a pre-defined mapping relationship)***. APPLE-1005, [0355] ("the UE may select a random value by using a certain value (e.g., … a preamble index selected by the UE)" and "the UE may select one CPRB of the CP group with respect to a PRACH, on the basis of the preamble selected by the UE"),

[0358] ("the CPRB may be selected on the basis of a transmitted preamble index"), [0367] ("the RRC/NAS request message is transmitted through CPRB selected based on … a preamble index," [0375] ("the CPRB can be selected on the basis of the transmitted preamble index"). *See also* [1.5] (regarding "first wireless resource" and "J candidate wireless resources", [5.1] (regarding "first sequence"), [5.2] (regarding "target time-frequency resource"); APPLE-1003, ¶229.

Furthermore, as discussed in sections IV.A.2 and IV.A.3 and for [1.6], the Lee-Freda system uses Freda's time-domain offset relative to "a start time of a transmission of a preamble" (***a location of the target time-frequency resource in time domain***) to determine a "PRB region" for transmitting the PUSCH data, and further uses Freda's frequency-domain offset relative to "a first PRB of a transmission of a preamble"(***a location of the target time-frequency resource in frequency domain***) to determine a specific RB (***the first wireless resource***) within the PRB region for transmitting the PUSCH data. APPLE-1006, [0209], [0211]; APPLE-1008, [0184], [0186]; APPLE-1009, [0192], [0194]; APPLE-1003, ¶230.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [5.3]; APPLE-1003, ¶¶227-231.

[5.4]

Lee discloses that the "index" of the RACH preamble sequences ***(index of the first sequence in the target sequence set)*** are sorted on the basis of its "preamble sequence numbers," such as in "descending order or ascending order" ***(…is an index for which the sequence in the target sequence set are sorted by a specific order).*** APPLE-1005, [0306]-[0307], [0311].

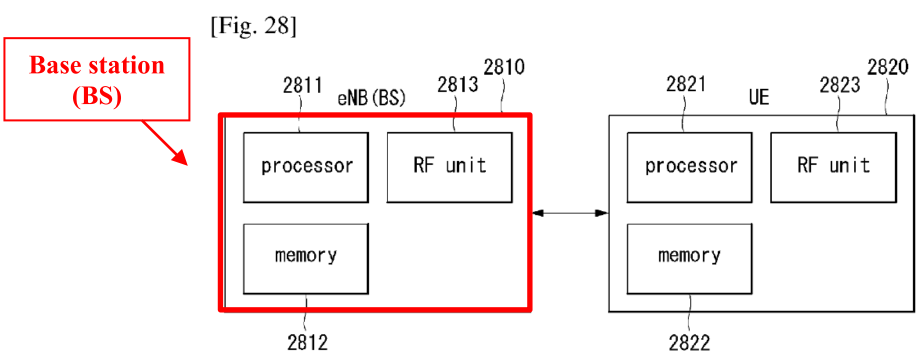
Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [5.4]; APPLE-1003, ¶¶232-234.

(f) **Claim 6**

[6.pre]

To the extent that the preamble is limiting, Lee-Freda-Ly discloses or renders obvious [6.pre]. APPLE-1003, ¶¶235-239.

Lee describes a "base station (BS) or "eNode B" (eNB) ***(base station)*** for communicating in a "wireless communications system" ***(… for wireless communication)***. APPLE-1005, Abstract, [0055]-[0056], [0385]-[0389], FIG. 28 (2810).



APPLE-1005, FIG. 28 (annotated)

Further, in view of Lee, Freda, and/or Ly, it would have been obvious to configure Lee's base station or eNB to perform ***a method for wireless communication*** including each of the operations recited in claim 6, as discussed in further detail below. APPLE-1003, ¶¶240-246.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [6.pre]; APPLE-1003, ¶239.

[6.1]

Lee's UE "transmit[s] … a random access preamble to a base station (BS)" ***(***the base station ***receiving a first wireless signal)***. APPLE-1005, Abstract. *See also* [1.1].

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [6.1]; APPLE-1003, ¶¶240-242.

[6.2]

Lee's UE additionally "transmit[s] … a radio resource control (RRC) request message to the BS through a contention-based physical uplink shared channel (PUSCH) resource block in which uplink data can be transmitted without uplink resource allocation scheduling" ***(***the base station ***receiving a second wireless signal)***. APPLE-1005, Abstract. *See also* [1.2].

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [6.2] APPLE-1003, ¶¶243-245.

[6.3] – [6.9]

See [1.3]-[1.9], *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious [6.3]–[6.9]; APPLE-1003, ¶246.

(g) Claims 7–10

See Claims 2-5, *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious claims 7–10, respectively. APPLE-1003, ¶247.

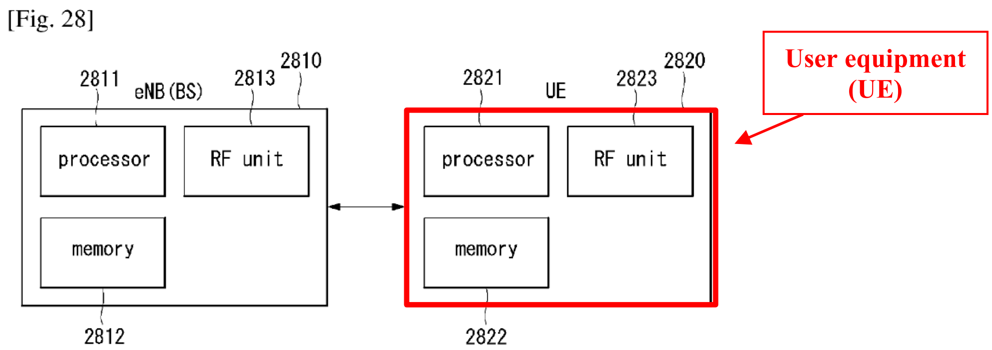
(h) Claim 11

Claim 11 and dependent claims 12-15 are directed to a "user equipment" and recite limitations that are analogous to claims 1-5. To the extent [11.3], [11.4], [11.5], [11.6], [11.9], [13.4] and claim 14 (which recite features of how signals are intended to be used) are deemed definite, these features are rendered obvious for reasons similar to those discussed in regard to claims 1-5; APPLE-1003, ¶248.

[11.pre]

To the extent that the preamble is limiting, Lee-Freda-Ly discloses or renders obvious [11.pre]. APPLE-1003, ¶¶248-251.

Lee describes a "***user equipment (UE)***" for communicating in a "wireless communications system" ***(… for wireless communication)***. APPLE-1005, Abstract, [0385]-[0389], FIG. 28 (2820). *See also* [1.pre].

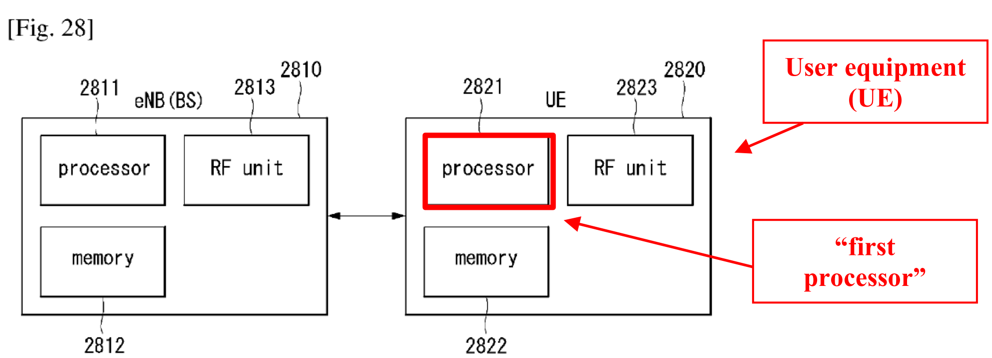


APPLE-1005, FIG. 28 (annotated)

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [11.pre]; APPLE-1003, ¶¶249-251.

[11.1]

Lee's "UE 2820 includes a processor 2821" ***(a first processor)***, which "may be configured to implement the functions, procedures and/or methods proposed by the present invention as described in FIG. 1-27." APPLE-1005, [0388], FIG. 28 (2821).



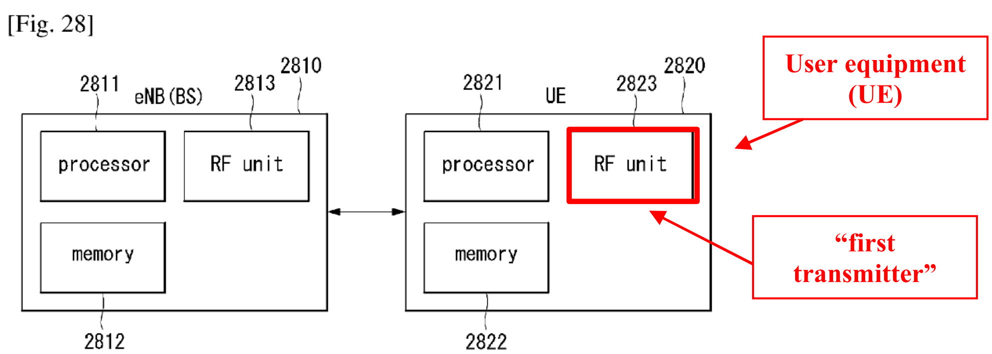
APPLE-1005, FIG. 28 (annotated)

Among these "functions, procedures, and/or methods" includes a UE "transmit[ting] … a random access preamble to a base station (BS)" ***(transmitting a first wireless signal)***. APPLE-1005, Abstract. *See also* [1.1].

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [11.1] APPLE-1003, ¶¶252-255.

[11.2]

Lee's "UE 2820 includes … an RF unit 2823" ***(a first transmitter)***, which "is connected to the processor 2811, transmits and/or receives an RF signal." APPLE-1005, [0388], FIG. 28 (2823).



APPLE-1005, FIG. 28 (annotated)

Lee's UE can transmit various RF signals, including "transmitting … a radio resource control (RRC) request message to the BS through a contention-based physical uplink shared channel (PUSCH) resource block in which uplink data can be transmitted without uplink resource allocation scheduling" ***(transmitting a second wireless signal)***. APPLE-1005, Abstract. *See also* [1.2].

Therefore, a POSITA would have understood Lee-Freda-Ly to render

obvious [11.2] APPLE-1003, ¶¶256-259.

[11.3] – [11.9]

See [1.3]-[1.9] , *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious [11.3]–[11.9] APPLE-1003, ¶260.

(i) **Claims 12–15**

See Claims 2–5, *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious claims 12–15, respectively APPLE-1003, ¶261.

(j) **Claim 16**

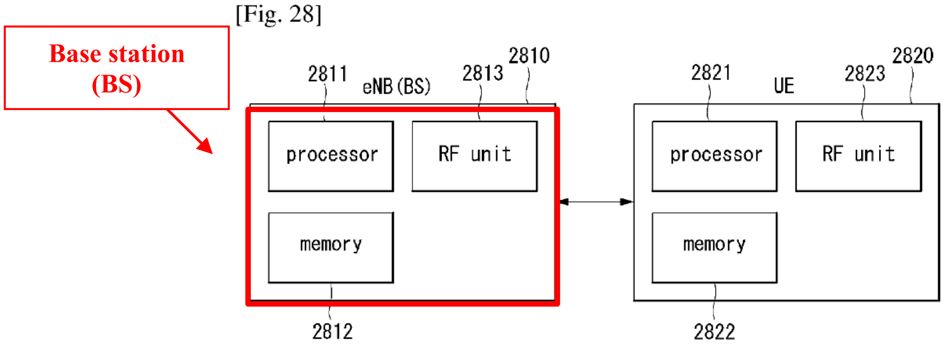
Claim 16 and dependent claims 17-20 are directed to a "base station" and recite limitations that are analogous to method claims 6-10. To the extent [16.3], [16.4], [16.5], [16.6], [16.9], [18.4] and claim 19 (which recite features of how signals are intended to be used) are deemed definite, these features are rendered obvious for reasons similar to those discussed in regard to claims 6-10. APPLE-1003, ¶262.

[16.pre]

To the extent that the preamble is limiting, Lee-Freda-Ly discloses or renders obvious [16.pre]. APPLE-1003, ¶¶263-265. .

Lee describes a "base station (BS) or "eNode B" (eNB) ***(base station)*** for communicating in a "wireless communications system" ***(… for wireless communication)***. APPLE-1005, Abstract, [0055]-[0056], [0385]-[0389], FIG. 28

(2810).



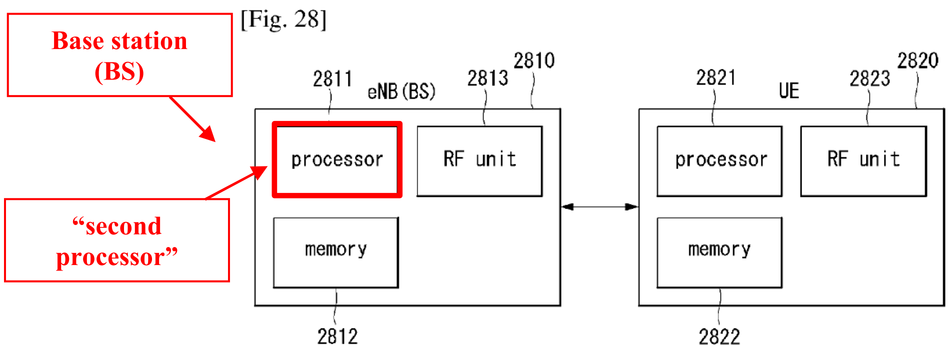
APPLE-1005, FIG. 28 (annotated)

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [16.pre]. APPLE-1003, ¶¶263-265.

[16.1]

The word "transmitting" in [16.1] appears to be a typographical error, as the corresponding method claim ([6.1]) refers to the base station "receiving" the first wireless signal. APPLE-1003, ¶267. As explained for [6.1], Lee discloses the base station "receiving" the first wireless signal. In addition, as discussed here, Lee-Freda-Ly renders obvious claim [16.1] even with the "transmitting" language. APPLE-1003, ¶267.

Lee's "eNB 2810 includes a processor 2811" ***(a second processor)***, which "may be configured to implement the functions, procedures and/or methods proposed by the present invention as described in FIG. 1-27." APPLE-1005, [0387], FIG. 28 (2811).



APPLE-1005, FIG. 28 (annotated)

Further, Lee's a UE "transmit[s] … a random access preamble to a base station (BS)" *(*the base station ***[receiving] a first wireless signal)***. APPLE-1005, Abstract; APPLE-1003, ¶¶268-269. *See also* [1.1].

To the extent that Lee does not expressly disclose that a base station or eNB "transmitting" a random access preamble, a POSITA nevertheless would have found it obvious to configure Lee's base station to transmit a random access preamble in view of Ly's teaching that base stations "may … communicate with one another, directly or indirectly, over wired and/or wireless connections." APPLE-1007, [0032]; APPLE-1010, [0028]; APPLE-1003, ¶270. In view of Ly, a POSITA would have found it obvious that, in the similar way as Lee's UE communicating wirelessly with a base station, Lee's base station can also communicate wirelessly with another base station. APPLE-1003, ¶270. Accordingly, a POSITA would have found to obvious to configure the Lee's base station transmit a random access preamble to another base station ***(transmit a first***

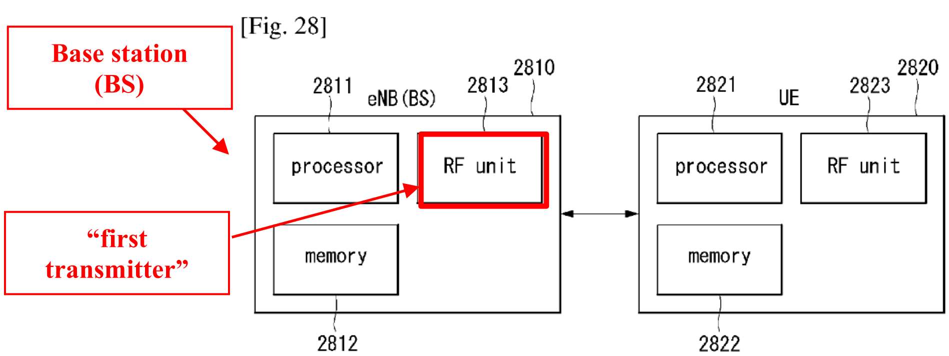
wireless signal) when two base stations are communicating wirelessly with another; APPLE-1003, ¶270.

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [16.1]. APPLE-1003, ¶¶266-271.

[16.2]

The word "transmitting" in [16.2] appears to be a typographical error, as the corresponding method claim ([6.2]) refers to the base station "receiving" the second wireless signal. APPLE-1003, ¶273. As explained for [6.2], Lee discloses the base station receiving the second wireless signal. In addition, as discussed here, Ly renders obvious claim [16.2] even with the "transmitting" language; APPLE-1003, ¶273.

Lee's "eNB 2810 includes … a radio frequency (RF) unit 2813 (a first transmitter), which "is connected to the processor 2811, transmits and/or receives an RF signal." APPLE-1005, [0388], FIG. 28 (2813).



APPLE-1005, FIG. 28 (annotated)

Lee further discloses that a UE can transmit various RF signals, including "transmitting … a radio resource control (RRC) request message to the BS through a contention-based physical uplink shared channel (PUSCH) resource block in which uplink data can be transmitted without uplink resource allocation scheduling" ***(***the base station ***[receiving] a second wireless signal)***. APPLE-1005, Abstract; APPLE-1003, ¶¶274-275. *See also* [1.2].

To the extent that Lee does not expressly disclose that a base station or eNB "transmitting" an RRC request message, a POSITA nevertheless would have found it obvious to configure Lee's base station to transmit an RRC request message in view of Ly's teaching that base stations "may … communicate with one another, directly or indirectly, over wired and/or wireless connections." APPLE-1007, [0032]; APPLE-1010, [0028]; APPLE-1003, ¶276. In view of Ly, a POSITA would have found it obvious that, in a similar way that Lee's UE communicates wirelessly with a base station, Lee's base station can also communicate wirelessly with another base station. APPLE-1003, ¶276. Accordingly, a POSITA would have found to obvious to configure the Lee's base station transmit a RRC request message to another base station ***(transmit a second wireless signal)*** when two base stations are communicating wirelessly with another. APPLE-1003, ¶276

Therefore, a POSITA would have understood Lee-Freda-Ly to render obvious [16.2]. APPLE-1003, ¶¶-272-277.

[16.3] – [16.9]

See [1.3]–[1.9] , *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious [16.3]–[16.9]. APPLE-1003, ¶278.

(k) **Claims 17–20**

See Claims 2-5, *supra*, based on which a POSITA would have understood Lee-Freda-Ly to render obvious claims 17–20, respectively. APPLE-1003, ¶279

V. DISCRETION SHOULD NOT PRECLUDE INSTITUTION

Petitioner believes that discretionary denial is unwarranted, and yet, Petitioner intends to utilize the bifurcated briefing process contemplated by the March 26, 2025, Stewart Memorandum to rebut contentions if offered by Patent Owner to the contrary.

VI. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VII. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Apple Inc. is the petitioner and the real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for inter partes review for the ’721 patent. The ’721 patent is the subject of a number of civil actions including: *Apex Beam Technologies LLC v. Apple Inc*, 6-24-cv-00223 (WDTX), filed April 29, 2024; *Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al*, 2-24-cv-00203 (EDTX), filed March 20, 2024.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR50095-0231IP1@fr.com.

Respectfully submitted,

Dated: April 28, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,969 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: April 28, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on April 28, 2025, a complete and entire copy of this Petition for *Inter Partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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