

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners,

v.

HANNIBAL IP LLC,

Patent Owner.

Case IPR2025-01189
Patent No. 11,368,911

PETITION FOR *INTER PARTES* REVIEW

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PETITIONERS' EXHIBIT LIST

Exhibit	Description
Ex. 1001	U.S. Patent No. 11,368,911 B2 to Tsai et al. (“the ‘911 patent”)
Ex. 1002	File History for U.S. Patent No. 11,368,911
Ex. 1003	Declaration of Dr. Apostolos K. Kakaes, Ph.D. (“Kakaes”)
Ex. 1004	Curriculum Vitae of Dr. Apostolos K. Kakaes, Ph.D.
Ex. 1005	International Patent Application Publication No. WO 2020/130930 A1 to <i>Nimbalker</i> et al. (“ <i>Nimbalker</i> ”)
Ex. 1006	Certified copy of U.S. Provisional Application No. 62/784,114 to <i>Nimbalker</i> et al., filed December 21, 2018 (“ <i>Nimbalker Provisional</i> ”)
Ex. 1007	3GPP TSG-RAN WG1 #96bis R1-1905031 (“PDCCH-based power saving channel design”) (Apr. 2019) (“ <i>R1-1905031</i> ”)
Ex. 1008	3GPP TSG-RAN WG1 #96 R1-1903016 (“Potential Techniques for UE Power Saving”) (Feb. 2019) (“ <i>R1-1903016</i> ”)
Ex. 1009	International Patent Application Publication No. WO 2019/135654 A1 to Anil et al. (“ <i>Anil</i> ”)
Ex. 1010	3GPP TS 36.321 v15.4.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (Release 15)”) (Dec. 2018) (“ <i>TS 36.321</i> ”)
Ex. 1011	3GPP TS 38.300 v15.5.0 (“Technical Specification Group Radio Access Network; NR; NR and NG-RAN Overall Description; Stage 2 (Release 15)”) (Mar. 2019) (“ <i>TS 38.300</i> ”)
Ex. 1012	3GPP TS 38.331 v15.4.0 (“Technical Specification Group Radio Access Network; NR; Radio Resource Control (RRC) protocol specification (Release 15)”) (Dec. 2018) (“ <i>TS 38.331</i> ”)

Exhibit	Description
Ex. 1013	3GPP TSG RAN WG1 #96bis R1-1904738 (“Discussion on power saving signal triggering UE adaptation”) (Apr. 2019) (“ <i>R1-1904738</i> ”)
Ex. 1014	3GPP TSG RAN WG1 #96bis R1-1905384 (“PDCCH-based power saving signal/channel”) (Apr. 2019) (“ <i>R1-1905384</i> ”)
Ex. 1015	3GPP TSG-RAN WG1 Meeting #96bis Tdoc R1-1905466 (“Design of PDCCH-based power saving signal/channel”) (Apr. 2019) (“ <i>R1-1905466</i> ”)
Ex. 1016	3GPP TSG RAN Meetings #83 RP-190727 (“New WID: UE Power Saving in NR”) (Mar. 2019) (“ <i>RP-190727</i> ”)
Ex. 1017	Excerpts from Stefania Sesia et al., <i>LTE – The UMTS Long Term Evolution from Theory to Practice</i> (John Wiley & Sons, Ltd. 2d ed. 2011) (“ <i>Sesia LTE</i> ”)
Ex. 1018	Excerpts from Chris Johnson, <i>Long Term Evolution in Bullets</i> (Chris Johnson 2d ed. 2012) (“ <i>LTE in Bullets</i> ”)
Ex. 1019	U.S. Patent Application Publication No. US 2017/0171818 A1 to Agarwal et al. (“ <i>Agarwal</i> ”)
Ex. 1020	3GPP TS 36.211 v14.9.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 14)”) (Dec. 2018) (“ <i>TS 36.211</i> ”)
Ex. 1021	3GPP TS 38.211 v15.4.0 (“Technical Specification Group Radio Access Network; NR; Physical channels and modulation (Release 15)”) (Dec. 2018) (“ <i>TS 38.211</i> ”)
Ex. 1022	3GPP TS 38.321 v.15.4.0 (“Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification (Release 15)”) (Dec. 2018) (“ <i>TS 38.321</i> ”)

Exhibit	Description
Ex. 1023	Michel Mouly and Marie-Bernadette Pautet, <i>The GSM System for Mobile Communications</i> (Bay Foreign Language Books 1992) (“ <i>Mouly</i> ”)
Ex. 1024	Martin Sauter, <i>From GSM to LTE; An Introduction to Mobile Networks and Mobile Broadband</i> (John Wiley & Sons, Ltd. 2011) (“ <i>Sauter</i> ”)
Ex. 1025	3GPP TS 36.331 v.15.4.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 15)”) (Dec. 2018) (“ <i>TS 36.331</i> ”)
Ex. 1026	Declaration of Friedhelm Rodermund

I. PRELIMINARY STATEMENT

Petitioners Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc., request IPR of U.S. Patent No. 11,368,911 (“the ’911 patent”), assigned to Hannibal IP LLC, and cancellation of claims 1-18. The patent is titled “Method of Physical Downlink Control Channel Monitoring and Related Device,” and claims a method and device for receiving a first configuration to configure a first search space of a physical downlink control channel (“PDCCH”) to monitor for a scheduling signal, receiving a second configuration to configure a second search space to monitor for a power saving signal for indicating wake-up information with a discontinuous reception (“DRX”) functionality, monitoring the first search space in a DRX active time, and not monitoring the second search space in response to the user equipment (“UE”) being in the DRX active time. Ex. 1001, Abstract, 3:50-4:23, 13:41-64, 14:45-15:7.

But the prior art disclosed this. For example, *Nimbalker*, like the ’911 patent, discloses DRX functionality where a wake-up signal indicated whether the UE should wake up and monitor PDCCH for scheduling information during an on-duration time. *Nimbalker* also teaches that the UE should not monitor the wake-up signal search space when the UE is in the DRX “active time,” such as while an inactivity timer is running. But the Examiner did not have *Nimbalker* when allowing the claims.

Claims 1-18 would have been anticipated or rendered obvious based on *Nimbalker* alone or in combination with other prior art.

The Board should thus institute review and cancel all challenged claims.

II. STATE OF THE ART

A. Search Spaces, Time/Frequency Domains, and PDCCH

The '911 patent acknowledges that a “search space” describes a set of time and frequency resources. *Id.*, 3:23-30, FIG. 3. In the context of the '911 patent, search spaces use conventional prior-art resource elements to configure UEs to perform PDCCH monitoring, such as shown in the “[d]ownlink resource grid” below. Ex. 1020, *TS 36.211*, FIG. 6.2.2-1.

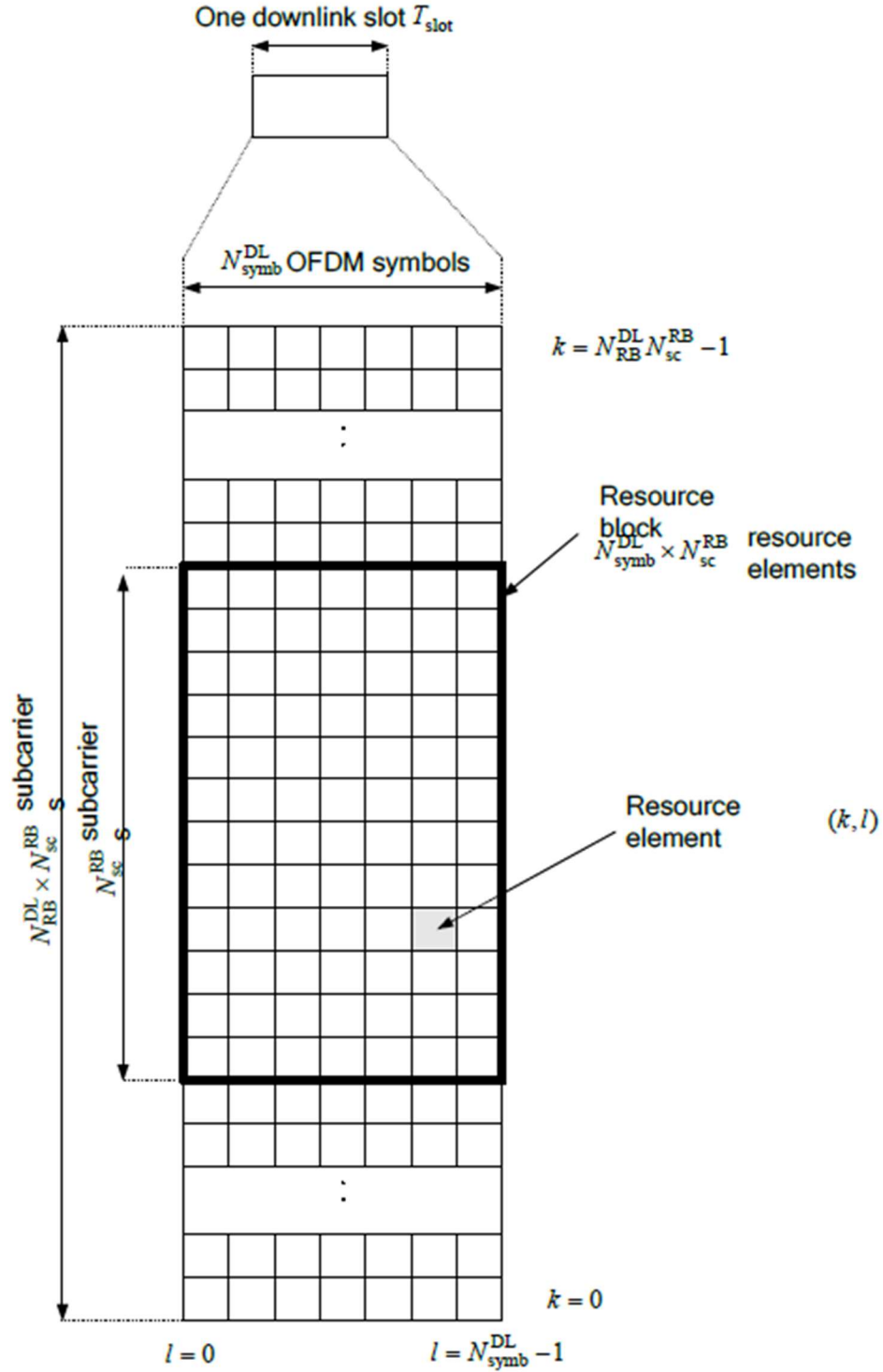


Figure 6.2.2-1: Downlink resource grid

Id.

The downlink resource grid consists of a number of “resource blocks” that include “resource element[s] ... uniquely identified by the index pair (k, l) ,” which “are the indices in the frequency and time domains, respectively.” *Id.*, 76-77.¹

Physical downlink control channel (“PDCCH”) resource blocks “carr[y] scheduling assignments and other control information.” *Id.*, 77, 99. The “PDCCH carries a message known as Downlink Control Information (DCI), which includes resource assignments [“resource grants” or scheduling information] and other control information for a UE or group of UEs.” *Sesia LTE*, 26, 28.

PDCCH messages “indicate to each mobile device [UE] as to when, where[,] and what kind of data is scheduled for them” using a “scheduling grant” that “describe[s] the modulation and coding” that the UE uses to receive the message. *Sauter*, 10, 17, 22. Requiring UEs to “check all possible PDCCH locations, PDCCH formats[,] and DCI formats” for scheduling information “would become a significant burden, leading to excessive power consumption in the UE receiver.” *Sesia LTE*, 35. Therefore, the base station “define[s] for each UE a limited set of CCE locations where a PDCCH may be placed” called a “*search space*.” *Id.*, 35-36 (emphasis added); see *Sauter*, 10 (“To reduce ... power consumption of mobile devices for decoding the control information [PDCCH], the control region is split

¹ Page citations are to exhibit page numbers (“Page x of y”).

into search spaces.”). “[S]earch space[s]” consist of specific PDCCH time and frequency resources (e.g., resource elements). Kakaes ¶¶75-76.

A physical control format indicator channel (“PCFICH”) is used to assign PDCCH search spaces for the UE to monitor for assignment messages (scheduling messages). *Sauter*, 23.

If the UE finds “a downlink assignment message” in the PDCCH search space, it will “attempt to decode all areas of the subframe in which its [scheduled] data is transmitted.” *Sauter*, 23-24, FIG. 4.15.

B. Discontinuous Reception (“DRX”) and Power Conservation

One UE power-saving solution is discontinuous reception (“DRX”), which was developed and implemented in “2G” GSM systems. *See Mouly*, 19; *Sauter*, 10, 23, 37-38. It is also used in UMTS and LTE systems. *LTE in Bullets*, 11.

In DRX, the UE is “configure[d] ... to only periodically check for scheduling assignments” on the PDCCH by “defin[ing] the value for a timer that starts running after each data block has been sent.” *Sauter*, 37. “A DRX cycle consists of an ‘On Duration’ [period] during which the UE should monitor the PDCCH and a ‘DRX period’ during which a UE can skip reception of downlink channels for battery saving purposes.” *Sesia LTE*, 23. As shown below, during the “On duration” period (defined by an “‘On’ duration timer”) at the start of each DRX cycle, the UE monitors the PDCCH for scheduling information. *LTE in*

Bullets, 11-12; *Sesia LTE*, 24. If “a scheduling message is received during an ‘On Duration’ [period], the UE starts a ‘DRX Inactivity Timer’ and monitors the PDCCH in every subframe [for data] while the DRX Inactivity Timer is running.”
Sesia LTE, 23-24; *LTE in Bullets*, 11-12.

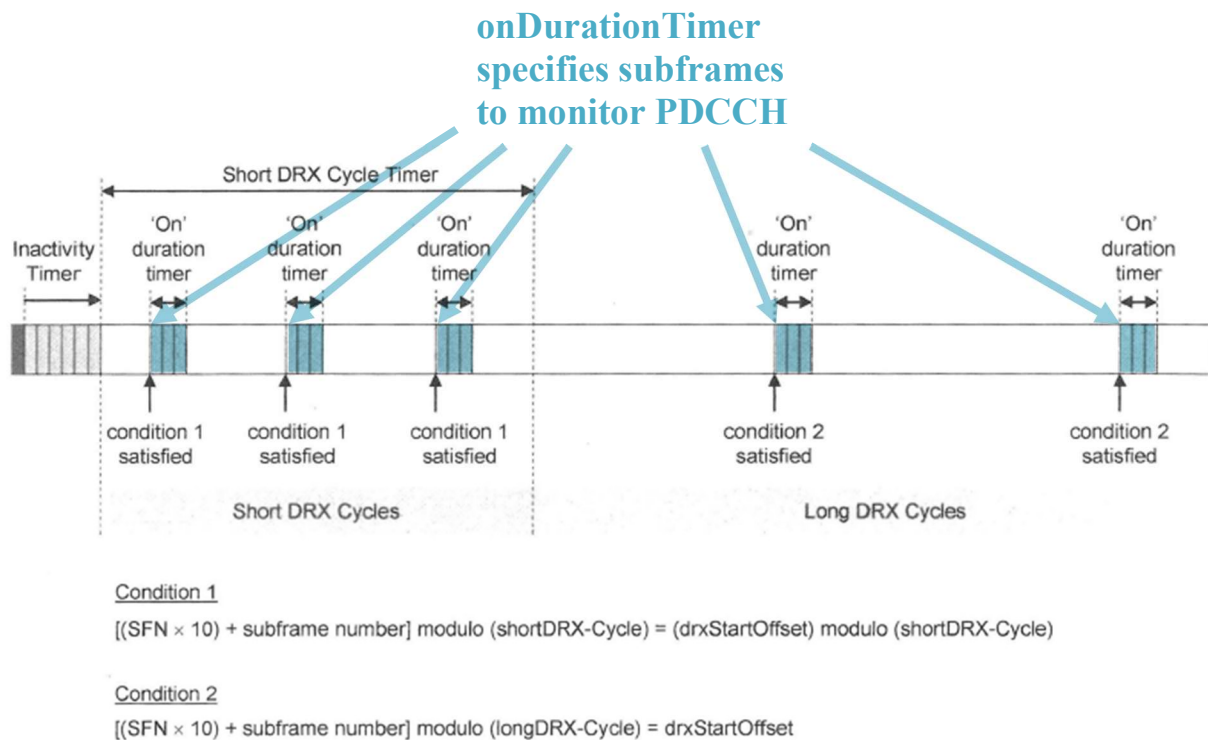
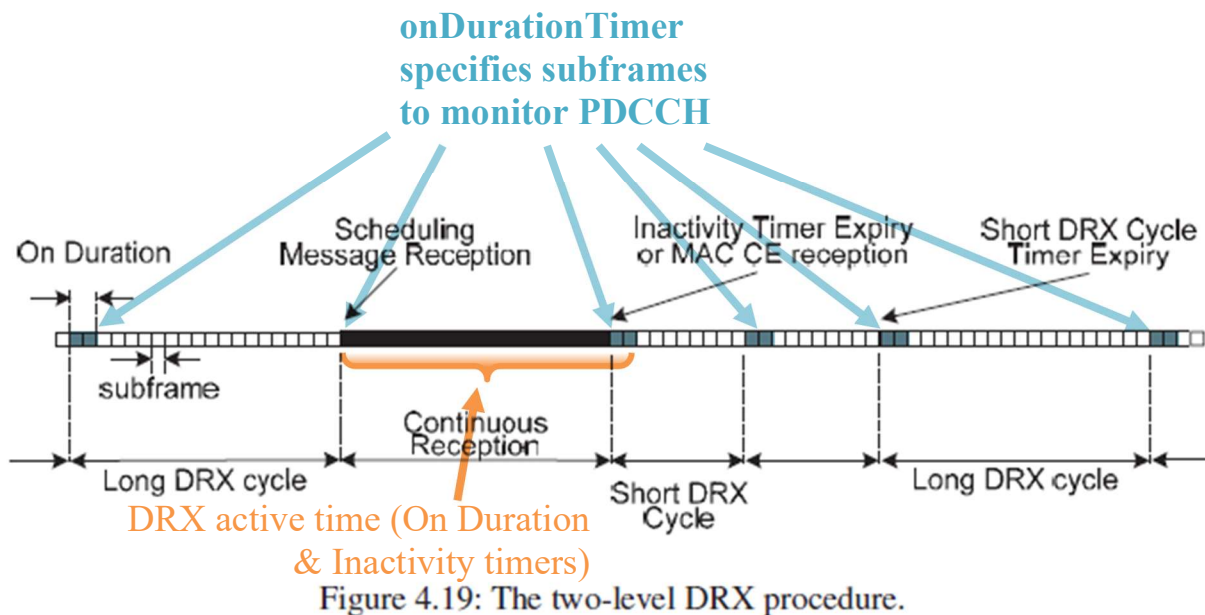


Figure 227 – DRX pattern (both short and long DRX cycles configured)

LTE in Bullets, FIG. 227; see also *id.*, 12, Table 279 (“onDurationTimer” specification).²

² Color annotations added unless otherwise noted.



Sesia LTE, FIG. 4.19.

3GPP incorporated this functionality into its technical specifications prior to the '911 patent's earliest claimed filing date. For example, Technical Specifications TS 36.321 v15.4.0 ("*TS 36.321*"; Ex. 1010), TS 38.331 v15.4.0 ("*TS 38.331*"; Ex. 1012), and TS 38.321 v15.4.0 ("*TS 38.321*"; Ex. 1022) discuss DRX-related topics, such as "DRX Cycle," "Active Time," "*onDurationTimer*," and "*drx-InactivityTimer*." *TS 36.321*, 8-9.

The *onDurationTimer* (also called *drx-onDurationTimer*) specified in "*DRX-Config*," for example, "[s]pecifies the number of consecutive PDCCH-subframe(s) at the beginning of a DRX Cycle" or "the duration at the beginning of a DRX Cycle" that the UE listens for PDCCH scheduling grants. *TS 36.321*, 8-9, 53, 123, Annex C; *TS 38.321*, 38; *TS 38.331*, 216-218; Ex. 1025, *TS 36.331*, 470, 473;

Ex. 1013, *R1-1904738*, 2; Ex. 1014, *R1-1905384*, 7; *Anil*, [226]-[227] (“When a DRX cycle is configured, the Active Time includes the time while[] []*drx-onDurationTimer* ... is running”); Ex. 1018, *LTE in Bullets*, 11-12 (describing “onDurationTimer” for ON duration PDCCH monitoring); *see also* Ex. 1001, 2:31-34 (acknowledging on-duration timer known in prior art).

TS 38.300 (Ex. 1011) explains that the PDCCH “can be ***used to schedule DL transmissions*** on PDSCH and UL transmissions on PUSCH, where the Downlink Control Information (DCI) on PDCCH” includes “[d]ownlink assignments containing at least ***modulation and coding format***, [and] ***resource allocation***” that provide scheduling information. *TS 38.300*, 19 (emphases added). To achieve this scheduling, the “***UE monitors a set of PDCCH candidates*** in the configured monitoring occasions ***in one or more configured Control Resource Sets (CORESETs) according to the corresponding search space configurations.***” *Id.* (emphases added).

TS 38.331 and *TS 38.321* describe the “DRX-Config” information element “is used to configure DRX related parameters,” such as CORESET information, search space configurations, “drx-onDurationTimer,” and “drx-InactivityTimer,” similar to *TS 36.321*, described above. These technical specifications also explain that CORESETs/search spaces may be configured by the network (e.g., base

station) to appropriately allocate resources among the UEs for PDCCH monitoring of scheduling grants. *TS 38.331*, 250, 319-322; *TS 38.321*, 38; *TS 36.321*, 53.

C. Wake-Up Signals for DRX Cycles

To further improve UE power consumption during DRX, 3GPP working group meetings discussed and developed operations for a “Power Saving Signal/Channel” (also referred to as a “wake-up signal[]”; “WUS”). *See, e.g., R1-1903016* (Ex. 1008), *R1-1904738* (Ex. 1013); *R1-1905031* (Ex. 1007); *R1-1905384* (Ex. 1014); *R1-1905466* (Ex. 1015).

R1-1903016 describes a “PDCCH-based Wake-Up Signaling” (“PDCCH-based WUS” or “PDCCH-WUS”) where the “UE wakes up from sleep (i.e., C-DRX off periods) and tries PDCCH-WUS decoding.” *R1-1903016*, 1-2, FIG. 1. “[W]hen a PDCCH-WUS is decoded, the UE performs wake-up of additional hardware and processing (e.g., by performing BWP switching, CSI-RS processing, etc.) to get ready for potential DL/UL scheduling” in ON duration, such as shown in FIG. 1. *Id.*

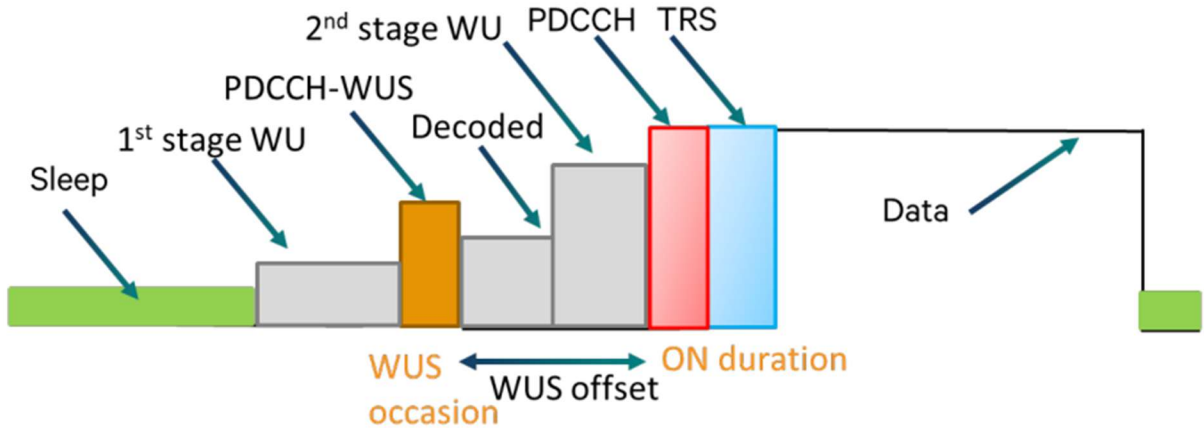


Figure 1: Two-stage wake-up timeline for PDCCH-based WUS

R1-1903016, FIG. 1. “[E]ach UE can be configured with a specific BWP [bandwidth part], CORESET/search space, ... RNTI, etc., to monitor and distinguish its own PDCCH-WUS from others.” *R1-1903016*, 2. *R1-1905031*, *R1-1904738*, *R1-1905384*, and *R1-1905466* further describe the PDCCH-WUS of *R1-1903016*. See *R1-1905031*, 1-2, FIG. 1 (describing UE monitoring “wake-up signaling (WUS) during the inactive state (e.g., C-DRX off periods)” and, “when a wake-up PDCCH is decoded, the UE transitions to the second stage, by waking up additional hardware and processing ... to get ready for DL/UL data scheduling” during ON duration PDCCH monitoring); *R1-1904738*, 2 (“if [the] UE successfully detects power saving [WUS] signal, [the] UE ... monitors PDCCH when drx-onDurationTimer is running as R15 DRX operation”), FIG. 1; *R1-1905466*, 3 (“if a WUS is detected in a WUS monitoring occasion, the UE

should wake-up for the ON duration(s) associated with the WUS monitoring occasion”).

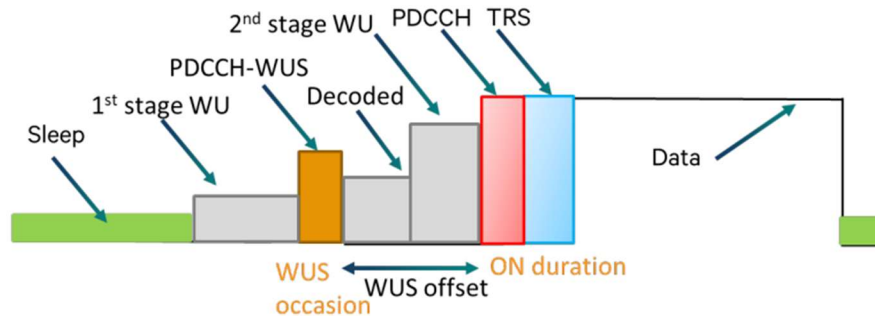


Figure 1: Two-stage wake-up timeline for PDCCH-based WUS (y-axis roughly proportional to power consumption)

R1-1905031, FIG. 1.

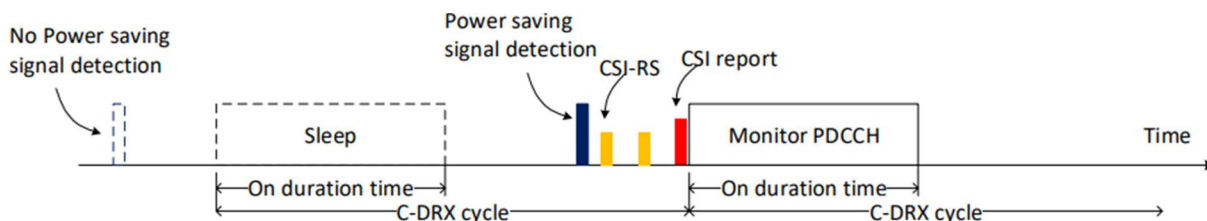


Figure 1. Procedure of CSI measurement before DRX ON triggered by power saving signal

R1-1904738, FIG. 1.

R1-1905031 explains that “[t]he primary function of the wake-up signal for C-DRX is to indicate whether the UE should wake-up and be prepared for transmission and reception in the upcoming C-DRX on-duration.” *R1-1905031*, 3. The WUS-PDCCH design includes a “wake-up PDCCH” design “includ[ing] a CORESET/Search space/BWP configuration.” *R1-1905031*, 2-3. A “[w]ake-up CORESET” can be “a CORESET containing the wake-up PDCCH hav[ing] a

configuration that can be distinct from CORESETs containing PDCCH scheduling transmissions” during ON duration monitoring. *R1-1905031*, 3.

R1-1905384 also describes the wake-up signal “search space” and “CORESET” configurations for WUS monitoring. *R1-1905384*, 1, 3, 7. For example, the PDCCH monitoring comprises a “***control resource set (CORESET) configuration*** for determining time and frequency resources for CCEs, ***search space set configuration*** for determining how and when UE monitors PDCCH, DCI format (part of search space set configuration) for determining signalled information[,] and ***RNTI for addressing the information to the certain UE(s)***.” *R1-1905384*, 1, 3, 7 (emphases added). “Each search space set is associated with one CORESET.” *R1-1905384*, 7 (describing “power saving channel specific search space set could be associated to power saving specific CORESET for power saving (CORESET-PS) for monitoring power save DCI format”).

R1-1905466 confirms that “the PDCCH based power saving signal needs to indicate ‘wake-up’ based on which the UE can decide to decode/not decode subsequent PDCCH monitoring occasion(s),” which can be performed “using a regular PDCCH decoder.” *R1-1905466*, 1-2.

R1-1905466 also addresses situations where the “UE miss[es] the WUS.” *Id.* Because “missing the WUS” “can increase latency significantly,” then “as a fall-

back[, the] UE should monitor some search spaces/PDCCH On durations even when WUS is not detected.” *R1-1905466*, 3-4.

Thus, these references show that a POSITA was well acquainted with the following DRX operations before April 30, 2019, the earliest claimed priority date of the '911 patent:

- The network (base station) providing configuration information to configure the UE to monitor a scheduling PDCCH search space during ON duration for scheduling information, such as the CORESET/search space in the DCI and/or RRC.
- The network (base station) providing configuration information to configure the UE to monitor a WUS PDCCH search space to receive wake-up information, such as the CORESET/search space in the DCI for the WUS monitoring.
- The UE monitoring the scheduling PDCCH CORESET/search space during ON duration for the period of the onDurationTimer to determine scheduling information for a downlink or uplink transmission.

- When the WUS is not detected, the UE may still monitor the PDCCH ON duration search space for scheduling information, for example, to prevent latency caused by not detecting the WUS.

III. THE '911 PATENT

The '911 patent “relates to wireless communications, and more particularly, to a method of [PDCCH] monitoring and a related device.” Ex. 1001, 1:16-21. The '911 patent acknowledges that, for prior-art LTE and 5G (NR) devices, a “UE power saving mechanism” known as “Discontinuous Reception (DRX)” was used, including a “wake-up/go-to-sleep mechanism.” *Id.*, 1:28-49. Prior-art DRX operations had known parameters, including an “on-duration” timer (e.g., “drx-onDurationTimer”) and “inactivity-timer,” which refer to the “duration that the UE waits after waking up, to receive PDCCHs,” and the “duration that the UE waits to successfully decode a PDCCH, from the last successful decoding of a PDCCH,” respectively. *Id.*, 2:29-41, 2:61-65. The DRX “active-time” describes the “total duration that the UE monitors PDCCH,” including “on-duration” timer and “inactivity-timer” periods of the DRX cycle. *Id.*, 2:46-51. The '911 patent also acknowledges that, for prior-art DRX devices, a “power saving signal/channel” was used to “trigger[] the UE to achieve reduction in PDCCH monitoring [that] is related to using the power saving signal/channel to trigger UE to skip PDCCH monitoring.” *Id.*, 2:1-18

In the prior art, the UE “monitor[s] a WUS [wake-up signaling] on a WUS occasion” and, “[i]f the UE receives the WUS signal,” then the UE may “wake up to monitor the PDCCH on the upcoming (or next) on-duration time of the DRX cycle,” but if the WUS is not received, the UE may “not wake up to monitor the PDDCH [sic],” as shown in FIG. 2. *Id.*, 3:13-22.

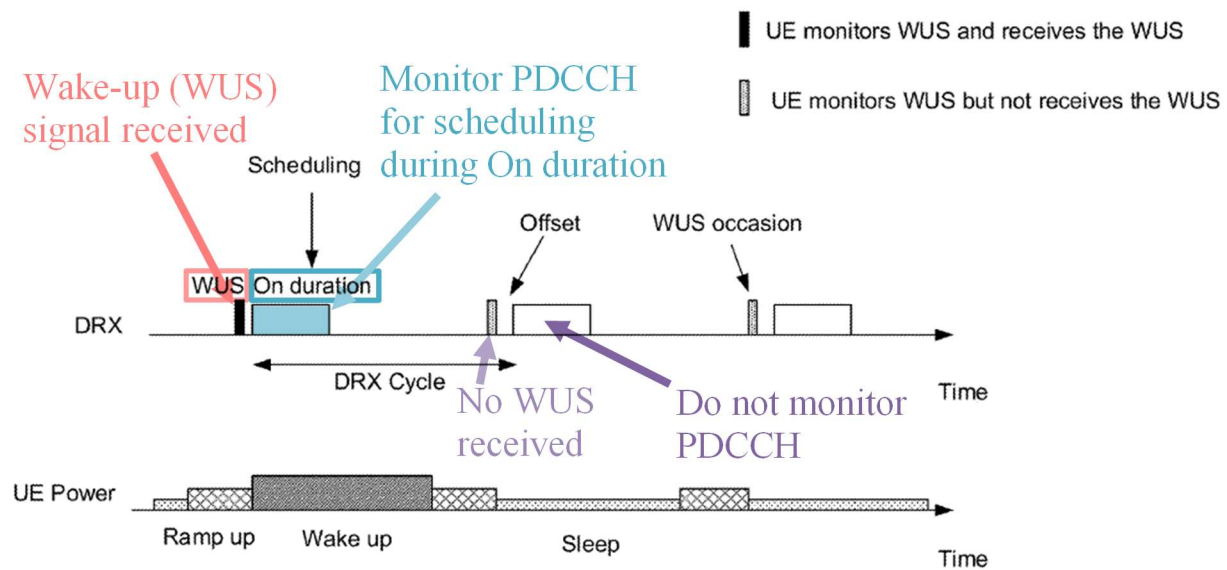


FIG. 2
(RELATED ART)

Id., FIG. 2.

The '911 patent also explains that the prior-art WUS “may be indicated by a control resource set (CORESET) or search space configuration” that is a “time and/or frequency resource for monitoring the WUS,” such as shown in FIG. 3. *Id.*, 3:23-34.

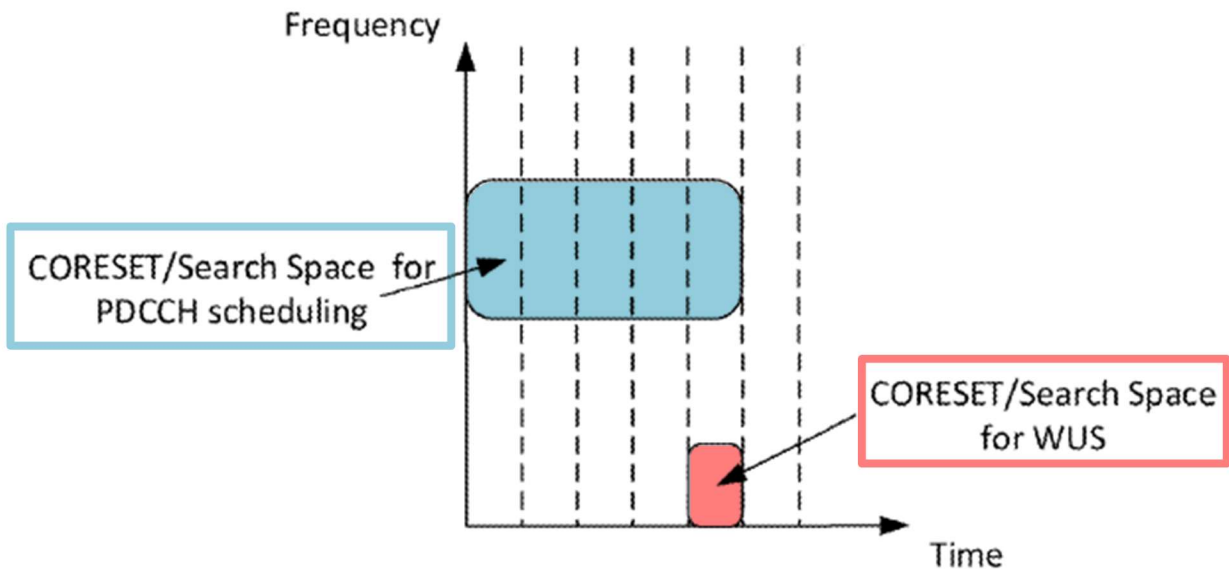


FIG. 3
(RELATED ART)

Id., FIG. 3.

The '911 patent purports to identify a problem in this prior art where, “if the active time of the UE overlaps with the on duration of the next DRX cycle ..., the UE may need to monitor the PDCCH for scheduling as well as the WUS occasion simultaneously, which increases power consumption of the UE.” *Id.*, 3:39-46, FIG. 4. The '911 patent claims to solve this issue “by not monitoring the search

space for scheduling the power saving signal (e.g., WUS) during the DRX active time,” such as shown in FIG. 6. *Id.*, 7:6-8.

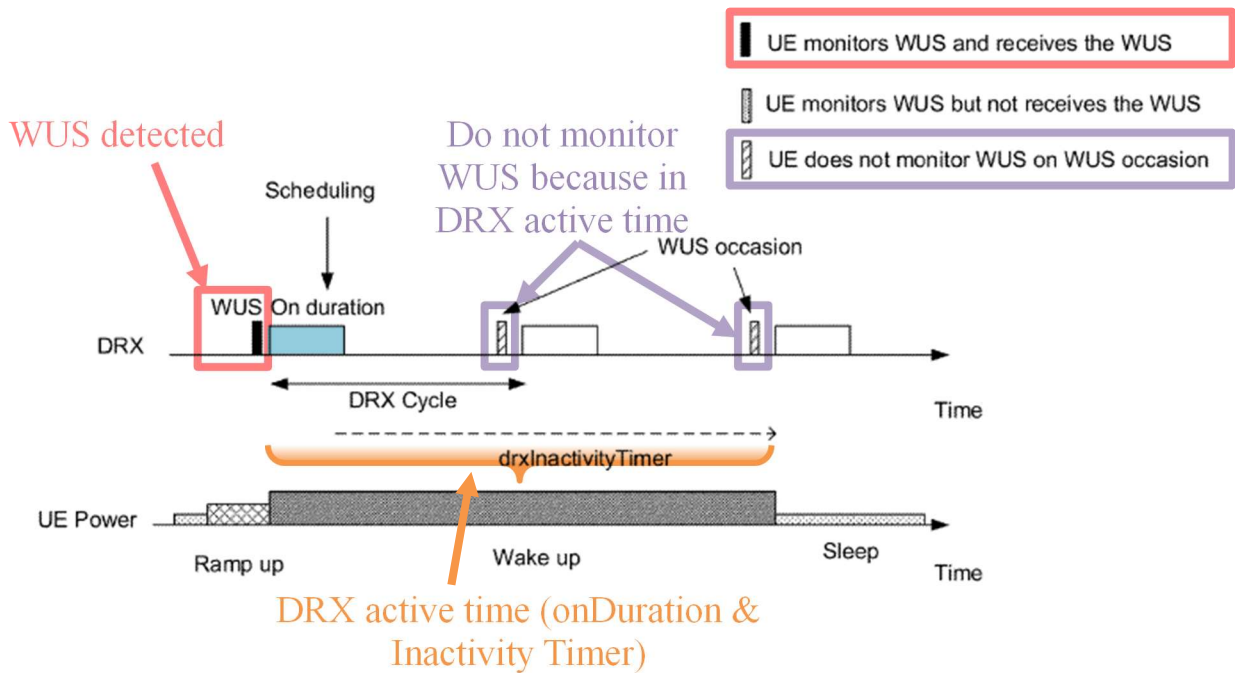


FIG. 6

Id., FIG. 6.

Claim 1, elements [1Preamble], [1a], [1b], and [1d], recite merely acknowledged conventional DRX wake-up signaling operations explained above. *See id.*, 1:25-3:46, FIGS. 2-4. Element [1c] recites the '911 patent's purported contribution over the prior art. *Id.*, 7:6-8, FIG. 5. Element [1c] was indicated as allowable subject matter and added by amendment to achieve allowance. Ex. 1002, 111, 147-154. But element [1c] is taught by *Nimbalker*, which was not before the Examiner.

IV. CLAIM CONSTRUCTION

The Board construes claims per *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Claims are construed only to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Here, no terms need construction to resolve the controversy in this forum.³

V. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) would have had at least a master’s degree in electrical engineering or a similar field and at least two years of experience working with wireless mobile telecommunications systems. Additional relevant work experience can compensate for less education, and vice versa. Kakaes ¶121.

³ Petitioners reserve the right to argue in an appropriate forum that certain limitations in the challenged claims are indefinite. Petitioners also reserve the right to challenge the priority date here and/or in other proceedings.

VI. STATEMENT OF PRECISE RELIEF REQUESTED

A. Prior Art

Ex. 1005	International Patent Application Publication No. WO 2020/130930 (“ <i>Nimbalker</i> ”)
Ex. 1007	3GPP TSG-RAN WG1 #96bis R1-1905031 (“ <i>R1-1905031</i> ”)
Ex. 1008	3GPP TSG-RAN WG1 #96 R1-1903016 (“ <i>R1-1903016</i> ”)
Ex. 1009	International Patent Application Publication No. WO 2019/135654 (“ <i>Anil</i> ”)

1. *Nimbalker*

Nimbalker was filed December 23, 2019, and published June 25, 2020. *Nimbalker* claims priority to U.S. Provisional Application No. 62/784,114 (“*Nimbalker Provisional*”; Ex 1006), filed December 21, 2018, which contains substantially the same relevant disclosures as *Nimbalker*. For purposes of applying *Nimbalker* as prior art, it was therefore effectively filed on December 21, 2018, and is prior art to the ’911 patent under 35 U.S.C. § 102(a)(2). “[U]nder AIA §§ 102(a)(2) and 102(d), there is no need to evaluate whether any claim of a reference patent document is actually entitled to priority when applying such a

reference patent as prior art.” *Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 at 29-30 (P.T.A.B. Mar. 10, 2023) (precedential). Nevertheless, support in the provisional application for at least one claim of *Nimbalker* does exist. Kakaes ¶124.

Nimbalker is analogous art to the ’911 patent because it is directed to the same field of endeavor—wireless communications, including physical downlink control channel (“PDCCH”) monitoring. *Nimbalker*, 2, 8-9, FIGS. 2-3; *Nimbalker Provisional*, 17-18, 20, FIGS. 2-3; Ex. 1001, 1:18-21, 3:50-4:23. *Nimbalker* is also directed to the same problem as the ’911 patent, for example, wake-up signals (“WUS”) for discontinuous reception (“DRX”). *Nimbalker*, 2, 8-9, FIGS. 2-3; *Nimbalker Provisional*, 17-18, 20, FIGS. 2-3; Ex. 1001, Abstract, 2:52-4:23; Kakaes ¶125.

2. *R1-1905031*

R1-1905031, titled “PDCCH-based power saving channel design,” was made publicly available not later than April 3, 2019, on 3GPP’s ftp server where it was accessible and known to be found by POSITAs. Rodermund ¶¶21, 69-77. *R1-1905031* was also made available and discussed at the 3GPP TSG-RAN WG1 #96bis meeting April 8-12, 2019, where it was publicly available to and discussed by POSITAs. *Id.* *R1-1905031* is prior art to the ’911 patent under 35 U.S.C. § 102(a)(1).

R1-1905031 is analogous art to the '911 patent because it is directed to the same field of endeavor—wireless communications, including PDCCH monitoring. *R1-1905031*, 1-10; Ex. 1001, 1:18-21, 3:50-4:23. *R1-1905031* is also directed to the same problem as the '911 patent, for example, WUS for DRX. *R1-1905031*, 1-10; Ex. 1001, Abstract, 2:52-4:23; Kakaes ¶127.

3. *R1-1903016*

R1-1903016, titled “Potential Techniques for UE Power Saving,” was made publicly available not later than February 16, 2019, on 3GPP’s ftp server where it was accessible and known to be found by POSITAs. Rodermund ¶¶20, 60-68. *R1-1903016* was also made available and discussed at the 3GPP TSG-RAN WG1 #96 meeting February 25 through March 1, 2019, where it was publicly available to and discussed by POSITAs. *Id.* *R1-1903016* is prior art to the '911 patent under 35 U.S.C. § 102(a)(1).

R1-1903016 is analogous art to the '911 patent because it is directed to the same field of endeavor—wireless communications, including PDCCH monitoring. *R1-1903016*, 1-4; Ex. 1001, 1:18-21, 3:50-4:23. *R1-1903016* is also directed to the same problem as the '911 patent, for example, WUS for DRX. *R1-1903016*, 1-4; Ex. 1001, Abstract, 2:52-4:23; Kakaes ¶129.

4. *Anil*

Anil was filed January 7, 2019; published July 11, 2019; claims priority to U.S. Provisional Application No. 62/613,977, filed January 5, 2018; and is prior art to the '911 patent under 35 U.S.C. § 102(a)(2).

Anil is analogous art to the '911 patent because it is directed to the same field of endeavor—wireless communications, including PDCCH monitoring. *Anil*, [222]-[262]; Ex. 1001, 1:18-21, 3:50-4:23. *Anil* is also reasonably pertinent to one of the problems of the '911 patent, for example, beam failure recovery during DRX. *Anil*, [222]-[262]; Ex. 1001, 9:21-38; Kakaes ¶131.

B. Challenges

Ground	Challenged Claims	35 U.S.C. Section	Prior Art
1/2	1-3, 5-6, 10-12, 14-15	102/103	<i>Nimbalker</i>
3	2, 4, 11, 13	103	<i>Nimbalker</i> and <i>R1-1905031</i>
4	2, 4, 11, 13	103	<i>Nimbalker</i> and <i>R1-1903016</i>
5	7-9, 16-18	103	<i>Nimbalker</i> and <i>Anil</i>

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Grounds 1 and 2: Claims 1-3, 5-6, 10-12, and 14-15 Are Anticipated or Rendered Obvious by *Nimbalker*

Nimbalker anticipates or renders obvious claims 1-3, 5-6, 10-12, and 14-15.

Kakaes ¶¶135-197.

1. Independent Claim 1

Claim 1, elements [1a], [1b], and [1d], recite conventional DRX and WUS operations. Kakaes ¶136. Element [1c] recites WUS misdetection. Element [1e] adds not monitoring the WUS when the WUS monitoring period overlaps with the active time. *Id.* A POSITA would have understood that *Nimbalker* discloses each element of claim 1 or, alternatively, renders obvious claim 1. Kakaes ¶¶136-173.

a. [1Preamble]: “A method for a user equipment (UE) monitoring a physical downlink control channel (PDCCH), the method comprising:”

Nimbalker discloses [1Preamble]. Kakaes ¶¶137-139.

Nimbalker discloses that “significant power can be spent on monitoring the Physical Downlink Control Channel (PDCCH)” in LTE and NR wireless communication systems using DRX. *Nimbalker*, 2; *Nimbalker Provisional*, 17-18. The user equipment (“UE”) may monitor or detect “its configured control resource sets (CORESETs) to identify whether there is a PDCCH sent to it.” *Nimbalker*, 2; *Nimbalker Provisional*, 18. *Nimbalker* teaches “[t]echniques that can reduce

unnecessary PDCCH monitoring ... and reduce power consumption.” *Nimbalker*, 2; *Nimbalker Provisional*, 18. Kakaes ¶138.

Nimbalker discloses monitoring PDCCH for a wake-up signal (“WUS”) and for scheduling and data transmissions during DRX “ON Duration” and inactivity timer times. *Nimbalker*, 9, 10, 19, 20, FIGS. 2-3; *Nimbalker Provisional*, 19, 20, 26, 27, FIGS. 2-3; Kakaes ¶139.

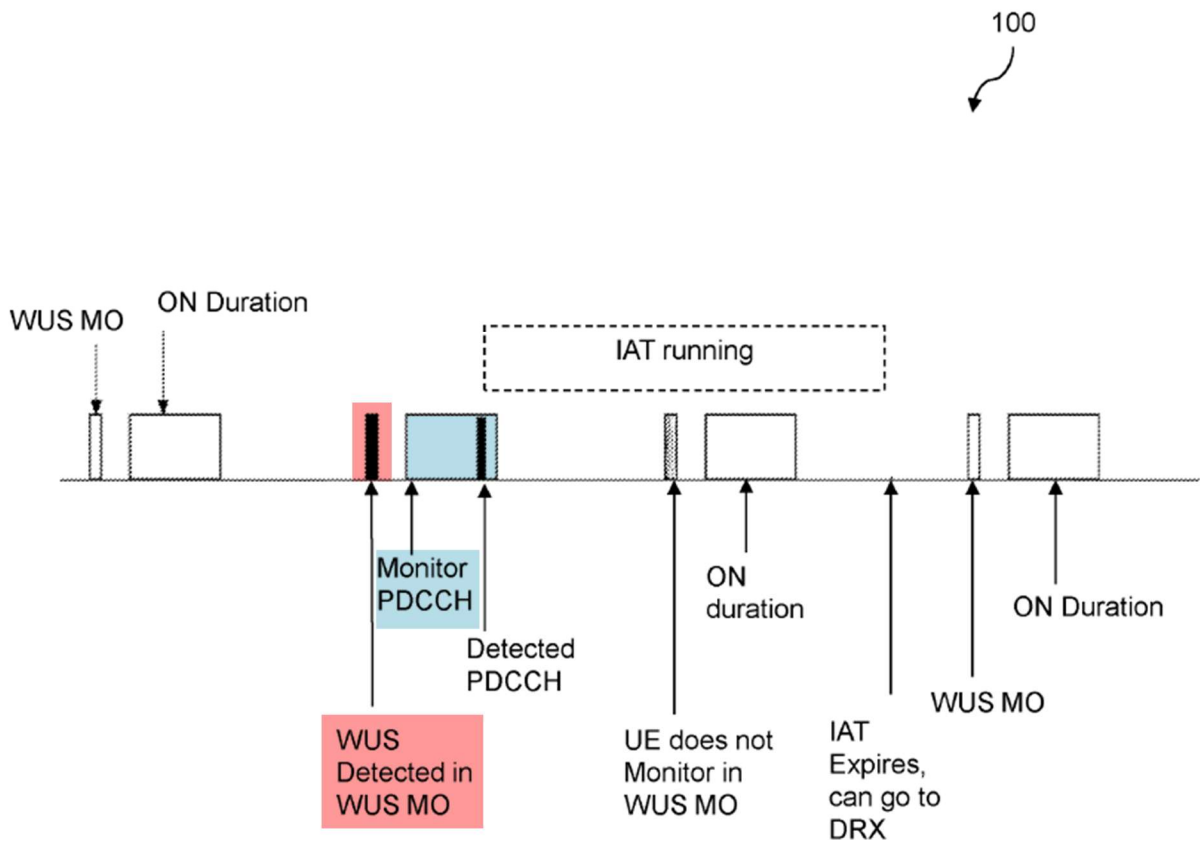


FIGURE 2

Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

- b. [1a]: “receiving a first configuration from a base station to configure the UE with a first search space of the PDCCH, wherein the first search space is used for monitoring a scheduling signal used for indicating scheduling information;”

Nimbalker discloses [1a]. Kakaes ¶¶140-144.

Nimbalker discloses that a “regular PDCCH monitoring CORESET may have multiple search spaces that include search spaces configured for higher aggregation levels” (received first configuration from a base station to configure the UE with a first search space of the PDCCH). *Nimbalker*, 19; *Nimbalker Provisional*, 26. This first search space for the “PDCCH monitoring occasion” may be “preconfigured by the network or a network node,” for example, “an evolved NodeB, a gNB, or any other base station” and sent to the UE (configuration received by the UE from the base station). *Nimbalker*, 10-11; *Nimbalker Provisional*, 20. In another example, the “PDCCH monitoring occasion” search space may “be dynamically configured using information from the WUS” sent from the base station to the UE. *Nimbalker*, 10-11; *Nimbalker Provisional*, 20. A CORESET configuration for monitoring PDCCH, disclosed in *Nimbalker*, was a conventional part of DRX monitoring cycles. Kakaes ¶141; *R1-1905384*, 3, FIG. 1 (“PDCCH monitoring” comprises “control resource set (CORESET) configuration for determining time and frequency resources,” “space set configuration for

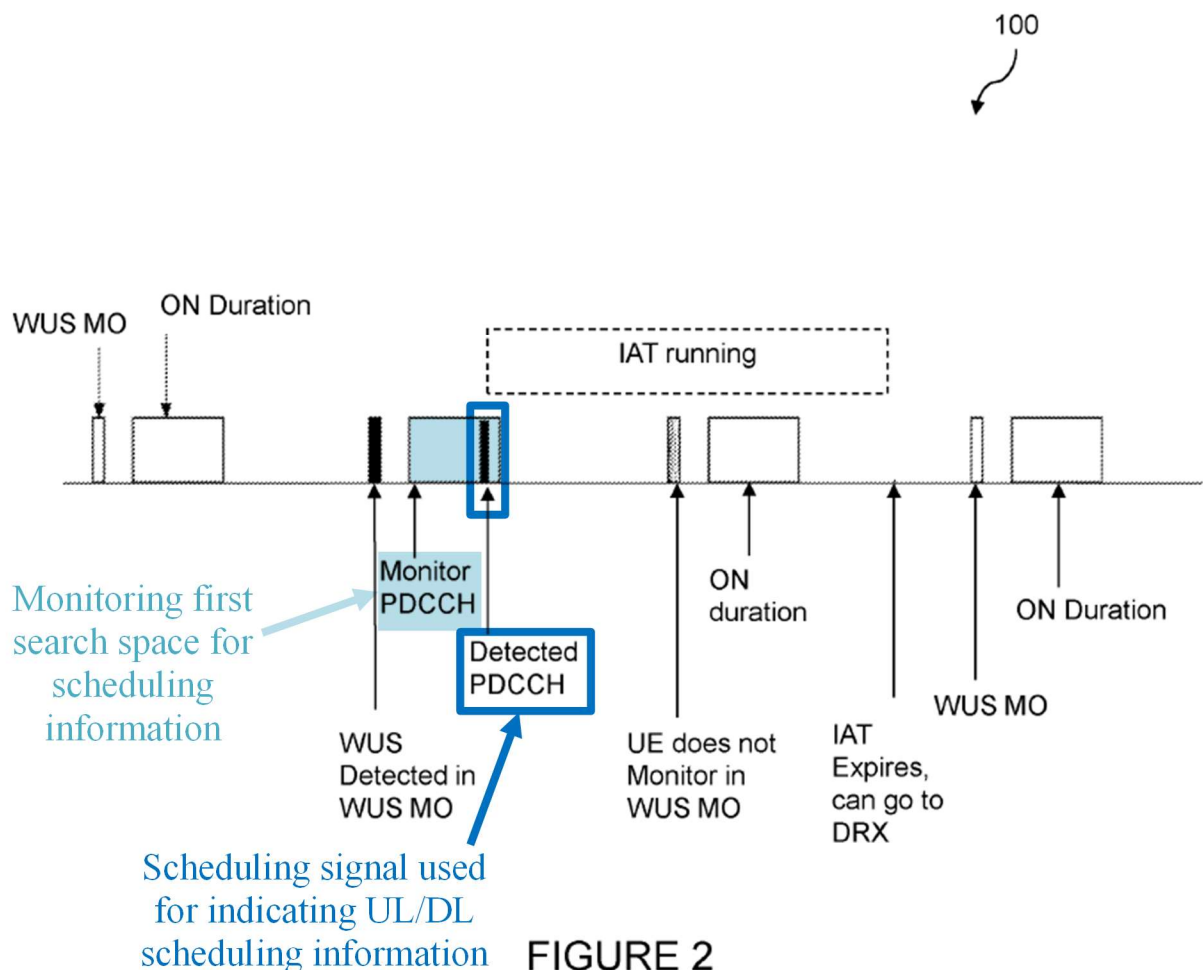
determining how and when UE monitors PDCCH,” and “DCI format (part of search space set configuration) for determining signalled information” to the UE).⁴

Nimbalker also discloses the UE performing “scheduling PDCCH monitoring” to monitor for a scheduling signal used to indicate scheduling information during the DRX ON duration time when “a WUS-compatible PDCCH format” is “detect[ed].” *Nimbalker*, 20; *Nimbalker Provisional*, 27. *Nimbalker*’s first search space of the PDCCH is a “scheduling PDCCH occasion[.]” having a signal indicating scheduling information, such as data transfer or that the UE can stop monitoring PDCCH. *Nimbalker*, 11; *Nimbalker Provisional*, 20. *Nimbalker* discloses that, while monitoring the PDCCH search space, “the UE may receive information in PDCCH Downlink Control Indicator or Downlink Control Information (DCI) (e.g.[,] in PDCCH scheduling UL/DL data for the UE)” (scheduling signal used for indicating scheduling information). *Nimbalker*, 9; *Nimbalker Provisional*, 19. Monitoring the PDCCH in ON duration for the scheduling signal containing scheduling information was the purpose of the awakened DRX cycle. Kakaes ¶¶142-143; *Nimbalker*, 8-11; *Nimbalker Provisional*, 18-20; *see also* Ex. 1017, *Sesia LTE*, 24 (“The UE checks for scheduling messages ... during the ‘On Duration’ period”); Ex. 1019, *Agarwal*,

⁴ “Each search space set is associated with one CORESET.” *R1-1905384*, 7.

[0056] (“A DRX cycle consists of an ‘on duration’ when the UE 115 may monitor for control information (e.g., on PDCCH) A UE 115 may receive scheduling messages on PDCCH during the on duration. While monitoring PDCCH for a scheduling message, the UE 115 may initiate a ‘DRX Inactivity Timer’.”).

Nimbalker FIG. 2 shows monitoring the first search space (monitor PDCCH) for the scheduling information (detected PDCCH with “Downlink Control Indicator or Downlink Control Information (DCI) (e.g., [.] in PDCCH scheduling UL/DL data for the UE)”). *Nimbalker*, 9; *Nimbalker Provisional*, 19.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

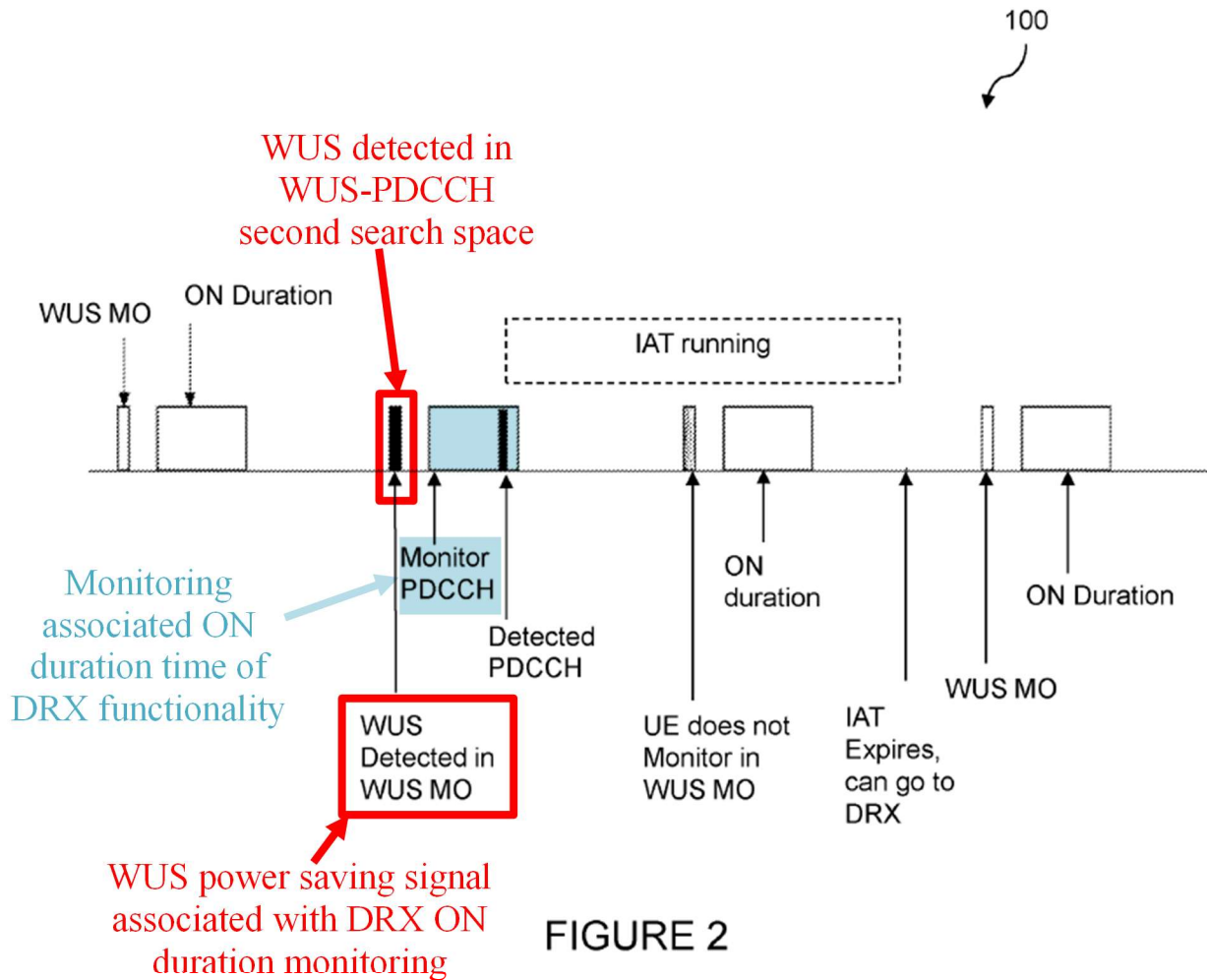
- c. [1b]: “receiving a second configuration from the base station to configure the UE with a second search space of the PDCCH, wherein the second search space is used for monitoring a power saving signal used for indicating wake-up information associated with a Discontinuous Reception (DRX) functionality;”

Nimbalker discloses [1b]. Kakaes ¶¶145-148.

Nimbalker discloses that the “network node” may “use[] a PDCCH structure to transmit [the wake-up signal] WUS.” *Nimbalker*, 13, *Nimbalker Provisional*, 22. In such cases, the base station may send, and “the UE may be configured” with, “WUS resources” that are a second configuration to configure the UE with a “WUS-PDCCH search space” (second search space of the PDCCH). *Nimbalker*, 14, 20; *Nimbalker Provisional*, 23, 27. The “network” (base station) may “configure dedicated WUS CORESETs, whereby the search spaces in these CORESETs are configured for lower aggregation levels.” *Nimbalker*, 19; *Nimbalker Provisional*, 26. These WUS CORESET search spaces are in “WUS-compatible PDCCH format” and include “the relevant REs [resource elements] in the WUS-PDCCH search space” for WUS monitoring. *Nimbalker*, 20; *Nimbalker Provisional*, 27. Kakaes ¶146.

The UE uses the WUS-PDCCH search space to monitor a “wake-up signal” (“WUS”). *Nimbalker*, 8, 10; *Nimbalker Provisional*, 19, 20. A “wake-up signal”

[WUS] is used to refer to any suitable signal, such as a power saving signal or signal for saving power.” *Nimbalker*, 8; *Nimbalker Provisional*, 19. The WUS indicates wake-up information associated with a DRX functionality, for example, “the UE may monitor (i.e., attempt to detect) a WUS [power saving signal] in a WUS monitoring occasion” comprising the WUS-PDCCH CORESET search space (second search space) that indicates that the UE should wake up and monitor for scheduling PDCCH information. *Nimbalker*, 10, 14, 19, 20; *Nimbalker Provisional*, 20, 23, 26, 27. “[T]he WUS monitoring occasion may be at the beginning of a DRX ON duration, or before a DRX ON duration.” *Nimbalker*, 10; *Nimbalker Provisional*, 20. “[I]f the UE detects a WUS in a WUS monitoring occasion, the UE may monitor the PDCCH during the PDCCH monitoring occasion(s) associated with the WUS monitoring occasion” for scheduling information. *Nimbalker*, 10; *Nimbalker Provisional*, 20. That is, the WUS indicates wake-up information associated with the DRX ON duration functionality for the UE to wake up and monitor for PDCCH scheduling information during the ON duration period. *Nimbalker*, 10; *Nimbalker Provisional*, 20; Kakaes ¶147.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

The UE receiving a CORESET configuration for a power saving channel (WUS), disclosed in *Nimbalker*, was a conventional part of PDCCH monitoring. Kakaes ¶148; *R1-1905384*, 3, FIG. 1 (“Main components in PDCCH monitoring comprise control resource set (CORESET) configuration for determining time and frequency resources for CCEs, search space set configuration for determining how and when UE monitors PDCCH, DCI format (part of search space set

configuration) for determining signalled information[,] and RNTI for addressing the information to the certain UE(s), as illustrated in Figure 1 (arrow shows the association direction).”).⁵ Kakaes ¶148.

- d. **[1c]: “in response to not receiving the power saving signal while monitoring the second search space, starting a DRX on-duration timer of the DRX functionality;”**

Nimbalker discloses or renders obvious [1c]. Kakaes ¶¶149-164.

Nimbalker discloses that “with the ‘successful/unsuccessful WUS detection’ criterion,” the UE may “determine whether to monitor/skip monitoring PDCCH in PDCCH monitoring occasion(s) corresponding to the WUS monitoring occasion.” *Nimbalker*, 8-9; *Nimbalker Provisional*, 18. The UE may make this determination in response to “unsuccessful WUS detection” (not receiving the power saving signal while monitoring the second search space) and may consider “another reliability condition” as part of whether to monitor the ON duration PDCCH for scheduling information. *Nimbalker*, 8-9, 12; *Nimbalker Provisional*, 18, 21. The

⁵ A “[p]otential dedicated search space set for power saving DCI format could be associated to one of the configured CORESETs[,] or another option would be to configure dedicated CORESET for monitoring power saving channel.”

R1-1905384, 7.

UE does this because “missed detection of a WUS may lead to increased latency and packet losses of data traffic that the UE is scheduled to receive.” *Nimbalker*, 12; *Nimbalker Provisional*, 21; Kakaes ¶150.

Therefore, if the “UE [does] not detect WUS in a WUS monitoring occasion before a DRX ON duration” (not receiving the power saving signal while monitoring the second search space), the UE may “monitor the PDCCH occasion during the ON duration [start a DRX on-duration timer of the DRX functionality] even if a WUS is not detected in the WUS monitoring occasion.” *Nimbalker*, 15; *Nimbalker Provisional*, 23; Kakaes ¶151. For example, the UE may “determine ... to wake-up and monitor the PDCCH” and start an ON duration timer of the DRX functionality in “circumstances where WUS detection is less reliable” or the RSRP is low or the decoder indicates lack of reliability. *Nimbalker*, 12, 15; *Nimbalker Provisional*, 21, 23; Kakaes ¶152.

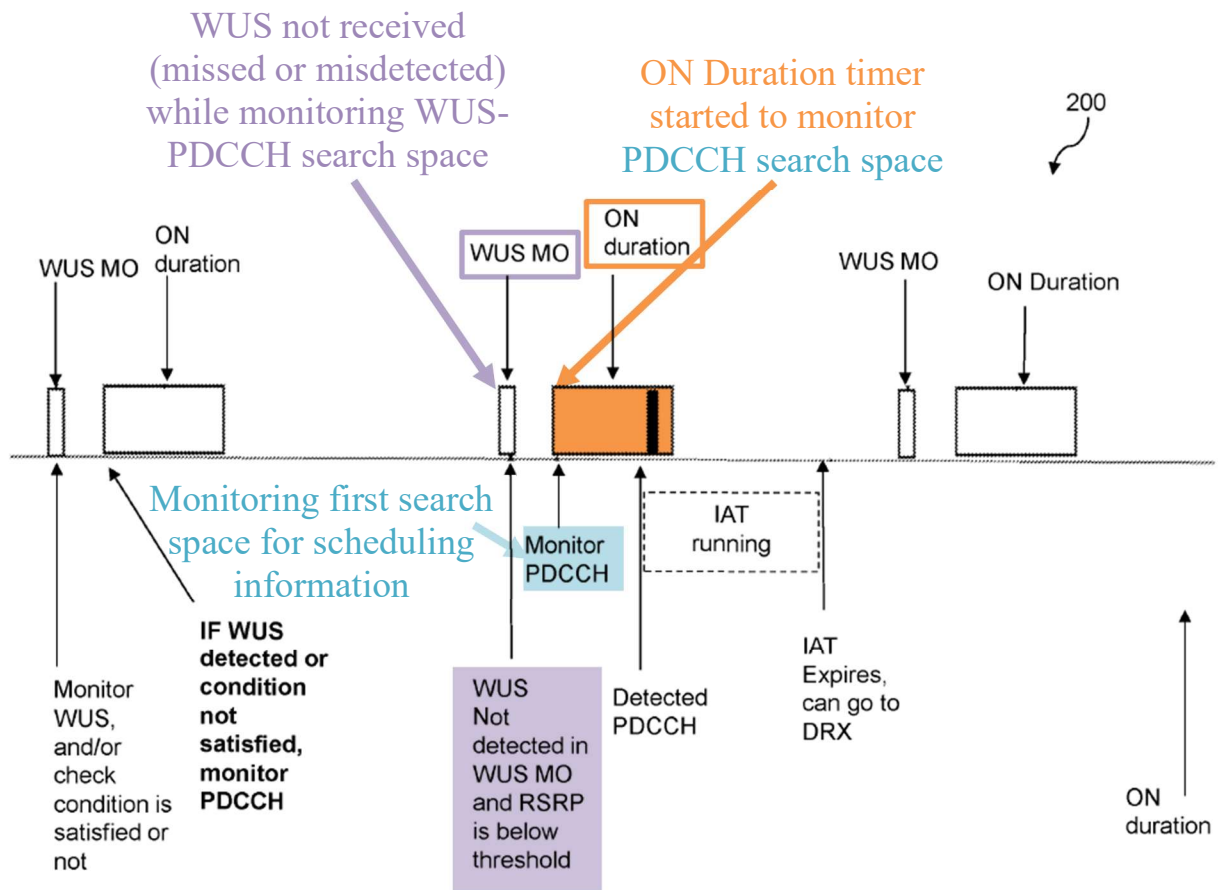


FIGURE 3

Nimbalker, FIG. 3; *Nimbalker Provisional*, FIG. 3.

A POSITA would have understood *Nimbalker*'s disclosure of starting an ON duration monitoring period also discloses starting a "DRX on-duration timer" because that was the standard operation for tracking the ON duration time period. Kakaes ¶153, §VI.C.2.

Nimbalker relates to 3GPP's "[n]ew radio (NR) standard" and describes the previously known PDCCH monitoring operation for LTE using DRX and wake-up signals to "reduce unnecessary PDCCH monitoring" and "allow the UE to ...

wake-up only when required.” *Nimbalker*, 2; *Nimbalker Provisional*, 17-18. As was well known for LTE and NR, the length of an ON duration monitoring period of a DRX cycle was specified by 3GPP as the *drx-onDurationTimer* parameter. Kakaes ¶154, §VI.C.2; *supra* II.B; *TS 38.331*, 216-218; *TS 36.331*, 470, 473; *TS 36.321*, 9, 53, 123; *TS 38.321*, 38; *R1-1904738*, 2; *R1-1905384*, 7; *Anil*, [226]-[227]; *LTE in Bullets*, 11-12; *see also* Ex. 1001, 2:31-34 (on-duration timer known in prior art).

Because *Nimbalker* relates to LTE and NR DRX for PDCCH monitoring, a POSITA would have recognized that the disclosure of starting a DRX ON duration period refers to starting the conventional *drx-onDurationTimer* specified in the configuration and described in 3GPP documents. Kakaes ¶155; *TS 38.331*, 216-218; *TS 36.331*, 470, 473; *TS 36.321*, 9, 53, 123; *TS 38.321*, 38; *R1-1904738*, 2; *R1-1905384*, 7; *LTE in Bullets*, 11-12; *see also* Ex. 1001, 2:31-34.

To the extent Patent Owner argues or the Board finds that *Nimbalker* does not disclose the limitations of [1c], *Nimbalker* would have rendered them obvious. Kakaes ¶156. *Nimbalker* discloses monitoring the first PDCCH search space during an “ON duration” period, as explained above and in Section VII.A.1.e ([1d]), *infra*. *Nimbalker* FIGS. 2-3 show boxes denoting the monitoring periods for WUS monitoring, ON duration PDCCH monitoring, and inactivity timer

monitoring along the time axis. *Nimbalker*, 15-16, FIGS. 2-3; *Nimbalker Provisional*, 24, FIGS. 2-3; Kakaes ¶157.

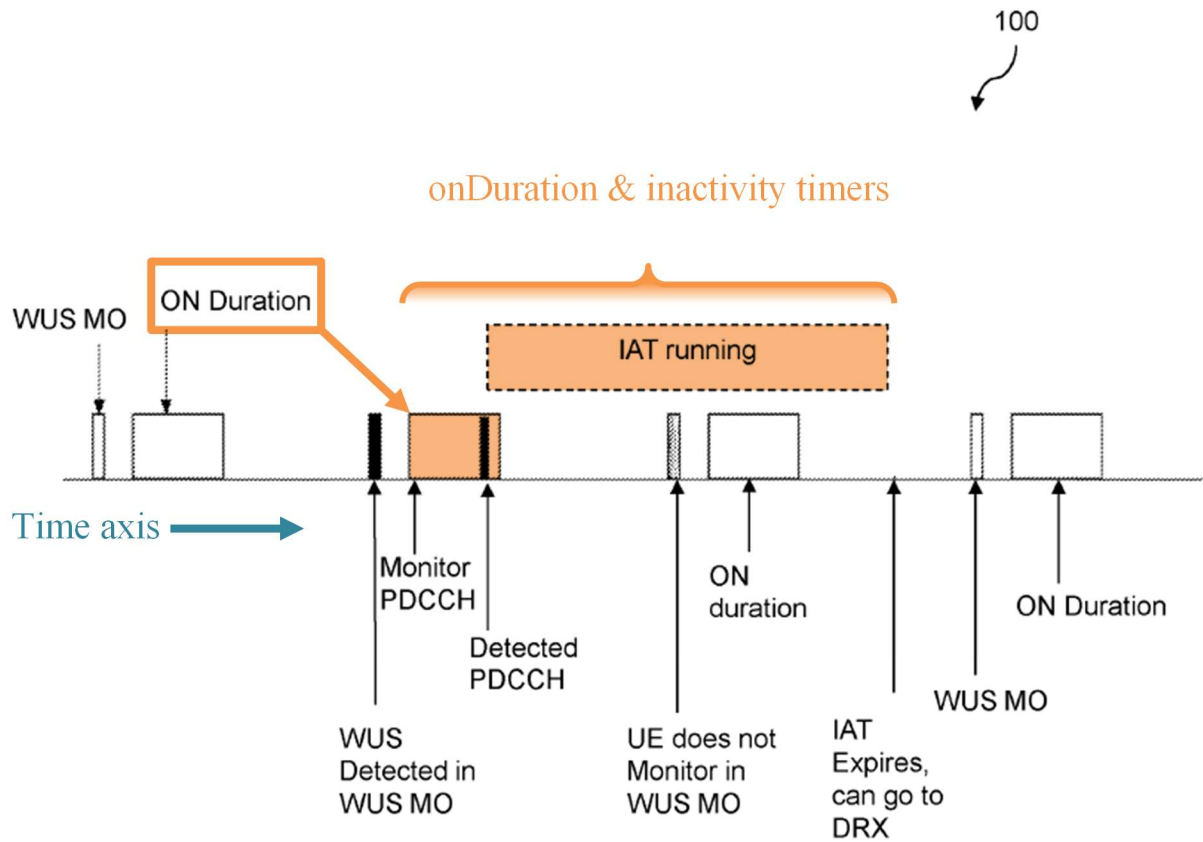


FIGURE 2

Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

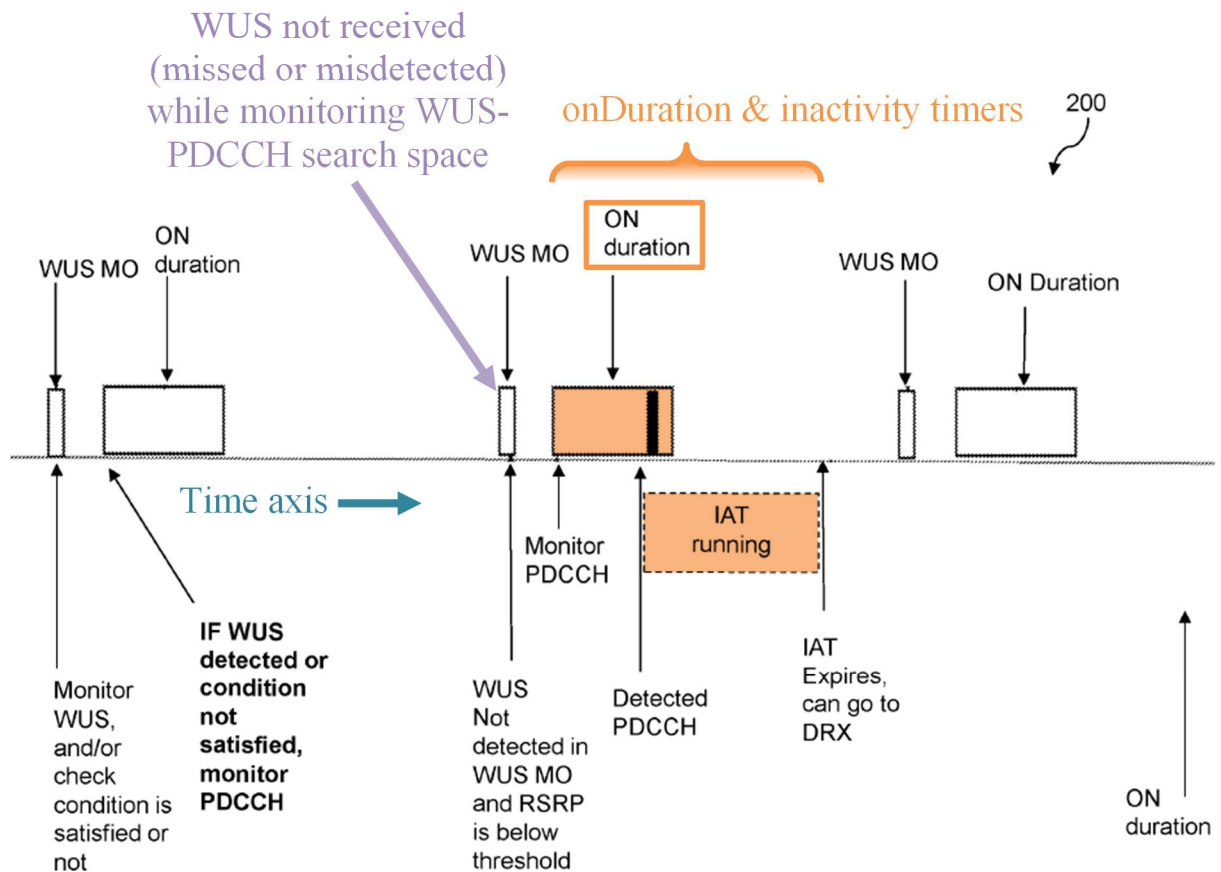


FIGURE 3

Nimbalker, FIG. 3; *Nimbalker Provisional*, FIG. 3.

The inactivity “timer” specifies the period of time that the UE monitors PDCCH before returning to sleep. *Nimbalker*, 8, 10, FIGS. 2-3; *Nimbalker Provisional*, 18, 20, FIGS. 2-3. A POSITA would have found it obvious to start a timer for monitoring the “ON duration” period of the DRX functionality to reduce power consumption by ensuring that the UE stops monitoring the first PDCCH search space if no scheduling information is received during “ON duration,” which performs the same function as the inactivity timer, but for the “ON duration”

period. Kakaes ¶158. A POSITA would have found this obvious because it merely involves implementing 3GPP standards and recommendations, improves UE operation, and reduces power consumption. *Id.*

i. Motivation

A POSITA would have been motivated to start a DRX on-duration timer of the DRX functionality in response to not receiving the power saving signal while monitoring the second search space. Kakaes ¶¶159-161; *Nimbalker*, 12-15, FIGS. 2, 3; *Nimbalker Provisional*, FIGS. 2, 3.

A POSITA would have recognized, as explained in Sections II.B-II.C, that on-duration timers were the conventional practice when monitoring an ON duration period, such as in *Nimbalker* FIG. 3, following the missed detection or misdetection of the WUS. Kakaes ¶160, §§VI.C.2-VI.C.3; *TS 38.331*, 216-218; *TS 36.331*, 470, 473; *TS 36.321*, 9, 53, 123; *TS 38.321*, 38; *R1-1904738*, 2; *R1-1905384*, 7; *LTE in Bullets*, 11-12. A POSITA would have been motivated to use this conventional on-duration timer functionality during *Nimbalker*'s ON duration PDCCH monitoring following WUS misdetection to preserve UE battery life by limiting the amount of time the UE may monitor the PDCCH first search space if no scheduling messages are received. Kakaes ¶160, §§VI.C.2-VI.C.3; *supra* II.B-II.C. A POSITA would have also been motivated to include this operation because it was specified in various 3GPP documents and was a well-

known operation for DRX PDCCH monitoring to reduce power consumption, which is one of *Nimbalker*'s objectives. Kakaes ¶160, §§VI.C.2-VI.C.3; *supra* II.B-II.C; *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1309 (Fed. Cir. 2006) (finding that compliance with regulations “suppl[ies] ample evidence of a motivation to provide” a claim element).

A POSITA would have recognized that this operation represents merely implementing known prior-art drx-onDuration timer functionality during the ON duration monitoring time period in response to not receiving the WUS, which would have yielded the predictable result of timing *Nimbalker*'s ON duration period following non-received WUS (e.g., missed or misdetected). *Supra* II.C; Kakaes ¶161, §§VI.C.2-VI.C.3. A POSITA would at least have found it obvious to try starting an on-duration timer for the ON duration PDCCH monitoring period in response to not receiving the WUS because it was a known technique that would have improved *Nimbalker*'s device in the same way as known in the prior art. *Supra* II.B-II.C; Kakaes ¶161, §§VI.C.2-VI.C.3.

ii. Expectation of Success

A POSITA would have reasonably expected to succeed in starting a DRX on-duration timer in response to not receiving the power saving signal while monitoring the second search space in *Nimbalker*. Kakaes ¶¶162-164.

A POSITA would have recognized that starting a DRX on-duration timer for monitoring an ON duration time period, either in response to receiving a WUS or in response to not detecting a WUS, was well known and routine in the prior art. *Supra* II.B-II.C; Kakaes ¶163, §§VI.C.2-VI.C.3; *TS 38.331*, 216-218; *TS 36.331*, 470, 473; *TS 36.321*, 9, 53, 123; *TS 38.321*, 38; *R1-1904738*, 2; *R1-1905384*, 7; *LTE in Bullets*, 11-12; *see also* Ex. 1001, 2:31-34. A POSITA would have expected to succeed in implementing this functionality because on-duration timer functionality was described in 3GPP documents. Kakaes ¶163; *supra* II.B-II.C; *see, e.g.*, *TS 38.331*, 216-218; *TS 36.331*, 470, 473; *TS 36.321*, 9, 53, 123; *TS 38.321*, 38; *R1-1904738*, 2; *R1-1905384*, 7; *LTE in Bullets*, 11-12.

Implementing this functionality in *Nimbalker*'s system in response to not receiving the WUS, such as for the ON duration period in FIG. 3 after the WUS is not received because it is missed or misdetected, would have been merely the straightforward application of known, conventional techniques used according to their known functions to yield predictable results. Kakaes ¶164; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007); *Slot Speaker Techs., Inc. v. Apple Inc.*, 680 F. App'x 932, 943-44 (Fed. Cir. 2017).

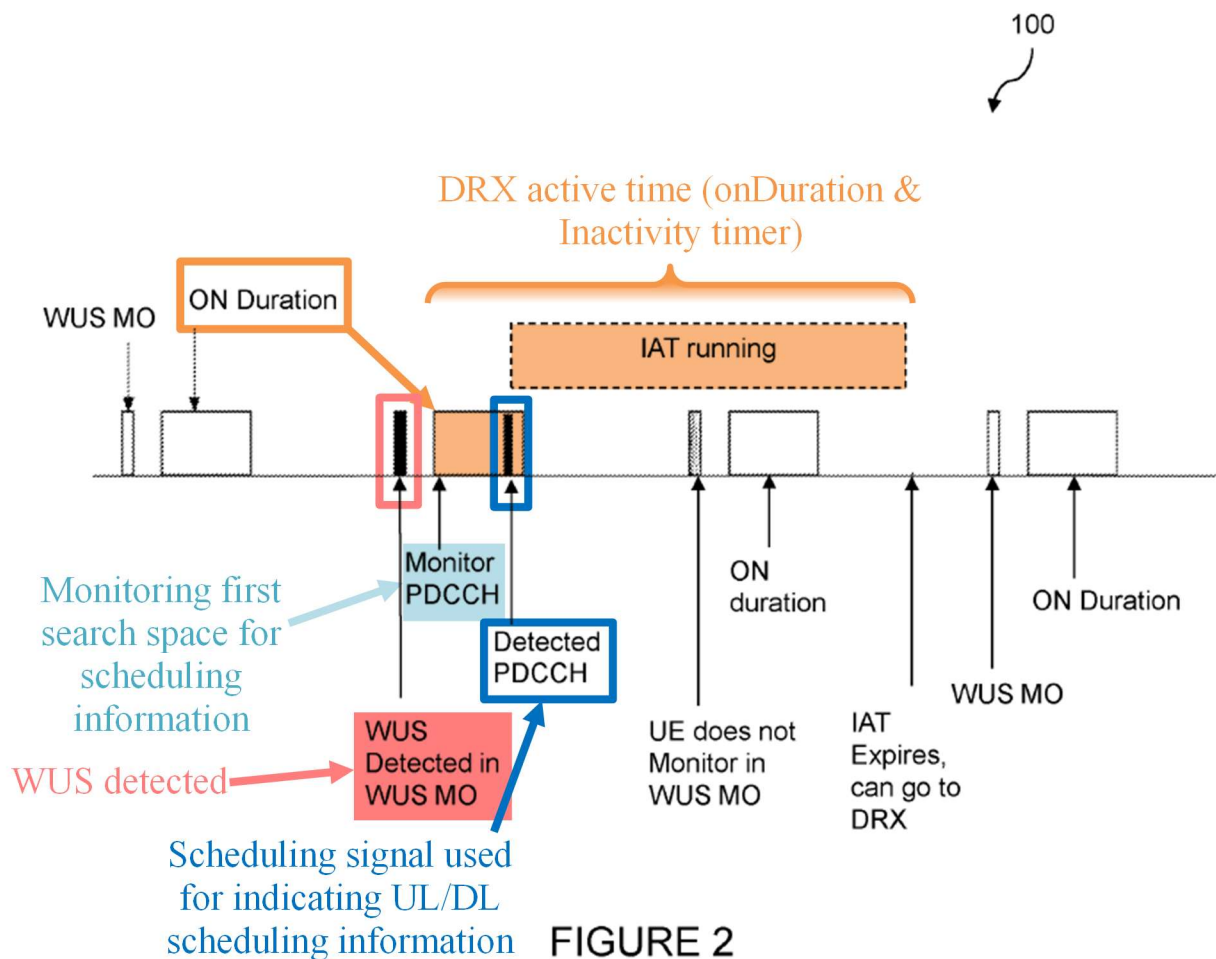
- e. **[1d]: “monitoring the first search space in response to the UE being in a DRX active time of the DRX functionality, wherein the DRX active time is a time during which the UE monitors the PDCCH; and”**

Nimbalker discloses [1d]. Kakaes ¶¶165-168.

Nimbalker discloses monitoring the first search space (e.g., PDCCH search space for UL/DL scheduling, *see* [1a]) in response to the UE being in a DRX active time in two ways: (1) when the WUS is detected to indicate the UE should monitor the PDCCH search space (e.g., *Nimbalker*, FIG. 2; *Nimbalker Provisional*, FIG. 2); and (2) when the WUS is not detected, but the UE determines it should monitor the PDCCH search space anyway (e.g., *Nimbalker*, FIG. 3; *Nimbalker Provisional*, FIG. 3). Monitoring the first PDCCH search space in response to the UE being in DRX “active time” includes at least during the ON duration and/or inactivity timer periods. Kakaes ¶166; *see* Ex. 1001, 7:18-21.

Nimbalker, discussing FIG. 2, discloses that, “if the UE detects a WUS in a WUS monitoring occasion, the UE may monitor the PDCCH during the PDCCH monitoring occasion(s) associated,” for example, within a corresponding “DRX ON duration associated with the WUS monitoring occasion.” *Nimbalker*, 10, 14; *Nimbalker Provisional*, 20, 23. Then, “[i]f the UE detects a PDCCH during the PDCCH monitoring occasion,” e.g., “within a DRX ON duration . . . , the UE may continue to monitor the PDCCH” “until [the] end of active time or until expiration

of Inactivity timer (IAT).” *Nimbalker*, 10, 12, 14; *Nimbalker Provisional*, 20, 21, 23. This active time monitoring includes the UE continuing to “decod[e] PDCCH candidates to detect a PDCCH intended for the UE” in the first PDCCH search space. *Nimbalker*, 10; *Nimbalker Provisional*, 20. FIG. 2 shows the UE monitoring the first PDCCH search space during the DRX active time. *Nimbalker*, 10; *Nimbalker Provisional*, 20; Kakaes ¶167.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

Alternatively, *Nimbalker* FIG. 3 shows the UE monitoring the first PDCCH search space during the DRX active time during the ON duration and inactivity timer (active time), “if the UE does not detect a WUS in a WUS monitoring occasion.” *Nimbalker*, 12, 15; *Nimbalker Provisional*, 21, 23. In such case, the UE may “wake-up and monitor the PDCCH” first search space during ON duration. *Nimbalker*, 12, 15; *Nimbalker Provisional*, 21, 23; Kakaes ¶168.

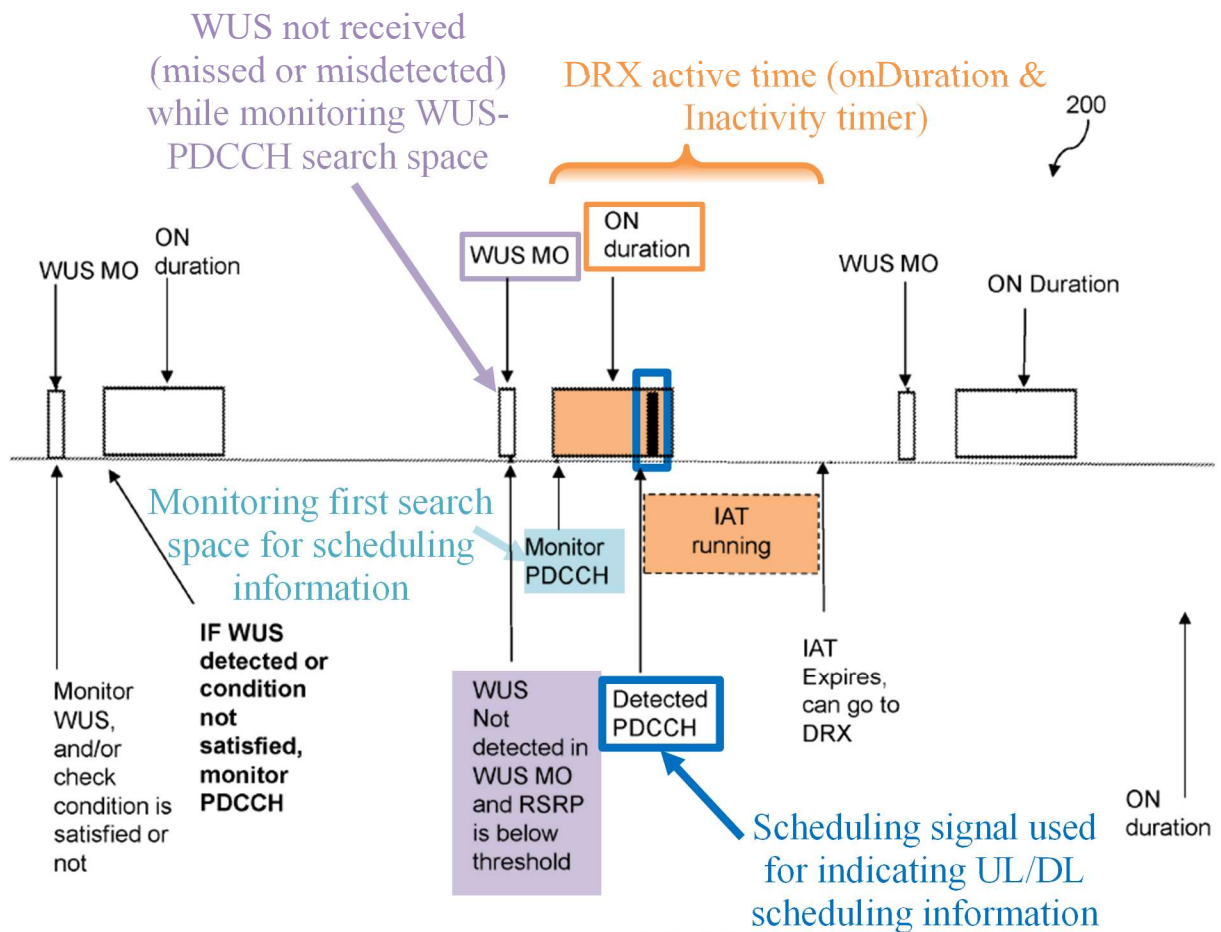


FIGURE 3

Nimbalker, FIG. 3; *Nimbalker Provisional*, FIG. 3.

f. [1e]: “not monitoring the second search space in response to the UE being in the DRX active time of the DRX functionality.”

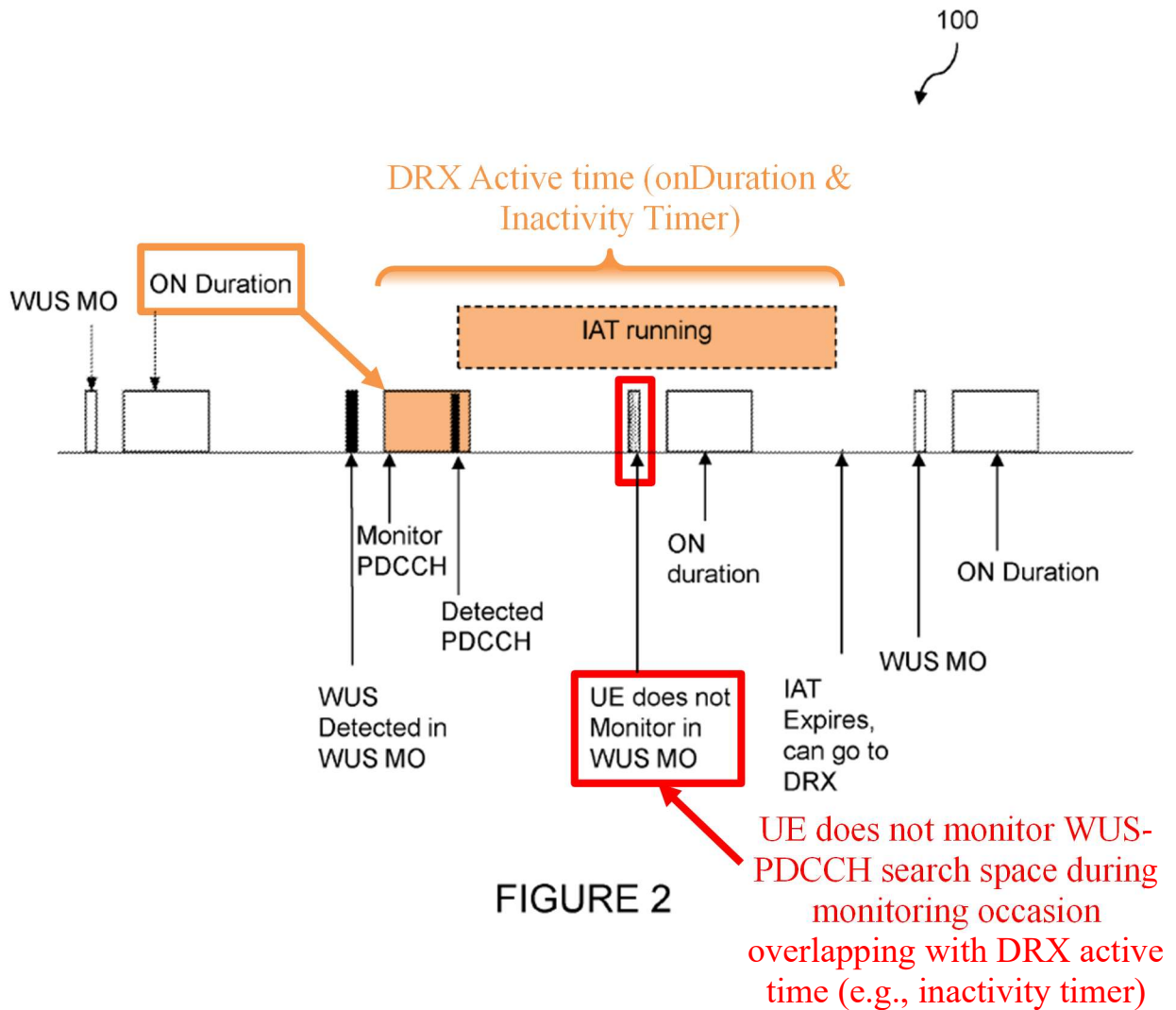
Nimbalker discloses [1e]. Kakaes ¶¶169-173.

Nimbalker discloses that, as explained in [1d], “if the UE detects PDCCH” during ON duration, “the UE may continue monitoring the PDCCH until end of active time” (e.g., inactivity timer). *Nimbalker*, 14; *Nimbalker Provisional*, 23. The UE does not monitor the WUS-PDCCH second search space while it is monitoring the PDCCH during active time (ON duration and/or inactivity timer). Kakaes ¶170

Nimbalker discloses that “the UE skip[s] monitoring of the WUS in a WUS occasion (or in one or more future WUS occasions) such as, for example, when the UE is in active time or when an inactivity timer is running.” *Nimbalker*, 8; *Nimbalker Provisional*, 18. Similarly, *Nimbalker* discloses that “the UE need not monitor for the WUS during WUS monitoring occasions that overlap the slots when the UE is monitoring the PDCCH (e.g., during ‘active time’).” *Nimbalker*, 11; *Nimbalker Provisional*, 20; *see also Nimbalker*, 9, 14 (“UE may skip WUS monitoring” “if a WUS monitoring occasion overlaps with” monitoring PDCCH “in active time”); *Nimbalker Provisional*, 18, 23; Kakaes ¶171.

Nimbalker FIG. 2 shows that the third WUS monitoring occasion overlaps with the inactivity timer (“IAT”) of the DRX active time, and the UE does not monitor this WUS-PDCCH search space in response to the UE being in DRX

active time of the DRX functionality. *Nimbalker*, 9, 11, 14, FIG. 2; *Nimbalker Provisional*, 18, 20, 23, FIG. 2; Kakaes ¶172.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

Nimbalker thus anticipates or renders obvious claim 1. Kakaes ¶¶136-173.

2. Claim 2

- a. **“The method of claim 1, wherein the first search space includes at least one of a first time and a first frequency resource for the UE to monitor the scheduling signal, and the second search space includes at least one of a second time and a second frequency resource for the UE to monitor the power saving signal.”**

Nimbalker discloses the additional limitations of claim 2. Kakaes ¶¶174-175.

Nimbalker discloses that “the WUS and PDCCH frequency resources may be different,” for example, “the WUS resources might be configured” at one “frequency location (or BWP)” (second search space includ[ing] ... a second frequency resource for the UE to monitor the power saving signal) and “the PDCCH might be configured in *another* frequency location” (the first search space includ[ing] ... a first frequency resource for the UE to monitor the scheduling signal). *Nimbalker* (emphasis added), 16; *Nimbalker Provisional*, 24. A POSITA would have understood that different “frequency resources (or BWP [bandwidth part])” refer to the frequencies of the respective CORESETs of the WUS-PDCCH second search space (*supra* [1b]) and PDCCH scheduling first search space (*supra* [1a]). Kakaes ¶175. When these CORESETs reside on different frequency resources or BWPs, as contemplated by *Nimbalker*’s description of “another” “frequency location (or BWP),” they identify respective first and second frequency resources that also have corresponding time resources within the respective

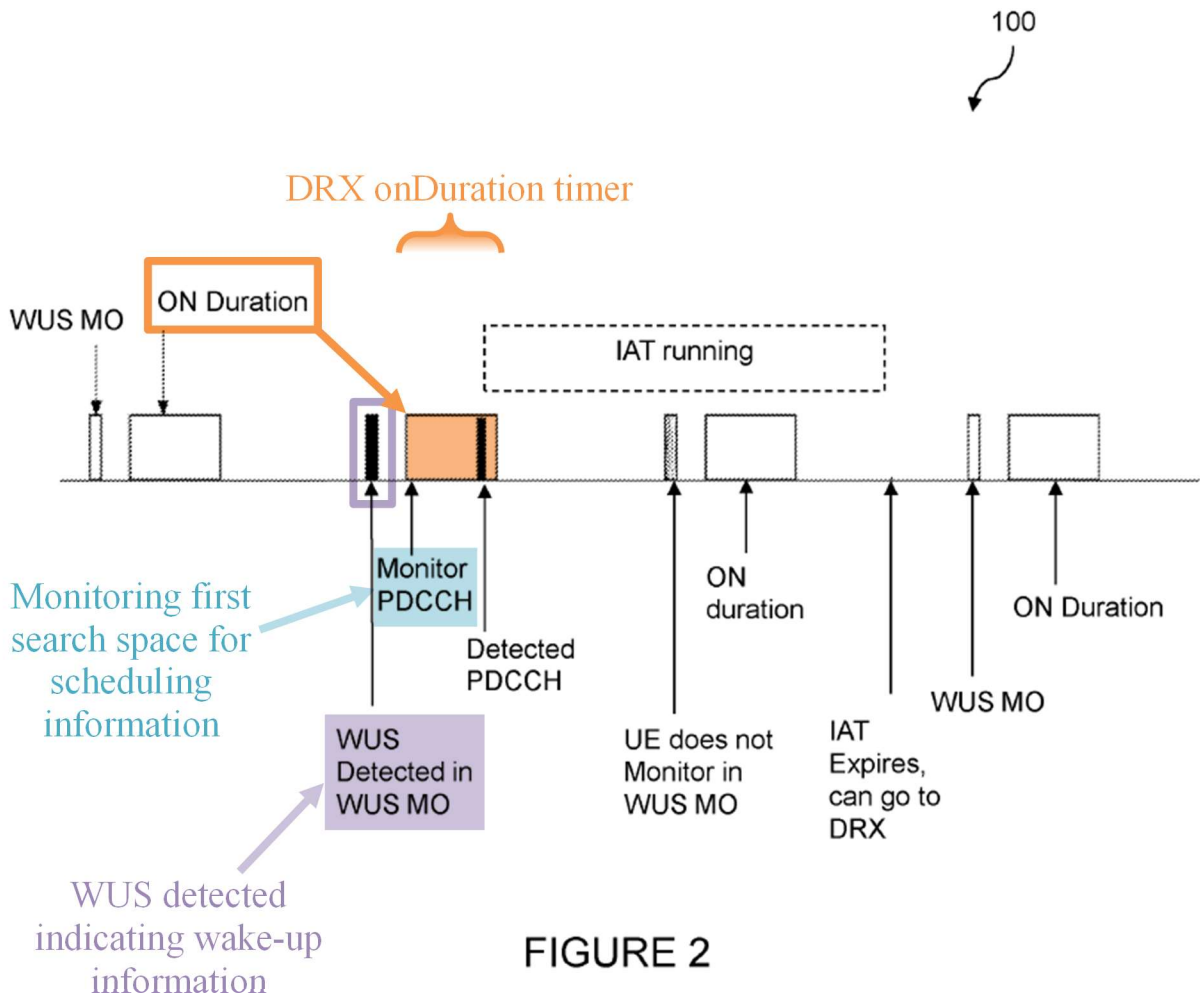
CORESET search spaces because each CORESET is a time-frequency pair. *Id.*, §§VI.C.1-VI.C.3; *supra* II.A-II.C, VII.A.1.b, VII.A.1.c.

3. Claim 3

- a. **“The method of claim 1, further comprising:
determining whether to start a DRX on-duration
timer of the DRX functionality according to the wake-
up information.”**

Nimbalker discloses or renders obvious the additional limitations of claim 3. Kakaes ¶¶176-178.

As explained in [1d], *Nimbalker* discloses the UE determining whether to monitor a PDCCH during a DRX ON duration monitoring period of the DRX functionality according to the WUS information, such as shown in FIG. 2. Kakaes ¶177. As explained in [1b], *Nimbalker*’s WUS provides wake-up information, such as the corresponding ON duration period to monitor for scheduling PDCCH. *Nimbalker*, 10, 14, 19, 20; *Nimbalker Provisional*, 20, 23, 26, 27; Kakaes ¶177. As explained in [1c], a POSITA would have understood that starting ON duration monitoring according to WUS wake-up information corresponds to starting an onDuration timer, such as described in 3GPP documents and well known in the art. Kakaes, ¶177.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

To the extent Patent Owner argues, or the Board finds, that *Nimbalker* does not disclose the additional limitations of claim 3, a POSITA would have found this obvious in view of the analysis here and in [1c]. Kakaes ¶178.

4. Claim 5

- a. **“The method of claim 1, wherein the power saving signal is not received in the second search space in response to when at least one of [i] the UE does not monitor the second search space and [ii] the UE unsuccessfully decodes the power saving signal.”**

Claim 5 recites two alternatives because it recites “the power saving signal is not received ... in response to when at least one of” the recited options being performed. Although the claim uses the word “and,” in context, the recitations are alternative options to satisfy claim 5. Kakaes ¶179. Satisfying either option satisfies the requirements of claim 5. *Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001); *see Fujifilm Corp. v. Motorola Mobility LLC*, 2015 WL 1265009, at *8 (N.D. Cal. Mar. 19, 2015) (construing “at least one of ... and” disjunctively and noting that “numerous courts” have done the same (collecting cases)).

Nimbalker discloses the additional limitations of claim 5.⁶ Kakaes ¶¶179-182.

⁶ Claim 1 recites “not receiving the power saving signal *while monitoring the second search space*,” but option [i] recites “the power saving signal is not received” when “the UE *does not monitor the second search space*” (emphases added). Petitioners reserve the right to argue this is indefinite. The Board need not resolve the issue because *Nimbalker* discloses option [ii].

As explained in [1c], *Nimbalker* discloses that “with the ‘successful/unsuccessful WUS detection’ criterion,” the UE may “determine whether to monitor/skip monitoring PDCCH in PDCCH monitoring occasion(s) corresponding to the WUS monitoring occasion.” *Nimbalker*, 8-9; *Nimbalker Provisional*, 18. When the UE performs “unsuccessful WUS detection” (the power saving signal is not received), such as by unsuccessfully decoding the WUS, the UE may consider “another reliability condition,” such as “whether [the] WUS-PDCCH decoder’s internal information suggests a presence of a compatibly encoded PDCCH.” *Nimbalker*, 8-9, 19, 47, 49 (“transmitted WUS is not successfully decoded by the UE”; “[UE] received the wake up signal but was unable to successfully decode it”; “[UE] was unable to detect or decode a wakeup signal sent by the network node”); *Nimbalker Provisional*, 18, 26, 53, 55; Kakaes ¶¶181-182.

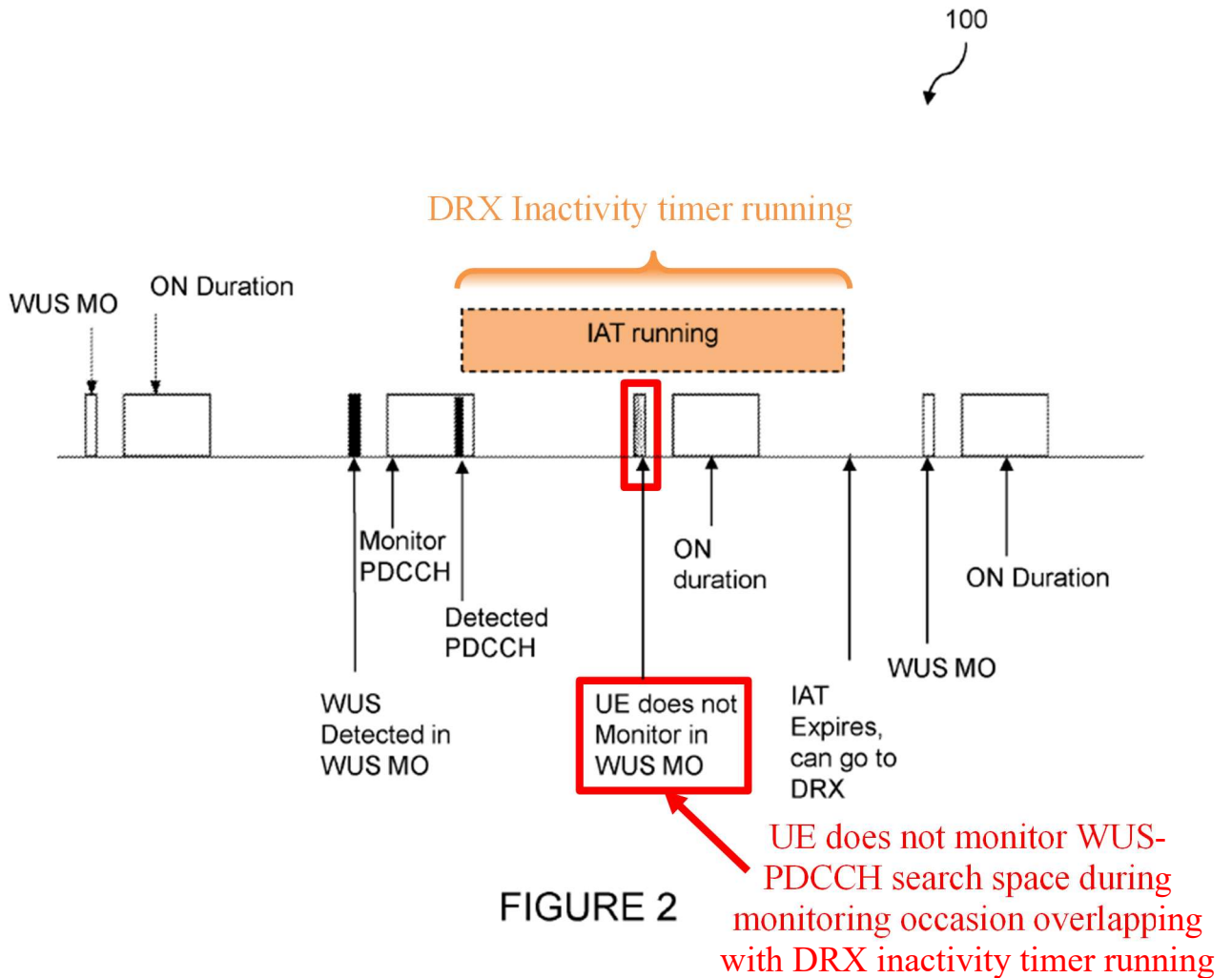
5. Claim 6

- a. “The method of claim 1, wherein the not monitoring the second search space comprises: not monitoring the second search space while a DRX inactivity timer of the DRX functionality is running.”**

Nimbalker discloses the additional limitations of claim 6. Kakaes ¶¶183-184.

As explained in [1e], *Nimbalker* discloses that the UE does not monitor the WUS second search space while a DRX inactivity timer (“IAT”) is running during

the DRX active time. FIG. 2 shows “the UE skip[s] monitoring of the WUS in a WUS occasion ... when an inactivity timer is running.” *Nimbalker*, 8; *Nimbalker Provisional*, 18; Kakaes ¶184.



Nimbalker, FIG. 2; *Nimbalker Provisional*, FIG. 2.

6. Independent Claim 10

- a. **[10Preamble]: “A user equipment (UE) monitoring a physical downlink (DL) control channel (PDCCH) in a wireless communication system, the UE comprising:”**

Nimbalker discloses [10Preamble] as discussed for [1Preamble]. Kakaes ¶185.

- b. **[10a]: “a processor, for executing computer-executable instructions; and a non-transitory machine-readable medium, coupled to the processor, for storing the computer-executable instructions, wherein the computer-executable instructions instruct the processor to:”**

Nimbalker discloses [10a], wherein the computer-executable instructions instruct the processor to perform the steps of [10b]-[10f]. Kakaes ¶¶186-188.

Nimbalker discloses that its described operations may be “implemented via processing circuitry, which may include one or more microprocessor[s],” and that the “processing circuitry may be configured to execute program code stored in memory.” *Nimbalker*, 46-47; *Nimbalker Provisional*, 52. The “processing circuitry 601 may be configured to process computer instructions and data,” and may be “operatively coupled” to memory and storage media. *Nimbalker*, 34, FIG. 9; *Nimbalker Provisional*, 37-38, FIG. QQ2; Kakaes ¶187.

Nimbalker’s memory is a non-transitory computer-readable medium, for example, a “[s]torage medium 621 may allow UE 600 to access computer-

executable instructions, application programs[,] or the like, stored on transitory or non-transitory memory media, to off-load data, or to upload data.” *Nimbalker*, 36; *Nimbalker Provisional*, 39. *Nimbalker* explains that “[p]rogram code stored in memory includes program instructions for executing one or more telecommunications and/or data communications protocols as well as instructions for carrying out one or more of the techniques described herein.” *Nimbalker*, 47; *Nimbalker Provisional*, 52-53. FIG. 9 shows a UE comprising memory 615 and storage media 621 being coupled to processor 601 via bus 602. *Nimbalker*, 34, 36; *Nimbalker Provisional*, 37-38, 40; Kakaes ¶188.

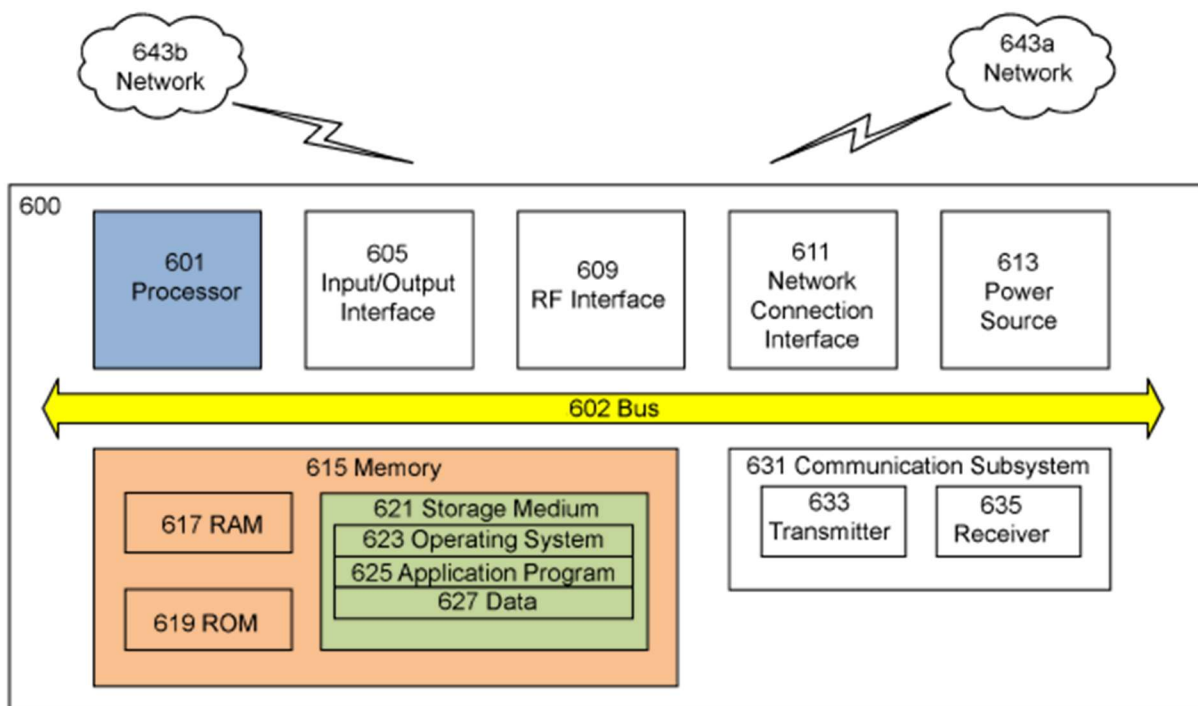


FIGURE 9

Nimbalker, FIG. 9; *Nimbalker Provisional*, FIG. QQ2.

- c. **[10b]: “receive a first configuration from a base station to configure the UE with a first search space of the PDCCH, wherein the first search space is used for monitoring a scheduling signal used for indicating scheduling information;”**

Nimbalker discloses [10b] as discussed for [1a]. Kakaes ¶189.

- d. **[10c]: “receive a second configuration from the base station to configure the UE with a second search space of the PDCCH, wherein the second search space is used for monitoring a power saving signal used for indicating wake-up information associated with a Discontinuous Reception (DRX) functionality;”**

Nimbalker discloses [10c] as discussed for [1b]. Kakaes ¶190.

- e. **[10d]: “in response to not receiving the power saving signal while monitoring the second search space, start a DRX on-duration timer of the DRX functionality;”**

Nimbalker discloses or renders obvious [10d] as discussed for [1c]. Kakaes ¶191.

- f. **[10e]: “monitor the first search space in response to the UE being in a DRX active time of the DRX functionality, wherein the DRX active time is a time during which the UE monitors the PDCCH; and”**

Nimbalker discloses [10e] as discussed for [1d]. Kakaes ¶192.

- g. **[10f]: “not monitoring the second search space in response to the UE being in the DRX active time of the DRX functionality.”**

Nimbalker discloses [10f] as discussed for [1e]. Kakaes ¶193.

7. Claim 11

- a. “The UE of claim 10, wherein the first search space includes at least one of a first time and a first frequency resource for the UE to monitor the scheduling signal, and the second search space includes at least one of a second time and a second frequency resource for the UE to monitor the power saving signal.”**

Nimbalker discloses the additional limitations of claim 11 as discussed for claim 2. Kakaes ¶194.

8. Claim 12

- a. “The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
determine whether to start a DRX on-duration timer of the DRX functionality according to the wake-up information.”**

Nimbalker discloses or renders obvious the additional limitations of claim 12 as discussed for claim 3. Kakaes ¶195.

9. Claim 14

- a. **“The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
not receive the power saving signal in the second search space in response to when at least one of [i] the UE does not monitor the second search space and [ii] the UE unsuccessfully decodes the power saving signal.”**

Nimbalker discloses the additional limitations of claim 14 as discussed for claim 5. Kakaes ¶196.

10. Claim 15

- a. **“The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
not monitor the second search space while a DRX inactivity timer of the DRX functionality is running.”**

Nimbalker discloses the additional limitations of claim 15 as discussed for claim 6. Kakaes ¶197.

B. Ground 3: Claims 2, 4, 11, and 13 Are Rendered Obvious by *Nimbalker* in View of *R1-1905031*

To the extent Patent Owner argues, or the Board finds, that *Nimbalker* alone does not disclose or render obvious claims 2 and 11, the combination of *Nimbalker* and *R1-1905031* renders them obvious. The combination of *Nimbalker* and *R1-1905031* also renders obvious claims 4 and 13. Kakaes ¶¶198-220.

1. Claim 2

Nimbalker and *R1-1905031* render obvious the additional limitations of claim 2. Kakaes ¶¶199-208.

As explained in Grounds 1/2, claim 2, *Nimbalker* discloses that the WUS-PDCCH and scheduling PDCCH “frequency resources may be different,” which results in different CORESET search spaces, including different BWPs or frequency resources. *Nimbalker*, 16; *Nimbalker Provisional*, 24; Kakaes ¶200.

R1-1905031 explains that “[i]t is advantageous for a CORESET containing the wake-up PDCCH [second search space] to have a configuration that can be distinct from CORESETs containing PDCCH scheduling transmissions [first search space].” *R1-1905031*, 3. A POSITA would have recognized that “distinct” CORESET configurations have their own time and frequency resources. Kakaes ¶201, §§VI.C.1-VI.C.3; *supra* II.A-II.C. This is especially true when they are on different bandwidth parts (“BWP”) that reside on different frequency bands of the carrier. Kakaes ¶201; *see R1-1905031*, 2, 7 (describing “wake-up PDCCH” CORESET/search space being on different BWP from PDCCH “for DL/UL data scheduling” and noting “BWP switching”).

A POSITA would have found it obvious to have the first search space include a first time and first frequency resource for the UE to monitor the scheduling signal, and the second search space include a second time and second

frequency resource for the UE to monitor the power saving signal, such that they are “distinct” CORESETs, as disclosed in *R1-1905031*. Kakaes ¶202; *R1-1905031*, 2-3. A POSITA would have recognized that distinct CORESETs would have allowed the “wake-up PDCCH [to] include a CORESET/Search space/BWP configuration [second search space] for power-efficient WUS detection,” while the scheduling PDCCH (first search space) would be chosen to provide efficient “DL/UL data scheduling” and data transfer. *R1-1905031*, 2; Kakaes ¶202.

a. Motivation to Combine

A POSITA would have been motivated to have the first search space include a first time and first frequency resource for the UE to monitor the scheduling signal, and the second search space include a second time and second frequency resource for the UE to monitor the power saving signal, such as taught by *R1-1905031*. Kakaes ¶¶203-205.

A POSITA would have recognized that *Nimbalker*’s WUS-PDCCH CORESET/search space (second search space) and scheduling PDCCH CORESET/search space (first search space) include time and frequency resources because they are specified in resource elements (REs). *Supra* II.A-II.C; Kakaes ¶204. A POSITA would have been motivated to provide for different time and frequency resources for each of these search spaces based on *R1-1905031*’s teaching that it is “advantageous” for these CORESETs to “be distinct,” for

example, on different BWPs. *R1-1905031*, 2-3; Kakaes ¶204. A POSITA would have also been motivated to provide for different time and frequency resources because this “advantageous” practice is described in 3GPP documents that provide for useful configurations in LTE and NR, like *Nimbalker*’s disclosed devices. *R1-1905031*, 2-3; *Nimbalker*, 2, 21-22; *Nimbalker Provisional*, 17, 29-30; Kakaes ¶204, §§VI.C.1-VI.C.3; *supra* II.A-II.C; *Ormco*, 463 F.3d at 1309.

A POSITA would have recognized that this operation merely implemented known prior art to provide the first and second search spaces on different time and frequency resources so that they do not collide with each other, which would have yielded the predictable result of allowing *Nimbalker*’s UE to receive and monitor each of the search spaces and to allocate system resources for more efficient use. *Supra* II.A-II.C; Kakaes ¶205, §§VI.C.1-VI.C.3. A POSITA would at least have found it obvious to try providing the first and second search spaces on different time and frequency resources because it was a known technique that would have improved *Nimbalker*’s device in the same way as known in the prior art. *Supra* II.A-II.C; Kakaes ¶205, §§VI.C.1-VI.C.3.

b. Expectation of Success

A POSITA would have reasonably expected to succeed in providing the first and second search spaces on different time and frequency resources. Kakaes ¶¶206-208.

A POSITA would have recognized that using different time and frequency resources for different CORESETs/search spaces was well known and routine in the prior art, including being referred to in different 3GPP documents. *Supra* II.A-II.C; Kakaes ¶207, §§VI.C.1-VI.C.3. A POSITA would have expected to succeed in implementing this functionality at least because the allocation of different times and frequencies for CORESETs/search spaces was described in 3GPP documents and also known for configuring the UE to monitor different resource elements of the PDCCH. Kakaes ¶207, §§VI.C.1-VI.C.3; *supra* II.A-II.C.

Implementing this functionality in *Nimbalker*'s system to assign different time and frequency resources (CORESETs/search spaces) to the first search space for PDCCH scheduling and second search space for WUS monitoring would have been merely the straightforward application of known, conventional techniques used according to their known functions to yield predictable results. Kakaes ¶208; *KSR*, 550 U.S. at 416; *Slot Speaker*, 680 F. App'x at 943-44.

2. Claim 4

- a. “The method of claim 1, wherein the power saving signal is further used for indicating a bandwidth part switch of a cell.”**

Nimbalker and *R1-1905031* render obvious the additional limitations of claim 4. Kakaes ¶¶209-218.

Nimbalker discloses that “the WUS and PDCCH frequency resources may be different,” such that “WUS resources might be configured in the same frequency location (or BWP)” and “PDCCH might be configured in another frequency location [or BWP].” *Nimbalker*, 16; *Nimbalker Provisional*, 24; Kakaes ¶210.

R1-1905031 explains that, “[i]n addition to including the wake-up CORESET and search space configurations, a wake-up BWP allows configuration[s] suitable for the wake-up PDCCH [BWP for power saving signal] ... that could be different from other, scheduling BWPs” for monitoring scheduling PDCCH during the ON duration. *R1-1905031*, 4; Kakaes ¶211. The “[w]ake-up DCI [d]esign” for the WUS-PDCCH search space includes a “**BWP id** ... so that the UE will have already ***switched to a BWP*** appropriate for the expected traffic by the time the C-DRX on-duration starts.” *R1-1905031*, 5, 2 (“when a wake-up PDCCH is decoded,” the UE performs “***BWP/CC switching***” to “get ready for DL/UL data scheduling”) (emphases added). This “can be achieved” using “a BWP indication in the wake-up DCI” of the WUS that “can provide ***per-cell***, not only per-UE, indication.” *Id.* (emphasis added).

A POSITA would have found it obvious to have the power saving signal be used for indicating a BWP switch of a cell to efficiently switch the UE between BWPs of the cell so that the UE can more efficiently monitor the WUS-PDCCH

during WUS monitoring and scheduling PDCCH during ON duration. Kakaes ¶212.

i. Motivation to Combine

A POSITA would have been motivated to have the power saving signal (WUS) be used for indicating a BWP switch of a cell, such as taught by *R1-1905031*'s . Kakaes ¶¶213-215.

A POSITA would have recognized that *Nimbalker*'s WUS-PDCCH CORESET/search space (second search space) and PDCCH for scheduling CORESET/search space (first search space) may be more efficiently monitored on different frequency resources. Kakaes ¶214; *see Nimbalker*, 16; *Nimbalker Provisional*, 24. A POSITA would have been motivated to have the power saving signal indicate the BWP that should be monitored, for example, in the WUS-PDCCH DCI, so that the UE monitors the correct BWP for the WUS search space or PDCCH scheduling search space. *R1-1905031*, 2-3; Kakaes ¶214. A POSITA would have also been motivated to include this functionality in *Nimbalker*'s system so the base station can indicate to the UE which BWP should be monitored to allow the base station to more efficiently allocate resources based on network usage and UE capabilities. Kakaes ¶214. A POSITA also would have been motivated to provide these configurations to facilitate LTE and NR operations in

Nimbalker's devices. *Nimbalker*, 2, 21-22; *Nimbalker Provisional*, 17, 29-30; Kakaes ¶214, §§VI.C.1-VI.C.3; *supra* II.A-II.C; *Ormco*, 463 F.3d at 1309.

A POSITA would have recognized that this operation represents merely implementing known prior art to have the power saving signal be used for indicating a BWP switch of a cell, which would have yielded the predictable result of allowing *Nimbalker's* UE to monitor each search space at the appropriate time and to allocate system resources for more efficient use. *Supra* II.A-II.C; Kakaes ¶215, §§VI.C.1-VI.C.3. A POSITA would at least have found it obvious to try having the power saving signal be used for indicating a BWP switch of a cell because it was a known technique that would have improved *Nimbalker's* device in the same way as known in the prior art and from 3GPP documents. *Supra* II.A-II.C; Kakaes ¶215, §§VI.C.1-VI.C.3.

ii. Expectation of Success

A POSITA would have reasonably expected to succeed in having the power saving signal be used for indicating a BWP switch of a cell. Kakaes ¶¶216-218.

A POSITA would have recognized that having the power saving signal be used for indicating a BWP switch of a cell was well known in the prior art, including its reference in 3GPP documents. *Supra* II.C; Kakaes ¶217, §VI.C.3; *R1-1905031*, 2-3; *R1-1903016*, 1, 4, 13. A POSITA would have expected to succeed in implementing this functionality in *Nimbalker's* system at least because

using the power saving signal for indicating a BWP switch of a cell was described in 3GPP documents to more efficiently allow the UE to monitor the WUS and PDCCH scheduling search spaces. Kakaes ¶217; *supra* II.C; *R1-1905031*, 2-3; *R1-1903016*, 1, 4, 13.

Implementing this functionality in *Nimbalker*'s system would have been merely the straightforward application of known, conventional techniques used according to their known functions to yield predictable results. Kakaes ¶218; *KSR*, 550 U.S. at 416; *Slot Speaker*, 680 F. App'x at 943-44.

3. Claim 11

Nimbalker and *R1-1905031* render obvious claim 11 as discussed for claim 2. Kakaes ¶219.

4. Claim 13

- a. “The UE of claim 10, wherein the power saving signal is further used for indicating a bandwidth part switch of a cell.”**

Nimbalker and *R1-1905031* render obvious claim 13 as discussed for claim 4. Kakaes ¶220.

C. Ground 4: Claims 2, 4, 11, and 13 Are Rendered Obvious by *Nimbalker* in View of *R1-1903016*

To the extent Patent Owner argues, or the Board finds, that *Nimbalker* alone does not disclose or render obvious claims 2 and 11, the combination of *Nimbalker*

and *R1-1903016* renders them obvious. The combination of *Nimbalker* and *R1-1903016* also renders obvious claims 4 and 13. Kakaes ¶¶221-238.

1. Claim 2

Nimbalker and *R1-1903016* render obvious the additional limitations of claim 2. Kakaes ¶¶222-226.

As explained in Grounds 1-3, claim 2, *Nimbalker* discloses that the WUS-PDCCH and PDCCH “frequency resources may be different,” which results in different CORESET search spaces, including different BWPs or frequency resources. *Nimbalker*, 16; *Nimbalker Provisional*, 24; Kakaes ¶223.

R1-1903016, like *Nimbalker*, discloses the “[d]esign of new dedicated PDCCH-WUS,” which includes a “PDCCH structure, CORESET/search space, [and] BWP configuration specific for the WUS occasion.” *R1-1903016*, 1-2. A POSITA would have understood that a “CORESET/search space[and] BWP configuration” that is “specific for the WUS occasion” describes *Nimbalker*’s WUS-PDCCH CORESET/search space (second search space) that is distinct from the PDCCH scheduling search space (first search space). *Id.*; Kakaes ¶¶223-224. This is confirmed by *R1-1903016*’s “PDCCH-WUS configuration” table providing “CORESET” configurations. *See R1-1903016*, 7.

a. Motivation to Combine and Expectation of Success

A POSITA would have found it obvious to have *Nimbalker*'s first PDCCH scheduling search space include first time and frequency resources for the UE to monitor the scheduling signal, and the second WUS-PDCCH search space include second time and frequency resources for the UE to monitor the power saving signal, such that they are distinct CORESETs, as explained for Grounds 1-3, claim 2. *Supra* VII.A.2, VII.B.1; Kakaes ¶¶225-226.

A POSITA would have been motivated to have the first PDCCH search space include first time and frequency resources for the UE to monitor the scheduling signal to receive PDCCH scheduling UL/DL information, and the second WUS-PDCCH search space include second time and frequency resources for the UE to monitor the WUS power saving signal, such as taught by *R1-1903016*, and reasonably expected to succeed in doing so, as discussed for Grounds 1-3, claim 2. *Supra* VII.A.2, VII.B.1; Kakaes ¶¶225-226.

2. Claim 4

Nimbalker and *R1-1903016* render obvious the additional limitations of claim 4. Kakaes ¶¶227-236.

As explained in Ground 3, claim 4, *Nimbalker* discloses that “the WUS and PDCCH frequency resources may be different” with each having a different “frequency location” (or BWP). *Nimbalker*, 16; *Nimbalker Provisional*, 24.

R1-1903016 discloses that, “when a PDCCH-WUS is decoded, the UE performs wake-up of additional hardware and processing (e.g., by performing BWP switching, ...) to get ready for potential DL/UL scheduling.” *R1-1903016*, 1. “One advantage of PDCCH-WUS” is that “the wake-up [PDCCH-WUS] DCI can contain a BWP ID for the UE to switch to, providing additional flexibility to the scheduler to select a desired BWP and enabling an earlier BWP switch compared to waiting until the ON duration to signal the new BWP.” *R1-1903016*, 4; Kakaes ¶229.

A POSITA would have found it obvious to have *Nimbalker*’s WUS-PDCCH power saving signal be used for indicating a BWP switch of a cell to efficiently switch the UE between BWPs of the cell so that the UE can more efficiently monitor the WUS-PDCCH during WUS monitoring and scheduling PDCCH during ON duration, as taught by *R1-1903016*. Kakaes ¶230.

a. Motivation to Combine

A POSITA would have been motivated to have the power saving signal (WUS) be used for indicating a BWP switch of a cell, such as taught by *R1-1903016*. Kakaes ¶¶231-233.

A POSITA would have recognized that *Nimbalker*’s WUS-PDCCH CORESET/search space (second search space) and PDCCH for scheduling CORESET/search space (first search space) may be more efficiently monitored on

different BWPs (frequency resources). Kakaes ¶232; *see Nimbalker*, 16; *Nimbalker Provisional*, 24. A POSITA would have been motivated to have the power saving signal indicate the BWP that should be monitored to “provid[e] additional flexibility to the scheduler to select a desired BWP and enable[e] an earlier BWP switch compared to waiting until the ON duration to signal the new BWP.” *RI-1903016*, 4; Kakaes ¶232. A POSITA would have also been motivated to include this functionality in *Nimbalker*’s system such that the base station can indicate to the UE which BWP should be monitored to more efficiently allocate resources based on network usage and UE capabilities. Kakaes ¶232. A POSITA also would have been motivated to provide for configurations that facilitate LTE and NR operations, like *Nimbalker*’s devices and methods. *Nimbalker*, 2, 21-22; *Nimbalker Provisional*, 17, 29-30; Kakaes ¶232, §§VI.C.2-VI.C.3; *supra* II.B-II.C; *Ormco*, 463 F.3d at 1309.

A POSITA would have recognized that implementing this operation in *Nimbalker*’s system represents merely implementing known prior art to have the power saving signal be used for indicating a BWP switch of a cell (e.g., via *RI-1903016*’s “BWP ID” in the wake-up [PDCCH-WUS] DCI), which would have yielded the predictable result of allowing *Nimbalker*’s UE to switch between monitoring the first and second search spaces at the appropriate time and more efficiently allocate system resources. *Supra* II; Kakaes ¶233, §§VI.C.1-VI.C.3. A

POSITA would at least have found it obvious to try having *Nimbalker*'s power saving signal be used for indicating a BWP switch of a cell because it was a known technique that would have improved *Nimbalker*'s device in the same way as known in the prior art and from 3GPP documents. *Supra* II.C; Kakaes ¶233, §VI.C.3.

b. Expectation of Success

A POSITA would have reasonably expected to succeed in having the power saving signal be used for indicating a BWP switch of a cell. Kakaes ¶¶234-236.

A POSITA would have recognized that having *Nimbalker*'s power saving signal be used for indicating a BWP switch of a cell was well known in the prior art, including its different 3GPP documents. *Supra* II.C; Kakaes ¶235, §VI.C.3; *R1-1903016*, 1, 4, 13; *R1-1905031*, 2-3. A POSITA would have expected to succeed in implementing this functionality in *Nimbalker*'s system at least because using the power saving signal for indicating a BWP switch of a cell was described in 3GPP documents to allow the UE to more efficiently monitor the WUS and PDCCH scheduling search spaces. Kakaes ¶235; *R1-1903016*, 1, 4, 13; *R1-1905031*, 2-3.

Implementing this functionality in *Nimbalker*'s system would have been merely the straightforward application of known, conventional techniques used

according to their known functions to yield predictable results. Kakaes ¶¶234-236; *KSR*, 550 U.S. at 416; *Slot Speaker*, 680 F. App'x at 943-44.

3. Claim 11

Nimbalker and *R1-1903016* render obvious claim 11 as discussed for claim 2. Kakaes ¶237.

4. Claim 13

Nimbalker and *R1-1903016* render obvious claim 13 as discussed for claim 4. Kakaes ¶238.

**D. Ground 5: Claims 7-9 and 16-18 Are Rendered Obvious by
Nimbalker in View of *Anil***

The combination of *Nimbalker* and *Anil* renders obvious claims 7-9 and 16-18. Kakaes ¶¶239-271.

1. **Claim 7**

- a. **“The method of claim 1, further comprising:
not monitoring the second search space in response to
the UE performing a random access procedure,
wherein the UE performs the random access
procedure in response to one of:
[i] a random access response window is running after
transmitting a first random access preamble; and
[ii] the UE has not received the scheduling signal on
the PDCCH indicating a new transmission addressed
to a Cell Radio Network Temporary Identifier
(C-RNTI) of the UE after successful reception of a
random access response corresponding to a second
random access preamble not selected by the UE
among contention-based random access preambles.”**

Claim 7 recites two alternatives because it recites “perform[ing] ... in response to one of” the two subsequent options. Although the claim uses the word “and,” in context, the recitations are alternative options to satisfy claim 7. *Kakaes* ¶240. Satisfying either option satisfies the requirements of claim 7. *Brown*, 265 F.3d at 1351; *Fujifilm*, 2015 WL 1265009, at *8.

Nimbalker and *Anil* render obvious the additional limitations of claim 7. *Kakaes* ¶¶240-252.

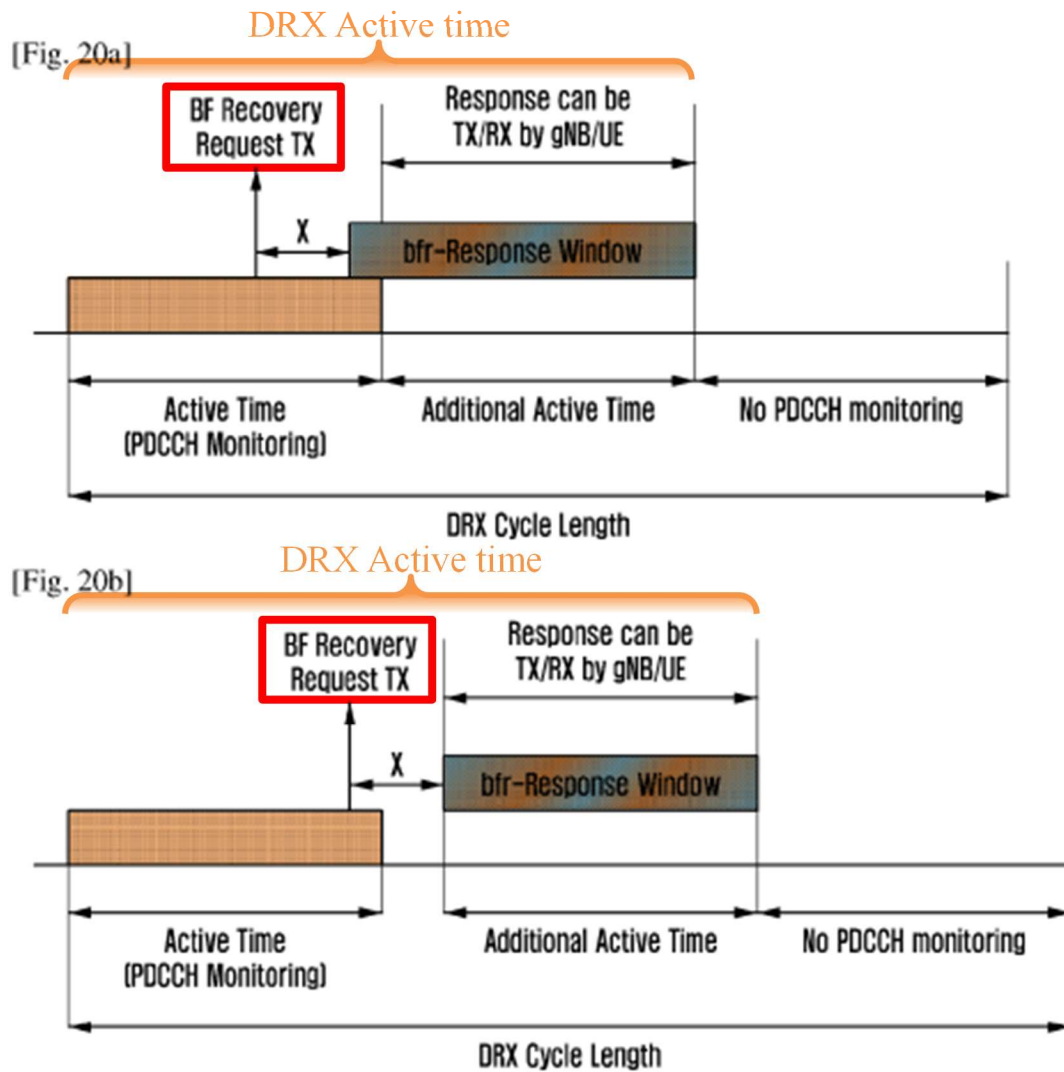
Anil, like *Nimbalker* and the ’911 patent, discloses DRX-related operations. *Anil* discloses performing a random access procedure of monitoring a PDCCH in response to a random access bfr-ResponseWindow running after the UE transmits

a first random access PRACH [Physical Random Access Channel] preamble. *Anil*, [89], [244]-[245]; Kakaes ¶242.

Anil discloses that “a UE ... transmits [a] PRACH preamble [random access preamble] indicating [a] [b]eam failure recovery request during the active time” of a DRX cycle. *Anil*, [244]. After “transmit[ting] a PRACH preamble,” the “UE starts the bfr-ResponseWindow (i.e., ra-response Window configured in beam failure recovery configuration) and monitors the PDCCH of the serving cell for which beam failure recovery is initiated while bfr-ResponseWindow is running.” *Anil*, [89]. *Anil* explains that, “[i]f DRX is configured and bfr-Response Window is running, [then] UE shall perform the operations ... defined for active time.” *Anil*, [245] (“active time also includes the time duration while bfr-Response Window (i.e., ra-response Window configured in beam failure recovery configuration) is running”). While in active time, “the UE shall monitor PDCCH at operation 2150” for scheduling information. *Anil*, [248]. *Anil*’s PDCCH monitoring in “active time” monitors a PDCCH for scheduling information during ON duration or the bfr-ResponseWindow timer. Kakaes ¶243; *Anil*, [248].

As explained in [1e], *Nimbalker* discloses that the UE does not monitor the WUS-PDCCH search space (second search space) during “active time.” *Supra* VII.A.1.f; Kakaes ¶244. The combination of *Anil* and *Nimbalker* would result in the UE not monitoring the second search space in response to performing the

random access procedure (*Anil*'s "monitor[ing] the PDCCH of the serving cell for which beam failure recovery is initiated") in response to when the random access response window is running ("while bfr-ResponseWindow is running") after transmitting the first random access preamble ("transmit[ting] PRACH preamble indicating [b]eam failure recovery request during the active time") because this search space is during "active time" where *Nimbalker* does not monitor WUS-PDCCH. *Anil*, [89], [244]-[245]; *Kakaes* ¶244.



Anil, FIGS. 20a, 20b.

A POSITA would have found it obvious to not monitor the WUS-PDCCH second search space in response to the UE performing a random access procedure in response to when a random access response window is running after transmitting a first random access preamble, as recited in claim 7. Kakaes ¶¶245-246. A POSITA would have found this obvious because *Anil* discloses the UE

transmits the PRACH preamble when there has been a beam failure and then monitors a PDCCH during “active time.” *Anil*, [89], [244]-[245]; Kakaes ¶245. *Nimbalker* teaches that, when the UE is in active time, it should not monitor the WUS-PDCCH. Kakaes ¶245; *supra* VII.A.1.f ([1e]).

i. Motivation to Combine

A POSITA would have been motivated to implement *Anil*’s random access functionality in *Nimbalker*’s system to provide beam failure procedures, while not monitoring the WUS-PDCCH during the active time to reduce power consumption, as taught by *Nimbalker*. Kakaes ¶¶247-250.

A POSITA would have recognized that *Nimbalker*’s teaching that the UE should not monitor the WUS-PDCCH second search space would similarly reduce UE power consumption during the beam failure recovery period taught by *Anil*, where the UE “shall monitor PDCCH” when the “bfr-ResponseWindow” is running during “active time.” *Anil*, [89], [244]-[245], FIGS. 20a, 20b; Kakaes ¶248. A POSITA would have been motivated to combine *Nimbalker* and *Anil* to perform the operations of claim 7 to improve performing beam failure recovery, while reducing UE power consumption, by not monitoring the WUS-PDCCH search space when the UE is already monitoring the PDCCH for a response to a beam failure recovery request. Kakaes ¶248.

Whether to monitor the second search space in response to the UE performing a random access procedure would also have been recognized as one of two alternative options: either monitoring or not monitoring the second search space. Kakaes ¶249. Choosing to turn on or off monitoring the second search space in response to an event was well known in the art (e.g., in response to low signal strength, the UE being in DRX active time, etc.) and taught by *Nimbalker*. A POSITA would have found it obvious to not monitor the second search space in response to the UE performing a random access procedure as merely another condition that could be used to trigger turning off the WUS-PDCCH search space monitoring during an “active time.” Kakaes ¶249. *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1338-41 (Fed. Cir. 2020).

A POSITA would have recognized that the combination of *Nimbalker* and *Anil* represents merely implementing known prior-art beam failure recovery with *Nimbalker*’s teaching to not monitor the WUS-PDCCH search space when the UE is running the bfr-ResponseWindow (active time). Kakaes ¶250. A POSITA would have been motivated to incorporate beam failure recovery so that the UE can obtain a new connection with the base station if a prior signal is lost. Kakaes ¶250. This would have yielded the predictable result of performing beam failure recovery, as taught by *Anil*, while reducing power consumption by not monitoring the WUS-PDCCH search space, as taught by *Nimbalker*, during the

bfr-ResponseWindow. Kakaes ¶250. A POSITA would at least have found it obvious to try not monitoring WUS-PDCCH while the bfr-ResponseWindow is running when performing beam failure recovery because it was a known technique that would have improved *Nimbalker*'s device in the same way as known in the prior art. Kakaes ¶250.

ii. Expectation of Success

A POSITA would have reasonably expected to succeed in implementing *Anil*'s beam failure recovery process into *Nimbalker*'s system, which does not monitor the second search space during the active time, to allow the UE to perform recovery when a beam fails, while providing for better power consumption during beam failure recovery procedures. Kakaes ¶¶251-252. A POSITA would have recognized that not monitoring the WUS-PDCCH search space while *Anil*'s bfr-ResponseWindow is running represents merely turning off the WUS-PDCCH search space monitoring, which was a well-known operation, as disclosed by *Nimbalker*. Kakaes ¶251. A POSITA would have expected to succeed in implementing this functionality in *Nimbalker*'s system because *Nimbalker* already discloses not monitoring the second (WUS-PDCCH) search space during DRX active time. Kakaes ¶251; *supra* VII.A.1.f ([1e]). *Anil* merely teaches that the “active time” where *Nimbalker* does not monitor the second search space may also

include while a bfr-ResponseWindow is running. *Anil*, [89], [244]-[245], FIGS. 20a, 20b.

Implementing this functionality in *Nimbalker*'s system would therefore have been merely the straightforward application of known, conventional techniques used according to their known functions to yield predictable results. Kakaes ¶¶251-252; *KSR*, 550 U.S. at 416; *Slot Speaker*, 680 F. App'x at 943-44.

2. Claim 8

- a. **“The method of claim 1, further comprising:
not monitoring the second search space in response to
at least one of [i] the UE performing a beam failure
recovery procedure and [ii] the UE monitoring a third
search space on the PDCCH, wherein the third search
space is configured for the UE to monitor a beam
failure response from the base station.”**

Claim 8 recites two alternatives because it recites “not monitoring ... in response to at least one of” the subsequent options. Although the claim uses the word “and,” in context, the recitations are alternative options to satisfy claim 8. Kakaes ¶253. Satisfying either option satisfies the requirements of claim 8. *Brown*, 265 F.3d at 1351; *Fujifilm*, 2015 WL 1265009, at *8.

Nimbalker and *Anil* render obvious the additional limitations of claim 8. Kakaes ¶¶253-258.

As explained above for claim 7, the combination of *Nimbalker* and *Anil* renders obvious not monitoring the WUS-PDCCH search space (second search

space) in response to the UE performing a beam failure recovery procedure under option [i], for example, when “monitor[ing] the PDCCH of the serving cell for which beam failure recovery is initiated while bfr-ResponseWindow is running.” *Anil*, [89]; *supra* VII.D.1 (claim 7); *see also Anil*, [244]-[245], FIGS. 20a, 20b.

Anil, in combination with *Nimbalker*, also renders obvious the alternative option [ii]: not monitoring the second search space in response to the UE monitoring a third search space on the PDCCH, wherein the third search space is configured for the UE to monitor a beam failure response from the base station. *Kakaes* ¶¶254-256.

As explained for claim 7, while the “bfr-Response Window is running,” the UE “perform[s] the operations ... defined for active time.” *Anil*, [245]. This includes “monitor[ing] the PDCCH of [an] SpCell” (monitoring a third search space on the PDCCH) “for [a] response to [the] beam failure recovery request identified by the C-RNTI” (for the UE to monitor a beam failure response from the base station). *Anil*, [245], FIGS. 20a, 20b.

A POSITA would have found it obvious to not monitor the second search space in response to either alternative of claim 8 to reduce UE power consumption, as explained for claim 7. *Supra* VII.D.1; *Kakaes* ¶¶256-258. A POSITA would have been motivated to implement, based on the combination of *Nimbalker* and *Anil*, not monitoring the second search space in response to either alternative

option in claim 8 to provide for beam failure recovery procedures while also reducing power consumption, and would have had a reasonable expectation of success in doing so, as explained for claim 7. *Supra* VII.D.1; Kakaes ¶¶257-258.

3. Claim 9

- a. “The method of claim 1, wherein the power saving signal is only received from a special cell (SpCell) of the base station.”**

Nimbalker and *Anil* render obvious the additional limitations of claim 9. Kakaes ¶¶259-268.

The ’911 patent does not explain what a “special cell (SpCell)” is. *See* Ex. 1001, 11:45-48, claims 9, 18; Kakaes ¶260.

Anil discloses that, “for Dual/Multi Connectivity operation[,] the term Special Cell (SpCell) refers to the Primary Cell (PCell) of the Master Cell Group (MCG) or the Primary Secondary Cell Group Cell (PSCell) of the Secondary Cell Group (SCG) depending on if the Media Access Control (MAC) entity is associated to the MCG or the SCG, respectively.... Otherwise[,] the term SpCell refers to the PCell.” *Anil*, [76]. *Anil* discloses that, “[a]fter reception of the Beam Failure Recovery Request from a UE, the SCell can share this information with SpCell” (e.g., primary cell) because the beam failure recovery may take place on the secondary cell (SCell). *Anil*, [83]; Kakaes ¶261.

A POSITA would have found it obvious to have *Nimbalker*'s WUS-PDCCH power saving signal be only received from a special cell (SpCell) of the base station to provide for the WUS to occur with "PDCCH scheduling [for] UL/DL data" in transmissions from the primary cell (PCell/SpCell), such as within a cell group disclosed by *Anil. Nimbalker*, 9; *Nimbalker Provisional*, 19; Kakaes ¶¶261-262. A POSITA would have found this obvious to allow the UE to reserve the secondary cell for other functions. Kakaes ¶¶261-262.

i. Motivation to Combine

A POSITA would have been motivated to implement *Nimbalker*'s WUS-PDCCH power saving signal being only received from a special cell (SpCell) of the base station when the WUS-PDCCH is carried on the primary cell of the cell group. Kakaes ¶¶263-266.

A POSITA would have recognized that implementing *Nimbalker*'s WUS-PDCCH such that the power saving signal is only received from a SpCell of the base station would have enabled the UE to reduce power consumption on the primary cell (PCell/SpCell) in a multi-cell system, while reserving the secondary cell for other operations. Kakaes ¶264.

A POSITA would have been motivated to implement *Nimbalker*'s WUS-PDCCH power saving signal to be only received from a special cell (SpCell) of the base station because, for example, it is one of a finite set of options (either

implementing only on the SpCell (PCell), only on the SCell, or on both the SpCell and SCell). Kakaes ¶265; *Uber*, 957 F.3d at 1338-41; *KSR*, 550 U.S. at 421; *Slot Speaker*, 680 F. App'x at 943-44. As such, a POSITA would have found it obvious, or at least obvious to try, in circumstances where using the WUS-PDCCH procedure on the SpCell might be beneficial to the UE, while not on another cell, which may use regular DRX or be reserved for maintenance operations. Kakaes ¶265.

A POSITA would have recognized that implementing this operation in *Nimbalker*'s system represents merely implementing a known prior-art technique, which would have yielded the predictable result of only receiving the WUS-PDCCH on the SpCell (e.g., PCell). Kakaes ¶¶265-266. A POSITA would at least have found it obvious to try because it was a known technique that would have improved *Nimbalker*'s device in the same way as known in the prior art. Kakaes ¶¶265-266.

ii. Expectation of Success

A POSITA would have reasonably expected to succeed in implementing *Nimbalker*'s WUS-PDCCH power saving signal being only received from a special cell (SpCell, e.g., PCell) of the base station when the WUS-PDCCH is carried on the primary cell signal. Kakaes ¶¶267-268.

A POSITA would have recognized that this merely represents performing the known operation (receiving the WUS-PDCCH power saving signal) from one cell, which was well known and routine in the prior art and represents merely monitoring the second search space for the SpCell. Kakaes ¶¶268, §§VI.C.2-VI.C.3. A POSITA would have expected to succeed in implementing this functionality in *Nimbalker*'s system because *Nimbalker* already discloses monitoring the second search space, and implementing the operations of claim 8 would require merely performing *Nimbalker*'s disclosed operation only for the SpCell. This would have been merely the straightforward application of known, conventional techniques used according to their known functions to yield predictable results. Kakaes ¶268; *KSR*, 550 U.S. at 416; *Slot Speaker*, 680 F. App'x at 943-44.

4. Claim 16

- a. “The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
not monitoring the second search space in response to the UE performing a random access procedure, wherein the UE performs the random access procedure in response to one of:
[i] a random access response window is running after transmitting a first random access preamble; and
[ii] the UE has not received the scheduling signal on the PDCCH indicating a new transmission addressed to a Cell Radio Network Temporary Identifier (C-RNTI) of the UE after successful reception of a random access response corresponding to a second random access preamble not selected by the UE among contention-based random access preambles.”**

Nimbalker and *Anil* render obvious claim 16 as discussed for claim 7.

Kakaes ¶269.

5. Claim 17

- a. “The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
not monitor the second search space in response to at least one of [i] the UE performing a beam failure recovery procedure and [ii] the UE monitoring a third search space of the PDCCH, wherein the third search space is configured for the UE to monitor a beam failure response from the base station.”**

Nimbalker and *Anil* render obvious claim 17 as discussed for claim 8.

Kakaes ¶270.

6. Claim 18

- a. “The UE of claim 10, wherein the power saving signal is only received from a special cell (SpCell) of the base station.”**

Nimbalker and *Anil* render obvious claim 18 as discussed for claim 9.

Kakaes ¶271.

VIII. MANDATORY NOTICES

A. Real Parties-in-Interest

The real parties-in-interest are Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc.

B. Related Matters

Hannibal IP LLC asserted the '911 patent in the following litigation:

Hannibal IP, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 4:25-cv-00200 (E.D. Tex.).

The '911 patent claims priority to U.S. Provisional Application No. 62/840,451. U.S. Patent Application No. 17/743,024, now U.S. Patent No. 11,871,351; U.S. Patent Application No. 18/511,142, now U.S. Patent No. 12,323,919; and U.S. Patent Application No. 19/206,879, which is pending, each claim priority to the '911 patent.

C. Lead and Backup Counsel, and Service Information

Lead Counsel	Backup Counsel
Joshua L. Goldberg, Reg. No. 59,369 joshua.goldberg@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue NW Washington, DC 20001-4413 Phone: 202-408-6092 Fax: 202-408-4400	Timothy J. May, Reg. No. 41,538 timothy.may@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue NW Washington, DC 20001-4413 Phone: 202-408-4447 Fax: 202-408-4400 Nicholas A. Cerulli, Reg. No. 71,900 nicholas.cerulli@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue NW Washington, DC 20001-4413 Phone: 202-408-4248 Fax: 202-408-4400 Chen Zang, Reg. No. 81,568 chen.zang@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue NW Washington, DC 20001-4413 Phone: 202-408-4416 Fax: 202-408-4400

Lead Counsel	Backup Counsel
	Kevin D. Rodkey, Reg. No. 65,506 kevin.rodkey@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 271 17th Street NW Suite 1400 Atlanta, GA 30363-6209 Phone: 404-653-6484 Fax: 404-653-6444

Please address all correspondence to counsel at the addresses above.

Petitioners consent to electronic service by email at the above email addresses.

IX. GROUNDS FOR STANDING

Petitioners certify that the '911 patent is available for IPR and that
Petitioners are not barred or estopped from requesting IPR challenging the patent
claims on the grounds identified herein.

X. CONCLUSION

For the reasons set forth above, Petitioners request institution of *inter partes*
review and cancellation of each challenged claim. The Office may charge any
required fees to Deposit Account No. 06-0916.

Dated: July 11, 2025

By: /Joshua L. Goldberg/
Joshua L. Goldberg,
Lead Counsel
Reg. No. 59,369

CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, Petitioners certify that the word count of Petitioners' Petition for *Inter Partes* Review (exclusive of any table of contents, table of authorities, mandatory notices under § 42.8, certificates of service and word count, and list of exhibits or claim listing) as measured by Microsoft Word is 13,895.

Dated: July 11, 2025

By: /Joshua L. Goldberg/
Joshua L. Goldberg
Lead Counsel
Reg. No. 59,369

CLAIMS APPENDIX

1. **[1Preamble]** A method for a user equipment (UE) monitoring a physical downlink control channel (PDCCH), the method comprising:
 - [1a]** receiving a first configuration from a base station to configure the UE with a first search space of the PDCCH, wherein the first search space is used for monitoring a scheduling signal used for indicating scheduling information;
 - [1b]** receiving a second configuration from the base station to configure the UE with a second search space of the PDCCH, wherein the second search space is used for monitoring a power saving signal used for indicating wake-up information associated with a Discontinuous Reception (DRX) functionality;
 - [1c]** in response to not receiving the power saving signal while monitoring the second search space, starting a DRX on-duration timer of the DRX functionality;
 - [1d]** monitoring the first search space in response to the UE being in a DRX active time of the DRX functionality, wherein the DRX active time is a time during which the UE monitors the PDCCH; and

[1e] not monitoring the second search space in response to the UE being in the DRX active time of the DRX functionality.

2. The method of claim 1, wherein the first search space includes at least one of a first time and a first frequency resource for the UE to monitor the scheduling signal, and the second search space includes at least one of a second time and a second frequency resource for the UE to monitor the power saving signal.
3. The method of claim 1, further comprising:
determining whether to start a DRX on-duration timer of the DRX functionality according to the wake-up information.
4. The method of claim 1, wherein the power saving signal is further used for indicating a bandwidth part switch of a cell.
5. The method of claim 1, wherein the power saving signal is not received in the second search space in response to when at least one of [i] the UE does not monitor the second search space and [ii] the UE unsuccessfully decodes the power saving signal.

6. The method of claim 1, wherein the not monitoring the second search space comprises:

not monitoring the second search space while a DRX inactivity timer of the DRX functionality is running.

7. The method of claim 1, further comprising:

not monitoring the second search space in response to the UE performing a random access procedure, wherein the UE performs the random access procedure in response to one of:

[i] a random access response window is running after transmitting a first random access preamble; and [ii] the UE has not received the scheduling signal on the PDCCH indicating a new transmission addressed to a Cell Radio Network Temporary Identifier (C-RNTI) of the UE after successful reception of a random access response corresponding to a second random access preamble not selected by the UE among contention-based random access preambles.

8. The method of claim 1, further comprising:

not monitoring the second search space in response to at least one of [i] the UE performing a beam failure recovery procedure and [ii] the UE monitoring a third search space on the PDCCH, wherein the third search space is configured for the UE to monitor a beam failure response from the base station.

9. The method of claim 1, wherein the power saving signal is only received from a special cell (SpCell) of the base station.
10. **[10Preamble]** A user equipment (UE) monitoring a physical downlink (DL) control channel (PDCCH) in a wireless communication system, the UE comprising:
 - [10a]** a processor, for executing computer-executable instructions; and
a non-transitory machine-readable medium, coupled to the processor,
for storing the computer-executable instructions, wherein the computer-executable instructions instruct the processor to:
 - [10b]** receive a first configuration from a base station to configure the UE with a first search space of the PDCCH, wherein the first search space is used for monitoring a scheduling signal used for indicating scheduling information;

[10c] receive a second configuration from the base station to configure the UE with a second search space of the PDCCH, wherein the second search space is used for monitoring a power saving signal used for indicating wake-up information associated with a Discontinuous Reception (DRX) functionality;

[10d] in response to not receiving the power saving signal while monitoring the second search space, start a DRX on-duration timer of the DRX functionality;

[10e] monitor the first search space in response to the UE being in a DRX active time of the DRX functionality, wherein the DRX active time is a time during which the UE monitors the PDCCH; and

[10f] not monitoring the second search space in response to the UE being in the DRX active time of the DRX functionality.

11. The UE of claim 10, wherein the first search space includes at least one of a first time and a first frequency resource for the UE to monitor the scheduling signal, and the second search space includes at least one of a second time and a second frequency resource for the UE to monitor the power saving signal.

12. The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:

determine whether to start a DRX on-duration timer of the DRX

functionality according to the wake-up information.
13. The UE of claim 10, wherein the power saving signal is further used for indicating a bandwidth part switch of a cell.
14. The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:

not receive the power saving signal in the second search space in response to

when at least one of [i] the UE does not monitor the second search

space and [ii] the UE unsuccessfully decodes the power saving signal.
15. The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:

not monitor the second search space while a DRX inactivity timer of the

DRX functionality is running.

16. The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
- not monitoring the second search space in response to the UE performing a random access procedure, wherein the UE performs the random access procedure in response to one of:
- [i] a random access response window is running after transmitting a first random access preamble; and [ii] the UE has not received the scheduling signal on the PDCCH indicating a new transmission addressed to a Cell Radio Network Temporary Identifier (C-RNTI) of the UE after successful reception of a random access response corresponding to a second random access preamble not selected by the UE among contention-based random access preambles.
17. The UE of claim 10, wherein the computer-executable instructions further instruct the processor to:
- not monitor the second search space in response to at least one of [i] the UE performing a beam failure recovery procedure and [ii] the UE monitoring a third search space of the PDCCH, wherein the third search space is configured for the UE to monitor a beam failure response from the base station.

18. The UE of claim 10, wherein the power saving signal is only received from a special cell (SpCell) of the base station.

CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105(a), the **Petition for *Inter Partes* Review, the associated powers of attorney, and Exhibits 1001-1026** were served via FedEx Priority Overnight on July 11, 2025, on the correspondence address of record below indicated in the Patent Office's Patent Center for U.S. Patent No. 11,368,911:

Marcella M. Bodner
Cole Schotz, P.C.
Court Plaza North 25 Main Street
Hackensack, NJ 07601
UNITED STATES

Dated: July 11, 2025

Respectfully submitted,

/William Esper/
William Esper
Senior Litigation Paralegal
Finnegan, Henderson, Farabow,
Garret & Dunner, LLP