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Title: METHOD AND DEVICE IN UE AND BASE STATION USED
FOR WIRELESS COMMUNICATION

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 10,568,113 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 10,568,113
APPLE-1002	U.S. Patent No. 10,568,113 File History
APPLE-1003	Declaration of Dr. Robert Akl
APPLE-1004	U.S. Patent No. 10,779,350 to Xia et al. (“Xia”)
APPLE-1005	U.S. Patent Application Publication No. 2015/0141026 to Jover (“Jover”)
APPLE-1006	3GPP TSG RAN WG1 NR Ad-Hoc#2, Qingdao, P.R. China 27th – 30th June 2017, published in 3GPP website (https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_AH/NR_AH_1706/Docs) on June 16, 2017 (R1-1710596) (“Proposal 7”)
APPLE-1007	U.S. Patent No. 10,461,994 to Liu et al. (“Liu”)
APPLE-1008	RESERVED
APPLE-1009	Raghav Pandey, Ashwani Awasthi, and Vikas Srivastava, “Comparison between Bit Error Rate And Signal To Noise Ratio in OFDM Using LSE Algorithm,” in Proceedings of the Conference on Advances in Communication and Control Systems (CAC2S 2013), pp. 463-466, Atlantis Press 2013 (“Pandey”)
APPLE-1010	Screen shot of 3GPP Portal showing the upload time of R1-1710596 on the 3GPP website
APPLE-1011	International Patent Publication No. WO 2017/024516 A1 to Lu et al., published February 16, 2017 (“Lu”)

APPLE-1012	U.S. Provisional Application No. 62/543,765 to Xia et al. ("Xia Provisional")
APPLE-1013	U.S. Patent No. 6,185,432 to Vembu ("Vembu")
APPLE-1014	U.S. Provisional Application No. 62,521,170 to Liu et al. ("Liu Provisional")
APPLE-1015	RESERVED
APPLE-1016	3GPP Declaration of Friedhelm Rodermund
APPLE-1017	First Amended Complaint, <i>Apex Beam Tech's LLC. v. Apple Inc.</i> , 6:24-cv-00223-ADA-DIG (WDTX May 2, 2024)
APPLE-1018	Complaint, <i>Apex Beam Tech's LLC. v. Apple Inc.</i> , 6:24-cv-00223-ADA-DIG (WDTX April 29, 2024)
APPLE-1019	Proof of Service, <i>Apex Beam Tech's LLC. v. Apple Inc.</i> , 6:24-cv-00223-ADA-DIG (May 14, 2024)
APPLE-1020	RESERVED
APPLE-1021	3GPP TSG RAN WG1 NR Ad-Hoc#2, R1-1710078, Qingdao, P.R. China 27th – 30th June 2017, published in 3GPP website (https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_AH/NR_AH_1706/Docs) on June 16, 2017 ("R1-1710078")
APPLE-1022	3GPP TSG RAN WG1 #87ah-NR, R1-1700771, Spokane, WA, USA, 16th – 20th January, 2017, published in 3GPP website (https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_AH/NR_AH_1701/Docs/) on January 10, 2017 ("R1-1700771")
APPLE-1023	3GPP TS 36.321 V14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio

Access (E-UTRA); Medium Access Control (MAC)
protocol specification (Release 14)

- APPLE-1024 3GPP TS 36.133 V14.4.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management (Release 14)
- APPLE-1025 3GPP TS 36.213 V14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 14)
- APPLE-1026 3GPP TS 36.300 V.14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 14)
- APPLE-1027 3GPP TS 36.331 V14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 14)
- APPLE-1028 3GPP TS 36.201 V14.1.0 (2017-03) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE physical layer; General description (Release 14)
- APPLE-1029 3GPP TS 36.212 V14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (Release 14)

APPLE-1030	Joint Claim Construction and Prehearing Statement, Apex Beam Technologies, LLC v. ZTE Corp., 2:22-cv-00031-JRG-RSP (Lead Case) (E.D. Tex) (Sept. 22, 2023)
APPLE-1031	U.S. Patent Publication. No 2017/0215207 to Yi et al. (“Yi”)
APPLE-1032	Memorandum: Interim Processes for PTAB Workload Management (“Stewart Memorandum”)
APPLE-1033	Patent Trial and Appeal Board (PTAB) Boardside Chat Interim processes relating to institution in AIA proceedings (April 24, 2025) <i>available at</i> https://www.uspto.gov/sites/default/files/documents/boardside_chat_interim_process_for_aia_institution_decisions_.pdf
APPLE-1034	RESERVED
APPLE-1035	3GPP TS 36.211 V14.3.0 (2017-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE physical layer; Physical channels and modulation (Release 14)
APPLE-1036	Patent Owner’s Response, IPR2023-00601, Paper 16
APPLE-1037	Patent Owner’s Response, IPR2023-00602, Paper 16
APPLE-1038	Petitioner’s Reply, IPR2023-00601, Paper 18
APPLE-1039	Oral Hearing Transcript, IPR2023-00601, Paper 28 (PTAB July 24, 2024)
APPLE-1040	Patent Owner Demonstratives, IPR2023-00601, EX2007
APPLE-1041	Decision Granting Institution, IPR2023-00601, Paper 11

LISTING OF CLAIMS

Claim 1	
1pre	A method in a User Equipment (UE) for wireless communication, comprising:
1a	receiving a target radio signal;
1b	transmitting a first radio signal on a first channel;
1c	transmitting a second radio signal on a second channel; and
1d	monitoring a third radio signal in a first time window;
1e	wherein a measurement for the target radio signal obtains a target measurement value, the target measurement value, when higher than a target threshold is used for triggering the transmission of the first radio signal and the second radio signal;
1f	a time resource occupied by the first radio signal is used for determining the start time of the first time window;
1g	a time domain resource occupied by the first radio signal is used for determining a second time window,
1h	a time domain resource occupied by the second radio signal is within the second time window, and the second time window is within the first time window;
1i	a time domain resource occupied by the second radio signal is used for determining a third time window, and the end time of the third time window is the end time of the first time window; and
1j	the second time window and the third time window have overlapped time domain resource(s).

Claim 2	
2a	The method according to claim 1, wherein at least one signal of the following set of signals: {the first radio signal, the second radio signal} is used for determining a multi-antenna related transmitting of the third radio signal; or,
2b	the first radio signal and the second radio signal together are used for determining the multi-antenna related transmitting of the third radio signal.
Claim 3	
3	The method according to claim 1, wherein the first channel is a first type of physical layer channel, the second channel is a second type of physical layer channel, and the first type of physical layer channel and the second type of physical layer channel are two different types of physical layer channels.
Claim 4	
4	The method according to claim 1, wherein the first channel is a physical layer control channel.
Claim 5	
5a	The method according to claim 1, wherein the first radio signal is used for determining a first antenna port group, and the first antenna port group is spatially related to an antenna port group used for transmitting the third radio signal, the being spatially related refers to being Quasi Co-Located (“QCL”); or,

5b	the first time window is divided into a second time interval and a third time interval, the second time interval is before the third time interval, the third time interval is behind a time domain resource occupied by the second radio signal, the first radio signal is used for determining a second antenna port group, in the second time interval, the second antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the second time interval, the second radio signal is used for determining a third antenna port group; in the third time interval, the third antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the third time interval.
Claim 6	
6pre	A method in a base station device for wireless communication, comprising:
6a	transmitting a target radio signal;
6b	receiving a first radio signal on a first channel;
6c	receiving a second radio signal on a second channel; and
6d	transmitting a third radio signal in a first time window;
6e	wherein a measurement for the target radio signal obtains a target measurement value, the target measurement value, when higher than a target threshold, is used for triggering the transmission of the first radio signal and the second radio signal;
6f	a time resource occupied by the first radio signal is used for determining the start time of the first time window;
6g	a time domain resource occupied by the first radio signal is used for determining a second time window,
6h	a time domain resource occupied by the second radio signal is within the second time window, and the second time window is within the first time window;

6i	a time domain resource occupied by the second radio signal is used for determining a third time window, and the end time of the third time window is the end time of the first time window; and
6j	the second time window and the third time window have overlapped time domain resource(s).
Claim 7	
7a	The method according to claim 6, wherein at least one signal of the following set of signals: {the first radio signal, the second radio signal} is used for determining a multi-antenna related transmitting of the third radio signal; or,
7b	the first radio signal and the second radio signal together are used for determining the multi-antenna related transmitting of the third radio signal.
Claim 8	
8	The method according to claim 6, wherein the first channel is a first type of physical layer channel, the second channel is a second type of physical layer channel, and the first type of physical layer channel and the second type of physical layer channel are two different types of physical layer channels.
Claim 9	
9	The method according to claim 6, wherein the first channel is a physical layer control channel.
Claim 10	
10a	The method according to claim 6, wherein the first radio signal is used for determining a first antenna port group, and the first antenna port group is spatially related to an antenna port group used for transmitting the third radio signal, the being spatially related refers to being Quasi Co-Located (“QCL”); or,

10b	the first time window is divided into a second time interval and a third time interval, the second time interval is before the third time interval, the third time interval is behind a time domain resource occupied by the second radio signal, the first radio signal is used for determining a second antenna port group, in the second time interval, the second antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the second time interval, the second radio signal is used for determining a third antenna port group; in the third time interval, the third antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the third time interval.
Claim 11	
11pre	A UE for wireless communication, comprising:
11a	a first receiver module, to receive a target radio signal;
11b	a second transmitter module, to transmit a first radio signal on a first channel;
11c	a third transmitter module, to transmit a second radio signal on a second channel; and
11d	a fourth receiver module, to monitor a third radio signal in a first time window;
11e	wherein a measurement for the target radio signal obtains a target measurement value, the target measurement value, when higher than a target threshold, is used for triggering the transmission of the first radio signal and the second radio signal;
11f	a time resource occupied by the first radio signal is used for determining the start time of the first time window;
11g	a time domain resource occupied by the first radio signal is used for determining a second time window,
11h	a time domain resource occupied by the second radio signal is within the second time window, and the second time window is within the first time window;

11i	a time domain resource occupied by the second radio signal is used for determining a third time window, and the end time of the third time window is the end time of the first time window; and
11j	the second time window and the third time window have overlapped time domain resource(s).
Claim 12	
12a	The UE according to claim 11, wherein at least one signal of the following set of signals: {the first radio signal, the second radio signal} is used for determining a multi-antenna related transmitting of the third radio signal; or,
12b	the first radio signal and the second radio signal together are used for determining the multi-antenna related transmitting of the third radio signal.
Claim 13	
13	The UE according to claim 11, wherein the first channel is a first type of physical layer channel, the second channel is a second type of physical layer channel, and the first type of physical layer channel and the second type of physical layer channel are two different types of physical layer channels.
Claim 14	
14	The UE according to claim 11, wherein the first channel is a physical layer control channel.

Claim 15	
15a	The UE according to claim 11, wherein the first radio signal is used for determining a first antenna port group, and the first antenna port group is spatially related to an antenna port group used for transmitting the third radio signal, the being spatially related refers to being Quasi Co-Located (“QCL”); or,
15b	the first time window is divided into a second time interval and a third time interval, the second time interval is before the third time interval, the third time interval is behind a time domain resource occupied by the second radio signal, the first radio signal is used for determining a second antenna port group, in the second time interval, the second antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the second time interval, the second radio signal is used for determining a third antenna port group; in the third time interval, the third antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the third time interval.
Claim 16	
16pre	A base station device for wireless communication, comprising:
16a	a first transmitter module, to transmit a target radio signal;
16b	a second receiver module, to receive a first radio signal on a first channel;
16c	a third receiver module, to receive a second radio signal on a second channel; and
16d	a fourth transmitter module, to transmit a third radio signal in a first time window;
16e	wherein a measurement for the target radio signal obtains a target measurement value, the target measurement value, when higher than a target threshold, is used for triggering the transmission of the first radio signal and the second radio signal;

16f	a time resource occupied by the first radio signal is used for determining the start time of the first time window;
16g	a time domain resource occupied by the first radio signal is used for determining a second time window,
16h	a time domain resource occupied by the second radio signal is within the second time window, and the second time window is within the first time window;
16i	a time domain resource occupied by the second radio signal is used for determining a third time window, and the end time of the third time window is the end time of the first time window; and
16j	the second time window and the third time window have overlapped time domain resource(s).
Claim 17	
17a	The base station device according to claim 16, wherein at least one signal of the following set of signals: {the first radio signal, the second radio signal} is used for determining a multi-antenna related transmitting of the third radio signal; or,
17b	the first radio signal and the second radio signal together are used for determining the multi-antenna related transmitting of the third radio signal.
Claim 18	
18	The base station device according to claim 16, wherein the first channel is a first type of physical layer channel, the second channel is a second type of physical layer channel, and the first type of physical layer channel and the second type of physical layer channel are two different types of physical layer channels.
Claim 19	
19	The base station device according to claim 16, wherein the first channel is a physical layer control channel.

Claim 20	
20a	The base station device according to claim 16, wherein the first radio signal is used for determining a first antenna port group, and the first antenna port group is spatially related to an antenna port group used for transmitting the third radio signal, the being spatially related refers to being QCL; or,
20b	the first time window is divided into a second time interval and a third time interval, the second time interval is before the third time interval, the third time interval is behind a time domain resource occupied by the second radio signal, the first radio signal is used for determining a second antenna port group, in the second time interval, the second antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the second time interval, the second radio signal is used for determining a third antenna port group; in the third time interval, the third antenna port group is spatially QCL with an antenna port group used for transmitting the third radio signal in the third time interval.

I. INTRODUCTION

Apple Inc. (“Apple” or “Petitioner”) petitions for IPR of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 10,568,113 (“the ’113 patent”). As explained herein, there exists a reasonable likelihood that Petitioner will prevail with respect to at least one Challenged Claim.

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 ’113 Patent is available for IPR. This petition is being filed within one year of service of a complaint against Apple. APPLE-1017–APPLE-1019. 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 an IPR on the grounds set forth in the table shown below, and requests that each of the Challenged Claims be found unpatentable. Additional explanation and support for each ground of rejection is set forth in APPLE-1003, the Declaration of Robert Akl, referenced throughout this Petition.

Ground	’113 Patent Claims	Basis for Rejection
Ground 1	1-20	§103: Xia
Ground 2	1-20	§103: Xia + Jover
Ground 3A	1, 3-4, 6, 8-9	§103: 3GPP-LTE
Ground 3B	11, 13-14, 16, 18-19	§103: 3GPP-LTE + Yi

APPLE-1003, ¶¶96-97.

Each prior art reference forming the grounds herein pre-dates the earliest claimed priority date of the '113 patent, August 11, 2017 (“Critical Date”),¹ which Petitioner does not concede.

Reference	Filing/Priority	Publication	Status
Xia	8/10/2017	2/14/2019	§102(a)(2)
Jover	11/15/2013	5/21/2015	§§102(a)(1)-(2)
3GPP-LTE	-	7/13/2017	§102(a)(1)
Yi	1/25/2017	7/27/2017	§102(a)(1)-(2)

Xia qualifies as prior art based on its priority claim to a provisional application filed 8/10/2017 (APPLE-1012). During the oral hearing in a prior proceeding, Patent Owner did not contest Xia’s prior art status. APPLE-1039, Paper 28, 25:2-7. Parallel citations to the Xia provisional (APPLE-1012) are provided herein. Jover is prior art at least as of 5/21/2015. Yi is prior art at least as of 7/27/2017. APPLE-1003, 54-79.

3GPP-LTE is the representation of a standard detailed by disclosures found in the collection of Technical Specifications listed in the table below, each being prior art as of its noted corresponding Release (also listed):

¹ Petitioner reserves the right to challenge the priority date here and/or in other proceedings.

Exhibit	Technical Specification	Public Availability
APPLE-1023	36.321	6/23/2017
APPLE-1024	36.133	7/7/2017
APPLE-1025	36.213	6/23/2017
APPLE-1026	36.300	6/23/2017
APPLE-1027	36.331	7/13/2017
APPLE-1028	36.201	3/23/2017
APPLE-1029	36.212	6/23/2017
APPLE-1035	36.211	6/23/2017

E.g., APPLE-1016, ¶¶20-26. 3GPP-LTE is prior art as of its latest constituent TS, publicly available by 7/13/2017. *Id.*; APPLE-1003, ¶¶67-72.

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, ¶¶85-95.

In IPR2023-00601,² Apex advanced the following constructions:

² APPLE-1036, Paper 16, 8-10; APPLE-1037, Paper 16, 11-13; *see also* APPLE-1040, EX2007 (PO's Demonstratives), 5-9.

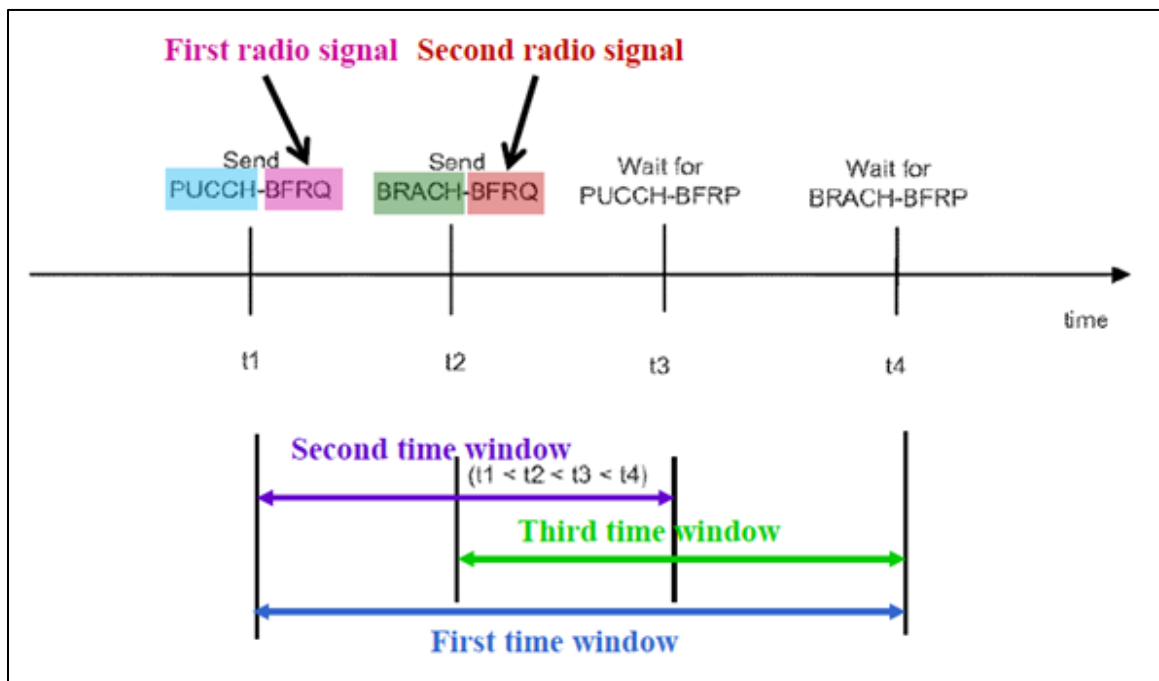
Term	PO's Proposed Constructions
triggering the transmission	causing the transmission
first time window	a period of time from the first radio signal in which to receive a third radio signal (i.e., a response to either the first or second radio signals)
second time window	a period of time from the first radio signal in which to transmit the second radio signal
third time window	a period of time from the second radio signal in which to receive a third radio signal (i.e., a response to either the first or second radio signals)

Resolution of these constructions would not inform the applicability of the grounds presented in this IPR. APPLE-1003, ¶¶85-95. The prior art renders obvious “causing” the transmission of a first radio signal and a second radio signal. For example, Xia alone or in combination with Jover transmits the PUCCH-BFRQ and BRACH-BFRQ³ based on beam failure detection reference signal measurements. Likewise, 3GPP-LTE transmits a Random Access (RA) preamble and an uplink shared channel transmission based on initiating a contention-based

³ BRACH-BFRQ” in FIG. 6B corresponds to the term “PRACH-BFRQ” used throughout the specification when referring to the second beam recovery request on the PRACH. APPLE-1003, ¶¶61-64.

RA procedure (CBRAP), which is caused by a determination of link failure based on measurements of cell-specific reference signal. *Infra*, §§III.E, VI.B-C.

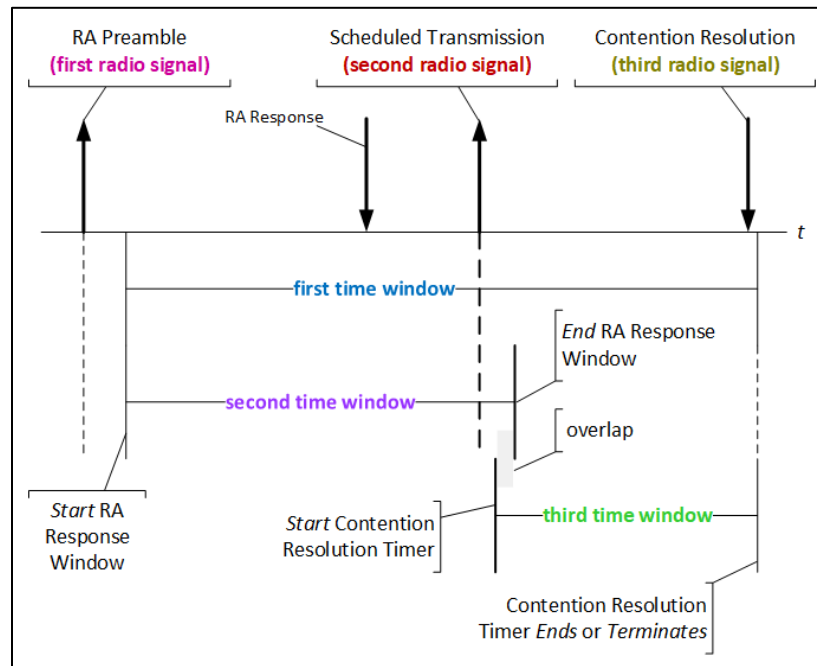
Xia also renders obvious the time window limitations, discussed herein. For example, Xia's UE transmits first and second radio signals within the claimed time windows, and monitors for the third radio signal within a third time window, as shown in FIG. 6B:



APPLE-1004, FIG. 6B (annotated); Xia Provisional, FIG. 6

APPLE-1003, ¶¶85-95.

The CBRAP described in 3GPP-LTE also renders obvious the first, second, and third time windows, as shown by way of example in Figure Ak11:



APPLE-1003, FIG. Akl1

APPLE-1003, ¶¶85-95.

As shown in the above figures and described herein, the prior art renders the “time windows” obvious. Thus, no construction is necessary or warranted to resolve the dispute because the prior art renders this limitation obvious. APPLE-1003, ¶¶85-95.

Additionally, Apple disagrees with the proposed construction of the triggering limitation because it merely swaps the word “triggering” for the word “causing,” thereby adding nothing. No ambiguity exists in the limitation, and Apex did not reveal what, if any, clarity flows from this change. Moreover, Apex did not specify the ambiguity with the claimed “triggering” or justify construction of this well-understood term. APPLE-1003, ¶¶85-95.

Apple disagrees with the above proposed constructions for the first and third time windows. First, no construction is necessary beyond the plain meaning. Apex has not identified ambiguity in the recited claim language, nor has it identified or even alleged lexicography in the specification or disclaimer/disavowal elsewhere. Second, the claims do not require receipt of the third radio signal during the first time window; the claims do not recite receiving the third radio signal at all. Rather, the claims require a first time window during which time the UE monitors for the third radio signal. The proposed construction is an improper attempt to inject unrecited limitation into the claim, without amendment, a practice routinely and rightly rejected within this forum and by the Federal Circuit. *E.g.*, *Source Vagabond Sys.*, 753 F.3d at 1299; APPLE-1003, ¶¶85-95. .

Apple also disagrees with the proposed second time window. Neither the specification nor claims limits the “second time window” in terms of the “second radio signal,” let alone requires that it be defined as “the period of time from the first radio signal in which to transmit the second radio signal.” The claim simply requires that “a time domain resource occupied by the second radio signal is within the second time window,” and nothing more. APPLE-1003, ¶¶85-95.

Apex previously advanced separate constructions in the parallel District Court litigation adverse to Samsung:

Claim Term	PO's Proposed Constructions
"time window"	"the time allocated to respond to a signal request"

APPLE-1030, 17, 38; APPLE-1038, Paper 18, 10-11. In support, Apex argued that the definition of window is "a time interval." APPLE-1030, 39.

Given that Apex has advanced various constructions at different times in different forums, it would be impossible now to predict what constructions they might offer in the future. Accordingly, and rather than guessing, Petitioner may seek to respond to new claim constructions that Apex advances in this proceeding.

III. PRIOR ART BACKGROUND

A. General Overview of MIMO and Antenna Beam Failure Recovery

Multiple-input and multiple-output (MIMO) radio communications was developed to improve speed, reliability, and coverage area of wireless signals transmitted over the air. APPLE-1003, ¶¶54-57. MIMO became a well-known physical layer technique, where a user equipment (UE) and a base station each transmit and receive wireless signals using multiple antennas. *Id.*

Each antenna emits a beam that directs the energy of wireless radio signals and allows the base station to transmit radio signals concurrently. *Id.* Due to time-varying fluctuations in the radio frequency channel conditions, the quality of each

beam (the quality of communication between the UE and base station) may vary over time based on various factors. *Id.*

When the quality of the beam is insufficient, a beam failure may be detected. *Id.* To resolve beam failure, the UE and base station undergo a beam failure recovery process: the UE and base station exchange messages to adjust beam patterns and improve the quality of communication links. *Id.* This process was well-known before the Critical Date. *Id.*; *see also*, APPLE-1012 (citing APPLE-1011 *inter alia*).

B. 3GPP Proposed Standard

The 3rd Generation Partnership Project (3GPP) is a well-known standards organization that promulgates cellular standards. APPLE-1003, ¶¶58-60. Generally, 3GPP holds working group meetings several times a year to provide a forum for proposals and discussion of changes or additions to the standard. *Id.* The 3GPP materials are made available to the public on the 3GPP website. *Id.*

During one particular working group meeting in China between June 27-30, 2017, the working group discussed the following proposal:

Proposal 7: A UE can transmit additional beam failure recovery request through PUCCH after it first transmits using PRACH and before it receives the corresponding Message 2.

APPLE-1006, 4; APPLE-1016, ¶¶29, 115-120; APPLE-1003, ¶¶58-60.

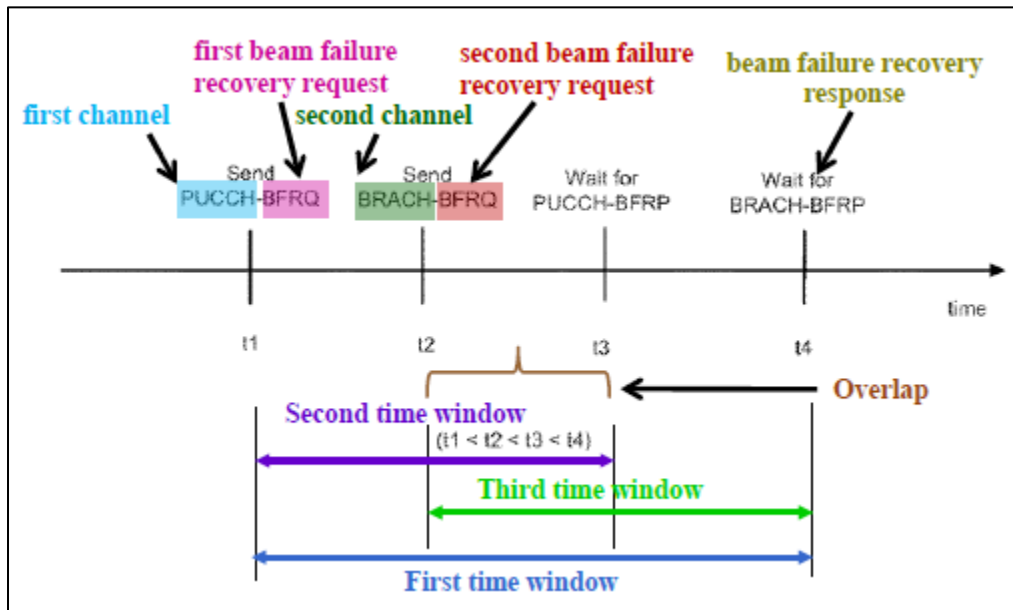
Proposal 7 describes a technique where a UE can send a second beam failure recovery request through a second channel, the Physical Uplink Control Channel (PUCCH), before receiving a response (the corresponding Message 2) to a first beam failure recovery request through a first channel, the Physical RA Channel (PRACH). APPLE-1003, ¶¶58-60. The meeting document (R1-1710596) was made publicly available on the 3GPP website on June 16, 2017, approximately two months prior to the Critical Date. *See* APPLE-1010, 23; APPLE-1016, ¶¶29, 115-120.

C. Patent Literature Implementing Proposed Standard – Xia

Between June 16 and August 11, 2017, several patent applications were filed on Proposal 7. *E.g.*, APPLE-1004, FIG. 6B; APPLE-1007, FIG. 5B. For example, Xia discloses a method in a UE where multiple beam failure recovery requests are transmitted to a base station. APPLE-1004, 12:57-13:2; APPLE-1012, [0084]. The UE first monitors a reference signal (beam failure detection RS) (target signal) to assess whether a beam failure trigger condition has been met (measurement for the target signal). APPLE-1004, 10:27-34; APPLE-1012, [0062]. If so, the UE transmits a **first beam failure recovery request** to the base station using a **first channel** (e.g., **PUCCH**), and subsequently transmits a **second beam failure recovery request** to the base station using a **second channel** (e.g., **PRACH**). APPLE-1004, 12:57-13:27, 13:43-14:24, 14:32-15:3, FIGS. 6B, 7A-7B; APPLE-

1012, [0084]-[0085], FIG. 6. Xia also discloses that the UE waits for a **beam failure recovery response** to the two beam failure recovery requests, at t3 or t4.

APPLE-1004, 14:7-12; APPLE-1012, [0084]-[0085], FIG. 6.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

APPLE-1003, ¶¶61-64.

Thus, per FIG. 6B, the UE waits for the response to the beam failure recovery requests within a time window (t1 to t4) (**first time window**). APPLE-1004, 14:7-12, 11:45-12:5; APPLE-1012, [0084]-[0085], FIG. 6. As shown, a response time window associated with the first beam failure recovery request (**second time window**) and a response time window associated with the second beam failure recovery request (**third time window**) have overlapped time domain resource(s). APPLE-1003, ¶¶61-64.

Xia is analogous art to the '113 patent because Xia, like the '113 patent, is directed to “wireless communication networks” that include methods for “recovering from a beam failure between [UE] and a base station.” APPLE-1004, 1:12-14; APPLE-1012, [0001]; APPLE-1001, 1:16-59; APPLE-1003, ¶¶61-64.

D. Jover

Jover discloses detecting a communication impairment (e.g., connection failure) between an endpoint device (e.g., UE) and base station. APPLE-1005, [0039]-[0040]. Jover explains that “a communication impairment may comprise a decreased signal-to-noise ratio (SNR), decreased signal-to-interference-and-noise (SINR) ratio, decreased received signal strength indication (RSSI) and/or an increased bit-error rate (BER) detected at the endpoint device 300.” *Id.* For example, the communication impairment is detected by “a threshold drop in the SNR or SINR (e.g., a 20 percent drop as compared to a preceding time period)[,] an increase in the BER (e.g., when the BER increases beyond one percent).” *Id.* When “one or more of such threshold conditions are met, the wireless channel sensing engine 320 may signal to the beam-forming engine 310 to begin the beam sweeping procedure.” *Id.*; APPLE-1003, ¶¶65-66.

Jover is analogous prior art to the '113 Patent under §§102(a)(1)-(2). Like the '113 patent, Jover pertains to wireless communication networks including “detecting a communication impairment” between an endpoint device (UE) and a

base station. APPLE-1005, [0001]-[0003], [0039]-[0040]; APPLE-1001, 1:16-59; APPLE-1003, ¶¶65-66. Both Jover and the '113 patent describe using SNR, SINR, BER, and BLER to detect communication impairment. *E.g.*, APPLE-1001, 4:66-5:15; APPLE-1005, [0039]-[0040]; APPLE-1003, ¶¶65-66.

E. 3GPP-LTE: Contention-Based RA Procedure (CBRAP)

3GPP Long Term Evolution (LTE) standard, Release 14 includes Technical Specifications (TS), each describing standardized techniques for implementing Evolve Universal Terrestrial Radio Access (E-UTRA) technologies, including the following:

Exhibit	Technical Specification
APPLE-1023	TS 36.321 V14.3.0
APPLE-1024	TS 36.133 V14.4.0
APPLE-1025	TS 36.213 V14.3.0
APPLE-1026	TS 36.300 V14.3.0
APPLE-1027	TS 36.331 V14.3.0
APPLE-1028	TS 36.201 V14.1.0
APPLE-1029	TS 36.212 V14.3.0
APPLE-1035	TS 36.211 V14.3.0

APPLE-1016, ¶¶20-26, *passim*; APPLE-1003, ¶¶67-72.

For example, “the radio interface protocols are specified in companion specifications of the 36 series.” *E.g.*, APPLE-1026, §1.

As noted in Section II.B, in this petition, the 3GPP standard for Release 14 described by this specific collectively of documents is referred to as “3GPP-LTE,” despite each TS being cited separately.

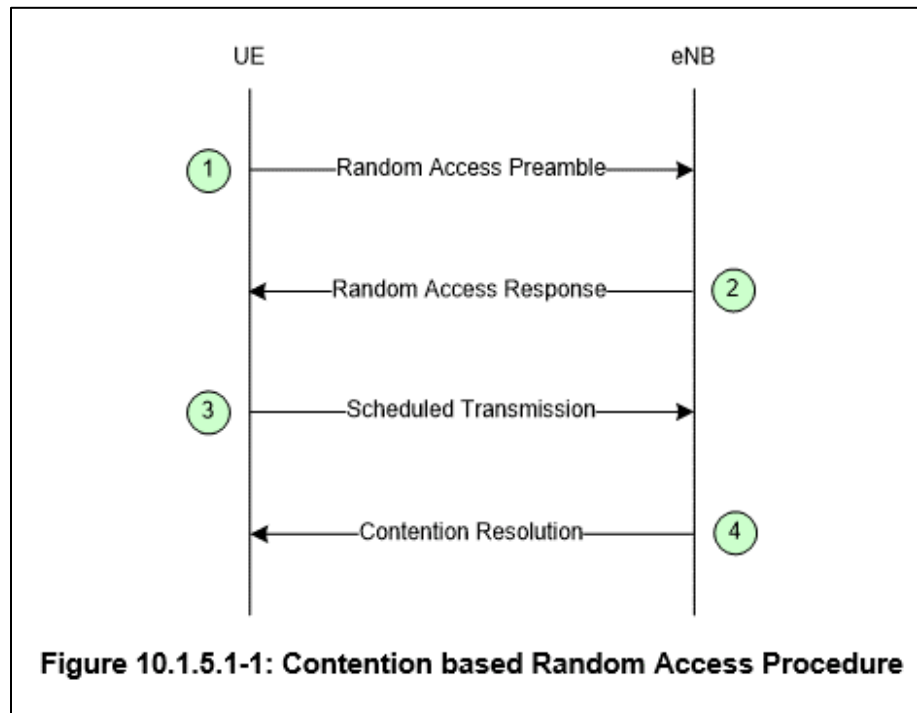
A POSITA would have understood that this collection of TSs are part of a larger collection of documents that make up the 3GPP Standard. APPLE-1003, ¶¶67-72. That is, each TS is considered part of a larger document. *Id.* The 3GPP TSs are collectively considered component teachings, each standing independent but each also standing as a complement to the others in describing the implementation of LTE E-UTRA technology. *Id.* Where one TS does not provide details of particular parameters and procedures or specifically references another TS, a POSITA would have looked to another TS for more information, considering it part of the information used to describe the implementation of LTE E-UTRA technology. *Id.*

Thus, the collection of documents identified as 3GPP-LTE describes, in aggregate, a specific teaching, eligible for consideration under as a piece of publication-based prior art eligible for grounds before the PTAB. A POSITA would have found it obvious to combine each of the 3GPP TS documents for determining the specifications described in each one to implement CBRAP correctly and in its entirety. *Id.*; *infra*, §VI.B-C. A POSITA would have had a reasonable expectation of success combining each of the 3GPP TS documents

because each 3GPP TS document is meant to be read as a single document, and each refers to other 3GPP TS documents. APPLE-1003, ¶¶67-72.

3GPP-LTE is analogous art because the '113 Patent expressly describes LTE and LTE-Advanced. APPLE-1001, 14:45-52. 3GPP-LTE is analogous art to Yi for similar reasons. *E.g.*, APPLE-1031, [0006]. A POSITA would have found it obvious to use standardized RAN technology features when implementing Yi because Yi expressly states its applicability to 3GPP-LTE. *Id.*; APPLE-1031, [0006]; APPLE-1003, ¶¶67-72. For similar reasons, a POSITA would have had a reasonable expectation of success applying features from 3GPP-LTE because they were well-known, standardized features for constructing and transmitting OFDM-based messages across a 3GPP-compliant wireless link. APPLE-1003, ¶¶63-71.

With this in mind, prior art that we reference as 3GPP-LTE describes a contention-based RA procedure (CBRAP) that a UE follows when experiencing link failure, described by the collection of documents in the above table. APPLE-1026, §10.1.5.1, §10.1.6. The CBRAP is outlined on Figure 10.1.5.1-1:



APPLE-1026, §10.1.5.1. Briefly, steps of CBRAP are:

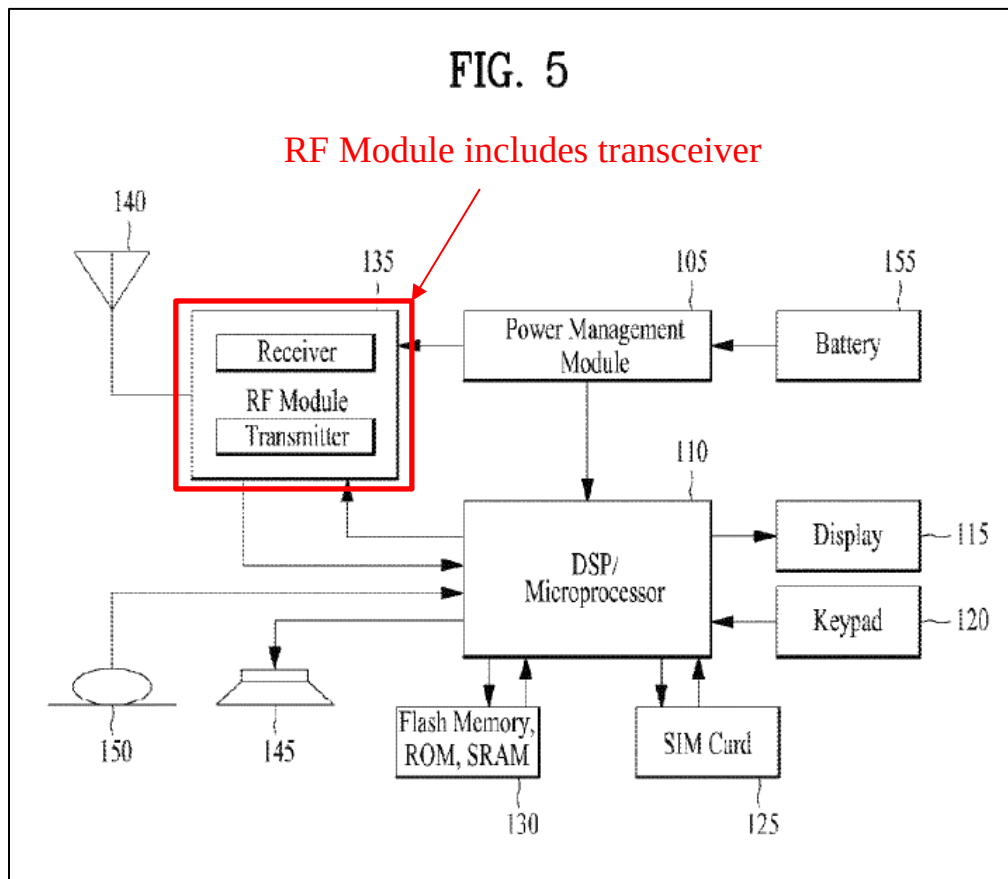
- 1) Msg1: UE transmits/base station (BS) receives RA Preamble on RACH, and RA response (RAR) window starts after UE sends Msg1;
- 2) Msg2: BS transmits/UE receives RAR generated by MAC on the downlink shared channel transport channel (DL-SCH), where RAR conveys information for the UE to transmit on the uplink shared channel transport channel (UL-SCH);
- 3) Msg3: UE transmits/BS receives first scheduled UL transmission on the UL-SCH, which is mapped to the Physical Uplink Shared Channel (PUSCH), and triggers contention resolution timer;

- 4) Msg4: BS transmits/UE receives contention Resolution on DL during
within the contention resolution timer.

Id.; APPLE-1029, §4.1; APPLE-1003, ¶¶67-72.

F. Patent Literature Implementing LTE CBRAP – Yi

Yi relates to “a random access procedure in a wireless communication system” applicable to LTE. APPLE-1031, Abstract, [0003]-[0012]. Yi describes a device for performing CBRAP, shown in FIG. 5:

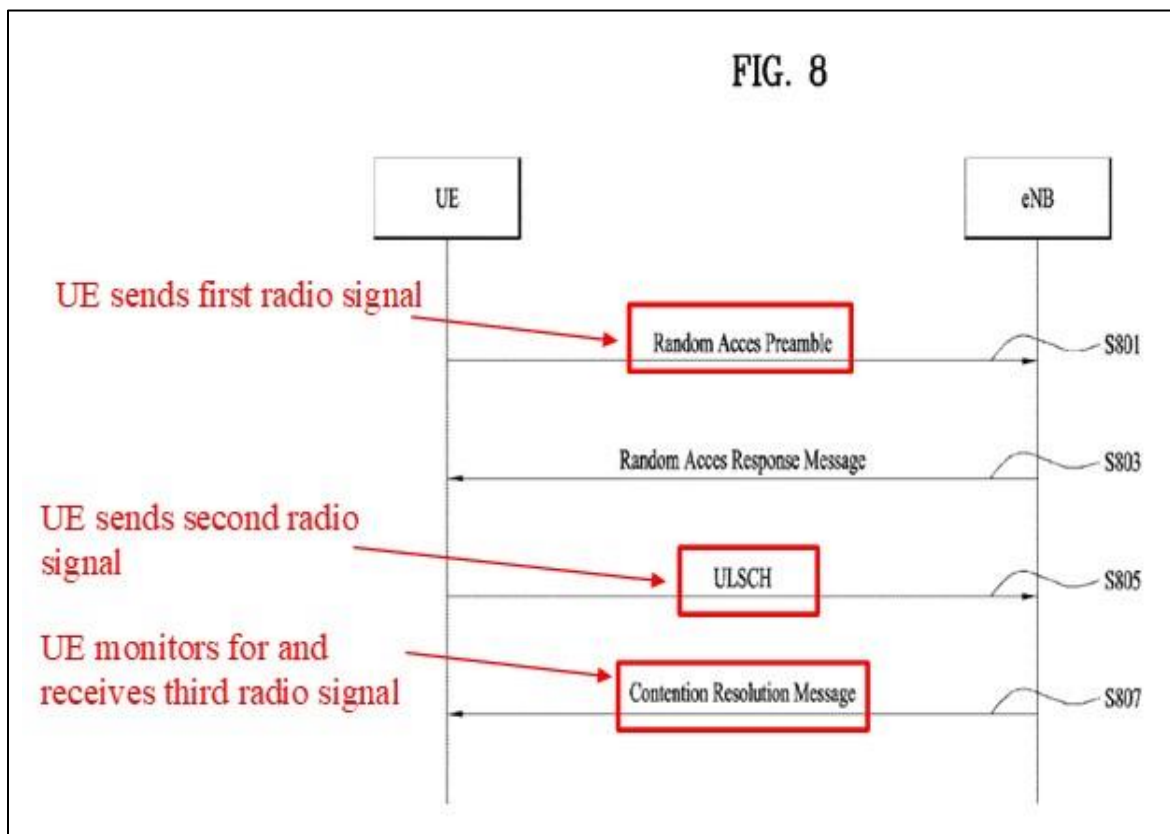


APPLE-1031, FIG. 5 (annotated)

APPLE-1003, ¶¶73-79.

Yi's UE has an RF module including a "receiver (135) configured to receive a request message from a network, and a transmitter (135) configured to transmit the transmission or reception timing information to the network." APPLE-1031, [0051]-[0057], [0072]. FIG. 5 shows the components of a network apparatus, which can be a base station (e.g., eNB). APPLE-1031, [0051]-[0055], [0184]. The CBRAP method "may be implemented in the form of modules, procedures, functions, etc. performing the above-described functions or operations." APPLE-1031, [0187]; *see* APPLE-1001, 25:17-19; APPLE-1003, ¶¶73-79.

Yi illustrates CBRAP in FIG. 8:



APPLE-1031, FIG. 8 (annotated)

The CBRAP uses a RAR window size that can exceed 10 subframes, e.g., when the UE is operating in enhanced coverage. APPLE-1031, [0072], [0149]; *see* APPLE-1001, 25:21-31; APPLE-1003, ¶¶73-79.

Yi is analogous prior art to the '113 Patent under §§102(a)(1)-(2). Like the '113 Patent, Yi describes communications between a base station and UE over an LTE-compliant wireless link. *E.g.*, APPLE-1031, [0002]-[0009]; APPLE-1001, 14:45-65; APPLE-1003, ¶¶73-79.

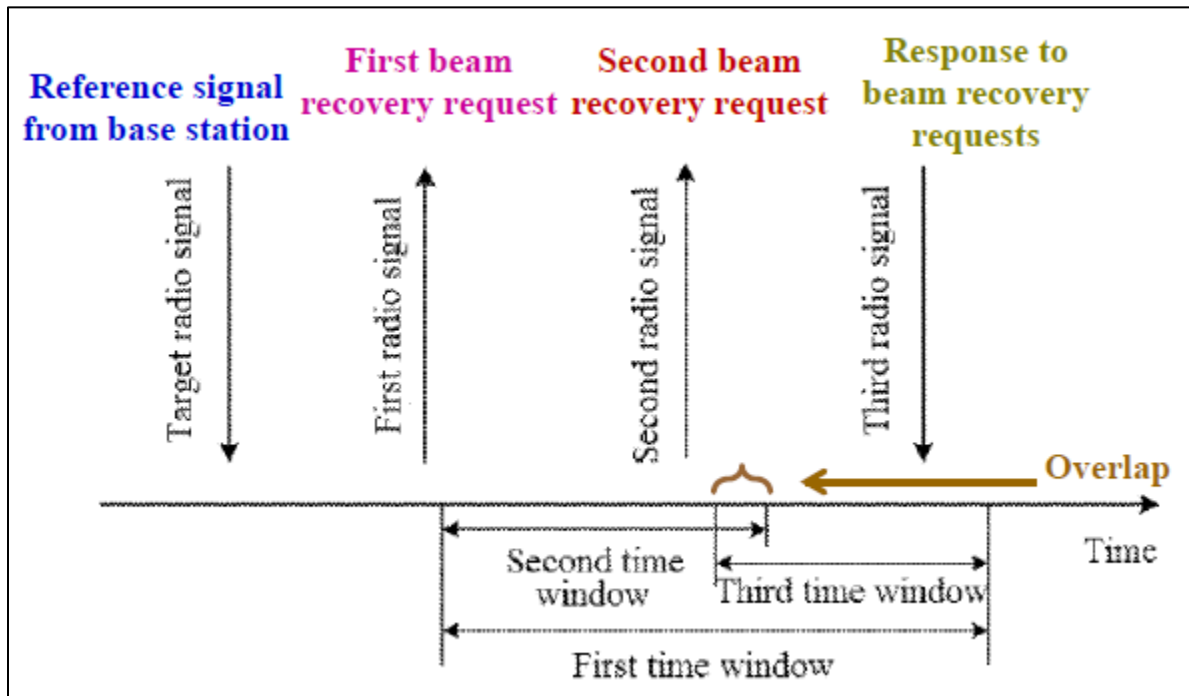
IV. SUMMARY OF THE '113 PATENT

A. Brief Description

The '113 patent describes wireless communications between a UE and base station using known procedures. It addresses beam recovery between a UE and base station in a wireless communication system. APPLE-1001, 1:43-52. The '113 patent contemplates a transmission scheme in a UE, where the UE receives a target radio signal (e.g., **reference signal**) from the base station and determines whether a triggering condition is met. APPLE-1001, 5:9-18, 23:48-54, 2:23-24; APPLE-1003, ¶¶80-82.

When the triggering condition is met, the UE transmits a first radio signal (**first beam recovery request**) to the base station using a first channel (PUCCH), and subsequently transmits a second radio signal (**second beam recovery request**) using a second channel (PRACH). APPLE-1001, 2:1-3, 8:57-65; APPLE-1003,

¶¶80-82. The base station receives both requests and sends a **beam recovery response**, shown in FIG. 6. APPLE-1001, 10:47-49, 10:63-64; APPLE-1003, ¶¶80-82.



APPLE-1001, FIG. 6 (annotated).

Per FIG. 6, the UE waits for the response to the beam failure recovery requests within a (first) time window from sending the first beam failure recovery request to receiving the response to the beam failure recovery requests. APPLE-1001, 2:3-7; APPLE-1003, ¶¶80-82. Further, a response (second) time window associated with the first beam failure recovery request and a response (third) time window associated with the second beam failure recovery request have overlapped time domain resource(s). APPLE-1001, 12:7-9, 22:51-56, 9:55-56; APPLE-1003,

¶¶80-82. As explained below, all claimed elements already existed in the prior art.

B. Prosecution History

During prosecution, in response to a prior art rejection, Applicant amended claims 1, 6, 11, and 16 by adding various time window limitations shown in FIG. 6 (discussed above) and argued the prior art does not disclose that “the second time window and the third time window have overlapped time domain resource(s).” APPLE-1002, 122-142, 153-159. The Examiner subsequently allowed the claims but without the benefit of the prior art applied herein. APPLE-1002, 123-142, 172-182.

C. IPR History

The '113 patent was the subject of an instituted IPR (consolidated IPR2023-00601 and IPR2023-00602), which did not reach FWD, as Patent Owner settled and terminated the proceeding. IPR2023-00601 involved obviousness grounds based on Xia and Xia-Jover, which prior art is presented in this petition to enable full consideration of the claims based on them.

V. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (POSITA) would have had at least an electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks. Additional education might substitute for some of the

experience, and additional substantial experience might substitute for some of the educational background. APPLE-1003, ¶¶50-53. A POSITA would also have familiarity with the 3GPP LTE standards, and would have understood how to search through the available Technical Specifications for implementing RAN technologies. *Id.*

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUNDS 1-2] – Xia (Ground 1) and Xia-Jover (Ground 2) Render Claims 1-20 obvious

Xia renders claims 1-20 obvious. Likewise, Xia-Jover renders claims 1-20 obvious. Hereafter, collectively, Grounds 1-2 are referred to as Xia/Xia-Jover.

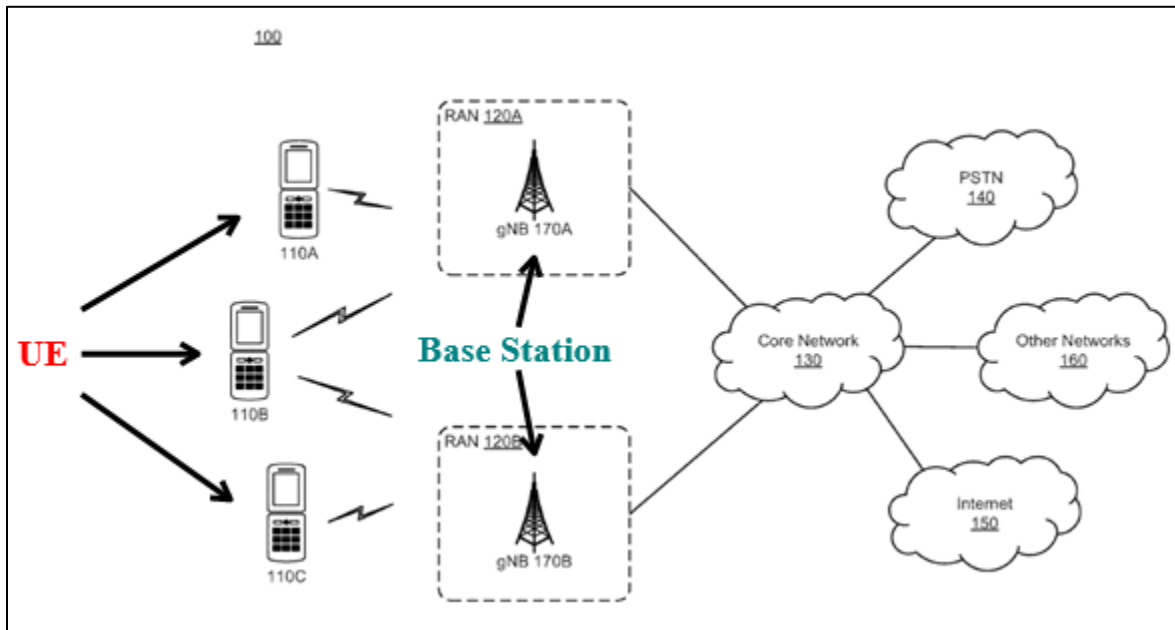
1. Claim 1

[1pre]

To the extent the preamble is limiting, Xia discloses [1pre]. APPLE-1003, ¶¶98-99. Per FIG. 1, Xia discloses wireless communication system 100 including “**user equipment 110A-110C**, radio access networks (RANs) 120A-120B, a core network 130, a public switched telephone network (PSTN) 140, the Internet 150,

and other networks 160.” APPLE-1004, 4:10-30;⁴ APPLE-1012, [0025]. The “[UE] 110A-110C are configured to operate and/or communicate in the system 100” and “transmit and/or receive wireless signals or wired signals.” APPLE-1004, 4:38-48; APPLE-1012, [0028]. “[T]he RANs 120A-120B include one or more base stations 170A, 170B (collectively, **base stations 170**)” that are “configured to wirelessly interface with one or more of the **UEs 110A, 110B, 110C** to enable access to the core network 130, the PSTN 140, the Internet 150, and/or the other networks.” APPLE-1004, 4:49-62; APPLE-1012, [0029]; APPLE-1003, ¶¶98-99.

⁴ All emphasis is added unless noted otherwise. Figures herein containing color (including text) are annotated relative to the original figures in the patent or prior art.

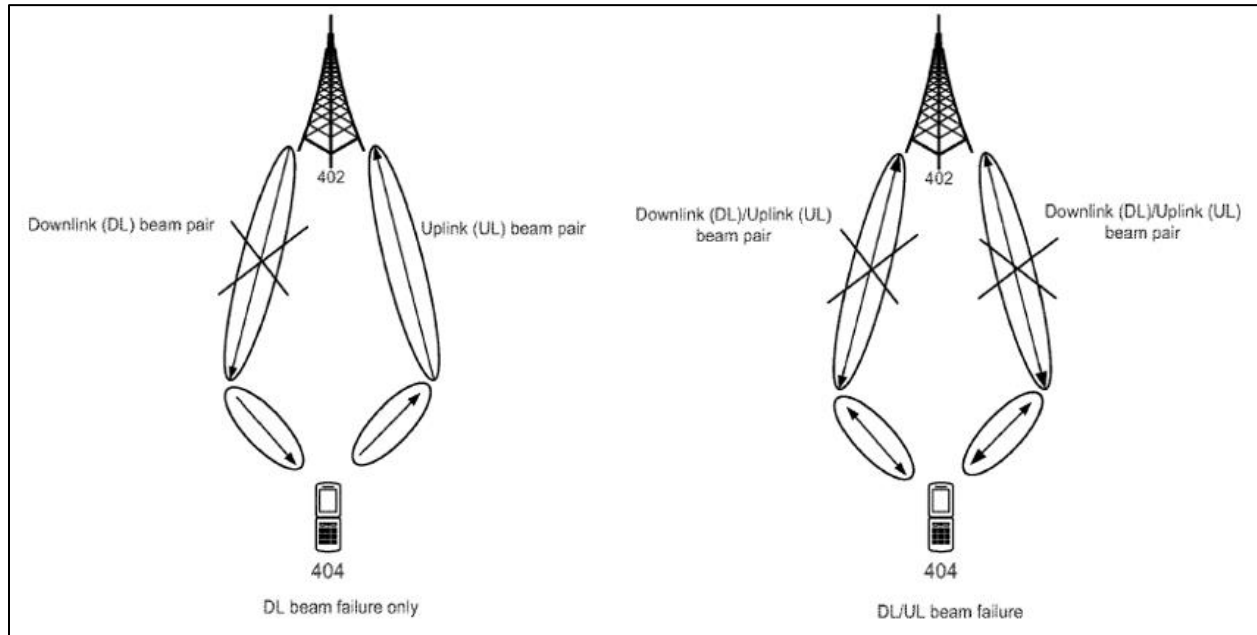


APPLE-1004, FIG. 1 (annotated); APPLE-1012, FIG. 1.

Xia describes a “method for beam failure recovery in [UE].” APPLE-1004, 1:51-57; APPLE-1012, [0004]. Xia’s method includes “detecting a beam failure event between the [UE] and a base station; sending a first beam failure recovery request (BFRQ) to the base station upon detection of the beam failure event; and searching for a beam failure recovery response (BFRP) within a first response window,” and “sending a second BFRQ to the base station for a same beam failure event; and indicating to the base station that the first and second BFRQs correspond to the same beam failure event.” APPLE-1004, 1:51-57; APPLE-1012, [0004], [0007]; APPLE-1003, ¶¶98-99.

[1a]

The UE receives a target radio signal, a “reference signal (beam failure detection RS),” from the base station. APPLE-1004, 10:27-60; APPLE-1012, [0062]; APPLE-1003, ¶¶100-102. Per FIGS. 4A-4B, “the base station 402 and [UE] 404 communicate via DL [downlink] beam pairs and UL [uplink] beam pairs.” APPLE-1004, 7:15-21; APPLE-1012, [0044]. FIG. 4A illustrates a case where “the DL beam pair fails”; FIG. 4B illustrates a case where “the DL/UL beam pair fails.” *Id.*



APPLE-1004, FIGS. 4A (left), 4B (right); APPLE-1012, FIGS. 4A-4B.

Per Xia, “[t]o detect a beam failure, the UE (e.g., 404) monitors a reference signal (beam failure detection RS) to assess whether a beam failure trigger condition has been met.” APPLE-1004, 10:27-34; APPLE-1012, [0062]. The beam failure detection RS includes “a periodic CSI-RS [channel state information-

reference signal] for beam management” or “the periodic CSI-RS and SS [synchronization signal]-blocks within the serving cell when the SS-block is used to detect beam failure.” APPLE-1004, 10:27-41; APPLE-1012, [0062]. A POSITA would have understood that Xia teaches that a UE receives the beam failure detection RS because the UE detects the beam failure and reports the detection. APPLE-1003, ¶¶100-102; APPLE-1004, 10:35-60; APPLE-1012, [0062].

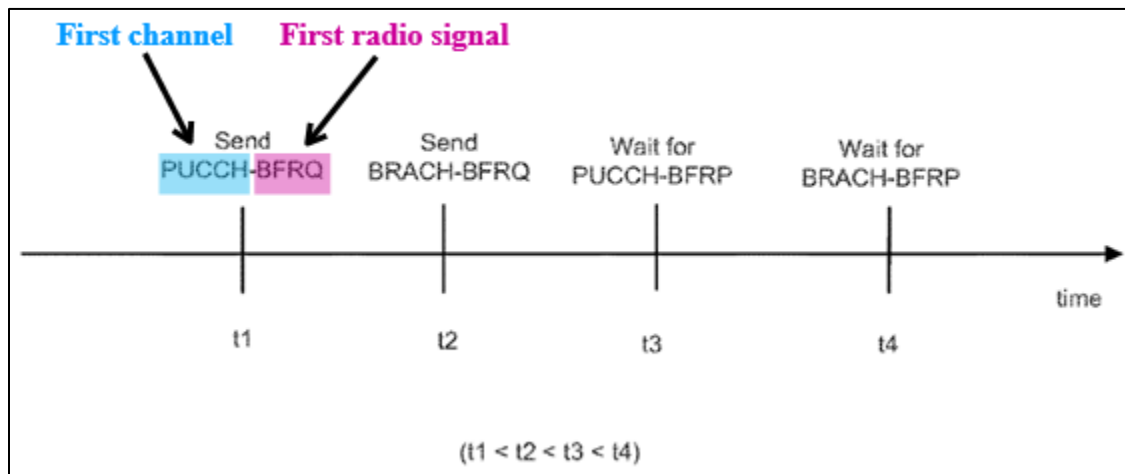
The '113 patent states that the claimed “target radio signal” can be a “reference signal” such as “a Channel State Information Reference Signal (CSI-RS) used for conducting a channel quality measurement of a physical layer control channel,” or a “Synchronization Signal (SS) used for conducting a channel quality measurement of a physical layer control channel.” APPLE-1001, 2:23-36. Thus, Xia’s reference signal (beam failure detection RS) (e.g., the periodic CSI-RS or the SS-block) is a “target reference signal.” APPLE-1003, ¶¶100-102.

[1b]

Xia discloses that, after the UE detects the beam failure, a BFRQ transmission is performed. APPLE-1004, 10:42-60; APPLE-1012, [0062]; APPLE-1003, ¶¶103-106. The UE may transmit more than one BFRQ (e.g., PUCCH-BFRQ, PRACH-BFRQ) for a single beam failure (BFR) event. APPLE-1004, 12:57-13:2; APPLE-1012, [0070]-[0072]. Because the UE may transmit

more than one BFRQ, different channels (e.g., PUCCH, PRACH) may be used to send the BFRQ (and receive the BFRP). APPLE-1004, 12:57-13:2; APPLE-1012, [0070]-[0072].

For example, per FIG. 6B, the UE transmits a first BFRQ (“**first radio signal**”) to the base station on a PUCCH (“**first channel**”) (PUCCH-BFRQ). APPLE-1004, 13:14-27, 13:43-46; APPLE-1012, [0073]-[0074], [0084], FIG. 6.



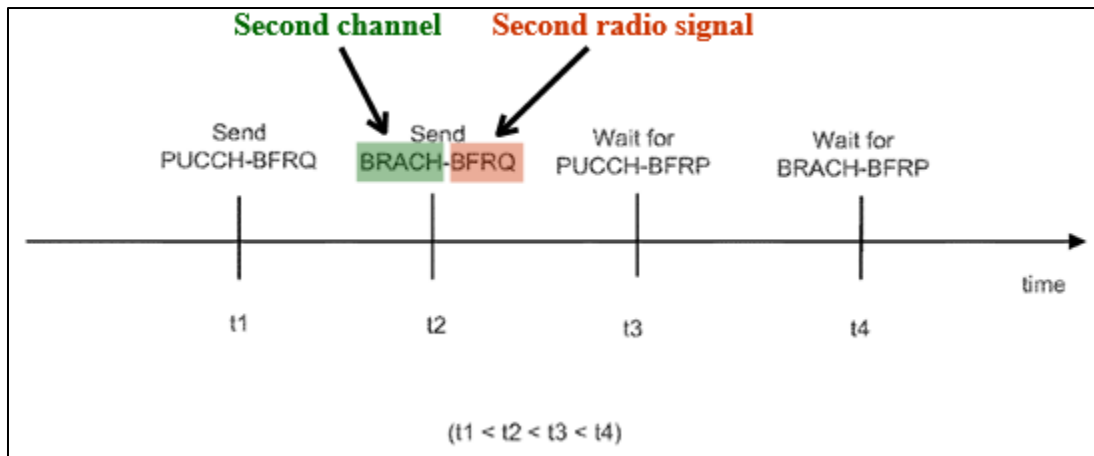
APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

APPLE-1003, ¶¶100-102. The '113 patent states that the claimed “first radio signal” can be a “beam recovery request[,]” and “the first channel” can be “a PUCCH.” APPLE-1001, 3:41-42, 8:57, *see id.*, 13:66-67.

Accordingly, Xia's first BFRQ is a "first radio signal," and Xia's PUCCH is a "first channel."⁵ APPLE-1003, ¶¶100-102.

[1c]

Xia discloses that, after the PUCCH-BFRQ is sent, the UE transmits a second BFRQ ("second radio signal") to the base station on a PRACH ("second channel") (PRACH-BFRQ), per FIG. 6B. APPLE-1003, ¶¶107-110.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

Specifically, after a PUCCH-BFRQ is sent at t1, and before a PUCCH-BFRP arrives at the UE from the base station, the UE has a PRACH-BFRQ

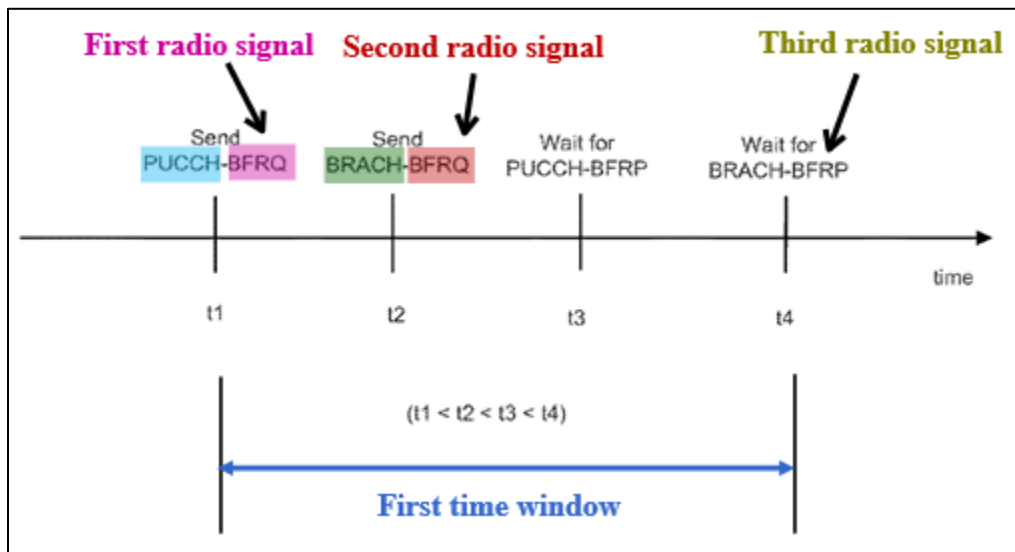
⁵ While, for the purposes of this Petition, the first channel is the PUCCH and the second channel is the PRACH, Xia clarifies that "the UE 404 may first send a PRACH-BFRQ, followed by a PUCCH-BFRQ, and that the disclosure is [not] limited to the depicted embodiment." APPLE-1004, 13:64-67.

Opportunity and sends a second BFRQ using a PRACH-BFRQ. APPLE-1004, 13:14-27, 14:7-12; APPLE-1012, [0065], [0084], FIG. 6. Note that in Xia, the UE sends both the PUCCH-BFRQ (first radio signal) and the PRACH-BFRQ (second radio signal) for the “same beam failure event.” APPLE-1004, 14:53-56; APPLE-1012, [0007], [0070]-[0078]; APPLE-1003, ¶¶107-110.

The ’113 patent states that a “second radio signal” can be a “beam recovery request[,]” and “the second channel” can be “a physical layer random access channel.” APPLE-1001, 8:18-19, 13:66-67. Therefore, Xia’s second BFRQ is a “second radio signal,” and Xia’s PRACH is a “second channel.” APPLE-1003, ¶¶107-110.

[1d]

After sending the BFRQs, Xia’s UE waits for (monitors) a BFRP (“**third radio signal**”) in a first time window, shown in FIG. 6B. APPLE-1004, 14:7-12, 11:45-12:5; APPLE-1012, [0083]-[0085], FIG. 6; APPLE-1003, ¶¶111-114.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

APPLE-1003, ¶¶111-114.

As shown, Xia's UE waits for the BFRP (i.e., PRACH-BFRP) from the base station from t1 to t4 ("**first time window**") because a single BFRP is sent in response to two BFRQs. APPLE-1004, 14:7-12; APPLE-1012, [0083]-[0085]. Specifically, the UE sends two BFRQs, a PUCCH-BFRQ at t1 and a PRACH-BFRQ at t2, and the UE waits for a single BFRP from the base station, a PUCCH-BFRP at t3 or a PRACH-BFRP at t4. APPLE-1004, 14:7-12; APPLE-1012, [0083]-[0085]. The UE also receives the BFRPs from the base station, implying that the base station sends the BFRPs. APPLE-1004, 2:37-45, 11:10-12, 14:7-24 (describing the base station sending BFRPs); APPLE-1003, ¶¶111-114.

In addition to satisfying the plain meaning construction, FIG. 6B shows that the first time window in Xia satisfies PO's previous constructions because it is a

period of time from (after) the first radio signal (PUCCH-BFRQ) for receiving the third radio signal (PRACH-BFRP), which is a response to one of the first or second radio signal (PUCCH-BFRQ or PRACH-BFRQ, respectively). The third radio signal (PRACH-BFRP) is received during the time allocated for its reception in Xia's beam forming process. APPLE-1004, 14:7-12 (describing UE waiting for BFRP during time windows defined by t3 and t4); APPLE-1012, [0083]-[0085]; APPLE-1003, ¶¶111-114.

The '113 patent indicates the "third radio signal" can be "a response to the second radio signal," or "a response to the first radio signal and the second radio signal." APPLE-1001, 10:47-49, 10:63-64. Thus, Xia's BFRP is a "third radio signal." APPLE-1004, 14:7-12; APPLE-1003, ¶¶111-114.

Moreover, per FIG. 6B, Xia waits for the single BFRP from the starting position (t1) and ending position (t4). APPLE-1004, 14:7-12; APPLE-1012, [0083]-[0085]. Xia's UE thus monitors the single BFRP between t1 and t4 ("first time window"). *Id.*; APPLE-1021, 1; APPLE-1003, ¶¶111-114.

[1e]

Xia (**Ground 1**) or Xia-Jover (**Ground 2**) renders obvious [1e]. APPLE-1003, ¶¶115-130.

Ground 1: Xia uses a channel state indicator reference signal (CSI-RS) to detect beam failure ("target measurement value") for triggering the transmission of

the first and second BFRQs (“the first radio signal and the second radio signal”).

Id. “To detect a beam failure, the UE (e.g., UE 404) monitors a reference signal (beam failure detection RS) to assess whether a beam failure **trigger condition** has been met.” APPLE-1004, 10:27-34; APPLE-1012, [0062]. In one embodiment, the beam failure detection RS is a periodic CSI-RS for beam management. APPLE-1004, 10:27-34; *supra* [1a] (describing the target signal). As explained below, the detection of beam failure based on measured signal values triggers (*causes*) the transmission of both the PUCCH-BFRQ and PRACH-BFRQ transmissions:

“After the UE 404 detects the beam failure; a beam failure recovery request (BFRQ) transmission is performed.” APPLE-1004, 10:27-34. “[M]ore than one BFRQ (e.g., PUCCH-BFRQ, PRACH-BFRQ) is transmitted by a UE 404 for a single beam failure (BFR) event” and “different channels (e.g., PUCCH and PRACH) may be used to send the BFRQ (and receive the BFRP).” APPLE-1004, 12:57-66 (PUCCH-BFRQ being the first radio signal sent on a first channel and the PRACH-BFRQ being the second radio signal sent on the second channel). The first and second BFRQs are transmitted in Xia only after the indication of the beam failure. APPLE-1004, 12:57-66, 13:3–27 (“UE 404 may signal (i.e., provide information) in the BFRQ that the PUCCH-BFRQ and the PRACH-BFRQ relate to the same event”). Accordingly, the indication of beam failure (“target

measurement value”) triggers the transmission of both the PUCCH-BFRQ (first radio signal) and the PRACH-BFRQ (second radio signal). APPLE-1003, ¶¶115-130.

A POSITA would have understood that many well-known indicators of beam quality were known, including, e.g., signal-to-noise ratio (SNR), signal-to-interference-plus-noise ratio (SINR), bit error rate (BER), and/or block error rate (BLER). APPLE-1003, ¶¶115-130; APPLE-1005, [0020], [0032], [0040] (describing SNR, SINR, received signal strength indication, and BER as known metrics for channel sensing). A POSITA would have also understood that beam failure (i.e., lower beam signal strength) may be indicated by lower SNR and SINR values or higher BER and BLER values. APPLE-1003, ¶¶115-130. Thus, it would have been obvious to compare these well-known indicators of beam quality to a target threshold to determine whether beam failure has occurred. *Id.* For example, a POSITA would have found it obvious to use SNR or SINR as the target measurement value such that the triggering condition would be met when the target measurement value is **lower** than a target threshold. *Id.* A POSITA likewise would have found it obvious to use BER or BLER as the target measurement value such that the triggering condition would be met when the target measurement value is **higher** than a target threshold. *Id.*

When dealing with the option of a high or low threshold, “there are a finite number of identified, predictable solutions, [and a POSITA] has good reason to pursue the known options within his or her technical grasp.” *Google LLC. v. Koninklijke Philips N.V.*, 795 Fed.Appx. 840, 843-844 (Fed. Cir. 2020) (quoting *KSR Int’l. Co. v. Teleflex Inc.*, 550 U.S. 398, 416-421 (2007)); APPLE-1003, ¶¶115-130. Here, only two options exist: high and low, both of which are well-known solutions for determining beam failure. The court has long held “simple substitution of one known element for another” as a basis for obviousness. *Id.*

A POSITA would have known that, generally, as values for SNR and SINR increase, values for BER and BLER decrease, and *vice versa*. *Id.*; APPLE-1005, [0039]; APPLE-1013, 7:25-28; *see* APPLE-1009, 4; APPLE-1025. A POSITA would also have known how to readily convert between SNR and SINR values and BER and BLER values. APPLE-1003, ¶¶115-130. Indeed, it was common by the Critical Date to use these values interchangeably. *Id.*

Thus, implementing a target measurement value that is lower (e.g., SNR, SINR) or higher (e.g., BER, BLER) than a target threshold as a triggering condition would have been a matter of simple design choice between two known alternatives (lower, higher), well within the skill of a POSITA. APPLE-1003, ¶¶115-130; *KSR*, 416-417, 421; *Google*, 843-844.

The '113 patent acknowledges these sets of values may be used interchangeably for triggering the transmission of the first and second radio signals. APPLE-1003, ¶¶115-130. Specifically, the '113 patent discloses using (1) a target measurement value such as a BER or BLER is higher than a target threshold; or (2) a target measurement value such as a SNR or SINR is less than a target threshold. APPLE-1001, 5:9-14, 4:52-5:3. But it does not describe advantages/disadvantages of using one triggering condition versus another. APPLE-1003, ¶¶115-130. Because both conditions lead to the same result—transmission of the first and second radio signals—a POSITA would have found it obvious to readily change between these well-known measurement values. *Id.*; *KSR*, 416-417, 421; *Google*, 843-844.

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to modify Xia's triggering condition to use a target measurement value, such that the beam failure recovery would be triggered if the value was **higher** than a target threshold. APPLE-1003, ¶¶115-130. For example, evaluating BER was well-known and widely used long before the Critical Date. *E.g.*, APPLE-1009, 1-4; APPLE-1013, 7:25-32, 7:37-47.

Thus, it would have been straightforward to modify Xia's triggering condition, and modifying Xia's trigger condition would have yielded predictable

results—namely, accurately and reliably determining beam failures. APPLE-1003, ¶¶115-130.

Ground 2: Xia-Jover renders [1e] obvious. *Id.* Jover discloses detecting a communication impairment (e.g., connection failure) between an endpoint device (UE) and a base station by detecting “a threshold drop in the SNR or SINR (e.g., 20 percent drop as compared to a preceding time period)[,] an increase in the BER (e.g., when the BER increases beyond one percent), and so forth.” APPLE-1005, [0040]. When “threshold conditions are met, the wireless channel sensing engine 320 may signal to the beam-forming engine 310 to begin the beam sweeping procedure.” APPLE-1005, [0040]. Thus, Jover specifically discloses using a target measurement value (BER) higher than a target threshold (1%) as a triggering condition. APPLE-1003, ¶¶115-130.

It would have been obvious to implement Jover’s teachings in Xia’s method such that Xia’s beam failure triggering condition uses BER as the target measurement value, as Jover teaches. APPLE-1005, [0039]-[0040]; APPLE-1003, ¶¶115-130. Both involve wireless communications between a UE and a base station. APPLE-1004, FIGS. 1, 8A-8B; APPLE-1012, FIGS. 1, 8A-8B; APPLE-1005, FIG. 1. Both are specifically directed to detecting a communication failure between the UE and base station. APPLE-1004, 12:57-13:27-, 13:43-14:24, 14:32-15:3, FIGS. 6B, 7A-7B; APPLE-1012, [0084]-[0085], FIG. 6B; APPLE-1005,

[0039]-[0040], FIG. 3. Jover provides using a target measurement value (BER) that is higher than a target threshold (1%) as a triggering condition. APPLE-1005, [0039]-[0040]; APPLE-1003, ¶¶115-130.

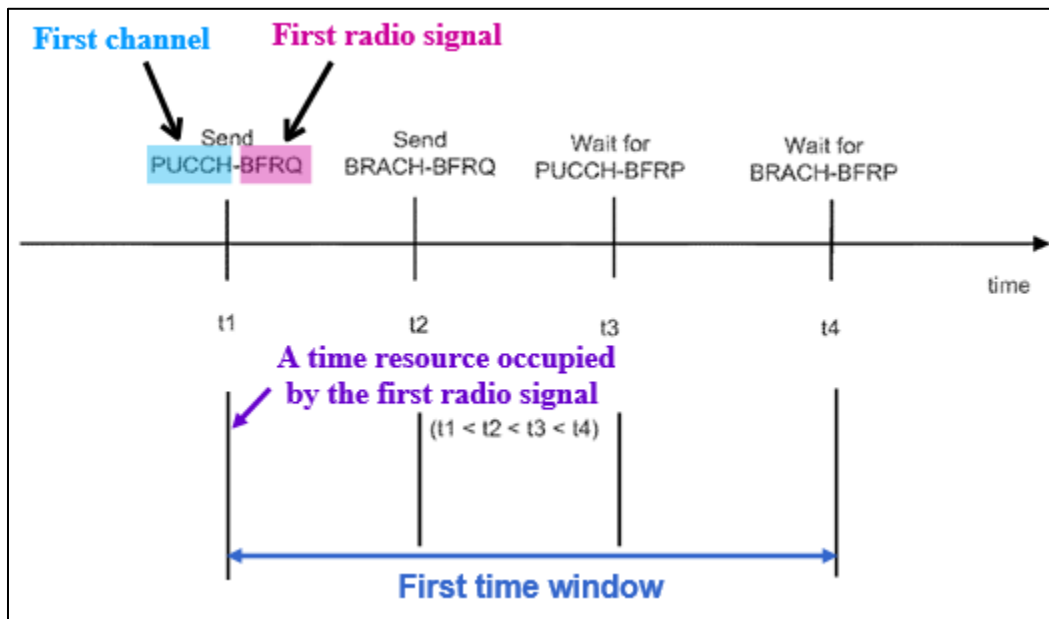
A POSITA would have been motivated to adopt Jover's specific triggering condition in Xia's method. APPLE-1003, ¶¶115-130. Xia already discloses that the transmission of the first and second BFRQs to the base station in response to the detection of a communication failure. *Id.* Jover simply provides details about how to implement Xia's teachings regarding detection of the communication failure; a POSITA would have been motivated and found it obvious to look to Jover to understand and implement its additional teachings. *Id.* A POSITA thus would have been motivated to implement Jover's triggering condition in Xia's method to improve the accuracy and reliability of the beam failure determination. *Id.* For example, the addition of a triggering condition based on BER would have provided additional measurements to ensure a beam failure detection is appropriate. *Id.* (citing APPLE-1013, 7:25-32, 7:37-47). Further, a POSITA would have been motivated to implement Jover's triggering condition because of the known benefits of evaluating BER or BLER. APPLE-1003, ¶¶115-130 (citing APPLE-1009, 1; APPLE-1013, 7:25-32, 7:37-47). Thus, a POSITA would have been motivated to implement Jover's triggering condition in Xia's method because

of the advantages triggering condition provides. APPLE-1003, ¶¶115-130; KSR, 417, 421; *Uber*, 1338-41.

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement Jover's triggering condition in Xia's method. APPLE-1003, ¶¶115-130. Xia and Jover include similar components that perform similar functions; both detect communication failures between the UE and the base station. Evaluating BER was well-known and widely used long before the Critical Date. *See, e.g.*, APPLE-1009, 1-4; APPLE-1013, 7:25-32, 7:37-47; APPLE-1003, ¶¶115-130. Thus, it would have been straightforward to add Jover's triggering condition (BER) to Xia's existing method. APPLE-1003, ¶¶115-130. Further, implementing Jover's teachings in Xia would have yielded predictable results—namely, accurately and reliably determining beam failures. *Id.*

Thus, Xia (**Ground 1**) or Xia-Jover (**Ground 2**) renders obvious [1e]. *Id.*
[1f]

Per FIG. 6B, Xia discloses that a time resource occupied by the first radio signal (t1 in FIG. 6B) is used for determining the start time of the first time window. APPLE-1003, ¶¶131-133.



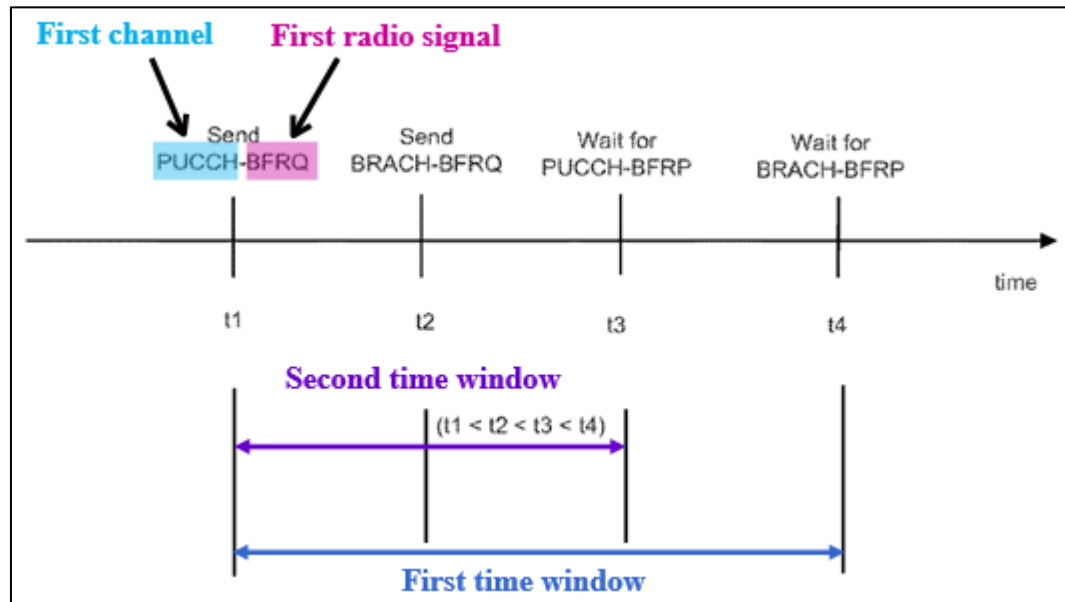
APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

A POSITA would have understood “a time resource occupied by the first radio signal” to include a start time of the first radio signal. *Id.* This is consistent with the ’113 patent, which explains that time domain resources of the first and second signals can be start times of the time windows. APPLE-1001, 23:13-22; APPLE-1003, ¶¶131-133.

Further, Xia discloses monitoring for a BFRP in the “first time window,” and that monitoring begins in response to the first BFRQ. *Supra*, §VI.A-[1d]. Thus, per FIG. 6B, a time resource occupied by the first BFRQ, for example, the starting time of the first BFRQ, is used for determining the start time of the first time window. APPLE-1003, ¶¶131-133.

[1g]

Per FIG. 6B, Xia discloses that a time domain resource occupied by the first radio signal (beginning at t1 in FIG. 6B) is used for determining a second time window (between t1 and t3). APPLE-1003, ¶¶134-137.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

Under a plain meaning construction of “time window” (i.e., “period of time”), Xia teaches the second time window, per FIG. 6B.

To the extent PO’s previous constructions are adopted (the second time window is a period of time from the first radio signal during which the second radio signal is transmitted), Xia still teaches it. APPLE, 1001, 22:53-61, [1h], *infra*. From the above, Xia discloses a period of time (t1 to t3) from the first radio signal (PUCCH-BFRQ) in which to transmit the second radio signal (PRACH-BFRQ). APPLE-1003, ¶¶134-137. In Xia, the time domain resource occupied by

the first radio signal establishes the start of the second time window. *Id.* Even if the length of the time window can be determined in other ways,⁶ the fact that a time domain resource for the transmission of the first radio signal is used for determining at least the start of the second time window satisfies both the plain meaning and PO's previously proposed construction of the claim term. *Id.*

Xia's UE waits for a single BFRP from the base station, a PUCCH-BFRP at t3 or a PRACH-BFRP at t4. *Supra*, §VI.A-[1d]; APPLE-1004, 14:7-12; APPLE-1012, [0083]-[0085]. Thus, the time window for waiting on the PUCCH-BFRP between t1 and t3 represents a "second time window" that begins in response to the first PUCCH-BFRQ. APPLE-1003, ¶¶134-137.

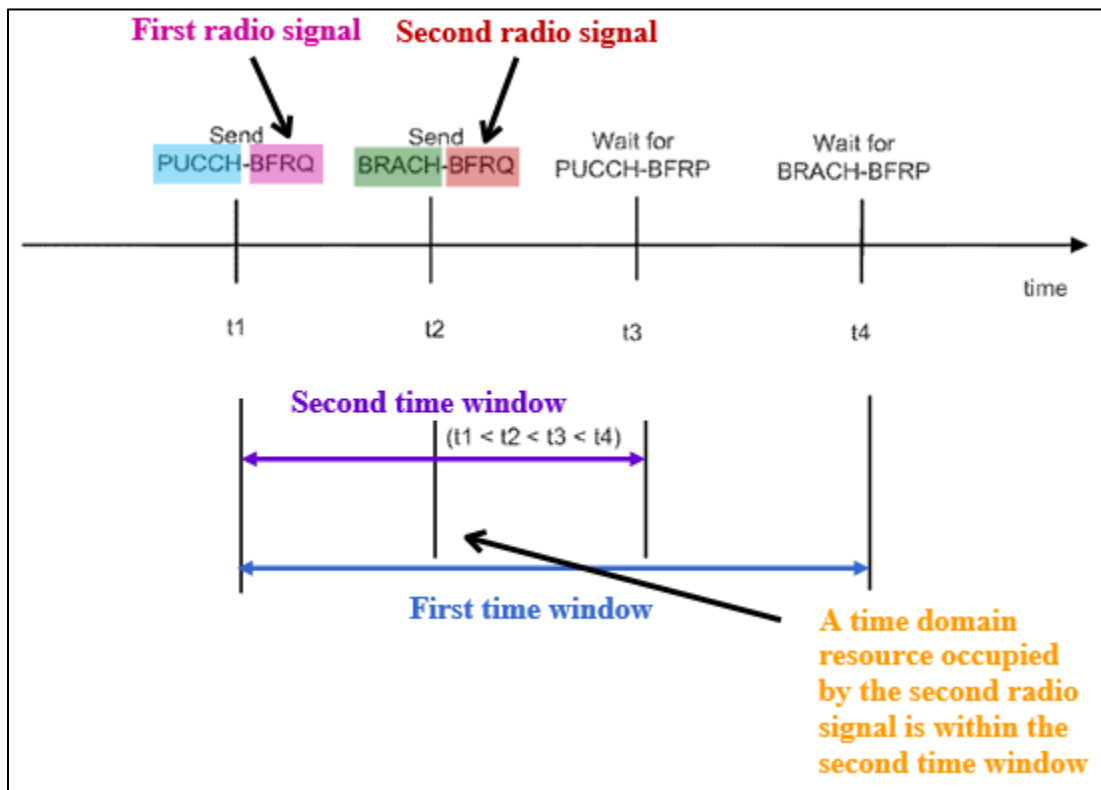
The '113 patent states that "the start time of the second time window and the start time of the first time window are the same." APPLE-1001, 9:23-25. Like the '113 patent, in Xia, the start time of the first and second time windows are the same. APPLE-1003, ¶¶134-137. In Xia, the second radio signal (PRACH-BFRQ) is transmitted during a transmission opportunity (e.g., a PRACH-BFRQ OPPORTUNITY), but such transmission only occurs after the transmission of the

⁶ According to the '113 Patent, the end of the second time window can be configured by default, preconfigured, or configured by a base station. APPLE-1001, 9:23-31.

first radio signal. APPLE-1004, 13:14-27. Thus, if PO's previous constructions were applied, then Xia satisfies them. That is, the second time window is a period of time from (after) the first radio signal in which to transmit the second radio signal, and the second radio signal (PRACH-BFRQ) is sent during a time allocated (PRACH-BFRQ OPPORTUNITY). APPLE-1003, ¶¶134-137.

[1h]

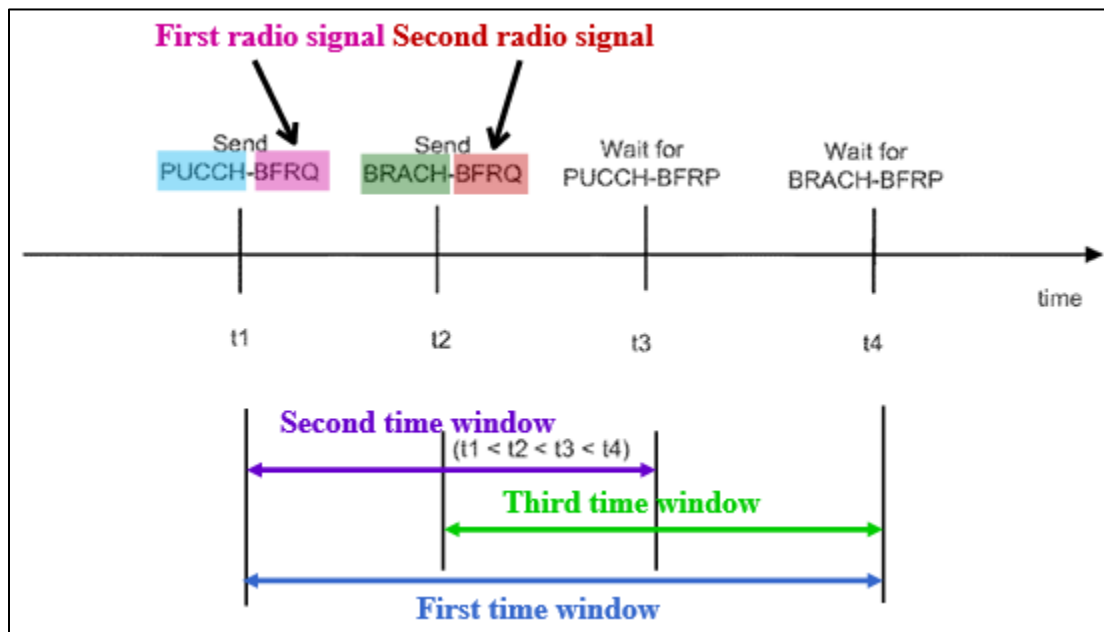
Per FIG. 6B, Xia discloses that a time domain resource occupied by the second radio signal (beginning at t2 in FIG. 6B) is within the second time window; and the second time window (between t1 and t3) is within the first time window (between t1 and t4). APPLE-1003, ¶138.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

[1i]

As discussed, applying the plain meaning or PO's previous constructions, the Petition shows that Xia meets the claimed "second time window," as depicted in FIG. 6B. APPLE-1003, ¶¶139-142. Per FIG. 6B, Xia discloses that a time domain resource occupied by the second radio signal (beginning at t2 in FIG. 6B) is used for determining a third time window (between t2 and t4). As further shown in FIG. 6B, the end time of the third time window (t4) is the end time of the first time window (t4). *Id.*



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

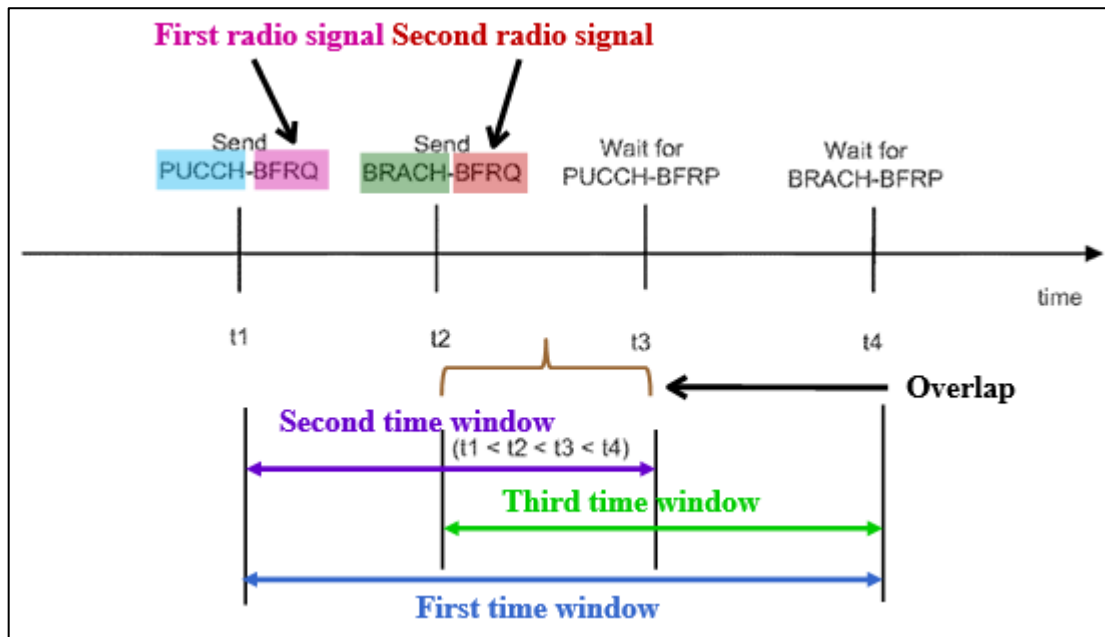
Xia's UE waits for a single BFRP from the base station, a PUCCH-BFRP at t3 or a PRACH-BFRP at t4. *Supra*, §VI.A-[1d]; APPLE-1004, 14:7-12; APPLE-1012, [0083]-[0085]. Thus, the time window for waiting on the PRACH-BFRP between t2 and t4 represents a "second time window" that begins in response to the first PRACH-BFRQ. APPLE-1003, ¶¶139-142.

Further, as discussed above for claims [1f], [1g], and [1i], the "first time window" and the "third time window" are time windows for monitoring for a BFRP. Thus, as illustrated in FIG. 6B, both the "first time window" and "third time window" end when the BFRP is received. *Id.*

If "second time window" is interpreted as a period of time from the first radio signal in which to transmit the second radio signal, which Petitioner does not concede, Xia nonetheless discloses this limitation. *Id.* Per FIG. 6B, Xia discloses a period (t1 to t3) from the first radio signal (PUCCH-BFRQ) in which to transmit the second radio signal (PRACH-BFRQ). Likewise, if the third time window is interpreted as "a period of time from the second radio signal in which to receive a third radio signal (i.e., response to either the first or second radio signals)," Xia also discloses it because the BRACH-BFRQ is received within the third time window (i.e., within t2 to t4). *Id.*

[1j]

Per FIG. 6B, Xia discloses that the second time window (between t_1 and t_3) and the third time window (between t_2 and t_4) have overlapped time domain resource(s). APPLE-1003, ¶¶143-145.



APPLE-1004, FIG. 6B (annotated); APPLE-1012, FIG. 6.

Per FIG. 6B, Xia discloses that the PUCCH-BFRQ is sent followed by the PRACH-BFRQ. APPLE-1004, 13:14-27; APPLE-1012, [0083]-[0085]. In particular, after a PUCCH-BFRQ is sent at t_1 , and before a PUCCH-BFRP arrives at the UE from the base station, the UE has a PRACH-BFRQ OPPORTUNITY and sends a second BFRQ using a PRACH-BFRQ. APPLE-1004, 13:14-27; APPLE-1012, [0083]-[0085]. Thus, because the second BFRQ is sent at t_2 before the UE

stops waiting for PUCCH-BFRP at t3, there must be an overlap between the second time window (which ends at t3) and the third time window (which starts at t2). APPLE-1003, ¶¶143-145.

Therefore, Xia (**Ground 1**) or Xia-Jover (**Ground 2**) renders obvious claim

1. *Id.*

2. Claim 2

[2a]

Xia discloses a MIMO system with multiple antenna arrangements in the base station and the UE. APPLE-1004, 9:58-10:21, FIG. 4C; APPLE-1012, [0002], [0030], [0037]-[0038], [0044]-[0048], [0055]-[0061], [0064]; APPLE-1003, ¶¶146-150.

Xia's base station transmits a BFRP ("third radio signal") in response to the two BFRQs ("first radio signal," "second radio signal"). *Supra*, §VI.A-[1d]. Xia also discloses that each BFRQ sent from the UE includes information about a new candidate beam determined by the UE. APPLE-1003, ¶¶146-150. For example, after the UE detects the beam failure, a BFRQ transmission is performed. APPLE-1004, 10:42-60; APPLE-1012, [0062]. The BFRQ contains information that includes at least the following: "explicit/implicit information that identifies the UE 404 and new gNB TX beam information, and explicit/implicit information that

identifies the UE 404 and whether a new candidate beam exists.” APPLE-1004, 10:42-60; APPLE-1012, [0062].

Xia further discloses that, “[i]n order for the base station 402 to send a BFRQ response, the [UE] 404 first determines which candidate beam(s) may be used by the base station 402 to send a response.” APPLE-1004, 9:1-9; APPLE-1012, [0055]. Specifically, in determining the candidate beam, the UE uses the spatial quasi co-located (SQCL’ed) information between the DL and the UL beams: “[t]o determine the **candidate beam**, the [UE] 402 uses the **spatial quasi co-located (SQCL’ed)** information between the base station 402 transmission (DL) and receive (UL) beams.” APPLE-1004, 9:10-20; APPLE-1012, [0055]-[0061]; APPLE-1003, ¶¶146-150.

Xia further discloses that the UE monitors the base station’s response to the BFRQ (i.e., BFRP) that is SQCL’ed with the identified candidate beam. APPLE-1003, ¶¶146-150. For example, Xia discloses that the UE will monitor the base station DL beam(s) SQCL’ed with the base station UL receive beam for BFRQ reception. APPLE-1004, 9:21-36; APPLE-1012, [0055]-[0061]. Specifically, the UE monitors the PDCCH region of a DL beam with the assumption that the corresponding PDCCH demodulation reference signal (DMRS) is SQCL’ed with the RS of the identified candidate beam(s) by the UE. APPLE-1004, 9:21-36; APPLE-1012, [0055]-[0061]. That is, Xia’s base station uses a UL BFRQ signal

received from the UE for determining a multi-antenna related transmitting of the response to the two BFRQs (i.e., BFRP). APPLE-1003, ¶¶146-150.

Thus, in Xia, the multi-antenna related transmitting of the single BFRP from the base station is determined based on the UL BFRQs from the UE. APPLE-1003, ¶¶146-150. Because there are two BFRQs (PUCCH-BFRQ, PRACH-BFRQ), determining the multi-antenna related transmitting of the single BFRP can be based on three potential scenarios: based on (1) PUCCH-BFRQ; (2) PRACH-BFRQ; or (3) both PUCCH-BFRQ and PRACH-BFRQ. APPLE-1003, ¶¶146-150; APPLE-1004, 14:1-24; APPLE-1012, [0083]-[0085]. That is, in Xia, at least one signal of the following set of signals {PUCCH-BFRQ, PRACH-BFRQ} is used for determining a multi-antenna related transmitting of the single BFRP. APPLE-1003, ¶¶146-150; APPLE-1021, 1, 4-5, FIG. 4.

[2b]

Claim 2 includes “or” between [2a] and [2b], so only [2a] **or** [2b] must be taught to satisfy claim 2. *Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001).

Nonetheless, Xia discloses [2b] in scenario (3) discussed above, where the multi-antenna related transmitting of the single BFRP is based on both PUCCH-BFRQ and PRACH-BFRQ. APPLE-1003, ¶151; APPLE-1021, 1, 4-5.

3. Claim 3

Xia's PUCCH constitutes a "first channel," and Xia's PRACH constitutes a "second channel." *Supra*, §VI.A-[1b]-[1c]. The PUCCH and the PRACH are both physical layer channels, and the PUCCH is a different type of physical layer channel than the PRACH, as claimed. APPLE-1003, ¶152.

4. Claim 4

Xia's PUCCH constitutes a "first channel." The PUCCH is a physical layer control channel, as claimed. *Supra*, §VI.A-[1b]; APPLE-1003, ¶153.

5. Claim 5

[5a]

As discussed for claim 2, Xia discloses that the base station's BFRP beam is quasi co-located with the UE's BFRQ beam. APPLE-1003, ¶¶154-157. For example, Xia discloses that the UE will monitor the base station DL beam(s) SQCL'ed with the base station UL receive beam for BFRQ reception. APPLE-1004, 9:21-36; APPLE-1012, [0055].

A POSITA would have understood that, because the base station's BFRP beam is quasi co-located with the UE's BFRQ beam, the antenna port(s) for the BFRP are SQCL'ed with the antenna port(s) for the BFRQ. APPLE-1003, ¶¶154-157. For example, R1-1700771 defines "QCL" as follows: "[t]wo antenna ports are said to be quasi co-located if properties of the channel over which a symbol on

one antenna port is conveyed can be inferred from the channel over which a symbol on the other antenna port is conveyed.” APPLE-1022, 1; APPLE-1016, ¶¶56-59; *see also*, APPLE-1004, 9:10-20.

As discussed with respect to claim 2, in Xia, determining the multi-antenna related transmitting of the single BFRP can be based on three potential scenarios: based on (1) PUCCH-BFRQ; (2) PRACH-BFRQ; or (3) both PUCCH-BFRQ and PRACH-BFRQ. APPLE-1003, ¶¶154-157. In scenarios (1) and (3), the PUCCH-BFRQ (“first radio signal”) is used for determining the antenna port group used for transmitting the single BFRP (“third radio signal”). *Id.*

Thus, in scenarios (1) and (3), the antenna port group for the first radio signal is quasi co-located with the antenna port group used for transmitting the third radio signal. *Id.*

[5b]

Claim 5 includes “or” between [5a] and [5b], so the above-discussed teachings of [5a] satisfy claim 5. *Brown*, 1351. APPLE-1003, ¶¶158.

6. Claim 6

[6pre]

Supra, §VI.A-[1pre]. Although Xia primarily describes the wireless communication method from the UE’s perspective, Xia also discloses the corresponding method performed by the base station because the method involves

the UE wirelessly interfacing with the base station. For example, a radio signal that is transmitted from the UE is also received by the base station for wireless communication. Likewise, a radio signal received by the UE is transmitted by the base station for wireless communication. APPLE-1003, ¶159.

[6a]-[6j]

Supra, §VI.A-[1a]-[1j]. Xia describes that the base station transmits the BFRP. *E.g.*, APPLE-1004, 2:37-45, 11:10-12, 14:7-24 (describing the base station sending BFRP); APPLE-1012, [0071]-[0085]; APPLE-1003, ¶¶160-161.

7. Claim 7

[7a]-[7b]

Supra, §VI.A-[2a]-[2b]. APPLE-1003, ¶162.

8. Claim 8

Supra, §VI.A.3. APPLE-1003, ¶163.

9. Claim 9

Supra, §VI.A.4. APPLE-1003, ¶164.

10. Claim 10

[10a]

Supra, §VI.A-[5a]. APPLE-1003, ¶165.

[10b]

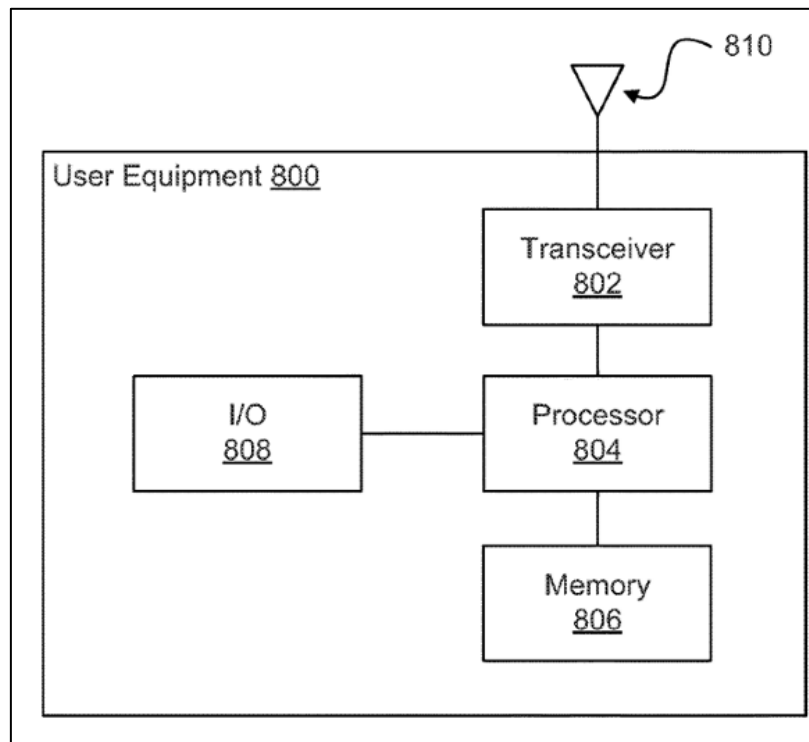
Claim 10 includes “or” between [10a] and [10b], so the above-discussed teachings of [10a] satisfy claim 10. *Brown*, 1351; APPLE-1003, ¶166.

11. Claim 11

[11pre]

Supra, §VI.A-[1pre].

Xia discloses the structure of the UE and how it is used for wireless communication. APPLE-1003, ¶¶167-173. Per FIG. 8A, UE includes a processor, a transceiver, an input/output devices, an antenna, and a memory. See APPLE-1004, 15:4-50; APPLE-1012, [0086]-[0089].



APPLE-1004, FIG. 8A; APPLE-1012, FIG. 8A.

Xia discloses that “one or multiple transceivers 802 could be used in the UE 800” and that “a transceiver 802 may also be implemented using at least one

transmitter and at least one separate receiver.” APPLE-1004, 15:18-32; APPLE-1012, [0087]. Thus, Xia’s UE has transmitters and receivers. APPLE-1003, ¶¶167-173. Xia further discloses that “[e]ach transceiver 802 may include any suitable structure for generating signals for wireless transmission and/or processing signals received wirelessly.” APPLE-1004, 15:18-32; APPLE-1012, [0087].

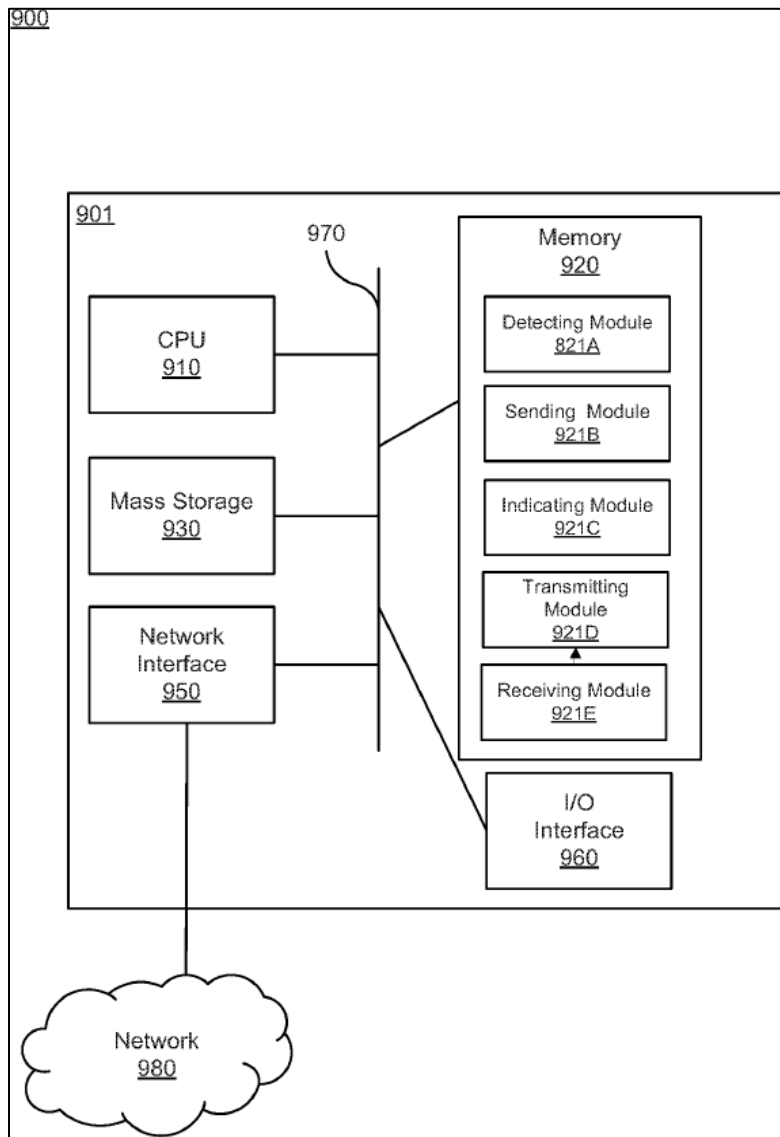
Additionally, each transceiver (or separate transmitter/receiver) is “configured to demodulate data or other content received by the at least one antenna 810,” and “[e]ach antenna 810 includes any suitable structure for transmitting and/or receiving wireless signals.” APPLE-1004, 15:18-32; APPLE-1012, [0087]. Thus, a POSITA would have understood that each antenna in Xia’s UE may be associated with a transmitter and receiver. APPLE-1003, ¶¶167-173.

Moreover, as discussed for [2a], Xia discloses a MIMO system, including multiple antenna arrangements in the UE. APPLE-1004, 9:58-10:21, FIG. 4C; APPLE-1012, [0030], [0064], [0037]-[0038], [0044]-[0048], [0055]-[0061], [0002]. Thus, a POSITA would have understood that, with a multiple antenna arrangement, Xia’s UE would have multiple transmitters and receivers for transmitting and receiving wireless signals. APPLE-1003, ¶¶167-173.

Furthermore, a POSITA would have understood that, in MIMO systems, each antenna arrangement (and therefore each transmitter/receiver associated with

that antenna) can transmit and receive any wireless signal sent or received by the UE. *Id.*

Per FIG. 9, Xia also discloses a network device to facilitate communications between the UE and base station. APPLE-1004, 16:13-49; APPLE-1012, [0092]-[0092]; APPLE-1003, ¶¶167-173. A POSITA would have understood that this network device 900 can be part of the UE. *Id.* The network device includes a memory 920 that includes “a detecting module 921A detecting a beam failure event between the [UE] and a base station,” “a receiving module 921E receiving a beam,” “a sending module 921B sending a first beam failure recovery request (BFRQ) to the base station upon detection of the beam failure, wherein the first BFRQ is sent using one of a physical uplink channel (PUCCH) and a beam failure random access channel (PRACH),” and “a transmitting module 921D transmitting a beam.” APPLE-1004, 16:13-49; APPLE-1012, [0092]-[0092].



APPLE-1004, FIG. 9; APPLE-1012, FIG. 9.

[11a]

Xia's UE receives a target radio signal. *Supra*, §VI.A-[1a]. Xia discloses a “first receiver module” in two ways. APPLE-1003, ¶¶174-176.

First, Xia's UE can have multiple receivers for receiving wireless signals. *Supra*, §VI.A-[11pre]. Thus, a POSITA would have understood that a first one of the receivers in Xia's UE provides [11a]. APPLE-1003, ¶¶174-176.

Second, Xia's UE can include a detecting module 921A detecting a beam failure event between the UE and a base station. *Supra*, §VI.A-[11pre]. As discussed for [1a], the '113 patent explains that the "target radio signal" can be a reference signal for detecting a beam failure. Thus, a POSITA would have understood that Xia's detecting module 921A provides [11a]. APPLE-1003, ¶¶174-176.

[11b]

Xia's UE transmits a first radio signal on a first channel. *Supra*, §VI.A-[1b]. Xia discloses a "second transmitter module" in two ways. APPLE-1003, ¶¶177-179.

First, Xia's UE can have multiple transmitters for transmitting wireless signals. *Supra*, §VI.A-[11pre]. Thus, a POSITA would have understood that a first one of the transmitters in Xia's UE provides [11b]. APPLE-1003, ¶¶177-179.

Second, Xia's UE can also include a sending module 921B for sending a first BFRQ to the base station. *Supra*, §VI.A-[11pre]. As discussed for [1b], the '113 patent explains that the "first radio signal" can be a beam recovery request.

Thus, a POSITA would have understood that Xia's sending module provides [11b].
APPLE-1003, ¶¶177-179.

[11c]

Xia's UE transmits a second radio signal on a second channel. *Supra*, §VI.A-[1c]. Xia discloses a "third transmitter module" in two ways. APPLE-1003, ¶¶180-182.

First, Xia's UE can have multiple transmitters for transmitting wireless signals, and in MIMO systems, multiple antenna arrangements (and therefore multiple transmitters associated with those arrangements) transmit wireless signals that go out of the UE. *Supra*, §VI.A-[11pre]; APPLE-1003, ¶¶180-182. Thus, a POSITA would have understood that a second one of the transmitters in Xia's UE provides [11c]. *Id.*

Second, Xia's UE can also include a transmitting module 921D for transmitting a beam. *Supra*, §VI.A-[11pre]. Thus, a POSITA would have understood that Xia's transmitting module 921D provides [11c]. APPLE-1003, ¶¶180-182.

[11d]

Xia's UE monitors a third radio signal in a first time window. *Supra*, §VI.A-[1d]. Xia discloses a "fourth receiver module" in two ways. APPLE-1003, ¶¶183-185.

First, Xia's UE can have multiple receivers for receiving wireless signals, and in MIMO systems, multiple antenna arrangements (and therefore multiple receivers) receive wireless signals that go into the UE. *Supra*, §VI.A-[11pre]; APPLE-1003, ¶¶183-185. Thus, a POSITA would have understood that a second one of the receivers in Xia's UE provides [11d]. *Id.*

Second, Xia's UE can also include a receiving module 921E for receiving a beam. *Supra*, §VI.A-[11pre]. Thus, a POSITA would have understood that Xia's receiving module 921E provides [11d]. APPLE-1003, ¶¶183-185.

[11e]-[11j]

Supra, §VI.A-[1e]-[1j].

Therefore, Xia/Xia-Jover (**Grounds 1 and 2**) render obvious claim 11. APPLE-1003, ¶¶186-187.

12. Claim 12

[12a]-[12b]

Supra, §VI.A-[2a]-2[b]. APPLE-1003, ¶¶188.

13. Claim 13

Supra, §VI.A.3. APPLE-1003, ¶¶189.

14. Claim 14

Supra, §VI.A.4. APPLE-1003, ¶¶190.

15. Claim 15

[15a]

Supra, §VI.A-[5a]. APPLE-1003, ¶¶191.

[15b]

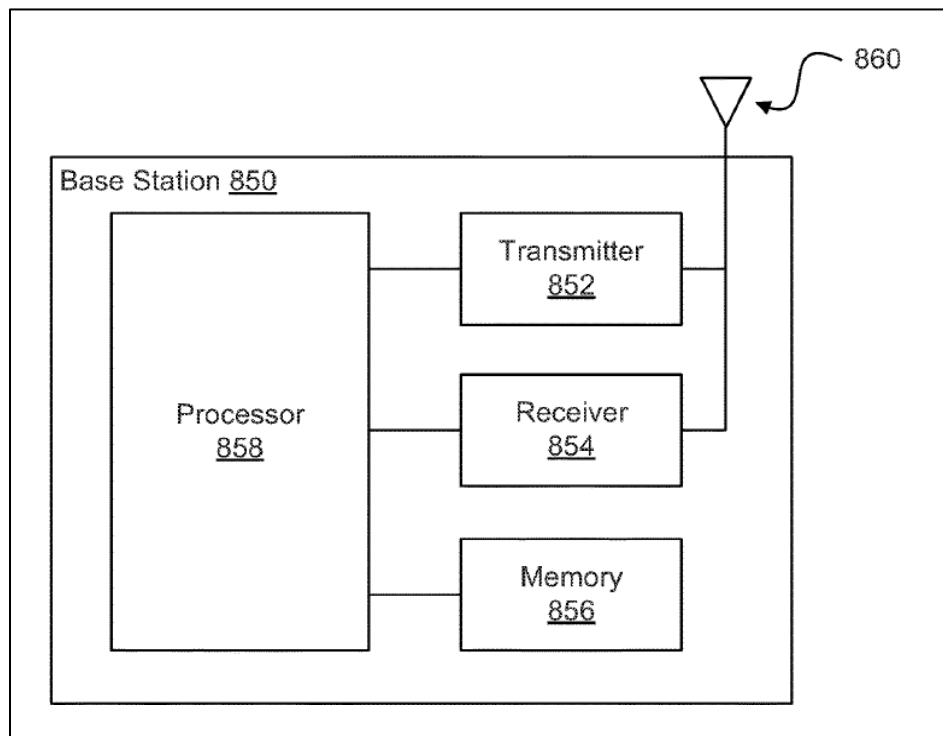
Claim 15 includes “or” between [15a] and [15b], so the above-discussed teachings of [15a] satisfy claim 15. *Brown*, 1351. APPLE-1003, ¶¶192.

16. Claim 16

[16pre]

Supra, §VI.A-[1pre].

Xia discloses the structure of the base station and how it is used for wireless communication. APPLE-1003, ¶¶193-197. Per FIG. 8B, the base station includes a processor, a transmitter, a receiver, antennas, and a memory. See APPLE-1004, 15:51-16:12; APPLE-1012, [0090]-[0091], FIG. 8B.



APPLE-1004, FIG. 8B; APPLE-1012, FIG. 8B.

Xia discloses that “[e]ach transmitter 852 includes any suitable structure for generating signals for wireless transmission to one or more UEs or other devices,” while “[e]ach receiver 854 includes any suitable structure for processing signals received wirelessly from one or more UEs or other devices.” APPLE-1004,15:65-16:12; APPLE-1012, [0091]. Xia further discloses that “[e]ach antenna 860 includes any suitable structure for transmitting and/or receiving wireless signals,” and that “one or more antennas 860 could be coupled to the transmitter(s) 852, and one or more separate antennas 860 could be coupled to the receiver(s) 854.” APPLE-1004, 15:65-16:12; APPLE-1012, [0091]. Thus, a POSITA would have understood that each antenna in Xia’s base station may be associated with a transmitter and a receiver. APPLE-1003, ¶¶193-197.

Moreover, as discussed for [2a], Xia discloses a MIMO system, including multiple antenna arrangements in the base station. APPLE-1004, 9:58-10:21, FIG. 4C; APPLE-1012, [0030], [0064], [0037]-[0038], [0044]-[0048], [0055]-[0061], [0002]; APPLE-1003, ¶¶193-197. Thus, a POSITA would have understood that, with a multiple antenna arrangement, Xia’s base station would have multiple transmitters and multiple receivers for transmitting and receiving wireless signals. APPLE-1003, ¶¶193-197.

Furthermore, a POSITA would have understood that, in MIMO systems, each antenna arrangement (and therefore each transmitter and receiver associated with that antenna) can transmit and receive any wireless signal sent or received by the base station. *Id.*

[16a]

Xia's base station transmits a target radio signal. *Supra*, §VI.A-[6a].

Further, Xia's base station can have multiple transmitters for transmitting wireless signals. *Supra*, §VI.A-[16pre]. Thus, a POSITA would have understood that a first one of the transmitters in Xia's base station provides [16a]. APPLE-1003, ¶¶198-199.

[16b]

Xia's base station receives a first radio signal on a first channel. *Supra*, §VI.A-[6b]. Further, Xia's base station can have multiple receivers for receiving wireless signals. *Supra*, §VI.A-[16pre]. Thus, a POSITA would have understood that a first one of the receivers in Xia's base station provides [16b]. APPLE-1003, ¶200.

[16c]

Xia's base station receives a second radio signal on a second channel. *Supra*, §VI.A-[6c]. In MIMO systems, multiple antenna arrangements (and therefore multiple receivers) receive wireless signals that go into the base station.

Supra, §VI.A-[16pre]; APPLE-1003, ¶201. Thus, a POSITA would have understood that a second one of the receivers in Xia's base station provides [16c].

Id.

[16d]

Xia's base station transmits a third radio signal in a first time window.

Supra, §VI.A-[6d]. In MIMO systems, multiple antenna arrangements (and therefore multiple transmitters) transmit wireless signals that go out of the base station. *Supra*, §VI.A-[16pre]; APPLE-1003, ¶202. Thus, a POSITA would have understood that a second one of the transmitters in Xia's UE provides [16d]. *Id.*

[16e]-[16j]

Supra, §VI.A-[16e]-[16j]. Xia/Xia-Jover renders [16e]-[16j] obvious.

Therefore, Xia (**Ground 1**) or Xia-Jover (**Ground 2**) render obvious claim 16. APPLE-1003, ¶¶203-204.

17. Claim 17

[17a]-[17b]

Supra, §VI.A-[2a]-[2b]. APPLE-1003, ¶205.

18. Claim 18

Supra, §VI.A.3. APPLE-1003, ¶206.

19. Claim 19

Supra, §VI.A.4. APPLE-1003, ¶207.

20. Claim 20

[20a]

Supra, §VI.A-[5a]. APPLE-1003, ¶208.

[20b]

Claim 20 includes “or” between [20a] and [20b], so the above-discussed teachings of [20a] satisfy claim 20. *Brown*, 1351. APPLE-1003, ¶209.

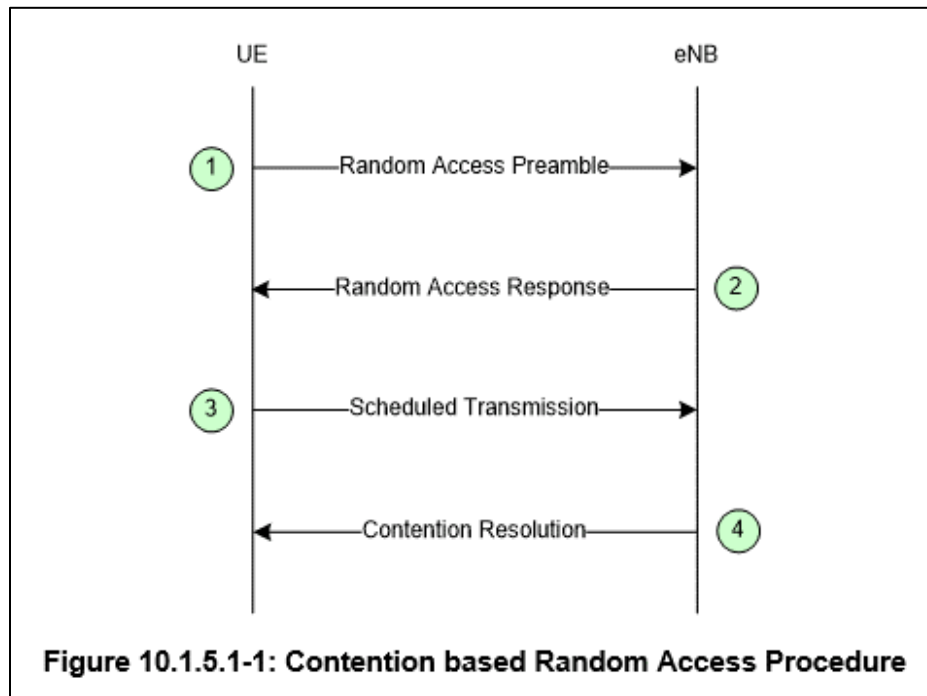
B. Ground 3A – 3GPP-LTE⁷ Renders Claims 1, 3-4, 6, and 8-9 obvious

1. Claim 1

[1pre]

3GPP-LTE renders [1pre] obvious. APPLE-1003, ¶210. 3GPP-LTE describes CBRAP, which includes wireless transmission by the UE to the base station (eNB) of a RA preamble (**first radio signal**) and a scheduled transmission/Msg3 (**second radio signal**) and the base station transmitting to the UE a contention resolution signal (**third radio signal**). APPLE-1026, §§10.1.5-10.1.5.1, 10.1.6. CBRAP is illustrated is below:

⁷ §III.D.



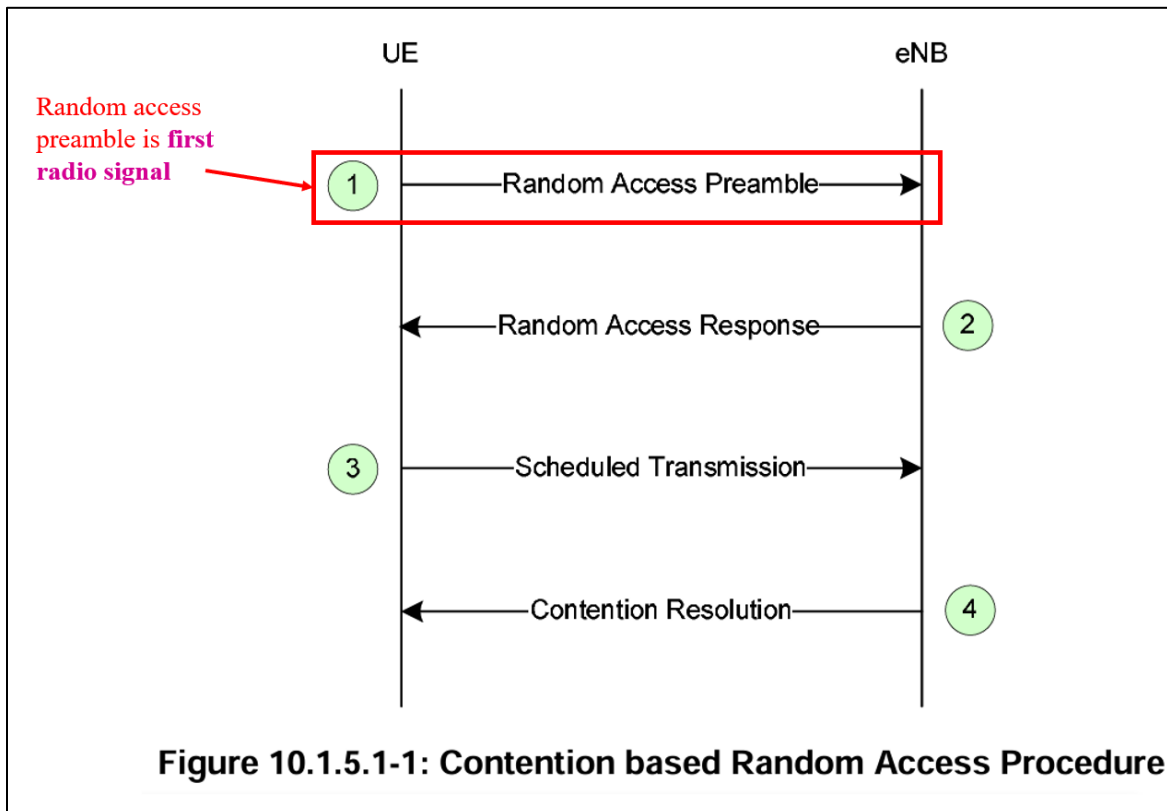
APPLE-1026, §10.1.5.1

[1a]

3GPP-LTE renders [1a] obvious. APPLE-1003, ¶211. The UE monitors the downlink quality based on **receiving** a cell-specific reference signal (CRS) (target radio signal) from a base station in order to detect the downlink radio link quality and determine radio link failure. APPLE-1024, §7.6.1; APPLE-1035, §6.10.1. The UE receives CRS in any downlink subframe. APPLE-1035, §6.10.1.

[1b]

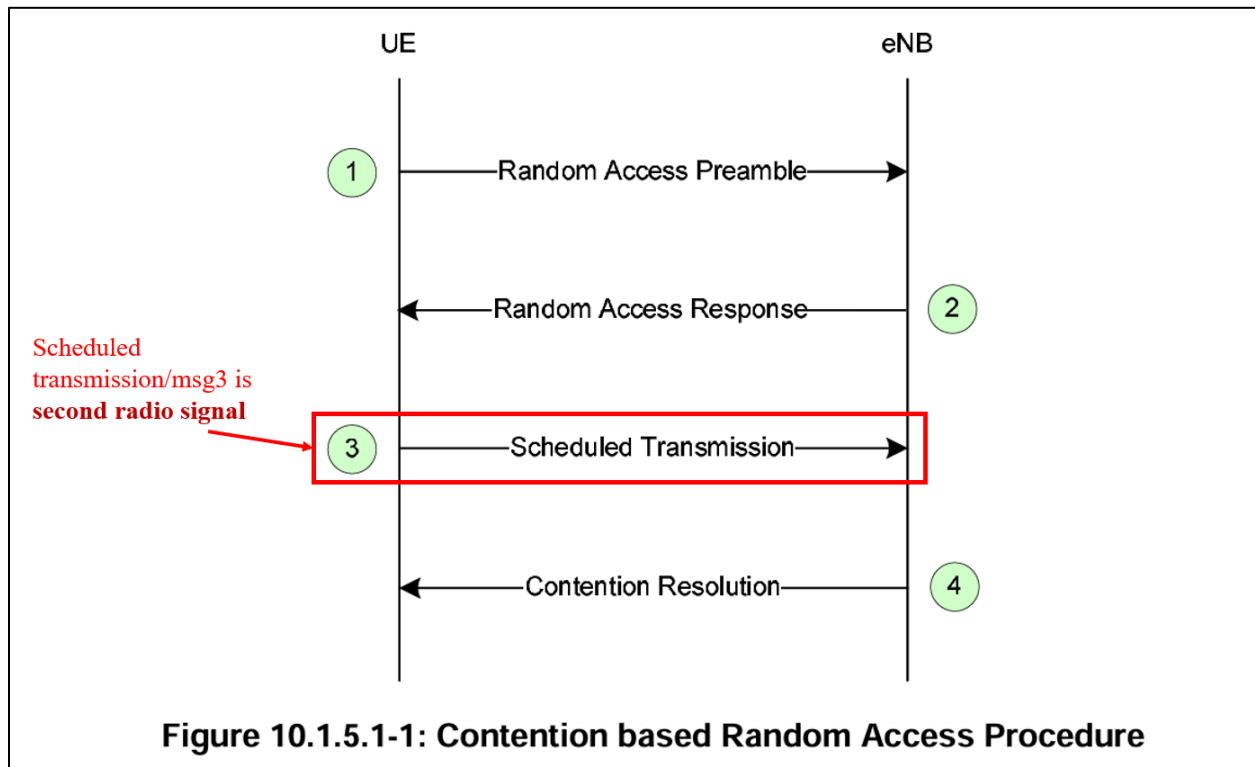
3GPP-LTE renders [1b] obvious. APPLE-1003, ¶212. As shown, CBRAP includes transmitting a RA preamble (**first radio signal**). *E.g.*, APPLE-1026, §10.1.5-10.1.5.1; APPLE-1023, §5.1.



APPLE-1026, §10.1.5.1. The RA Preamble is transmitted on the PRACH (**first channel**). APPLE-1023, §5.1.3; APPLE-2020, §10.1.5.1; APPLE-1003, ¶212.

[1c]

3GPP-LTE renders [1c] obvious. APPLE-1003, ¶¶213-214. CBRAP includes the transmission of the **second radio signal**:



APPLE-1026, §10.1.5.1; APPLE-1026, §10.1.5-10.1.5.1; APPLE-1023, §5.1. As shown above, CBRAP includes the UE transmitting the scheduled transmission/msg3⁸ (**second radio signal**).

The scheduled transmission is transmitted by the UL-SCH transport channel mapped to the PUSCH (**second channel**). APPLE-1023, §§5.1.3, 4.5; APPLE-1026, §10.1.5.1; APPLE-1028, §4.1.1; APPLE-1029, §4.1; APPLE-1003, ¶¶213-214.

⁸ The 3GPP TS refers to the scheduled transmission as message 3 or Msg3.

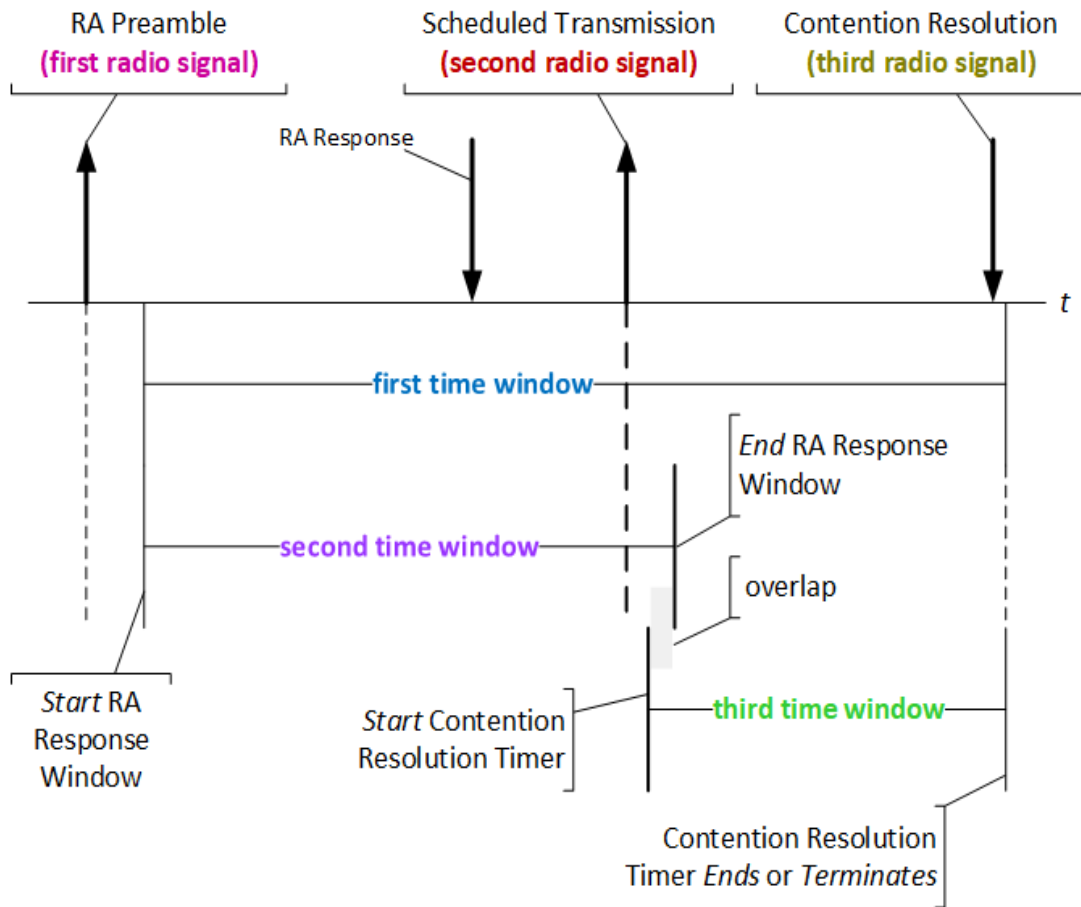
APPLE-1023, §§5.1.5, 3.1.

[1d]

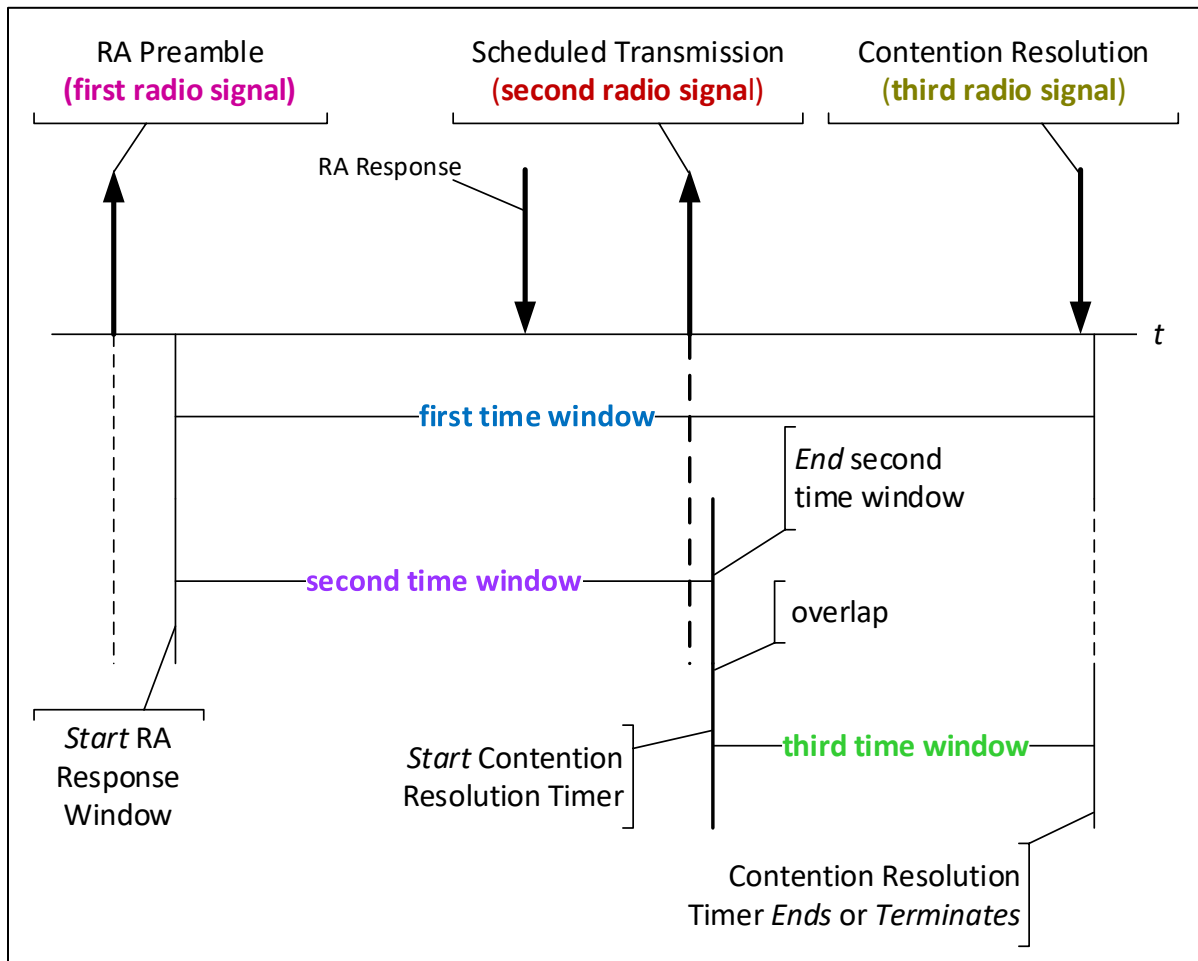
3GPP-LTE renders [1d] obvious. APPLE-1003, ¶¶215-219. During CBRAP, the UE monitors for the contention resolution message/msg4 (**third radio signal**) during the first time window. APPLE-1023, §5.1; APPLE-1003, ¶¶215-219. The contention resolution message (**third radio signal**) is a PDCCH transmission from the base station to the UE during the contention resolution window, which starts after the UE sends Msg3 (**second radio signal**). APPLE-1023, §5.1.5, §3.1; APPLE-1026, §10.1.5.1.

The **first time window** begins with the start of the RAR window and ends with the expiration of the *mac-ContentionResolutionTimer* or after a contention resolution message is received. APPLE-1023, §§5.1.1, 5.1.5. The RAR window “starts at the subframe that contains the end of the preamble transmission plus three subframes.” APPLE-1023, §5.1.4. In this way, a time domain resource (subframe) of the RA preamble (**first radio signal**) “is used for determining the start time of the first time window.” APPLE-1003, ¶¶215-219.

The **first time window** ends when the contention resolution window ends. CBRAP. APPLE-1023, §5.1.5; APPLE-1001, 22:54-56. The third time window is the contention resolution timer. APPLE-1003, ¶¶215-219. Thus, in 3GPP-LTE the first time window can be illustrated according to FIGS. Akl1 or Akl2:



APPLE-1003, FIG. Akl1



APPLE-1003, FIG. Akl2

In both scenarios, the **first time window** starts with the start of the RAR Window and ends with the termination or expiration of the contention resolution timer. *Id.*

During the **first time window**, the UE monitors for the contention resolution message (**third radio signal**). APPLE-1023, §5.1.5, §3.1.

[1e]

Supra, §VI.B-[1a] (describing the UE receiving the CRS (target radio signal) as part of the link monitoring process); APPLE-1024, §7.6.1. Generally, the UE's

determination of radio link failure triggers CBRAP. APPLE-1026, §10.1.5.1, §10.1.6 (after radio link failure, the “UE accesses the cell through the random access procedure”). APPLE-1003, ¶¶220-223.

The UE can determine link failure by determining that the UE is “out-of-sync” through Radio Link Monitoring. APPLE-1024, §7.6; APPLE-1025, §4.2.1. The UE uses the CRS (target radio signal) to estimate (obtain) the downlink radio link quality (target measurement value). APPLE-1024, §7.6. The UE then compares the downlink radio link quality estimation (target measurement value) to the threshold Q_{out} (target threshold) for the purpose of monitoring downlink radio link quality. *Id.* “The threshold Q_{out} is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical PDCCH transmission taking into account the PCFICH errors with transmission parameters specified in Table 7.6.1-1.” APPLE-1024, §7.6.1. The UE indicates “out-of-sync” “when the radio link quality is worse than the **threshold Q_{out}** .” APPLE-1025, §4.2.1; APPLE-1003, ¶¶220-223.

The UE determines radio link failure based on receiving an out-of-sync indication and the expiration of a timer. APPLE-1027, §§5.3.11.1, 5.3.11.3, 5.3.10.7, 9.2.5. The UE starts CBRAP after determining radio link failure. APPLE-1026, §10.1.5.1, §10.1.6. Thus, when the downlink radio link quality estimation (target measurement value) exceeds the threshold Q_{out} (threshold value),

the UE triggers the transmission of the RA preamble as part of the CBRAP.

APPLE-1003, ¶¶220-223.

Initialization of CBRAP causes the UE to send the RA preamble (**first radio signal**) and scheduled UL transmission/Msg3 (**second radio signal**). APPLE-1026, §10.1.5.1 (describing CBRAP as including sending RA Preamble and scheduled UL transmission); APPLE-1003, ¶¶220-223. Accordingly, a POSITA would have understood from 3GPP-LTE that the transmissions of the first (RA preamble) and second (scheduled UL transmission/Msg3) radio signals are only sent (triggered) by the measurement of the CRS exceeding the BLER threshold, which initializes CBRAP process. *Id.*

To the extent it is argued that 3GPP-LTE does not describe [1e], 3GPP-LTE renders [1e] obvious. APPLE-1003, ¶¶220-223. A POSITA would have found it obvious that the CRS exceeding the BLER threshold would have triggered transmitting the RA preamble and the UL-SCH/Msg3. *Id.* First, the transmission of the RA preamble is part of the initial steps of CBRAP. *Supra*, §VI.B.1.[1a]. Because CBRAP is initialized based on link failure, the UL-SCH/Msg3 transmission would not occur without first initializing CBRAP and sending the RA preamble. *Supra*, §VI.B.1.[1b]. Thus, a POSITA would have found obvious that the CRS exceeding the BLER triggers the transmission of both the RA preamble (**first radio signal**) and the UL-SCH/Msg3 (**second radio signal**). APPLE-1003,

¶¶220-223.

[1f]

Supra, §VI.B-[1d] (describing start and end of first time window). 3GPP renders [1f] obvious. APPLE-1003, ¶224. In 3GPP-LTE, the **first time window** begins with the start of the RAR window and ends with the end of the *mac-ContentionResolutionTimer*. APPLE-1023, §5.1; APPLE-1003, ¶224. The RAR window “starts at the subframe that contains the end of the preamble transmission plus three subframes.” APPLE-1023, §5.1.4. In this way, a time domain resource of the RA preamble (**first radio signal**) “is used for determining the start time of the first time window.” APPLE-1003, ¶224.

[1g]

Supra, §VI.B.1.[1f] (describing start of first time window). 3GPP-LTE renders obvious that “a time domain resources occupied by the first radio signal is used for determining a second time window.” APPLE-1003, ¶¶225-238. Under a broad interpretation, in 3GPP-LTE CBRAP, the **second time window** starts with the RAR response window and ends after the start of the *mac-ContentionResolutionTimer*, which starts after UL-SCH/Msg3 is transmitted. *Id.* Alternatively, applying Apex’s narrow interpretation, in 3GPP-LTE CPRAP, the **second time window** is the RAR response window. *Id.*

(a) [1g] Should Be Interpreted Broadly

The plain meaning of [1g] only requires that a time domain resource occupied by the first radio signal be used for determining the second time window. [1g] does not specify whether the time domain resource is used for determining the start time or the entirety of the second time window. This ambiguity favors interpreting the claim broadly to include either. APPLE-1003, ¶¶225-238. The specification supports a broad interpretation. For example, when describing the FIG. 6 embodiment, the '113 patent specifies that “a time domain resource occupied by the first radio signal is used for determining the start time of a second time window.” *E.g.*, APPLE-1001, 22:44-49, 23:14-19, FIG. 6.⁹ In other embodiments, the '113 patent more broadly states that “a time domain resource occupied by the first radio signal is used...to determine a second time window.” *E.g.*, *id.*, 22:28-31.

Apex may seek to narrow the interpretation of [1h] by contrasting [1f], which state “a time resource occupied by the first radio signal is used for determining **the start time of** the first time window.” But [1f] is the narrower implementation. By not specifying that the first radio signal is used for

⁹ The Board considered the Figure 6 embodiment to be exemplary of the challenged claims. APPLE-1041, Paper 11, 5.

determining the start time of the second time window, the claim leaves open both possible interpretations literally supported by the specification. APPLE-1003, ¶¶225-238.

Next, the claims themselves provide features that assist in understanding what the second time window is. For example, the second time window has the following attributes:

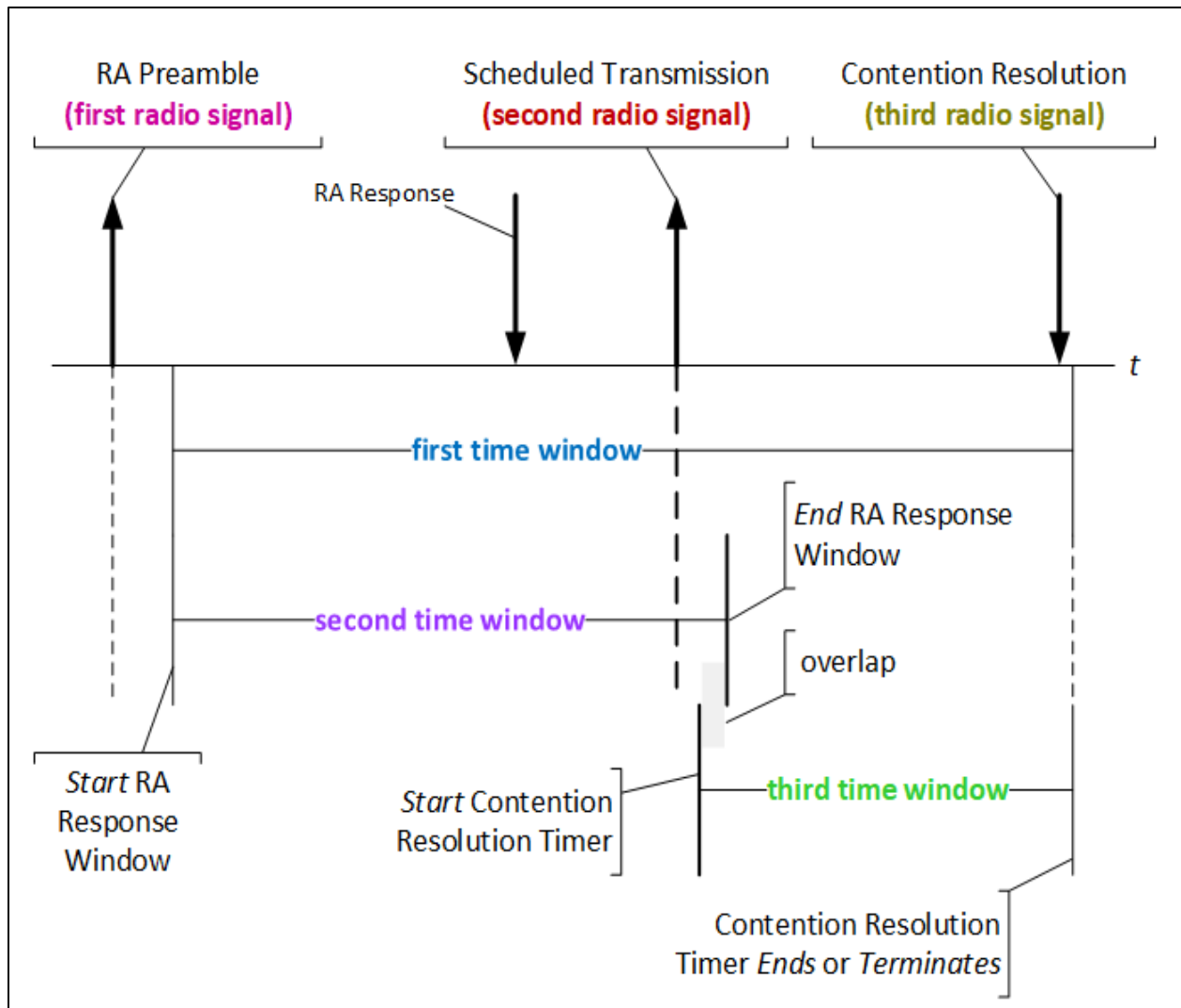
- (1) the first radio signal is used for determining the second time window; [1g]
- (2) a time domain resource occupied by the second radio signal is within the second time window; [1h]
- (3) the second time window is within the first time window; [1h]
- (4) the second time window and the third time window have overlapped time domain resource(s). [1j]

Based on the forgoing, 3GPP-LTE CBRAP renders obvious [1g].

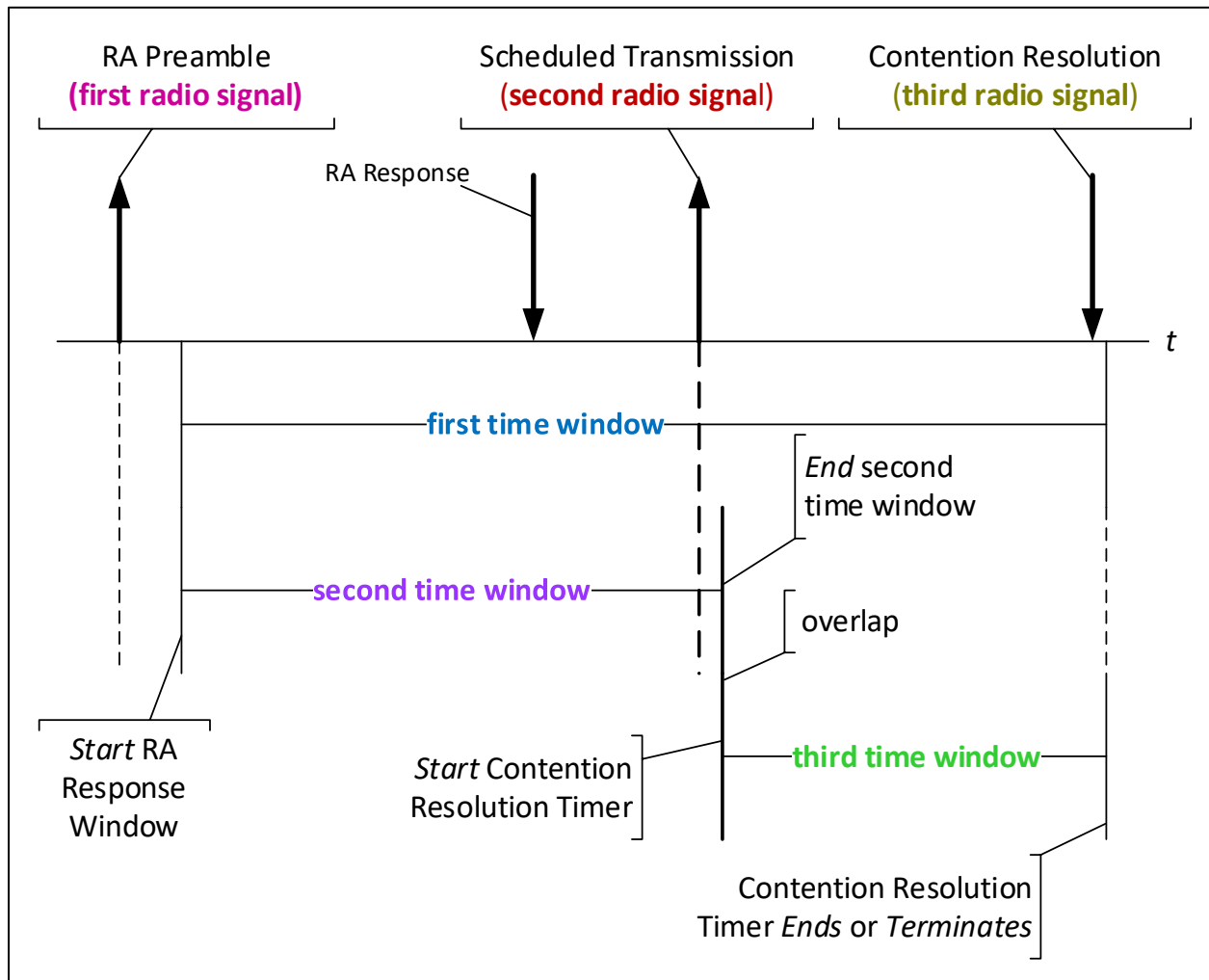
Regarding (1): A time domain resource occupied by the first radio signal is used for determining the start time of the first time window. Specifically, the transmission of the RA preamble (first radio signal) starts the RAR window (start of the first time window). *Supra*, §VII.B.1.[1f]; APPLE-1023, §5.1.4; APPLE-1001, 23:17-19. Per the '113 patent, the start time of the first time window and

second time window are the same. APPLE-1001, 22:51-53. Thus, the RA preamble (first radio signal) is used for determining the start time of both the first and second time window. APPLE-1003, ¶¶225-238.

Regarding (2): the UL-SCH/Msg3 is transmitted after the start of the RAR window but before the start of the contention resolution timer. *Supra*, §§III.E, VI.B.1.[1c]-[1e]; APPLE-1023, §5.1.5, §3.1. This is shown in FIGS. Akl1-2:



APPLE-1003, FIG. Akl1



APPLE-1003, FIG. Akl2

APPLE-1003, ¶¶225-238. Because the UL-SCH/Msg3 is transmitted during the second time window, at least one symbol (time-domain resource) of the UL-SCH/Msg3 transmission (**second radio signal**) is within the **second time window**.

Id.

For (3): the '113 patent does not establish an end time or a length for the second time window but does indicate the “second time interval refers to a time

interval from the start time of the first time window to the start time of the third time window.” APPLE-1001, 10:5-7. Additionally, the ’113 patent states “the end time of the second time interval is behind a time domain resource occupied by the second radio signal.” APPLE-1001, 6:52–54; APPLE-1003, ¶¶225-238.

FIGS. Akl1-2 illustrate how 3GPP-LTE satisfies (3), as informed by the ’113 patent. As shown, the second time window starts at the same time as the first time window and ends before the end of the first time window. FIGS. Akl1-2. In any case, the UL-SCH/Msg3 (**second radio signal**) is transmitted during the second time window. APPLE-1003, ¶¶225-238.

For (4): in FIGS. Akl1-2, there is at least one symbol overlap between the second and third time windows, even if the second time window ends when the third time window begins. APPLE-1003, ¶¶225-238, FIGS. Akl1-2. Recall that the “second time interval refers to a time interval from the start time of the first time window to the start time of the third time window.” *Id.*; APPLE-1001, 10:5-7.

To the extent that PO argues that CBRAP does not teach element [1g], it would have been obvious to a POSITA that the transmission of the RA preamble was used to determine a second time window for which to transmit the UL-SCH/Msg3. APPLE-1003, ¶¶225-238. As already established, the UE starts CBRAP due to link failure; thus CBRAP is the UE’s attempt to reestablish the link

to transmit the scheduled transmission. *Supra*, [1e]. It would have been obvious to a POSITA that the RA preamble would establish the second time window because a POSITA would have known that, if the UE were unable to transmit the UL-SCH/Msg3 transmission within a certain amount of time, then the UE would need to take steps to reestablish the link, such as by restarting CBRAP. APPLE-1003, ¶¶225-238.

(b) 3GPP-LTE Renders [1g] Obvious Under a Narrow Interpretation

Under a narrower (and incorrect) interpretation, the time domain resource occupied by the first radio signal is used for determining the entirety of the second time window. APPLE-1003, ¶¶225-238. In this case, 3GPP-LTE CBRAP still render [1g] obvious. *Id.* In CBRAP, the second time window is the RAR window. *Id.*, FIGS. Akl3-4. FIGS. Akl3-4 illustrate this scenario:

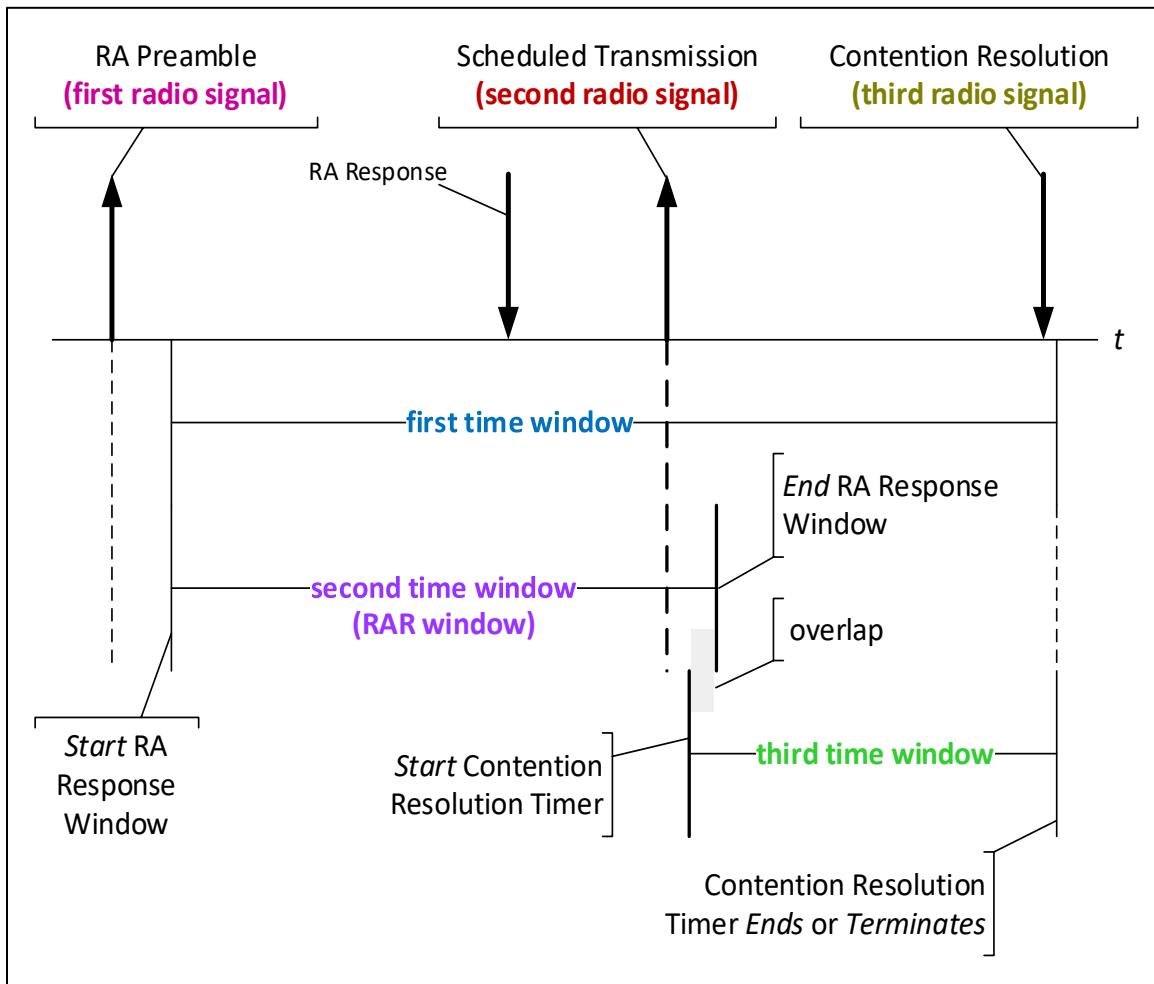


FIG. Akl3

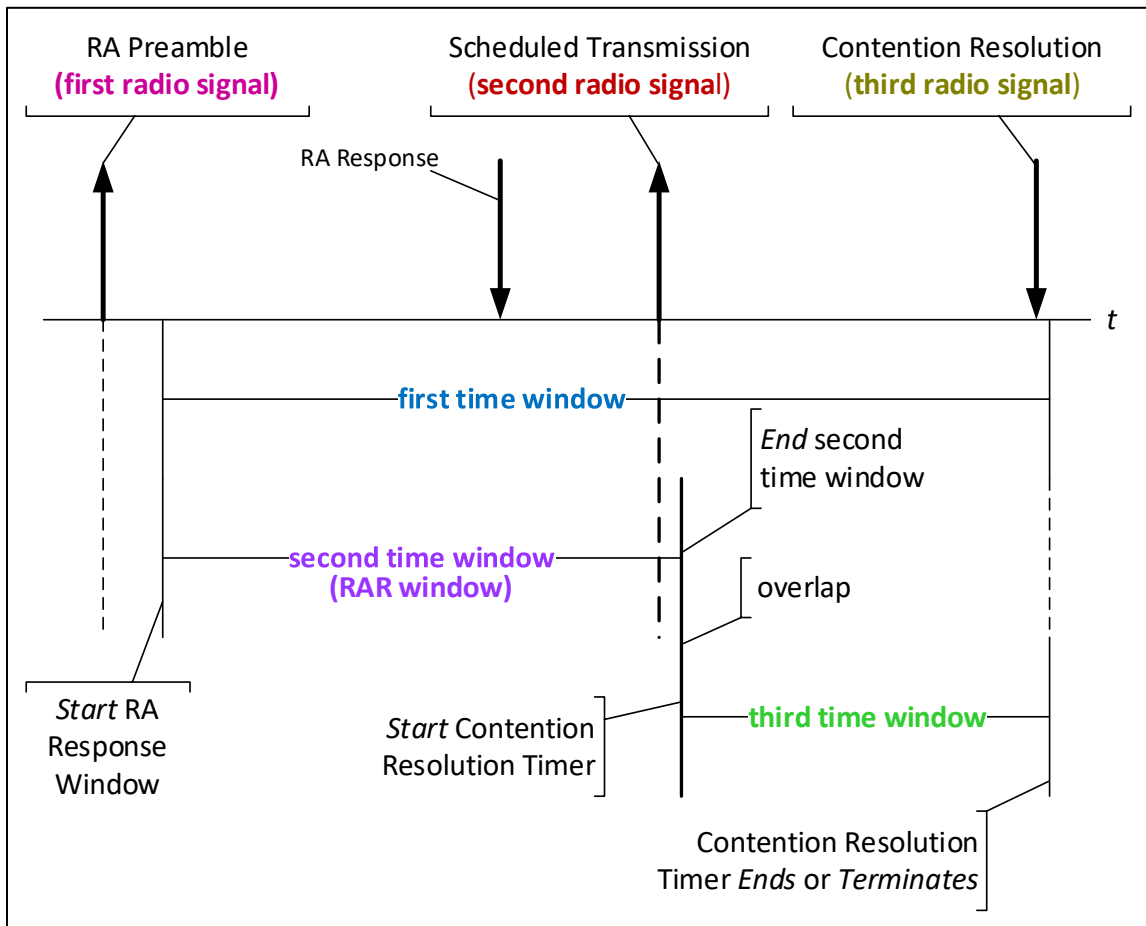


FIG. Akl4

Id.

As explained, the RAR window is initialized after the RA preamble is transmitted. APPLE-1023, §5.1.4. According to 3GPP-LTE, the RAR window is of a preconfigured size (number of subframes), based on the value set for *ra-ResponseWindowSize* in the radio resource control information element (RRC IE), which does not terminate after an RA response is received. APPLE-1023, §5.1.1 (“the RA response window size *ra-ResponseWindowSize*”), §5.2 (); APPLE-1027,

§6.2.1 (*ra-ResponseWindowSize* can be anywhere from 2-400 subframes); APPLE-1003, ¶¶225-238. A POSITA would have recognized the need to lengthen the RAR window to complete CBRAp to re-establish the connection after link failure without having to restart the process. APPLE-1003, ¶¶225-238.

The second time window mapping to the RAR window satisfies both interpretations of [1g]. The broad interpretation is satisfied because 1) the RAR window starts based on the RA preamble (**first radio signal**) being sent; 2) the Msg3 (**second radio signal**) is transmitted during the RAR window; 3) the RAR window is inside the first time window, where the first time window begins with the start of the RAR window and ends with the expiration of the *mac-ContentionResolutionTimer* or after a contention resolution message is received. APPLE-1023, §5.1; APPLE-1003, ¶¶225-238; and 4) the RAR window has at least one time-domain resource in common with the time period defining the contention resolution timer, which starts after the Msg3 (**second radio signal**) is transmitted.

Also, both constructions are satisfied because the scheduled transmission/msg3 (**second radio signal**) is transmitted within the RAR window (**second time window**). APPLE-1003, ¶¶225-238. Therefore, the RA response can be received and the scheduled transmission (**second radio signal**) can be transmitted all within the RAR window. *Id.*

To the extent Apex argues that 3GPP-LTE does not describe [1g] even under the narrower construction, a POSITA would have found obvious that the RAR window was the second time window. APPLE-1003, ¶¶225-238. A POSITA would have recognized that the RAR window was long enough to receive the RA response from the base station, transmit the UL-SCH/Msg3, and start the contention resolution timer. *Id.* As already established, the UE starts the CBRAP due to link failure; thus CBRAP is the UE's attempt to reestablish the link to transmit the scheduled transmission. *Supra*, §VII.B.1.[1e]. It would have been obvious to a POSITA that the RA preamble would establish the second time window as the RAR window because a POSITA would have known that if the UE were unable to transmit the UL-SCH/Msg3 transmission within a certain amount of time, then the UE would need to take steps to reestablish the link (e.g., by restarting CBRAP). APPLE-1003, ¶¶225-238. A POSITA would have had a reasonable expectation of success relying on the RAR window as the second time window for transmitting the UL-SCH/Msg3 because 3GPP-LTE provides the radio resource control capabilities to establish a RAR window of sufficient length to send the UL-SCH/Msg3. *Id.*

[1h]

Supra, §VI.B-[1d]-[1g] for discussion of element [1h]. Regarding Attribute (2), the end time of the second time window occurs after the second radio signal is

transmitted and the contention resolution timer starts. APPLE-1003, ¶¶239-240.

The scheduled transmission/msg3 (**second radio signal**) triggers the contention resolution timer (**third time window**). *Id.* Thus, at least one symbol (time-domain resource) for the UL-SCH/Msg3 transmission (**second radio signal**) is within the **second time window**. *Id.* For Attribute (3), the second time window starts at the same time as the first time window and ends before the end of the first time window. *Id.*, FIGS. Akl1-2.

Alternatively, the RAR window is the **second time window**. *Id.* In that case, a time domain resource occupied by the UL-SCH/msg3 transmission (**second radio signal**) is within the RAR window (alternative **second time window**). *Id.*, FIG. Akl3.

[1i]

Supra, §§VI.B-[1e]-[1h] (describing third time window). A time domain resource for the scheduled transmission/msg3 (**second radio signal**) is used to initialize the contention resolution timer (**third time window**). APPLE-1023, §5.1.5, §3.1; APPLE-1003, ¶¶241-242. In this way, the time domain resource occupied by the second radio signal is used for determining the third time window. APPLE-1003, ¶¶241-242. The '113 patent teaches that “the start time of the third time window is equal to the time domain resource occupied by the second radio signal plus an offset” (APPLE-1001, 23:23-25), meaning that the third time

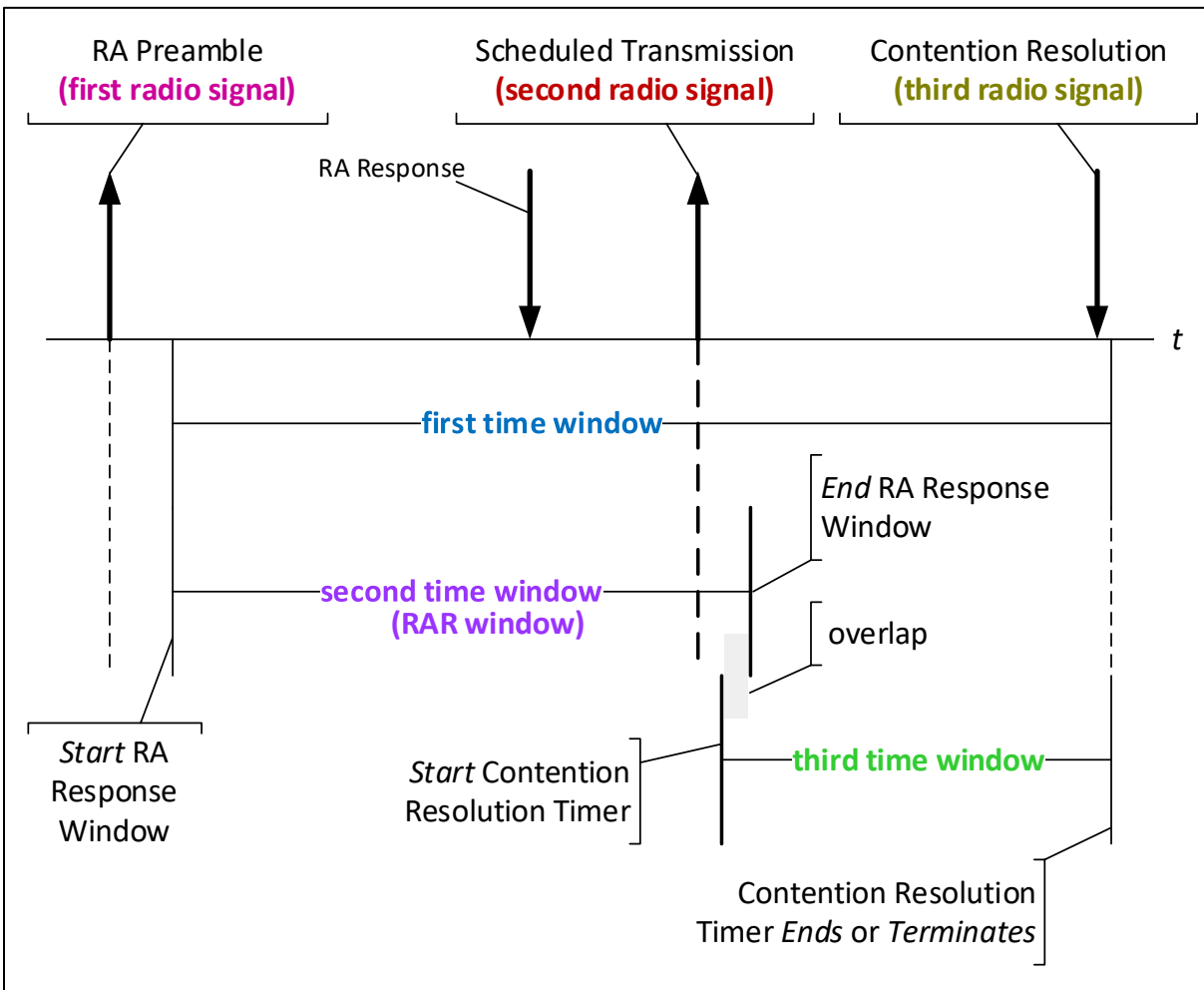
window can begin after the second radio signal is transmitted, consistent with the contention resolution timer starting “after” the scheduled transmission/Msg3 is transmitted. APPLE-1003, ¶¶241-242.

The first time window begins with the start of the RAR window and ends with the expiration of the *mac-ContentionResolutionTimer* or after a contention resolution message is received (third time window). APPLE-1023, §5.1.5 (if PDCCH received or if MAC PDU is successfully decoded: stop *mac-ContentionResolutionTimer*); APPLE-1003, ¶¶241-242. APPLE-1023, §5.1.5. So, when the UE receives the contention resolution message and the contention resolution is successful, the UE will stop monitoring for the contention resolution message (**third radio signal**), thereby ending the first and third time windows. APPLE-1023, §5.1.5; APPLE-1003, ¶¶241-242.

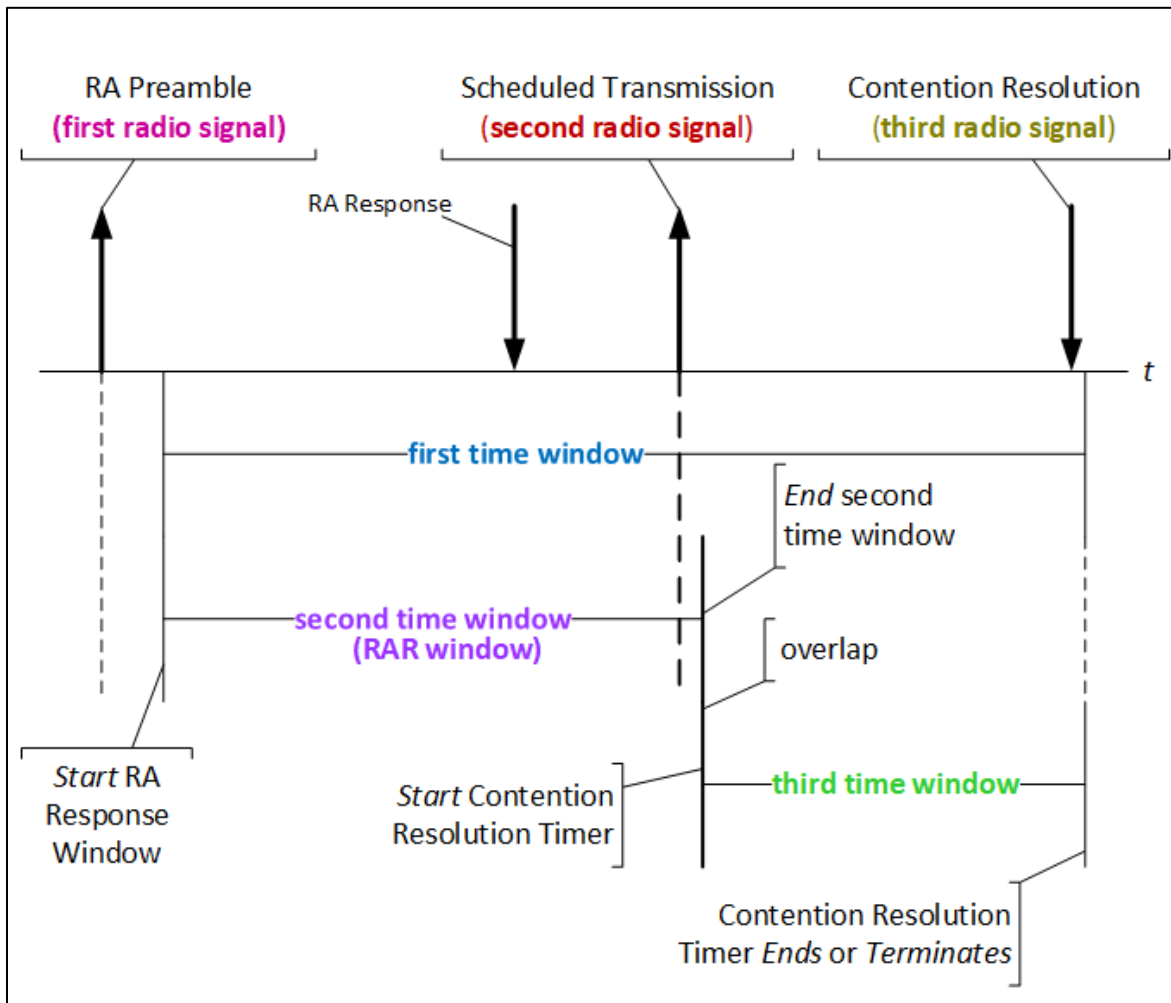
[1j]

See, *supra*, §VI.B-[1g] (describing Attribute (4)). In the 3GPP-LTE CBRAP, the **second time window** and the **third time window** have overlapped time domain resources. APPLE-1003, ¶¶243-244. In FIGS. Akl1-2, at least one symbol overlaps between the second and third time windows, even if the second time window ends when the third time window begins. *Id.*; see also APPLE-1001, 10:5-7.

In the mapping of the **second time window** to the RAR window, the RAR window includes time domain resources for the transmission of the scheduled transmission/msg3 (**second radio signal**). *Supra*, §VI.B-[1h]-[1i]; APPLE-1003, ¶¶243-244. The transmission of the scheduled transmission/msg3 (**second radio signal**) initializes the contention resolution timer (**third time window**). APPLE-1023, §5.1.5, §3.1. Thus, the second and third time windows have overlapped time domain resources, illustrated in FIGS. Ak11-2:



APPLE-1003, FIG. Ak11



APPLE-1003, FIG. Akl2 (annotated)

APPLE-1003, ¶¶243-244. The '113 patent supports this interpretation. APPLE-1001, 6:44-45. Additionally, the RAR window (**second time window**) can end after or at the same time as the start of the contention resolution timer (**third time window**). APPLE-1003, ¶¶243-244.

2. Claim 3

The RA Preamble (first radio signal) is transmitted on the PRACH (first channel). APPLE-1023, §5.1.3; APPLE-2020, §10.1.5.1; APPLE-1003, ¶245. The

scheduled transmission/msg3 (second radio signal) is transmitted by the Uplink Shared Channel (UL-SCH) transport channel on the Physical Uplink Share Channel (PUSCH) (second channel). APPLE-1023, §5.1.3; APPLE-1026, §10.1.5.1. A POSITA would have recognized that the PRACH and PUSCH were different channels. APPLE-1003, ¶245.

3. Claim 4

Supra, §VI.B.3 (RA Preamble (first radio signal) is transmitted on the PRACH). APPLE-1023, §5.1.3; APPLE-2020, §10.1.5.1. A POSITA would have recognized that the PRACH is a physical layer control channel. APPLE-1003, ¶246.

4. Claim 6

[6pre]-[6j]

Supra, §VI.B-[1pre]-[1j]. A POSITA would have recognized that 3GPP-LTE CBRAP is performed between a base station and a UE, and that 3GPP-LTE describes the complementary base station procedures recited in [6pre]-[6j]. APPLE-1003, ¶¶247. For example, a POSITA would have recognized that the base station transmits the CRS (target radio signal) to the UE. *Supra*, §§III.E, VI.B.1.[1a]. And the base station would receive the first radio signal (RA preamble) and second radio signal (UL-SCH/Msg3), as claimed, as part of CBRAP procedure. *Supra* §§III.E, VI.B.1.[1b]-[1c]. The base station would then transmit

the third radio signal (contention resolution signal). *Supra*, §§III.E, VI.B.1.[1i].

APPLE-1003, ¶247.

5. Claim 8

Supra, §VI.B.3. APPLE-1003, ¶248.

6. Claim 9

Supra, §VI.B.4. APPLE-1003, ¶249.

C. Ground 3B – 3GPP-LTE/Yi Renders Claims 11, 13-14, 16, & 18-19 Obvious

3GPP-LTE discloses UE and network nodes that perform various functions, including CBRAP. *Supra* §III.E; APPLE-1026, §10.1.5.1. If the UE and network nodes of 3GPP-LTE are not understood to include, e.g., receiver modules and transmitter modules, a POSITA would have found inclusion of these components obvious for those devices to perform processing and radio communications, including performing CBRAP, per Yi. APPLE-1003, ¶¶76-79; *supra* §III.F. Thus, in the 3GPP-LTE and Yi combination (3GPP-LTE/Yi), 3GPP-LTE's CBRAP procedure is performed using receiver and transmitter modules, as in Yi. APPLE-1003, ¶¶76-79.

Like 3GPP-LTE, Yi describes enabling communications between devices, including UE and access equipment (*e.g.*, eNB), using radio access technologies for performing CBRAP. APPLE-1031, [0002]-[0008], [0010]; APPLE-1003, ¶¶76-79. As discussed in §III.E, *supra*, Yi discloses a 3GPP network that includes

a UE and “eNode Bs (eNBs).” APPLE-1031, [0007]. Yi’s UE and eNB perform functions, including CBRAP. APPLE-1031, [0081], [0093]-[0098], FIG. 8. To perform these functions, Yi provides components in the UE and eNB. APPLE-1031, [0051]-[0055].

Yi’s UE and eNB (Figure 5) includes a DSP/microprocessor electrically connected to and controlling an RF module (transceiver;135), and a memory device based on implementation and designer choice. APPLE-1031, [0051]-[0055]. The UE transceiver includes a receiver and transmitter that operate to perform CBRAP. APPLE-1031, [0051]-[0055], Claims 9-16. The eNB has similar modules. APPLE-1031, [0051]-[0055]; APPLE-1003, ¶¶76-79.

Yi also describes a solution to the increased possibility of collisions of Msg3 transmitted by different UEs using the same PRACH resource when the RAR window size is increased. APPLE-1031, [0149], [0152]-[0182]. A POSITA looking to implement the increased RAR window size to support CBRAP would have been motivated to implement a solution, such as Yi’s, to decrease the changes of Msg3 collisions. *Id.*; APPLE-1003, ¶¶76-79.

Combining the teachings of 3GPP-LTE with Yi would have merely involved combining prior art elements according to known methods to yield predictable results. APPLE-1003, ¶¶76-79. Yi discloses communication devices (e.g., UEs, eNBs) communicating in a 3GPP-LTE network. APPLE-1031, [0005]-[007],

[0051]-[0057]; [0184]. Yi discusses implementation of CBRAP. *Id.*, [0002]-[0008], [0010]. A POSITA would have been motivated to combine the teachings of 3GPP-LTE with Yi to realize implementation details, *e.g.*, processing circuitry and radio circuitry for processing, receiving, and transmitting data. APPLE-1003, ¶¶76-79. The combination would have been predictable and foreseeable because 1) 3GPP-LTE and Yi disclose communications between a UE and an eNB; and 2) the combination merely involves incorporating known features that Yi expressly discloses for implementing CBRAP described by 3GPP-LTE and that a POSITA would have understood as likely present, but not explicitly disclosed by 3GPP-LTE. APPLE-1003, ¶¶76-79; APPLE-1031, [0002]-[0008].

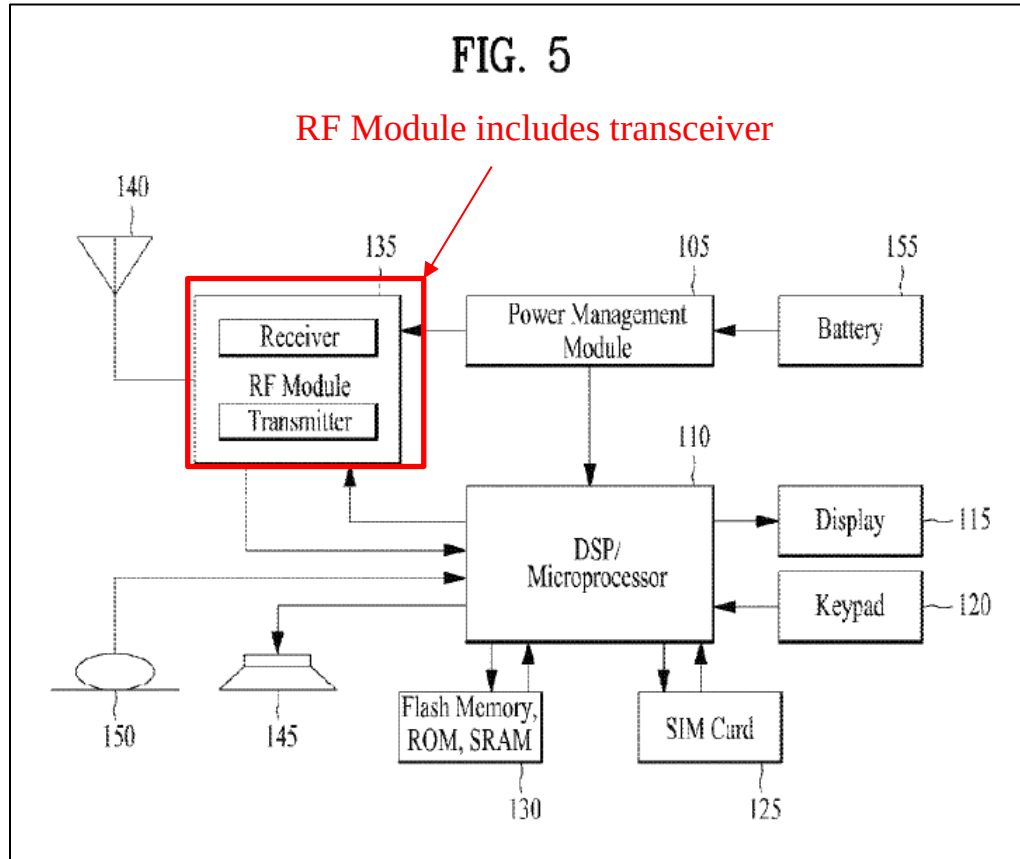
A POSITA would have had a reasonable expectation of success combining 3GPP with Yi because elements of the combined system would each perform similar functions they had been known to perform prior to the combination. APPLE-1003, ¶¶76-79. For example, the UE in 3GPP-LTE would still perform the same or similar functions, including performing CBRAP, as it did prior to the combination with Yi. *Id.* Indeed, Yi's transmitter and receiver modules are designed for implementing CBRAP. *See, e.g., id.*; APPLE-1021, [0093]-[0100].

1. Claim 11

[11pre]

Supra, §III.E-F; §VI.B-[1pre].

Yi describes a UE that performs CBRAP, shown in FIG. 5. APPLE-1031, Abstract, [0003]-[0012], [0081], [0093]-[0100], FIG. 8; APPLE-1003, ¶¶250-252.



APPLE-1031, FIG. 5 (annotated)

The UE has an RF module including a “receiver (135) configured to receive a request message from a network, and a transmitter (135) configured to transmit the transmission or reception timing information to the network.” APPLE-1031, [0051]-[0055], [0056]-[0060], [0072]. The CBRAP method “may be implemented in the form of **modules**, procedures, functions, etc. performing the above-described functions or operations.” APPLE-1031, [0187]; see APPLE-1001, 25:17-19 (“each

module unit ... realized in the form of hardware, or in the form of software function modules”); APPLE-1003, ¶¶250-252.

[11a]-[11d]

Supra, §III.E-F; §VI.B-[1a]-[1d]; §VI.C-[1pre] (UE includes an RF module). Yi provides an RF module. APPLE-1031, [0051]-[0055]. Yi describes that CBRAP can be implemented “in the form of modules.” *Id.*, [0187]. A POSITA would have found obvious that in 3GPP-LTE, the CRS (target radio signal) was received by a receiver, and the UE transmits the RA preamble (first radio signal) and Msg3 (second radio signal) and using a transmitter module and monitors for and receives the contention resolution message (third radio signal) using a receiver module, where modules are implemented in hardware and/or software, like Yi’s modules. APPLE-1031, [0093]-[0094], [0100], [0152]-[0153]. A POSITA would have found it obvious that in 3GPP-LTE, the CRS (target radio signal) was received by a receiver, implemented in hardware and/or software, like Yi’s modules. APPLE-1003, ¶¶253-254.

[11e]-[11j]

Supra, §VI.B-[1e]-[1j]. APPLE-1003, ¶255.

2. Claim 13

Supra, §VI.B.3. APPLE-1003, ¶256.

3. Claim 14

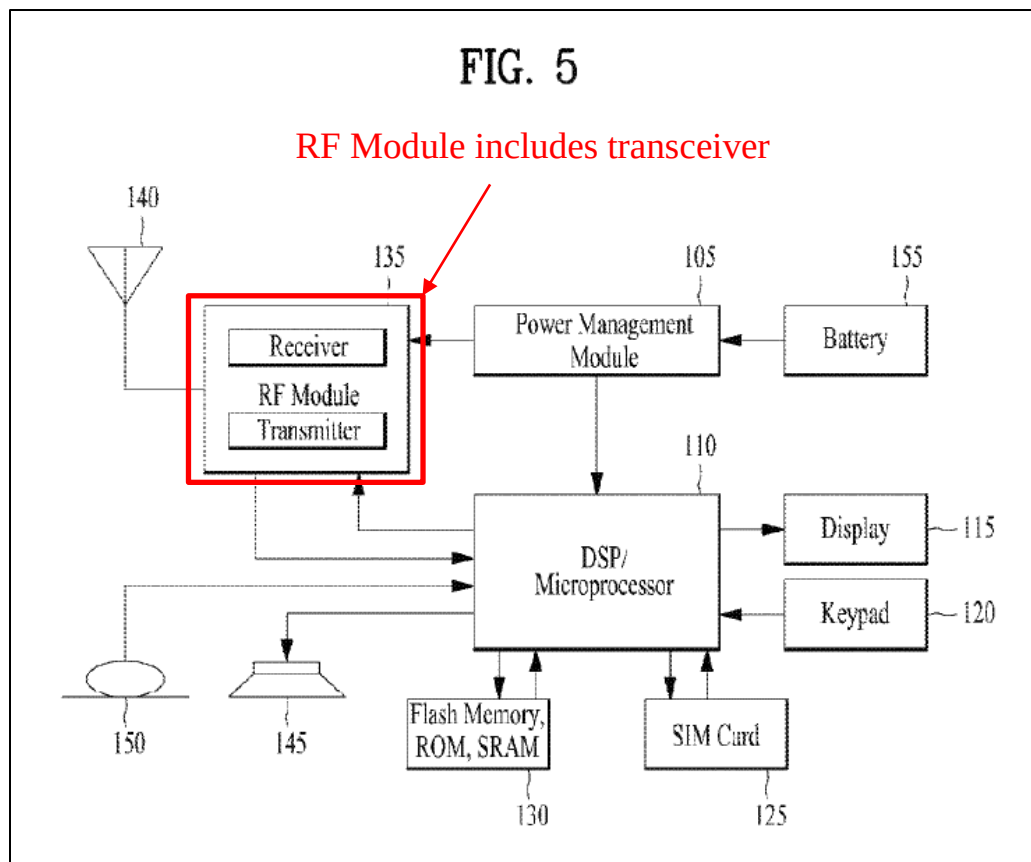
Supra, §VI.B.4. APPLE-1003, ¶257.

4. Claim 16

[16pre]

Supra, §III.F; §VI.B-[1pre] (3GPP-LTE teaching a method performed by a UE and eNB). Yi provides an eNB that performs CBRAP, shown in FIG. 5.

APPLE-1031, Abstract, [0002]-[0007]; APPLE-1003, ¶¶258-260.



APPLE-1031, FIG. 5 (annotated)

Yi describes the eNB as having an RF module including “a transmitter (135) configured to transmit a request message to a UE and a receiver (135) configured

to receive the transmission or reception timing information from the UE.” APPLE-1031, [0051]-[0055]. The CBRAP method “may be implemented in the form of **modules**, procedures, functions, etc. performing the above-described functions or operations.” APPLE-1031, [0187] (emphasis added); see APPLE-1001, 25:17-19.

[16a]-[16.d]

Supra, §III.F (eNB includes RF module); §VI.B-[1a]-[1d]. Yi teaches an RF module. APPLE-1031, [0051]-[0055]. Yi teaches that CBRAP can be implemented “in the form of modules.” *Id.*, [0187]. A POSITA would have found obvious that in 3GPP-LTE, the eNB transmits the CRS (target radio signal) to the UE using a transmitter module, receives the RA preamble (first radio signal) using a receiver module, receives Msg3 (second radio signal) by a receiver module, and sends the contention resolution message (third radio signal) using a transmitter module, each module implemented in hardware and/or software, per Yi. APPLE-1031, [0093]-[0094], [0152]-[0153], [0100]; APPLE-1003, ¶¶261-264.

[16e]-[16j]

Supra, §VI.B-[1e]-[1j]. APPLE-1003, ¶¶265-270.

5. Claim 18

Supra, §VI.B.2. APPLE-1003, ¶271.

6. Claim 19

Supra, §VI.B.3. APPLE-1003, ¶272.

VII. TRIAL SHOULD BE INSTITUTED

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. *See, e.g.*, APPLE-1032; APPLE-1033; <https://uspto.cosocloud.com/p9xpz6s4jn75/> (Video).

VIII. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Please charge to Deposit Account 06-1050.

IX. 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 '113 Patent. The '113 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; *Samsung Electronics Co., Ltd. et al. v. Apex Beam Technologies LLC*, IPR2023-00601 (PTAB), filed February 28, 2023; *Samsung Electronics Co., Ltd. et al v. Apex Beam Technologies LLC*, IPR2023-00602 (PTAB), filed February 28, 2023; *Apex Beam Technologies LLC v.*

Samsung Electronics Co., Ltd. et al, 2-24-cv-00188 (EDTX), filed June 1, 2022;
Apex Beam Technologies LLC v. ZTE Corporation, 2-22-cv-00031 (EDTX), filed
February 1, 2022; *Apex Beam Technologies LLC v. OnePlus Technology*
(Shenzhen) Co., Ltd., 2-22-cv-00032 (EDTX), filed February 1, 2022; *Apex Beam*
Technologies LLC v. TCT Mobile International Limited et al, 2-21-cv-00438
(EDTX), filed November 30, 2021.

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 IPR50095-0226IP1@fr.com.

Respectfully submitted,

Dated: May 2, 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 13,999 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: May 2, 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 May 2, 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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