

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Alireza Babaei
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Title: WIRELESS DEVICE FEEDBACK FOR SEMI-PERSISTENT
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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 11,108,639 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

TABLE OF CONTENTS

I.	REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104.....	1
A.	Grounds for Standing Under 37 C.F.R. § 42.104(a).....	1
B.	Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested	1
C.	Claim Construction under 37 C.F.R. §§ 42.104(b)(3).....	3
II.	SUMMARY OF THE '639 PATENT	3
A.	Brief Description.....	3
B.	Summary of the Prosecution History of the '639 Patent.....	7
III.	LEVEL OF ORDINARY SKILL	7
IV.	DETAILED EXPLANATION OF GROUNDS.....	7
A.	GROUND 1 – Claims 1-20 are obvious over Fakoorian-1 in view of Takahashi	7
1.	Fakoorian-1	8
2.	Takahashi.....	10
3.	Predictable Fakoorian-1-Takahashi Combination	11
4.	Application to Challenged Claims	19
B.	GROUND 2A – Claims 1-20 are obvious over Fakoorian-2	49
1.	Fakoorian-2	49
2.	Application to Challenged Claims	52
C.	GROUND 2B – Claims 1-20 are obvious over Fakoorian-2 and Takahashi	77
1.	Predictable Combination of Fakoorian-2 & Takahashi	77
2.	Application to Challenged Claims	79
V.	DISCRETIONARY CONSIDERATIONS	84
VI.	PAYMENT OF FEES – 37 C.F.R. § 42.103.....	84
VII.	MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1).....	84
A.	Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	84
B.	Related Matters Under 37 C.F.R. § 42.8(b)(2).....	84
C.	Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3).....	85
D.	Service Information	85

LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 11,108,639 to Babaei (“the ’639 Patent”)
APPLE-1002	Prosecution History of the ’639 Patent (“the Prosecution History”)
APPLE-1003	Declaration and Curriculum Vitae of Dr. Narayan B. Mandayam
APPLE-1004	U.S. Patent Publication No. 2023/0084754 (“Fakoorian-1”)
APPLE-1005	U.S. Patent No. 11,464,001 (“Fakoorian-2”)
APPLE-1006	Certified English-language translation of WIPO PCT App. Pub. No. WO 2021/064961A1 to Takahashi <i>et al.</i> (“Takahashi”)
APPLE-1007	APEX BEAM TECHNOLOGIES LLC, First Amended Complaint, ’639 Patent, 6:24-cv-00223 (WDTX)
APPLE-1008	U.S. Provisional Application 62/868,632 filed on Jun. 28, 2019 (“Fakoorian-1-Provisional”)
APPLE-1009	U.S. Provisional Application 62/888,098 filed on Aug. 16, 2019 (“Fakoorian-2-Provisional”)
APPLE-1010	WIPO PCT App. Pub. No. WO 2021/064961A1 to Takahashi <i>et al.</i> (“Takahashi-Japanese”)
APPLE-1011	Original complaint filed in <i>Apex Beam Technologies LLC v. Apple Inc.</i> , Case No. 6-24-cv-00223 (WDTX) (April 29, 2024)
APPLE-1012	Amended Complaint filed in <i>Apex Beam Technologies LLC v. Apple Inc.</i> , Case No. 6-24-cv-00223-ADA-DIG (WDTX) (May 2, 2024)

- APPLE-1013 Proof of Service of Amended Complaint in Apex Beam Technologies LLC v. Apple Inc., Case No. 6-24-cv-00223-ADA-DIG (WDTX) (May 14, 2024).
- APPLE-1014 U.S. Provisional Application No. 62/931,798 (“the ’798 provisional application”)

LISTING OF CLAIMS

Claim	Identifier	Claim Language
1	[1pre]	A wireless device comprising:
	[1a]	one or more processors; and
	[1b]	memory storing instructions that, when executed by the one or more processors, cause the wireless device to:
	[1c]	receive one or more radio resource control (RRC) messages comprising:
	[1d]	a first configuration parameter, of a first semi-persistent scheduling (SPS) configuration, indicating a first hybrid automatic repeat request (HARQ) codebook identifier;
	[1e]	a second configuration parameter, of a second SPS configuration, indicating a second HARQ codebook identifier, wherein the second HARQ codebook identifier is the same as the first HARQ codebook identifier; and
	[1f]	a third configuration parameter indicating a state that is mapped to the first SPS configuration and the second SPS configuration;
	[1g]	receive a downlink control information (DCI), wherein a value of one or more bits of a HARQ process number field of the DCI indicates the state;
	[1h]	deactivate the first SPS configuration and the second SPS configuration in response to receiving the DCI; and
	[1i]	transmit an acknowledgment.
2	[2a]	The wireless device of claim 1, wherein deactivating the first SPS configuration and the second SPS configuration comprises deactivating: a first plurality of resources associated with the first SPS configuration; and
	[2b]	a second plurality of resources associated with the second SPS configuration.
3	[3a]	The wireless device of claim 2, wherein:

Claim	Identifier	Claim Language
		the DCI comprises a physical downlink shared channel (PDSCH)-to-HARQ feedback timing field; and
	[3b]	a value of the PDSCH-to-HARQ feedback timing field indicates a time duration between the DCI and the acknowledgement.
4	[4]	The wireless device of claim 3, wherein the instructions, when executed by the one or more processors, further cause the wireless device to determine a timing of the acknowledgement based on a first timing of the DCI and the value of the PDSCH-to-HARQ feedback timing field.
5	[5a]	The wireless device of claim 2, wherein: the first HARQ codebook identifier indicates a first HARQ feedback codebook for transmission of an acknowledgement associated with releasing the first SPS configuration or a HARQ feedback for a transport block received via a resource associated with the first SPS configuration;
	[5b]	the second HARQ codebook identifier indicates a second HARQ feedback codebook for transmission of an acknowledgement associated with releasing the second SPS configuration or a HARQ feedback for a transport block received via a resource associated with the second SPS configuration; and
	[5c]	the first HARQ feedback codebook is the same as the second HARQ feedback codebook based on the first HARQ codebook identifier being the same as the second HARQ codebook identifier.
6	[6]	The wireless device of claim 2, wherein the state is associated with a plurality of configuration indexes comprising a first configuration index, of the first SPS configuration, and a second configuration index of the second SPS configuration.
7	[7]	The wireless device of claim 2, wherein transmitting the acknowledgement is in response to the DCI indicating

Claim	Identifier	Claim Language
		release of the first SPS configuration and the second SPS configuration.
8	[8]	The wireless device of claim 2, wherein the one or more RRC messages further comprise a fourth configuration parameter indicating a configured scheduling radio network temporary identifier, wherein the DCI is associated with the configured scheduling radio network temporary identifier.
9	[9a]	The wireless device of claim 2, wherein the instructions, when executed by the one or more processors, further cause the wireless device to: receive a first activation DCI indicating activation of a first plurality of resources associated with the first SPS configuration; and
	[9b]	receive a second activation DCI indicating activation of a second plurality of resources associated with the second SPS configuration.
10	[10]	The wireless device of claim 2, wherein the one or more RRC messages further comprise fourth configuration parameters of a bandwidth part of a cell, wherein the first SPS configuration and the second SPS configuration are for the bandwidth part.
11	[11a]	The wireless device of claim 1, wherein: the DCI comprises a physical downlink shared channel (PDSCH)-to-HARQ feedback timing field; and
	[11b]	a value of the PDSCH-to-HARQ feedback timing field indicates a time duration between the DCI and the acknowledgement.
12	[12]	The wireless device of claim 11, further comprising determining a timing of the acknowledgement based on a first timing of the DCI and the value of the PDSCH-to-HARQ feedback timing field.
13	[13]	The wireless device of claim 12, wherein the one or more RRC messages further comprise fourth configuration parameters of a bandwidth part of a cell, wherein the first

Claim	Identifier	Claim Language
		SPS configuration and the second SPS configuration are for the bandwidth part.
14	[14a]	The wireless device of claim 1, wherein: the first HARQ codebook identifier indicates a first HARQ feedback codebook for transmission of an acknowledgement associated with releasing the first SPS configuration or a HARQ feedback for a transport block received via a resource associated with the first SPS configuration;
	[14b]	the second HARQ codebook identifier indicates a second HARQ feedback codebook for transmission of an acknowledgement associated with releasing the second SPS configuration or a HARQ feedback for a transport block received via a resource associated with the second SPS configuration; and
	[14c]	the first HARQ feedback codebook is the same as the second HARQ feedback codebook based on the first HARQ codebook identifier being the same as the second HARQ codebook identifier.
15	[15]	The wireless device of claim 14, wherein the one or more RRC messages further comprise fourth configuration parameters of a bandwidth part of a cell, wherein the first SPS configuration and the second SPS configuration are for the bandwidth part.
16	[16]	The wireless device of claim 1, wherein the state is associated with a plurality of configuration indexes comprising a first configuration index, of the first SPS configuration, and a second configuration index of the second SPS configuration.
17	[17]	The wireless device of claim 1, wherein transmitting the acknowledgement is in response to the DCI indicating release of the first SPS configuration and the second SPS configuration.

Claim	Identifier	Claim Language
18	[18]	The wireless device of claim 1, wherein the one or more RRC messages further comprise a fourth configuration parameter indicating a configured scheduling radio network temporary identifier, wherein the DCI is associated with the configured scheduling radio network temporary identifier.
19	[19a]	The wireless device of claim 1, wherein the instructions, when executed by the one or more processors, further cause the wireless device to: receive a first activation DCI indicating activation of a first plurality of resources associated with the first SPS configuration; and
	[19b]	receive a second activation DCI indicating activation of a second plurality of resources associated with the second SPS configuration.
20	[20]	The wireless device of claim 1, wherein the one or more RRC messages further comprise fourth configuration parameters of a bandwidth part of a cell, wherein the first SPS configuration and the second SPS configuration are for the bandwidth part.

Apple Inc. (“Apple”/“Petitioner”) petitions for Inter Partes Review (“IPR”) of claims 1-20 (“Challenged Claims”) of U.S. 11,108,639 (“ ’639 Patent”).

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

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

Apple Inc. certifies that the ’639 Patent is available for IPR. The present petition is being filed within one year of service of a complaint against Apple.

Apple is not barred or estopped from requesting this review. APPLE-1007, -0011, -0012.

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

Petitioner requests IPR based on the following grounds, as further explained in this Petition and supported by the Declaration of Dr. Narayan B. Mandayam.

Ground	’639 Claims	§103 Basis
Ground 1	1-20	Fakoorian-1 and Takahashi
Ground 2A	1-20	Fakoorian-2
Ground 2B	1-20	Fakoorian-2 and Takahashi

The ’639 Patent issued on August 31, 2021, from U.S. Patent Application No. 17/236,001 (“the ’001 application”), filed on April 21, 2021. *See* APPLE-1002. The earliest claimed priority date of the ’639 Patent is the November 6, 2019 filing date of U.S. Provisional Application No. 62/931,798 (“the ’798 provisional application”). However, the ’639 Patent is not entitled to the claimed priority date

of November 6, 2019, at least because Limitation [1e] of the Challenged Claims is *not* supported in the '798 provisional application. APPLE-1013. Regardless, even if the '639 Patent were entitled to the asserted provisional priority date of November 6, 2019 (which it is not), each of following patent documents is prior art under at least §102(a)(2) because they pre-date the '798 provisional.

Reference	Prior Art Date	Section
Fakoorian-1 (US20230084754A1)	June 28, 2019	§102(a)(2)
Fakoorian-2 (US11464001)	August 16, 2019	§102(a)(2)
Takahashi (WO2021064961A1)	October 3, 2019	§102(a)(2)

Fakoorian-1 (APPLE-1004) is entitled to its provisional filing date, because Fakoorian-1 and Fakoorian-1-Provisional (APPLE-1008) share the same figures and virtually identical description. To further confirm Fakoorian-1-Provisional supports Fakoorian-1's teachings, Fakoorian-1-Provisional (APPLE-1008) is cited throughout this Petition when citing Fakoorian-1 (APPLE-1004). Likewise, Fakoorian-2 (APPLE-1005) is entitled to the filing date of its provisional application (APPLE-1009). Fakoorian-2 (APPLE-1005) and Fakoorian-2-Provisional (APPLE-1009) are cited in parallel in this Petition.

Fakoorian-1 and Fakoorian-2 are prior art for the reasons indicated above. Moreover, the provisionals (APPLE-1008/1009) readily support respective claims of Fakoorian-1 and Fakoorian-2, and would have qualified under the no-longer-

applicable *Dynamic Drinkware* jurisprudence. *Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 (March 10, 2023). APPLE-1003, ¶49 (mapping exemplary support for claims).

Takahashi (APPLE-1006) is a certified English translation of prior art reference WO 2021/064961 A1 (APPLE-1010), filed October 3, 2019, and cited throughout to reveal relevant aspects thereof.

C. Claim Construction under 37 C.F.R. §§ 42.104(b)(3)

All claim terms should be construed according to the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. §42.100. Petitioner submits that no claim terms need be construed to resolve issues of controversy in the present Petition, especially in view of the similarity between the '639 Patent's specification examples and the prior art of Grounds 1-2. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011).¹

II. SUMMARY OF THE '639 PATENT

A. Brief Description

The '639 Patent relates to wireless device feedback for semi-persistent

¹ Petitioner is not conceding that each claim satisfies all statutory requirements, nor waiving any arguments concerning claim scope or grounds that can only be raised in district court.

scheduling (“SPS”) release. APPLE-1001, Title. In general, SPS is an alternative to dynamic scheduling that can be used in long-term evolution (LTE) and 5G new radio (NR) technologies to pre-allocate radio resources for certain network transmissions. APPLE-1003, ¶36.

The UE receives Radio Resource Control (RRC) messaging that includes configuration parameters of various SPS configurations. APPLE-1001, Abstract, *see* 26:58-27:8; APPLE-1003, ¶37. An example of this well-known RRC concept is illustrated at Fig. 16 of the ’639 Patent (reproduced below). APPLE-1001, Fig. 16.

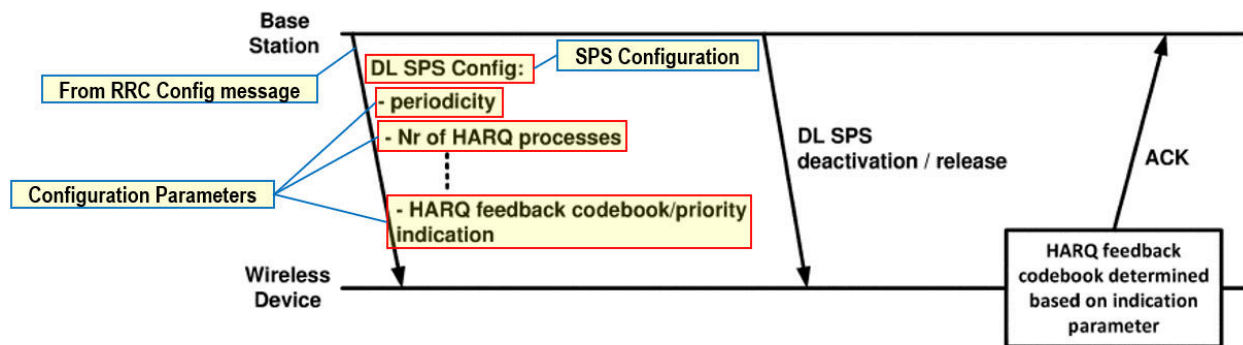


FIG. 16

APPLE-1003, ¶¶36-37 (APPLE-1001, Fig. 16 (annotated))

The UE “may receive one or more message[s] comprising configuration parameters,” where the “messages may comprise radio resource control (RRC) messages” and “[a] parameter of the configuration parameters may be in at least one of the one or more messages.” APPLE-1001, 26:58-63. The ’639 Patent states the “messages may comprise information element (IEs),” that an information

element “includes single or multiple fields,” and that “fields in an IE may be individual contents of the IE.” *Id.*, 26:63-27:1 (“[t]he terms configuration parameter, IE and field may be used equally in this disclosure.”).

The parameters indicate HARQ codebook identifiers, and it is possible for the same HARQ codebook identifier to be indicated for at least two SPS configurations using the respective parameters of the at least two SPS configurations. APPLE-1001, Abstract, *see* 49:31-50, cl. 1; APPLE-1003, ¶38. The UE receives a downlink (DL) control information (DCI) message with bit(s) that indicate a state of the SPS configurations. APPLE-1001, Abstract; APPLE-1003, ¶38. The DCI can include “a plurality of fields including a HARQ process number (HPN) field.” APPLE-1001, 49:3-5.

The preceding discussion provides context for understanding the alleged problem recited in the ’639 Patent. *See* APPLE-1003, ¶¶39-42, 62. “For deactivation of a DL SPS configuration[], the base station may transmit a release/deactivation DCI indicating that the DL SPS configuration is deactivated,” and the UE should “acknowledge the receipt of the release/deactivation DCI so that the base station determines that the wireless device correctly received the DCI and that the wireless device deactivated resources corresponding to the DL SPS configurations.” APPLE-1001, 32:56-63.

When a group of downlink (DL) “SPS configurations are jointly

deactivated/released by a single deactivation/release DCI,” the ’639 Patent explains that “existing [prior art] acknowledgement processes or HARQ feedback codebook determination processes **lead to inefficient DL SPS operation**. There is a need to enhance the existing DL SPS deactivation/release mechanisms when a group of DL SPS configurations are jointly released/deactivated. Example embodiments enhance the DL SPS deactivation/release mechanisms when a group of DL SPS configurations are jointly released/deactivated.” *Id.*, 32:63-33:8.

The purported solution of the ’639 Patent involves the UE “transmit[ting] an acknowledgement (e.g., HARQ ACK)” “indicating the reception of the DCI,” where the DCI “indicates SPS release of the first SPS configuration and the second SPS configuration.” *Id.*, 49:50-56. In particular, the UE “may transmit the acknowledgement based on **the first HARQ codebook identifier being the same as the second HARQ codebook identifier in response to the first SPS configuration index and the second SPS configuration index being associated with the same deactivation state**.” *Id.*, 49:58-62. Further, the UE “may transmit the acknowledgement [...] in response to the DCI indicating joint deactivation/release of the first SPS configuration and the second SPS configuration.” *Id.*, 49:63-67.

As explained by Dr. Mandayam, the alleged problem recited by the ’639 Patent was already addressed in the art and its purported solution was well-known

before the '639 Patent. APPLE-1003, ¶¶38-42, 62.

B. Summary of the Prosecution History of the '639 Patent

The '001 application was allowed after Applicant responded to an initial office action by submitting an e-Terminal Disclaimer to obviate a double-patenting rejection with respect to Pat. No. 11,018,946. APPLE-1002, pp. 39-55 (Citation to PDF pages). Had more pertinent art, such as Fakoorian-1, Takahashi, and Fakoorian-2 been properly considered, the claims of the '639 patent would not have issued in their current form.

III. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art at the time of the '639 Patent (a “POSITA”) would have had a bachelor’s degree in in electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks, including long-term evolution LTE/4G or 5G new radio (NR) cellular technology. APPLE-1003, ¶¶30-33. Additional years of experience could substitute for an advanced-level degree (and vice versa). *Id.*

IV. DETAILED EXPLANATION OF GROUNDS

A. GROUND 1 – Claims 1-20 are obvious over Fakoorian-1 in view of Takahashi

1. Fakoorian-1²

Fakoorian-1 describes “[j]oint activation and/or release for multiple configured grant and/or semi-persistent scheduling configurations.” APPLE-1004/APPLE-1008, Title. A “user equipment (UE) may receive a single downlink control information (DCI) message” and “map a bit sequence in the single DCI message to a configuration set that includes multiple downlink semi-persistent scheduling [SPS] configurations” “to be jointly activated *or released*.” *Id.*, Abstract.

A “downlink SPS configuration, which is initially indicated in an RRC configuration[,] and a subsequent DCI message activates and/or releases the downlink SPS configuration.” *Id.*, ¶[0038], [0040]/¶[0037], [0039]. Fakoorian-1 describes various “hybrid automatic repeat request-acknowledgement (HARQ-ACK) codebook[s],” (cl. 5 (APPLE-1004)/cl. 14 (APPLE-1008)) including a “HARQ-ACK codebook for” transmitting “HARQ-ACK information that corresponds to an SPS PDSCH release” to “acknowledge the SPS configuration(s)

² General descriptions provided for this and other references and combinations thereof are incorporated into each subsection and mapping of the claims that includes citations to these references. All emphasis is added unless otherwise indicated.

[...] released by the single DCI message.” *Id.*, cl. 5 (APPLE-1004)/cl. 14 (APPLE-1008), ¶[0062]/¶[0061].

For example, Fakoorian-1’s UE “receive[s], a single DCI message that includes a bit sequence to indicate [...] SPS configurations to be jointly [...] released.” *Id.*, ¶[0045]/¶[0044]. The bit sequence can be “provided in a [HARQ] process number field of the single DCI message.” *Id.*, cl. 19 (APPLE-1004)/cl. 11 (APPLE-1008). The “HARQ process number” is described as a “4-bit field” used to indicate a “HARQ index that belongs to” an SPS configuration(s) and that “can be used to” “release,” or deactivate, the corresponding configuration. *Id.*, ¶[0057]/¶[0056]. In the case of an “SPS configuration” that is released, “the UE may acknowledge” the “release by transmitting the acknowledgement in a codebook through a physical uplink control channel (PUCCH) resource.” *Id.*, ¶[0058]/¶[0057].

Fakoorian-1 acknowledges the well-known advantages of semi-persistent scheduling configurations; noting, for example, that “[s]emi-persistent scheduling (SPS) enables radio resources to be semi-statically configured and allocated to a UE for a longer time period than one subframe.” *Id.*, ¶[0038]/¶[0036]. This “may avoid the need for specific downlink assignment messages and/or uplink grant messages over a physical downlink control channel (PDCCH) for each subframe.” *Id.*

For example, in prior art approaches “**different** downlink **SPS configurations** [...] are activated and **released individually**,” such that “a base station needs to send N DCI messages to a UE” “to activate N downlink SPS configurations,” and “separately releas[e] the downlink SPS configurations,” which can increase network overhead and resources. *Id.*, ¶[0041]/¶[0040].

2. Takahashi

Takahashi describes a “wireless communication method capable of appropriate feedback of HARQ-ACK when multiple SPSs are used,” including techniques for conveying delivery acknowledgement information, *e.g.*, hybrid automatic repeat request acknowledgement (HARQ-ACK) “for multiple SPSs.” APPLE-1006, ¶¶[0008]-[0009]. For example, Takahashi describes including “more than one set of delivery acknowledgement information,” *e.g.*, HARQ-ACK, for multiple SPSs in one HARQ-ACK codebook. *Id.*; APPLE-1003, ¶56.

Takahashi describes that “SPS setting[s],” which are also “referred to as setting information for the SPS,” may be set in the UE by using higher layer signaling such as “radio resource control (RRC) signaling.” APPLE-1006, ¶¶[0019], [0020], [0038]. Takahashi’s “setting information for the SPS” can be “an ‘SPS-Config’ information element for RRC” and may include an index (SPS index) for identifying the SPS. *Id.*, ¶¶[0022], [0015]; APPLE-1003, ¶57. Takahashi’s

SPS settings include at least the SPS configurations, and corresponding configuration parameters. APPLE-1003, ¶¶57-59. Takahashi's "UE may activate or deactivate (release) an SPS setting based on a downlink control channel (physical downlink control channel (PDCCH))" and "may receive a [PDSCH] of the corresponding SPS," based on the activated SPS setting. APPLE-1006, ¶[0014]. In particular, Takahashi discloses "DCI for activating or deactivating the SPS setting," and that "SPS deactivation DCI may be referred to as SPS release DCI." *Id.*, [0016].

Takahashi discloses a UE that determines a size of a semi-static HARQ-ACK codebook "including a HARQ-ACK corresponding to a downlink shared channel (physical downlink shared channel (PDSCH)) of semi-persistent scheduling (SPS)." APPLE-1006, Abstract. Takahashi's UE determines the size "based on the number of set SPS settings, the number of set or activated cells, and the number of HARQ-ACK timing values" included in a set of HARQ-ACK timing values. APPLE-1006, Abstract, ¶¶[0010]. Takahashi's UE transmits "a HARQ-ACK information bit corresponding to the HARQ-ACK codebook by using a resource of an uplink control channel," *e.g.*, a physical uplink control channel (PUCCH). *Id.* The "HARQ-ACK can [thus] be appropriately fed back even when multiple SPSs are used." *Id.*, Abstract.

3. Predictable Fakoorian-1-Takahashi Combination

A POSITA would have found it obvious to combine Fakoorian-1 and Takahashi to utilize configuration parameters of an SPS configuration to indicate a particular HARQ codebook identifier, as suggested by Takahashi, when implementing techniques for efficient release of SPS configurations consistent with Fakoorian-1's teachings. APPLE-1006, ¶¶[0028]-[0046]; APPLE-1003, ¶¶60-73.

Fakoorian-1 configures its SPS configuration using RRC signaling. APPLE-1004/APPLE-1008, ¶[0040]/¶[0039]. Takahashi's "HARQ-ACK codebook" is "set in the UE by using a higher layer **parameter**" corresponding to a configuration parameter, and the "**higher layer signaling may be**" "**radio resource control (RRC) signaling.**" APPLE-1006, ¶¶[0031], [0020]. Indeed, Takahashi's "UE may **determine which codebook to use based on higher layer signaling,**" *e.g.*, "**the RRC parameter.**" *Id.*, ¶[0059]. Takahashi provides additional teachings and implementation details for HARQ processes that would have enabled more efficient methods for transmitting HARQ acknowledgements ("HARQ-ACK") in Fakoorian-1's UE. APPLE-1003, ¶61; *see* APPLE-1006, ¶¶[0039]-[0046]. Multiple reasons would have led a POSITA to combine teachings of Fakoorian-1 and Takahashi. *See* APPLE-1003, ¶¶62-73.

First, a POSITA would have been motivated to combine the teachings of Fakoorian-1 and Takahashi to achieve multiple known advantages, including advantages expressly articulated in Fakoorian-1 and Takahashi. APPLE-1003, ¶62.

These include facilitating decreased network overhead and reduced resource consumption at least from: i) releasing (or deactivating) multiple SPS configurations using a single DCI message, as suggested by Fakoorian-1 (*see* APPLE-1004/APPLE-1008, Abstract, ¶¶[0006]/[0005], [0042]/[0041]-[0043]/[0042]); and ii) determining (or defining) “HARQ-ACK codebooks for multiple SPSs” such that “appropriate HARQ control” is “performed when multiple SPSs are used” and “appropriate feedback of HARQ-ACK” is communicated “when multiple SPSs are used,” as suggested by Takahashi³. APPLE-1006, ¶¶[0007]-[0011]; APPLE-1003, ¶¶63-73.

From these express advantages, a POSITA would have been motivated to combine Fakoorian-1’s technique of joint release for multiple SPS configurations with Takahashi’s suggestions for “configuring multiple SPSs,” *e.g.*, “in one cell group” and “utilize[ing] multiple SPS settings for one or more serving cells,” to facilitate the express benefit of “more flexible control,” in accordance with Takahashi. APPLE-1004/APPLE-1008, Title; APPLE-1006, ¶[0044]; APPLE-

³ The problem and solution articulated by each of Fakoorian-1 and Takahashi is not unlike the purported problem and solution recited by the ’639 Patent itself.

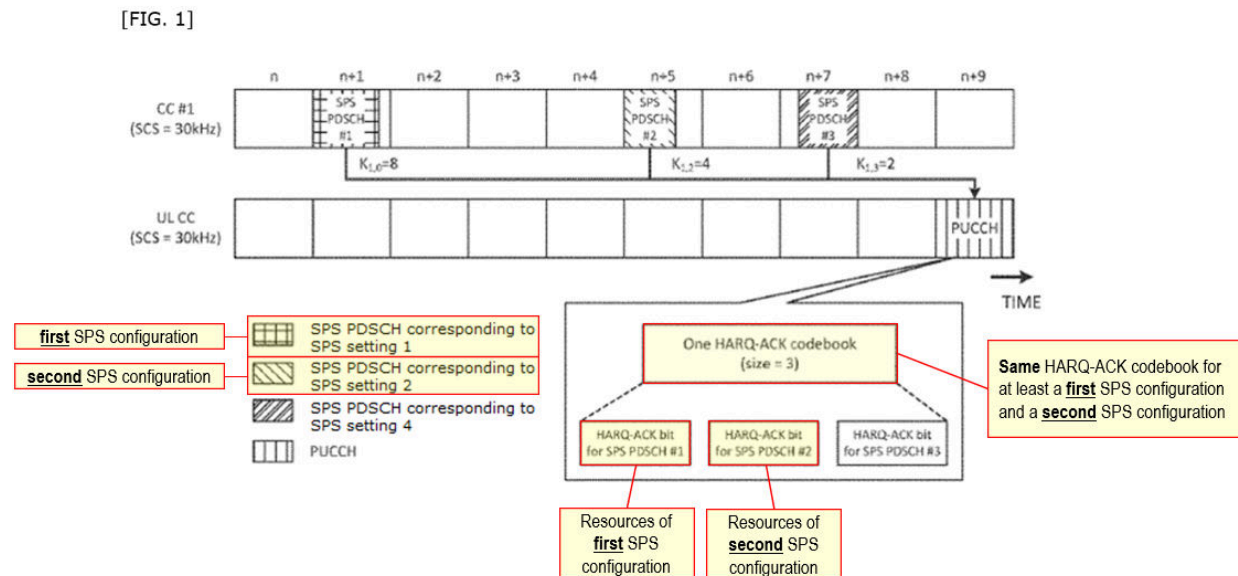
APPLE-1003, ¶62; *see e.g.*, APPLE-1001, 32:56-33:5; APPLE-1004/APPLE-1008, ¶¶[0041]/[0040]-[0043] / [0042]; APPLE-1006, ¶¶[0005]-[0011].

1003, ¶64. Indeed, Takahashi teaches methods for appropriately feeding back the HARQ-ACK when multiple SPSs are used. APPLE-1006, Abstract, ¶¶[0011], [0046].

Specifically, Takahashi discloses parameters of an SPS configuration that indicate a HARQ codebook identifier. APPLE-1003, ¶65. For example, Takahashi's "UE may determine [] the HARQ-ACK codebook corresponding to the SPS setting" (*i.e.*, SPS configuration) "based on an **RRC parameter** 'n1PUCCH-AN' indicating a PUCCH resource of the SPS setting." *Id.*, ¶¶[0061], [0091] ("***UE may determine the HARQ-ACK codebook size and corresponding bits to transmit*** in the UL slot based on the determined set of occasions for candidate SPS PDSCH reception"), [0093] ("the ***UE may determine which codebook to use based on higher layer signaling*** (for example, ***the RRC parameter***"). A POSITA would have predictably looked to other teachings such as Takahashi to implement and further enhance Fakoorian-1's flexibility to control how a UE jointly releases multiple downlink SPS configurations and transmits a message to jointly acknowledge SPS configurations (and resources) that were released. APPLE-1003, ¶65; *see* APPLE-1004/APPLE-1008, ¶¶[0057], [0058].

Second, a POSITA would have been motivated to combine Fakoorian-1 and Takahashi to achieve the benefit of using one (*i.e.*, the same) HARQ codebook to transmit HARQ acknowledgement (ACK) information for at least two SPS

configurations, as taught by Takahashi. APPLE-1003, ¶66. It would have been apparent to a POSITA, based on Takahashi's disclosure, that HARQ feedback for multiple SPS configurations, including SPS PDSCHs resources, may be transmitted using the same HARQ feedback codebook. *Id.* For example, Takahashi discloses that “more than one set of HARQ-ACK information for multiple SPSs” can be “included in one HARQ-ACK codebook.” APPLE-1006, ¶[0045]; Fig. 1 (reproduced below).



APPLE-1003, ¶66 (APPLE-1006, Fig. 1 (annotated))

Relatedly, Fakoorian-1 teaches that certain “SPS configurations” of the UE may be “grouped within the same configuration set.” APPLE-1004/APPLE-1008, ¶[0048]/¶[0047]. Fakoorian-1's UE transmits, through a PUCCH resource, “a codebook that includes an individual acknowledgement bit” based on the bit sequence indicating “**the multiple downlink SPS configurations**” to be jointly

released.” *Id.*, ¶[0081]/¶[0080]. In Fakoorian-1, a “single DCI message” can release multiple SPS configurations. *Id.*, ¶[0059]/¶[0058]; APPLE-1003, ¶67. And, based on the single DCI message, the UE can transmit a HARQ acknowledgement, or a location of an acknowledgement bit in the codebook, which is an individual bit used to acknowledge all SPS configurations that were released. APPLE-1004/APPLE-1008, ¶[0059].

Based on the combined teachings of Fakoorian-1 and Takahashi, a POSITA would have recognized the benefits of transmitting HARQ acknowledgement (ACK) information using one (*i.e.*, the same) HARQ codebook for at least two SPS configurations to be released. APPLE-1003, ¶68.

Moreover, a POSITA would have been motivated to combine Takahashi’s explicit teaching of transmitting HARQ feedback for multiple SPS configurations using the same HARQ feedback codebook with Fakoorian-1’s suggestion of a codebook (and codepoint), individual acknowledgement bit, and bit sequence that are associated with **multiple downlink SPS configurations to be jointly released**. APPLE-1003, ¶68; *see* APPLE-1006, ¶[0045]; *see* APPLE-1004/APPLE-1008, ¶¶[0057]/¶[0056], [0059]/[0058], [0048]/[0047], [0081]/[0080].

Third, combining the teachings of Fakoorian-1 with Takahashi would have merely involved combining prior art elements according to known methods to yield predictable results. APPLE-1003, ¶69; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398,

417 (2007) (“[W]hen a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.”); *see also Intel Corp.*, 61 F.4th at 1379-80 (“a person of ordinary creativity, not an automaton”).

A POSITA would have also had a reasonable expectation of success based on the straightforward programming changes that would have been used to modify Fakoorian-1’s RRC signaling/messaging. APPLE-1003, ¶¶70-73. The combination merely involves at least one of Fakoorian-1’s “multiple SPS configurations” including a parameter that indicates the same HARQ codebook identifier indicated by a parameter of another SPS configuration, consistent with Takahashi’s teachings. APPLE-1003, ¶70; APPLE-1004/APPLE-1008, ¶[0059]/¶[0058].

Moreover, Fakoorian-1 and Takahashi are in the same field of endeavor/technology as the claimed invention of the ’639 Patent, *e.g.*, each relate to semi-persistent scheduling (SPS) release, including joint release for multiple SPS

configurations in 3GPP systems, and are analogous art⁴. *See* APPLE-1003, ¶¶71-72; APPLE-1004/APPLE-1008, Abstract (“semi-persistent scheduling configurations” “to be jointly” “released”), ¶[0040]/¶[0039] (“DCI message [...] releases the downlink SPS configuration”); APPLE-1006, Abstract (“semi-persistent scheduling (SPS) based on the number of set SPS settings”), ¶[0014] (“deactivate (release) an SPS setting based on a downlink control channel”); *see* §II.A, “Brief Description” of the ’639 Patent. Given this extensive overlap in subject matter, a POSITA would have had reason to consult Takahashi when

⁴ Each of Fakoorian-1 and Takahashi is analogous art to the claimed invention of the ’639 Patent. As noted, each of Fakoorian-1 and Takahashi is in the same field of endeavor/technology as the claimed invention of the ’639 Patent, *e.g.*, each relates generally to joint release for multiple SPS configurations, including transmitting HARQ acknowledgements regarding the same. Moreover, each of Fakoorian-1 and Takahashi is reasonably pertinent to the problem addressed by the ’639 Patent. *See* APPLE-1001, 32:63-33:3. Fakoorian-2 is analogous art to the claimed invention of the ’639 Patent for substantially the same reasons as Fakoorian-1, and at least in view of the overlap in subject matter between Fakoorian-2 and Fakoorian-1.

assessing Fakoorian-1's disclosure, and would have had a reasonable expectation of success. APPLE-1003, ¶72.

Takahashi, like Fakoorian-1, discloses techniques for deactivating or releasing multiple SPS configurations based on RRC signaling, HARQ codebooks, and DCI messages, and teachings of Takahashi's RRC signaling, configuration parameters, and HARQ codebook identifiers would have been readily implemented in Fakoorian-1. APPLE-1006, [0009], [0011], [0022], [0045]; APPLE-1003, ¶73. Moreover, a POSITA would have found implementation of techniques for jointly releasing multiple SPS configurations based on Fakoorian-1 and Takahashi to be a matter of design choice, in view of the conventional use of such technologies. APPLE-1003, ¶73.

4. Application to Challenged Claims

[1pre]

Fakoorian-1-Takahashi provides a wireless device. For example, Fakoorian-1 discloses “[a] user equipment (UE)” of a “wireless communication network” comprising “a number of user equipment (UEs).” APPLE-1004/APPLE-1008, ¶[0004]/¶[0003]; ¶¶[0007]/[0006], [0004]/[0003] (“a UE for wireless communication” with a base station (BS) via “downlink and uplink” wireless transmissions.); APPLE-1003, ¶¶74-75.

[1a]

The Fakoorian-1-Takahashi combination includes one or more processors. For example, Fakoorian-1's UE includes "a memory and one or more processors operatively coupled to the memory." APPLE-1004/APPLE-1008, ¶[0007]/¶[0006]; cl.1, cl. 17 (APPLE-1004)/cl. 22, cl. 23 (APPLE-1008) ("one or more instructions" can be "executed by one or more processors of a user equipment (UE)" to cause the UE to perform operations for SPS configuration release.); APPLE-1003, ¶76.

[1b]

Fakoorian-1-Takahashi renders obvious [1b]. For example, Fakoorian-1's memory includes "a non-transitory computer-readable medium" that "store[s] one or more instructions for wireless communication." APPLE-1004/APPLE-1008, ¶[0008]/¶[0007]. Fakoorian-1's **"one or more instructions, when executed by one or more processors of a UE,** may cause the one or more processors," and the UE, to perform operations related to SPS configuration release. *Id.*; APPLE-1003, ¶77.

[1c]:

In the Fakoorian-1-Takahashi combination, the UE (*e.g.*, Fakoorian-1's UE) receives one or more RRC messages. APPLE-1003, ¶¶78-79. For example, Fakoorian-1's UE includes "multiple downlink SPS configurations" based on "a

radio resource control [RRC] configuration message” received at the UE.

APPLE-1004/APPLE-1008, ¶[0079]/¶[0078]. Indeed, Fakoorian-1’s “SPS configurations” are “indicated **to the UE in an RRC configuration**” received via one or more RRC messages. APPLE-1004/APPLE-1008, ¶[0045]/¶[0044]; APPLE-1003, ¶¶78-96; *see also, infra*, Ground 1, Analysis of Limitations [1d] and [1e] (incorporated here).

[1d]

The Fakoorian-1-Takahashi combination provides a first configuration parameter, of a first semi-persistent scheduling (SPS) configuration, indicating a first HARQ codebook identifier. APPLE-1003, ¶¶80-96; *see infra*, Ground 1, Analysis of Limitation [1e] (incorporated here).

A first configuration parameter of a first SPS configuration

In the combination, Fakoorian-1 includes “multiple SPS configurations,” which provides at least a first SPS configuration. APPLE-1004/APPLE-1008, ¶[0065]/¶[0064]. Fakoorian-1’s first SPS configuration includes configuration parameters comprising a “**periodicity**,” “**CS-RNTI**,” “**HARQ process number**,” and “service type.” APPLE-1004/APPLE-1008, ¶¶[0047]/[0046], [0050]/[0049], [0053]/[0052]-[0055]/[0054], [0057]/[0056]. Each of these items are configuration parameters of an SPS configuration, just like ’639 Patent’s examples. APPLE-

1001, 33:12-15 (“DL SPS configuration may comprise a first parameter indicating a **periodicity**, a second parameter indicating a **number of HARQ processes** associated with the DL SPS configurations”); APPLE-1003, ¶¶81-82. To be clear, any one of Fakoorian-1’s **CS-RNTI, periodicity, and number of HARQ processes** can represent a first configuration parameter, a second configuration parameter, or both (e.g., across first and second SPS configurations). APPLE-1003, ¶82.

Fakoorian-1’s “multiple downlink SPS configurations” can form a configuration set and “a mapping between the [SPS] configurations and the configuration set[] may be indicated to the UE **in an RRC configuration.**” APPLE-1004/APPLE-1008, ¶[0048]/¶[0047]. The SPS configurations of the mappings indicated in these RRC configuration messages include configuration parameters (e.g., at least a first configuration parameter) of those SPS configurations. APPLE-1003, ¶82. Thus, Fakoorian-1 provides an RRC message comprising at least a first configuration parameter of a first SPS configuration. *Id.*

First configuration parameter indicating a first HARQ codebook identifier

In the combination, Fakoorian-1’s “HARQ process number” provides at least one example of the first configuration parameter indicating a first HARQ codebook identifier. APPLE-1003, ¶83. The number of HARQ processes of the first SPS configuration is a configuration parameter that indicates a HARQ codebook

identifier. *Id.* For example, Fakoorian-1's "HARQ process number" is "used to indicate which [SPS] configuration(s) are to be" released, and Fakoorian-1's UE acknowledges the "release by transmitting the acknowledgement in a **codebook** through a physical uplink control channel (PUCCH) resource." APPLE-1004/APPLE-1008, ¶¶[0043]/[0042], [0058]/[0057].

Specifically, the HARQ process number comprises a "bit sequence" of "4 bits" that indicates a HARQ index "used to activate or **release** the corresponding [SPS] configuration." *Id.*, ¶[0057]/¶[0056].

From at least these descriptions, it would have been apparent and obvious to a POSITA, based on Fakoorian-1, that the HARQ process number indicates an identifier for the HARQ codebook to be used by the UE to transmit the acknowledgment. APPLE-1003, ¶84; *see infra*, Ground 1, Analysis of Limitation [1i] (incorporated here).

[1e]

The Fakoorian-1-Takahashi combination provides a second configuration parameter of a second SPS configuration, indicating a second HARQ codebook identifier. APPLE-1003, ¶¶85-96.

A second configuration parameter of a second SPS configuration

The combination renders obvious "multiple downlink SPS configurations"

associated with its UE, and provides at least a first SPS configuration and a second SPS configuration, as claimed. APPLE-1004/APPLE-1008, ¶[0048]/¶[0047]; APPLE-1003, ¶86; *supra* Analysis at Limitation [1d]. Indeed, Fakoorian-1 expressly describes the “UE has **16 downlink SPS configurations**,” providing at least the first and second SPS configurations (*i.e.*, two of the 16 downlink SPS configurations). APPLE-1004/APPLE-1008, ¶[0049]/¶[0048]; APPLE-1003, ¶86. Fakoorian-1’s second SPS configuration comprises configuration parameters such as “**periodicity**,” “**CS-RNTI**,” “**HARQ process number**,” and “**a codepoint that indicates a [] configuration index**.” APPLE-1004/APPLE-1008, ¶¶[0047]/[0046], [0053]/[0052], [0057]/[0056]; APPLE-1003, ¶86; *supra*, Analysis of Limitation [1d].

Second configuration parameter indicating a second HARQ codebook identifier that is the same as the first HARQ codebook identifier

In the combination, the “HARQ process number” of the second SPS configuration, in accordance with Fakoorian-1, provides at least one example of the second configuration parameter indicating a second HARQ codebook identifier. APPLE-1003, ¶87. Indeed, at least the number of HARQ processes of the second SPS configuration is a second configuration parameter that indicates a HARQ codebook identifier. *Id.* In the combination, the “HARQ process number” indicates which SPS configurations are to be released, and the UE acknowledges

the “release by transmitting the acknowledgement in a **codebook** through a physical uplink control channel (PUCCH) resource.” APPLE-1004/APPLE-1008, ¶¶[0043]/[0042], [0058]/[0057].

Notably, Fakoorian-1 provides Limitation [1e] according to Patent Owner’s interpretation asserted in its amended complaint in the co-pending litigation: “[i]f a state is mapped to multiple SPS configurations, each of these SPS configurations is configured with the same HARQ-codebookID.” See APPLE-1007, ¶311 (citing “TS 38.331 V16.5.0, Section 6.3.2”); APPLE-1003, ¶88.

311. For example, the Accused Products comprise a second configuration parameter of a second SPS configuration, indicating a second HARQ codebook identifier, wherein the second HARQ codebook identifier is the same as the first HARQ codebook identifier.

– SPS-Config

The IE *SPS-Config* is used to configure downlink semi-persistent transmission. Multiple Downlink SPS configurations may be configured in one BWP of a serving cell.

SPS-Config ::= SEQUENCE (
...
harq-CodebookID-r16 INTEGER (1..2)
OPTIONAL, -- Need R
...
harq-CodebookID

Indicates the HARQ-ACK codebook index for the corresponding HARQ-ACK codebook for SPS PDSCH and ACK for SPS PDSCH release. 282

sps-ConfigDeactivationStateList

Indicates a list of the deactivation states in which each state can be mapped to a single or multiple SPS configurations to be deactivated, see clause 10.2 in TS 38.213 [13]. If a state is mapped to multiple SPS configurations, each of these SPS configurations is configured with the same *harq-CodebookID*. 283

APPLE-1003, ¶88 (APPLE-1007, ¶311 (annotated))

Fakoorian-1 describes a state that is mapped to multiple SPS configurations such that each of those SPS configurations is configured with the same HARQ

codebookID. APPLE-1003, ¶89. For example, Fakoorian-1 indicates the “bit sequence may be a codepoint that indicates a particular configuration index,” and this particular configuration index is used to jointly “release all members of a [SPS] configuration set that includes the particular configuration index as a member.” APPLE-1004/APPLE-1008, ¶[0047]/¶[0046].

The “UE may identify a codepoint from the bit sequence,” where “the codepoint” “correspond[s] to a configuration index associated with a particular” SPS configuration to be released. *Id.* The UE can jointly “release each” “**SPS configuration that is a member of the same set as the particular**” “SPS configuration corresponding to the codepoint indicated in the bit sequence.” *Id.* The binary value(s) of the bit sequence indicates a release state (or “deactivation states”) of the SPS configurations to be jointly released, which also indicates that “a state is mapped” to those SPS configurations. APPLE-1003, ¶90; APPLE-1007, ¶311; *see* APPLE-1001, 49:31-47 (“first HARQ codebook identifier, indicated by the first SPS configurations, and the second HARQ codebook identifier, indicated by the second SPS configurations, **may be the same** in response to the first SPS configuration (first SPS **configuration index**) and the second SPS configuration (second SPS **configuration index**) being associated **with the same SPS deactivation state**”).

From at least these descriptions, a POSITA would have recognized that

Fakoorian-1 provides a state that is mapped to multiple SPS configurations, such that each of those SPS configurations is configured with the same HARQ codebookID. APPLE-1003, ¶91. Thus, according to Patent Owner's interpretation of Limitation [1e], as stated in its amended complaint Fakoorian-1 discloses Limitation [1e]. *See* APPLE-1007, ¶¶309-311.

Even if Fakoorian-1 did not expressly describe Limitation [1e] (which it does), a POSITA would have additionally found it obvious to configure Fakoorian-1's RRC messaging to convey, and its UE to receive, a configuration parameter of a second SPS configuration that indicates the same HARQ codebook identifier as the one indicated by the first configuration parameter of the first SPS configuration, in accordance with Takahashi's teachings. APPLE-1003, ¶¶93-96; *supra*, IV.A.3 (Predictable Fakoorian-1-Takahashi combination).

Beyond Fakoorian-1's express disclosure, Limitation [1e] is additionally provided in the combined system (and UE) based on Takahashi's teachings. Takahashi discloses "multiple SPS settings (SPS settings 1 to 4)" and "[p]arameters (the SPS period, etc.) of each SPS setting **may be the same as** or different from each other." APPLE-1006, ¶[0063]. Takahashi therefore provides at least first and **second SPS configurations** (*e.g.*, first and **second SPS settings** among its "multiple SPS settings") as well as first and **second configuration parameters** (*e.g.*, its "[p]arameters" "of each SPS setting"). *Id.*; *infra* §IV.A.2

(“Takahashi’s SPS settings disclose/include at least the SPS configurations, and corresponding configuration parameters, of the Challenged Claims”); APPLE-1003, ¶94. To be clear, Takahashi’s multiple SPS settings provide the first and second SPS configurations and its parameters (of each SPS setting) that **may be the same** provides the first and second configuration parameters. APPLE-1003, ¶94.

Takahashi describes the UE determines which “**HARQ-ACK codebook to use**” “based on at least one of an SPS index, the SPS period, etc.,” *i.e.*, a configuration parameter. *Id.*, ¶[0062]; APPLE-1003, ¶95. The Fakoorian-1-Takahashi combination’s UE would have received one or more RRC messages comprising a configuration parameter of a second SPS configuration that indicates a HARQ codebook identifier that is the same as the HARQ codebook identifier indicated by the first parameter of the first SPS configuration, in accordance with Takahashi’s teachings. Indeed, each of Fakoorian-1 and Takahashi discloses using RRC (*e.g.*, RRC configuration, messages, or signaling) to establish SPS configurations at the UE. APPLE-1003, ¶¶95-96; *see* APPLE-1004/APPLE-1008, ¶¶[0038]/¶[0037]-[0040]/¶[0039]; APPLE-1006, ¶¶[0020], [0022], [0038], [0061]-[0063]. And Fakoorian-1 teaches its HARQ index is “associated with the individual [SPS] configuration to be activated **or released**.” APPLE-1004/APPLE-1008, ¶[0070]/¶[0069].

[1f]

Fakoorian-1-Takahashi renders obvious a third configuration parameter indicating **a state** that is mapped to the first and second SPS configurations.

APPLE-1003, ¶¶97-104; *see infra*, Ground 1, Analysis of Limitation [1g] (incorporated here)..

Fakoorian-1 describes a third configuration parameter (e.g. “configuration index” (or “configuration set”)). APPLE-1004/APPLE-1008, ¶[0047]/¶[0046] (“bit sequence may be a codepoint that indicates a particular **configuration index (e.g., an index associated with ... a particular SPS configuration)**”); APPLE-1003, ¶98. The configuration index is also included in an RRC configuration message received by its UE that includes one (e.g., a single) configuration set. APPLE-1004/APPLE-1008, ¶[0055]/¶[0054]; (“mapping between configurations and one ... configuration set[]”). APPLE-1003, ¶¶98-99. For example, Fakoorian-1 describes “mapping between configurations” and one configuration set “may be **RRC configured** (e.g., based on service type, periodicity, MCS, time offset, and/or the like),” and its “configuration set may be associated with an index.” APPLE-1004/APPLE-1008, ¶[0055]/¶[0054]; APPLE-1003, ¶¶98-99. This establishes the “configuration index” (or “configuration set”) as “a third configuration parameter” that would have been included in the RRC configuration messages provided to Fakoorian-1’s UE. APPLE-1003, ¶¶98-100.

In accordance with Fakoorian-1's description, the "configuration index" indicates a "release" state that is mapped to Fakoorian-1's SPS configurations, which are associated with its configuration index. APPLE-1003, ¶¶99-101; *see* APPLE-1004/APPLE-1008, ¶¶[0047]/¶¶[0046]. For example, Fakoorian-1 describes the "**configuration index**" is "used as a proxy to jointly" "release all members of a configuration set that includes the particular configuration index as a member." APPLE-1004/APPLE-1008, ¶¶[0047]/¶¶[0046]. Thus, in accordance with Fakoorian-1's description, the configuration index: i) corresponds to a single configuration set; ii) may be a member of the configuration set, which includes individual SPS configurations (*e.g.*, a first & second SPS configuration); and iii) indicates "a state" (*i.e.*, **release**) that is mapped to those SPS configurations (*e.g.*, the first & second SPS configurations) in the configuration set. APPLE-1003, ¶101; *see* APPLE-1004/APPLE-1008, ¶¶[0049]/¶¶[0048], FIG. 3.

Fakoorian-1's Fig. 3 (reproduced below) includes a bit sequence (or codepoint) indicating "a configuration [set] with index '0110' is to be" "**released.**" APPLE-1004/APPLE-1008, ¶¶[0049]/¶¶[0048]. The UE can identify all SPS configurations that are members of a configuration set, and **the identified SPS configurations** may be **jointly "released."** APPLE-1004/APPLE-1008, Fig. 3, ¶¶[0052]/¶¶[0051]. For example, Fakoorian-1 describes the UE identifies the "SPS configuration with the index '0110'" and jointly "**release[s] all members of the**

configuration set that includes the” “SPS configuration with the index ‘0110’ as a member.” *Id.*, ¶¶[0049]/¶[0048].

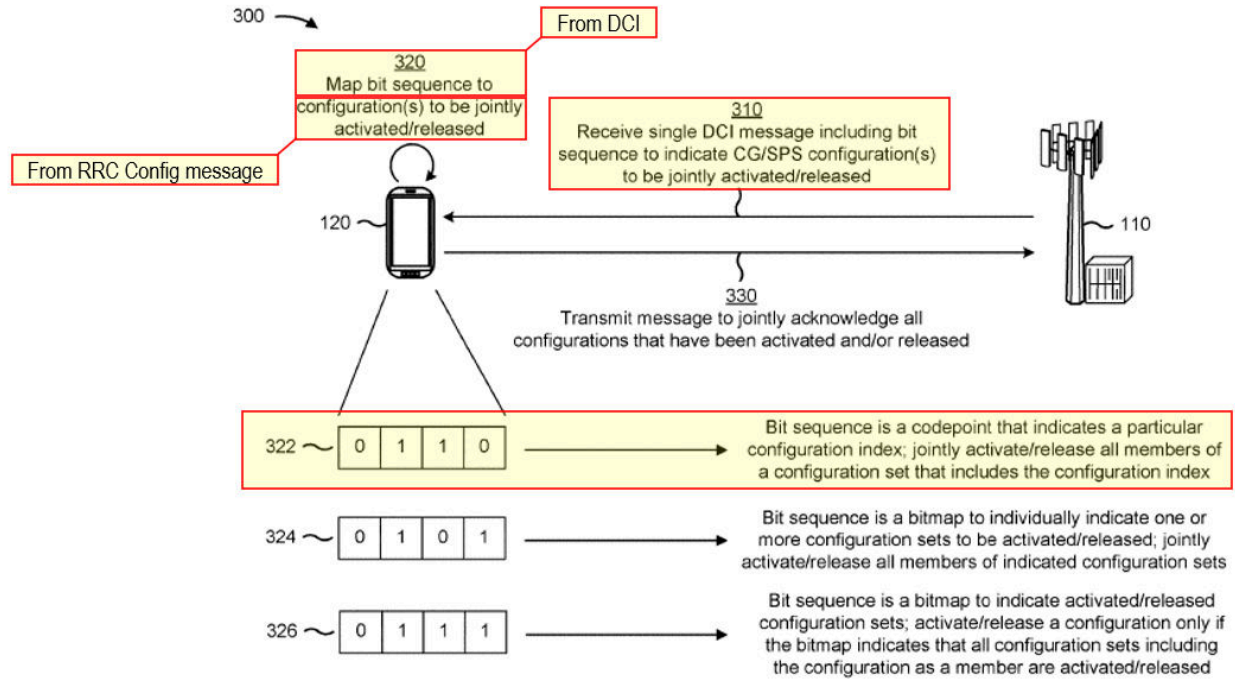


FIG. 3

APPLE-1003, ¶102 (APPLE-1004/APPLE-1008, Fig. 3 (annotated))

Specifically, Fakoorian-1 describes that a configuration set comprising 4 members (*i.e.*, 4 SPS configurations), and the configuration index ‘0110,’ may be jointly released based on the index ‘0110’ being a member of the configuration set. APPLE-1004/APPLE-1008, ¶¶[0049]/¶[0048]. All members of a configuration set may be jointly released when “an individual configuration index within that configuration set is to be” “released.” *Id.* The configuration index is used as a proxy to represent all members (*i.e.*, SPS configurations) of the corresponding configuration set. *Id.*; APPLE-1003, ¶¶103-104. Thus, Fakoorian-1-Takahashi

renders obvious “**a state** that is mapped to the” first and second SPS configurations, as claimed.

[1g]

The Fakoorian-1-Takahashi combination receives a DCI, wherein a value of one or more bits of a HARQ process number field of the DCI indicates the state mapped to the SPS configurations. APPLE-1003, ¶¶105-108.

For example, in the combination, the UE “**receiv[es] a single** downlink control information (**DCI**) **message**” and “a bit sequence in the single DCI message” is “**mapp[ed] ... to a configuration set that includes multiple downlink semi-persistent scheduling configurations**” to be jointly released. APPL E-1004/APPLE-1008, ¶[0036]/¶[0035]. The bit sequence is a 4-bit field corresponding to the HARQ process number field. *Id.*, ¶¶[0057]/[0056] (“a HARQ process number, which is a 4-bit field;” “field for the HARQ process number has 4 bits”); [0078]/[0077] (“bit sequence is provided in a HARQ process number field of the DCI message”). *See* APPLE-1003, ¶106.

Fakoorian-1 describes “**existing DCI field (e.g., a HARQ process number)**” is “**used to indicate** which [SPS] configuration(s) are to be [...] released.” APPLE-1004/APPLE-1008, ¶[0043]/¶[0042]. This describes a DCI that is received at the UE, as claimed. APPLE-1003, ¶107. And Fakoorian-1’s

indication of “release[]” (or deactivation) corresponds to the “state” indicated by the one or more bits of the HARQ process number. *Id.* For example, Fakoorian-1 describes the “bit sequence is provided in a **[HARQ] process number field of the single DCI message.**” APPLE-1004/APPLE-1008, cl. 3/APPLE-1008, cl. 11; APPLE-1003, ¶¶107-108.

[1h]

The Fakoorian-1-Takahashi combination renders obvious deactivating the first and second SPS configurations in response to receiving the DCI. APPLE-1003, ¶¶109-112. For example, in the combination UE receives a single DCI message, and “**based on the single DCI message,**” the UE transmits a HARQ acknowledgement, or a location of an acknowledgement bit in the codebook, which is an individual bit used to acknowledge all SPS configurations that were released. APPLE-1004/APPLE-1008, Abstract, ¶¶[0006]/[0005], [0059]/[0058]; APPLE-1003, ¶110.

In the combination, Fakoorian-1’s FIG. 3, and its related description, describe joint release for multiple semi-persistent scheduling configurations. APPLE-1004/APPLE-1008, ¶[0015]/¶[0014]; APPLE-1003, ¶111. The UE uses “a single DCI message to jointly” “release multiple downlink SPS configurations.” APPLE-1004/APPLE-1008, ¶[0042]/¶[0041]. This provides the deactivate (or

release) of the first SPS configuration and the second SPS configuration in response to receiving the DCI, as claimed. APPLE-1003, ¶¶111-112.

The UE may also transmit “a message to jointly acknowledge all” “SPS configurations that were” “**released by the single DCI message.**” APPLE-1004/APPLE-1008, ¶[0058]/¶[0057]. Fakoorian-1 describes “all the members of a configuration set are” “**jointly released based on the codepoint and/or bitmap indicated in the single DCI message.**” *Id.*, ¶[0055]/¶[0054]. For example, as shown by reference number 322 of Fakoorian-1’s FIG. 3 (reproduced below), “the bit sequence is a codepoint that indicates a particular configuration index” and the **DCI** causes the UE to “jointly []release all members of a configuration set that indicates the configuration index.” *Id.*, FIG. 3; *see* APPLE-1003, ¶112.

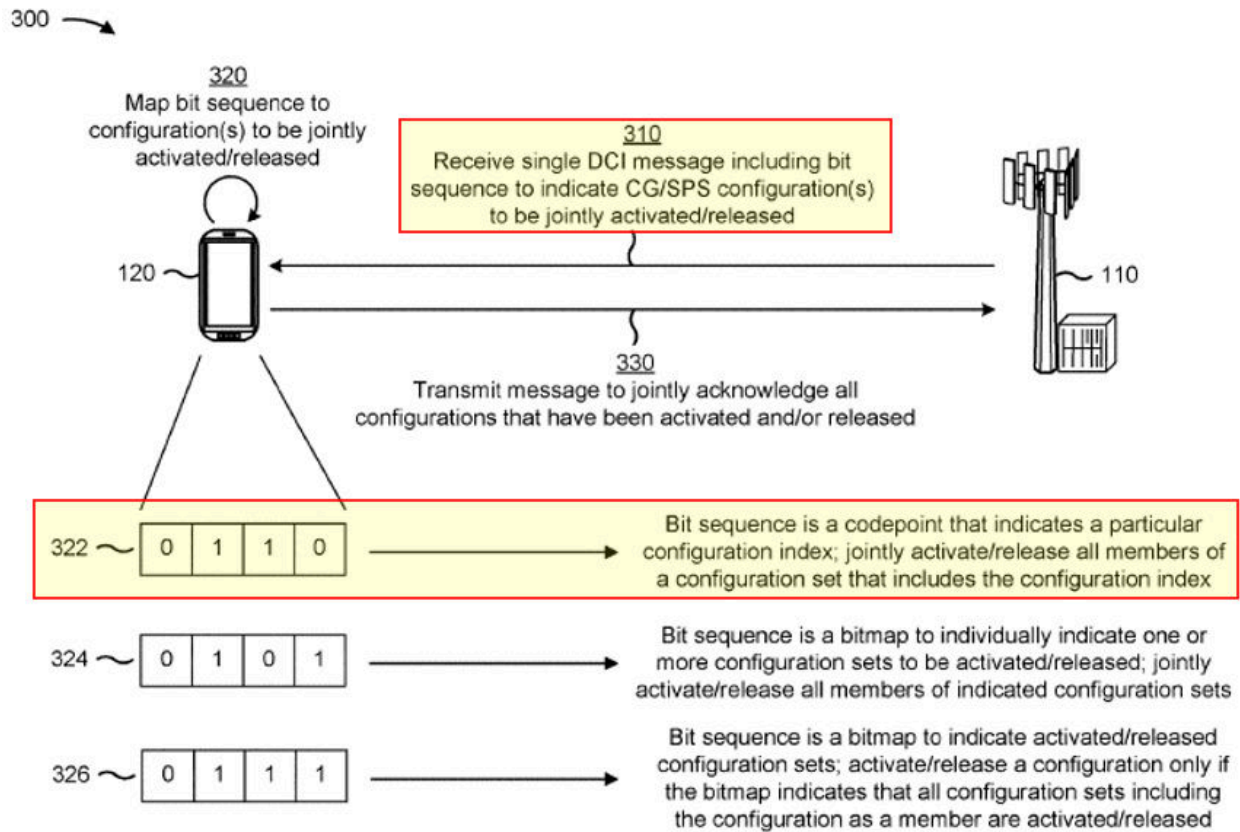


FIG. 3

APPLE-1003, ¶112 (APPLE-1004/APPLE-1008, Fig. 3 (annotated))

[1i]

The Fakoorian-1-Takahashi combination renders obvious [1i]. APPLE-1003, ¶¶113-117.

For example, Fakoorian-1 states that “in the case of an SPS configuration that is [] **released**, the UE may acknowledge the [] **release** by **transmitting the acknowledgement** in a codebook through a physical uplink control channel (PUCCH) resource.” APPLE-1004/APPLE-1008, ¶[0058]/¶[0057]. Indeed, Fakoorian-1 describes UE “transmit[s], to the BS, a message to jointly

acknowledge all” “SPS configurations that were” “**released by the single DCI message.**” *Id.* This provides the transmit of the acknowledgement, as claimed. APPLE-1003, ¶114; *see* ¶¶115-117.

[2a]

The Fakoorian-1-Takahashi combination renders obvious [2a]. APPLE-1003, ¶¶118-122. Fakoorian-1 and Takahashi each describe deactivating/releasing resources of a first and second SPS configuration. APPLE-1003, ¶119. For example, Fakoorian-1 describes jointly “releasing **multiple** downlink SPS configurations” using a single DCI message as a way to “conserve network **resources**, base station **resources**, UE **resources**” relative to current approaches that use multiple DCIs. APPLE-1004/APPLE-1008, ¶[0043]/¶[0042]. A POSITA would have known that these resources include channel resources, such as time/frequency resource allocations, that include an SPS PDSCH resource for a given SPS configuration. APPLE-1003, ¶119.

When Fakoorian-1’s SPS configurations are individually released, “a location of the acknowledgement bit in the codebook is associated with the physical downlink shared channel (PDSCH)” resource corresponding to the individually “**released SPS configuration (e.g., based on a time domain resource allocation (TDRA) table).**” APPLE-1004/APPLE-1008, [0059]/[0058]. Fakoorian-1 describes “SPS PDSCH release” “for a corresponding SPS PDSCH

reception,” including a “PDSCH reception occasion of the SPS configuration.” *Id.*, [0062]/[0061]. A POSITA would have recognized that PDSCH is a resource allocation (*e.g.*, time/frequency resource) to a UE for conveying user data to the UE. APPLE-1003, ¶120; *see* ¶¶121-122. Fakoorian-1’s “SPS PDSCH release” therefore provides deactivating (or releasing) resources associated with multiple SPS configurations, which would include resources of at least a first and second SPS configuration. *Id.*, ¶120.

[2b]

The Fakoorian-1-Takahashi combination renders obvious deactivating (*i.e.*, releasing) resources associated with the first and second SPS configurations. APPLE-1003, ¶¶118-123. *Supra*, Analysis of Limitation [2a] (incorporated here).

[3a]

The Fakoorian-1-Takahashi renders obvious provides a DCI comprising the PDSCH-to-HARQ feedback timing field. APPLE-1003, ¶¶124-126; *supra*, Analysis of Limitation [1g].

Takahashi provides the PDSCH-to-HARQ feedback timing field that would have been included in Fakoorian-1’s DCI received at the combination’s UE. For example, Takahashi’s “PDSCH-to-HARQ feedback timing corresponds to a timing indicating field for a HARQ corresponding to the PDSCH.” APPLE-1006,

¶[0053]. For example, Takahashi explicitly discloses a **“PDSCH-to-HARQ feedback timing indicator included in”** its DCI. *Id.*, ¶[0055]. Further, Takahashi states that the **“PDSCH-to-HARQ feedback timing indicator”** is **“included in the DCI format 1_1.”** *Id.*

Modifying Fakoorian-1’s DCI to include Takahashi’s PDSCH-to-HARQ feedback timing field would have merely involved application of known techniques (Takahashi’s “timing indicating field for a HARQ corresponding to the PDSCH”) to known layer 1 control channel messaging techniques (Fakoorian-1’s DCI) ready for improvement to yield predictable results. APPLE-1003, ¶126. Indeed, a POSITA would have recognized that Fakoorian-1 describes timing concepts that correspond to Takahashi’s PDSCH-to-HARQ feedback timing field. *Id.*

[3b]

The Fakoorian-1-Takahashi combination renders obvious a value of the timing field indicates a time duration between the DCI and the acknowledgement. APPLE-1003, ¶¶127-128; *supra*, Analysis of Limitation [3a] (incorporated here).

Takahashi describes the value that indicates the time duration between the DCI and the acknowledgement. APPLE-1003, ¶128. For example, Takahashi’s **“PDSCH-to-HARQ feedback timing, K_1 ,”** is **“specified by the [] DCI.”** APPLE-1006, ¶[0050]. Takahashi’s “PDSCH-to-HARQ feedback timing corresponds to a **timing indication field** for a HARQ corresponding to the PDSCH” and “[w]hen

the last slot that has received the PDSCH is **defined as n**, the UE may **transmit the HARQ-ACK** corresponding to the PDSCH **in an $n+K_1$ slot**. *Id.*, ¶[0050].

Takahashi's value of the K_1 field in the DCI provides the claimed "value of the PDSCH-to-HARQ feedback timing field." APPLE-1003, ¶128. And, Takahashi's " $n+K_1$ slot" indicates a time duration between the DCI and the acknowledgement (*i.e.*, HARQ-ACK), as stated in Limitation [3b]. APPLE-1003, ¶128. A POSITA would have found apparent and obvious that the determined value of the number of slots indicates a time duration between the DCI and the acknowledgement. APPLE-1003, ¶128.

[4]

The Fakoorian-1-Takahashi combination renders obvious determining a timing of the acknowledgement based on a first timing of the DCI and the value of the PDSCH-to-HARQ feedback timing field. APPLE-1003, ¶¶129-131; *supra*, Analysis of Limitations [3a], [3b] (incorporated here).

For example, Takahashi discloses that "[w]hen the last slot that has received the PDSCH is **defined as n**, the UE may **transmit the HARQ-ACK corresponding to the PDSCH in an $n + K_1$ slot**." APPLE-1006, ¶[0053].

Takahashi's "PDSCH in [the] $n + K_1$ slot" teaches the claimed "first timing of the DCI." APPLE-1003, ¶¶130-131. And Takahashi's "PDSCH-to-HARQ feedback timing may be referred to as the PDSCH-to-HARQ-ACK feedback timing," which

corresponds to the determined timing of the acknowledgement. APPLE-1006, ¶[0053]; APPLE-1003, ¶¶130-131. Indeed, Takahashi's Fig. 4 embodiment (reproduced below) discloses a timing of the acknowledgement based on a first timing of the DCI corresponding to the release of SPS PDSCH #1. APPLE-1006, Fig. 4; APPLE-1003, ¶131.

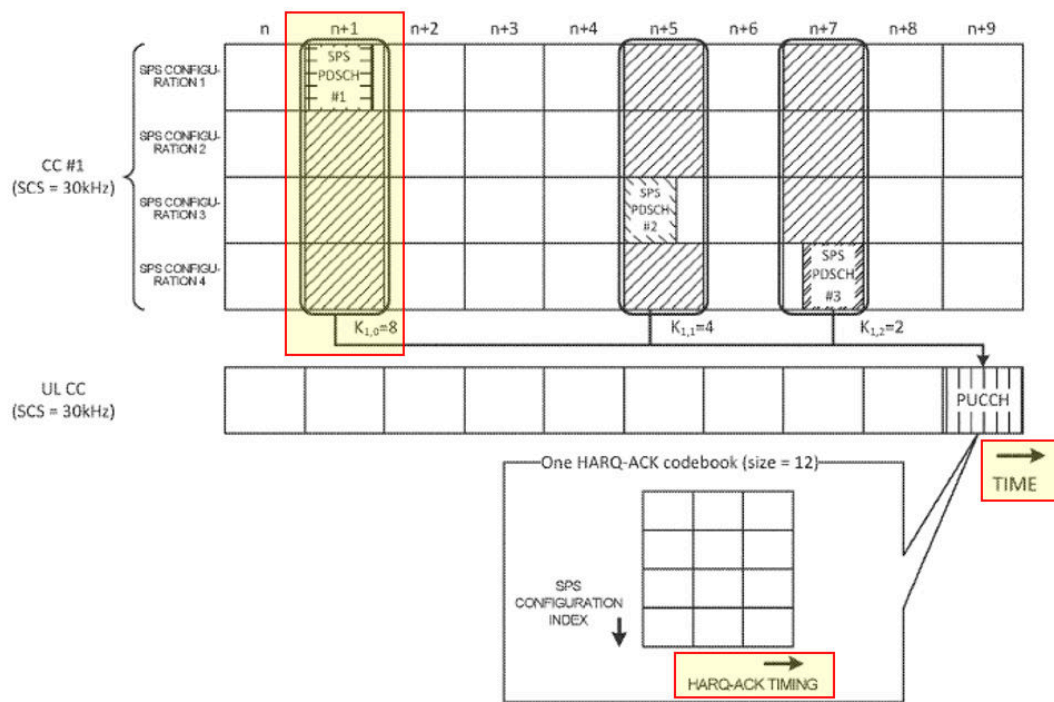


FIG. 4

APPLE-1003, ¶131 (APPLE-1006, Fig.4 (annotated))

[5a]

The Fakoorian-1-Takahashi combination's first HARQ codebook identifier indicates a first HARQ feedback codebook for transmission of an acknowledgement associated with releasing the first SPS configuration. APPLE-1003, ¶132; *supra*, Analysis of Limitations [1d], [1e] (incorporated here).

Fakoorian-1 describes that, for “an SPS configuration” that is released, the UE “acknowledge[s] the release by transmitting the acknowledgement in a codebook.” APPLE-1004/APPLE-1008, ¶¶[0058]/¶[0057]. Fakoorian-1 notes that different techniques can “be used to transmit the acknowledgement and/or the location of the acknowledgement bit in the codebook” when “multiple SPS configurations” are jointly released. *Id.*, ¶[0059]/¶[0058]; APPLE-1003, ¶133. *[5b]*

The Fakoorian-1-Takahashi combination’s second HARQ codebook identifier indicates a second HARQ feedback codebook for transmission of an acknowledgement associated with releasing the second SPS configuration. APPLE-1003, ¶134; *supra*, Analysis of Limitations [1e], [5a] (incorporated here).

For example, Takahashi’s “HARQ-ACK codebook” transmitted using the PUCCH can include “a HARQ-ACK bit” that is “disposed between a HARQ-ACK bit corresponding to one SPS PDSCH and a HARQ-ACK bit corresponding to another SPS PDSCH.” APPLE-1006, ¶[0146]. Takahashi confirms that each HARQ-ACK bit can be a “HARQ-ACK bit corresponding to [an] SPS release.” *Id.*; APPLE-1003, ¶135. Thus, in this example, the “one SPS PDSCH” is a first SPS configuration to be released, whereas the “another SPS PDSCH” is a second SPS configuration to be released. APPLE-1003, ¶135.

Takahashi indicates that “**the SPS, an SPS PDSCH, the SPS setting, an SPS**

occasion, SPS reception, **SPS PDSCH reception**, SPS scheduling, etc.” generally refer to the same overall SPS configuration concept and may be used interchangeably. APPLE-1006, ¶[0015]; APPLE-1003, ¶136; *infra* §IV.A.2.

[5c]

Supra, Analysis of Limitations [1e], [5a], [5b] (incorporated here). APPLE-1003, ¶137.

[6]

Fakoorian-1-Takahashi renders obvious Claim [6]. APPLE-1003, ¶¶138-141; *supra*, Analysis of Limitation [1f] (incorporated here).

Fakoorian-1 discloses a “state” that corresponds to a “bit sequence” or “bitmap” in a DCI message. APPLE-1004/APPLE-1008, ¶¶[0048]/[0047], [0052]/[0051]; APPLE-1003, ¶139. For example, Fakoorian-1’s UE “identif[ies] a codepoint from the bit sequence in the single DCI message.” APPLE-1004/APPLE-1008, ¶¶[0048]/[0047]. The codepoint “correspond[s] to a **configuration index**,” or multiple configuration indexes, associated with a particular SPS configuration to be released. *Id.* Fakoorian-1’s UE may **jointly release each “SPS configuration that is a member of the same set as the particular ... SPS configuration corresponding to the codepoint indicated in the bit sequence of the single DCI message.”** *Id.*; APPLE-1003, ¶139.

Additionally, Fakoorian-1 discloses a “bitmap” with “4 bits to represent four individual configuration sets, each of which may have one or more members.” APPLE-1004/APPLE-1008, Fig., 3, ¶[0052]/¶[0051]. In Fakoorian-1’s Fig. 3, the bitmap includes the bit sequence ‘0101’ to indicate that the second and fourth configuration sets are to be” released, *e.g.*, based on the second and fourth bits being set to ‘1’. *Id.* The UE can identify: i) all “SPS configurations that are members of the second configuration set” and ii) all “SPS configurations that are members of the fourth configuration set.” APPLE-1004/APPLE-1008, Fig., 3, ¶[0052]/¶[0051]. The identified SPS configurations are jointly “released based on the bitmap in the single DCI message,” further confirming that the state (*e.g.*, release) is associated with a plurality of configuration indexes, as claimed. *Id.* APPLE-1003, ¶¶140-141.

[7]

The Fakoorian-1-Takahashi combination provides transmitting the acknowledgement in response to the DCI indicating release (or deactivation) of the first and second SPS configurations. APPLE-1003, ¶¶142-144; *supra*, Analysis of Limitation [1i] (incorporated here).

The UE receives a DCI message and, in response, transmits the acknowledgement, *e.g.*, via a codebook that includes an acknowledgement bit that

indicates SPS configurations for release. *Id.*; see APPLE-1004/APPLE-1008, [0058]-[0063]/[0057]-[0062]. For example, Fakoorian-1's "UE may transmit, to the BS, a message to jointly **acknowledge** all" "SPS configurations that were" "**released by the single DCI message.**" APPLE-1004/APPLE-1008, ¶[0058]/¶[0057]. For an SPS configuration that is released, Fakoorian-1's UE "**acknowledge[s] the ... release by transmitting the acknowledgement in a codebook.**" *Id.* A POSITA would have readily recognized that Fakoorian-1's transmitting of the acknowledgement would have been in response to its UE receiving the DCI, which is the indicator of the SPS configurations to be released. APPLE-1003, ¶¶143-144.

[8]

Fakoorian-1-Takahashi renders obvious Claim [8]. APPLE-1003, ¶¶145-147. For example, Fakoorian-1 describes a fourth configuration parameter indicating a CS-RNTI. APPLE-1003, ¶146. "[W]ith a downlink SPS configuration, RRC may define a periodicity of the configured downlink assignments while a PDCCH addressed to the CS-RNTI can activate and/or **release the configured downlink assignment** (e.g., a PDCCH addressed to the CS-RNTI may indicate that the **downlink assignment can be implicitly reused according to the periodicity defined by RRC until released**)." APPLE-1004/APPLE-1008, ¶[0053]/¶[0052]; APPLE-1003, ¶146.

The DCI is associated with the CS-RNTI. APPLE-1003, ¶147. For example, Fakoorian-1's "UE may be associated with multiple CS-RNTIs, and each CS-RNTI may correspond to a particular configuration set that contains one or more multiple configurations that can be jointly activated or released. In this way, **with multiple different CS-RNTIs, the bit sequence in the DCI that is used to jointly activate or release** uplink CG configurations, downlink SPS configurations, and/or the like may be reduced, thus achieving greater reliability." APPLE-1004/APPLE-1008, ¶[0054]/¶[0053]. This describes Fakoorian-1's DCI being associated with the CS-RNTI. APPLE-1003, ¶¶146-147.

[9a]

Fakoorian-1-Takahashi renders obvious [9a]. APPLE-1003, ¶¶148-150.

Each of Fakoorian-1 and Takahashi discloses a UE that receives an activation DCI. APPLE-1004/APPLE-1008, ¶[0040]/¶[0039] ("DCI message activates ... the downlink SPS configuration"); APPLE-1006, ¶[0016] ("[t]he DCI for activating ... the SPS setting may be referred to as SPS activation DCI"); APPLE-1003, ¶149. And each of Fakoorian-1 and Takahashi discloses that activation of resources associated with an SPS configuration involves activation of DL SPS resources of that configuration, including SPS PDSCH and PUSCH/PUCCH (*e.g.*, UL grant). APPLE-1004/APPLE-1008, ¶¶[0058]/[0057]-

[0061]/[0060]; APPLE-1006, ¶¶[0066], [0167] (“the DCI for scheduling the PDSCH may be referred to as DL assignment” and “the DCI for scheduling the PUSCH may be referred to as UL grant”); APPLE-1003, ¶149.

Takahashi describes “SPS PDSCH associated with the activation DCI” means “the first SPS PDSCH to be activated (triggered) by the activation DCI.” APPLE-1006, ¶[0026]. Takahashi notes that “**SPS PDSCH**,” “**SPS setting**,” and “**SPS PDSCH reception**” refer to the same overall SPS configuration concept and may be used interchangeably. *Id.*, ¶[0015]; APPLE-1003, ¶150; *infra* §IV.A.2 (“Takahashi’s SPS settings disclose/include at least the SPS configurations, and corresponding configuration parameters, of the Challenged Claims”).

[9b]

The Fakoorian-1-Takahashi combination receives a second activation DCI indicating activation of resources associated with the second SPS configuration. APPLE-1003, ¶¶151-152; *supra* Analysis at Limitation [9a].

In the combination, Takahashi provides the instruction and processor-based UE function of receiving a second activation DCI indicating activation of a second plurality of resources associated with the second SPS configuration. APPLE-1003, ¶152. For example, Takahashi’s express disclosure of “**second and subsequent SPS PDSCHs activated by the activation DCI**” provides the second activation

DCI indicating activation of resources associated with the second SPS configuration. APPLE-1006, ¶[0027].

[10]

Fakoorian-1-Takahashi renders obvious Claim 10. APPLE-1003, ¶¶153-155; *see* Analysis at Limitations [1c]-[1f]. For example, Fakoorian-1 describes **“UE can be provided with multiple downlink SPS configurations for a given bandwidth part (BWP) of a serving cell,”** expressly indicating the first and second SPS configurations, which would have been among its multiple downlink SPS configuration, are for the bandwidth part of a cell, as claimed. APPLE-1004/APPLE-1008, ¶[0040]/¶[0039]. APPLE-1003, ¶154.

Fakoorian-1 further describes downlink SPS configurations are **“initially indicated in an RRC configuration,”** which is conveyed to the UE via one or more RRC messages. APPLE-1004/APPLE-1008, ¶[0040]/¶[0039]; APPLE-1003, ¶155. Fakoorian-1 therefore provides the RRC configuration messages that further comprise fourth configuration parameters, as claimed. APPLE-1003, ¶155.

[11a]

Supra, Analysis of Limitation [3a] (incorporated here). APPLE-1003, ¶156.

[11b]

Supra, Analysis of Limitation [3b] (incorporated here). APPLE-1003, ¶157.

[12]⁵

Supra, Analysis of Claim [4] (incorporated here). APPLE-1003, ¶158.

[13]

Supra, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶159.

[14a]

Supra, Analysis of Claim [5a] (incorporated here). APPLE-1003, ¶160.

[14b]

Supra, Analysis of Claim [5b] (incorporated here). APPLE-1003, ¶161.

[14c]

Supra, Analysis of Claim [5c] (incorporated here). APPLE-1003, ¶162.

[15]

Supra, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶163.

[16]

⁵ Claim 12 improperly requires both apparatus and method limitations. *IPXL Holdings, LLC v. Amazon.com, Inc.*, 430 F.3d 1377 (Fed. Cir. 2005). Yet, unpatentability of claim 12 can be determined here, because the prior art discloses both the apparatus and method limitations.

Supra, Analysis of Claim [6] (incorporated here). APPLE-1003, ¶164.

[17]

Supra, Analysis of Claim [7] (incorporated here). APPLE-1003, ¶165.

[18]

Supra, Analysis of Claim [8] (incorporated here). APPLE-1003, ¶166.

[19a]

Supra, Analysis of Limitation [9a] (incorporated here). APPLE-1003, ¶167.

[19b]

Supra, Analysis of Limitation [9b] (incorporated here). APPLE-1003, ¶168.

[20]

Supra, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶169.

B. GROUND 2A – Claims 1-20 are obvious over Fakoorian-2

1. Fakoorian-2

Fakoorian-2 is analogous art⁶ to the claimed invention of the '639 Patent and is directed to “[j]oint activation [and release] of multiple semi-persistent scheduling configurations in a single message.” APPLE-1005, Title/APPLE-1009, Title. Fakoorian-2’s UE is provided “multiple downlink SPS configurations ... for a

⁶ *Supra*, Ground 1, fn. 4.

given bandwidth part (BWP) of a serving cell.” *Id.*, 13:65-14:1/*Id.*, ¶[0052].

Fakoorian-2 configures SPS resources (*e.g.*, SPS configurations) at its UE via RRC signaling. APPLE-1003, ¶50. For example, Fakoorian-2 describes that “[t]o configure SPS resources, radio resource control (RRC) signaling may indicate an interval at with which the radio resources are periodically assigned.” APPLE-1005, 12:59-62/APPLE-1009, ¶[0048].

Fakoorian-2’s UE identifies “semi-persistent scheduling (SPS) configurations” to be jointly activated or released. *Id.*, cl. 1/*Id.*, cl. 1. Once the SPS configurations are activated, the UE “receive[s] DL data on the PDSCH for one or more of the activated SPS configurations during a first SPS reception.” *Id.*, 17:21-23/*Id.*, ¶[0065]. For each SPS configuration, the UE determines whether “the transmitted DL data was received and correctly decoded, and then transmit[s] HARQ feedback information to the base station [] on the PUCCH. The HARQ feedback information may include ACKs to acknowledge portions of the DL data that were received and correctly decoded.” *Id.*, 17:24-30/*Id.*, ¶[0065].

Fakoorian-2 discloses “jointly releasing multiple downlink SPS configurations” using a single DCI message. *Id.*, 14:51-53/*Id.*, ¶[0054].

Fakoorian-2’s single DCI message includes “an existing DCI field (*e.g.*, a HARQ process number)” that is “used to indicate which [SPS] configurations” are to be released, thereby avoiding a need to introduce a new DCI field to indicate which

configurations are to be released. *Id.*, 14:66-15:3, *see* 27:46-50/*id.*, ¶[0054], *see* ¶[00112]. Jointly “releasing multiple downlink SPS configurations” using a single DCI message can “conserve network resources, base station resources, and UE resources relative to current approaches that use multiple DCI messages to separately” release multiple DL SPS configurations. *Id.*, 14:51-58/*Id.*, ¶[0054].

Fakoorian-2’s different SPS configurations received by its “UE may be divided or otherwise grouped into different sets, and a bit sequence in a single DCI message can be used to indicate multiple SPS configurations” that are to be jointly released. *Id.*, 14:30-35/*Id.*, ¶[0053]. Fakoorian-2’s “bit sequence” includes a “codepoint that indicates an index associated with a particular SPS configuration” to be released, “and all SPS configurations ... that are members of the set that includes the particular SPS configuration” can be jointly “released by the single DCI message.” *Id.*, 14:36-42/*Id.*, ¶[0053].

Fakoorian-2’s UE “transmit[s] a hybrid automatic repeat request acknowledgement (HARQ-ACK)” based on the DCI message. *Id.*, Abstract/*Id.*, cl. 1, Fig. 8, Fig. 9. For example, the UE “transmit[s] a message (to the base station 402) that jointly acknowledges all SPS configurations” that were released by the DCI message. APPLE-1005, 16:66-17:3/*Id.*, ¶[0063]. For an SPS configuration that is released, the UE acknowledges the “release by transmitting the

acknowledgement in a codebook through a PUCCH resource.” APPLE-1005, 17:3-7/*Id.*, ¶[0063].

2. Application to Challenged Claims

[1pre]

Fakoorian-2 discloses a wireless device. For example, Fakoorian-2 relates to a “wireless communication system” that includes “a user equipment (UE).”

APPLE-1005, 1:19-23, Abstract/APPLE-1009, ¶[0001] (“wireless communication systems”), ¶[0006]. Fakoorian-2’s UE **“may also be referred to as ... a wireless device” or “a wireless communications device.”** *Id.*, 8:28-46/*Id.*, ¶[0031]; APPLE-1003, ¶170-171.

[1a]

Fakoorian-2 discloses one or more processors. For example, Fakoorian-2’s UE is a “wireless communication device” that includes “at least one modem,” **“at least one processor,”** and “at least one **memory communicatively coupled with the at least one processor.**” *Id.*, 3:1-5, cl. 15/*Id.*, Fig. 3, Fig. 13, cl. 24, ¶[0019]; APPLE-1003, ¶172.

[1b]

Fakoorian-2 discloses a memory storing instructions that are executable by the one or more processors. APPLE-1003, ¶173. For example, Fakoorian-2’s

“memory **may store instructions that, when executed by the at least one processor** ..., causes the wireless communication device to perform operations,” such as operations for jointly releasing multiple SPS configurations. APPLE-1005, 3:5-8/APPLE-1009, *see* ¶¶[0019], [0020], [00107]; cl. 25.

*[1c]*⁷

Fakoorian-2’s UE receives one or more RRC messages. APPLE-1003, ¶¶174-176; *infra*, Ground 2A, Analysis of Limitations [1d] and [1e] (incorporated here). For example, Fakoorian-2 configures SPS resources at its UE via RRC signaling, which includes the UE receiving one or more RRC messages from a base station. APPLE-1003, ¶174. In Fakoorian-2, “[t]o configure SPS resources” at its UE, “radio **resource control (RRC) signaling** may indicate an interval at with which the radio resources are periodically assigned.” APPLE-1005, 12:59-62/APPLE-1009, ¶[0048]. A POSITA would have recognized that RRC signalling conveys RRC messages. APPLE-1003, ¶174.

Fakoorian-2’s “[d]ownlink SPS resources ... are **configured by the RRC**,” and it would have been apparent and obvious to a POSITA that an RRC message

⁷ The “comprising” element is addressed more fully with reference to limitations *[1d]* and *[1e]*.

received by the UE would have been used to facilitate configuring the SPS resources at the UE. APPLE-1005, 13:23-24/APPLE-1009, ¶[0050]; APPLE-1003, ¶175. The UE's "controller/processor 359 provides **RRC layer functionality** associated with system information ... **acquisition, [and] RRC connections.**" APPLE-1005, 12:12-15/APPLE-1009, ¶[0044]. This corresponds to the UE receiving one or more RRC messages and an example system that facilitates this is indicated at Fakoorian-2's Fig. 3 embodiment (reproduced below).

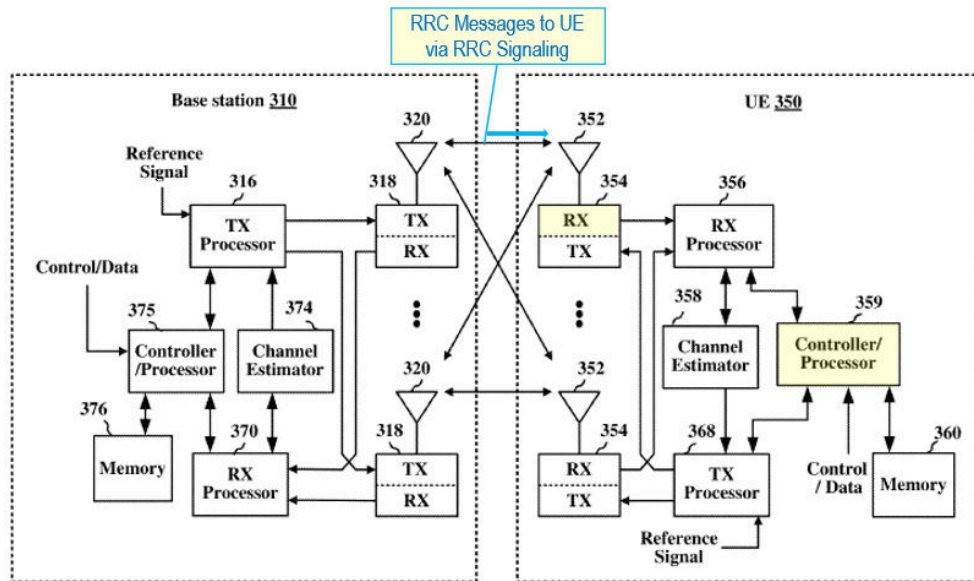


Figure 3

APPLE-1003, ¶175 (APPLE-1005/APPLE-1009, Fig. 3 (annotated))

[1d]

Fakoorian-2 discloses a first configuration parameter of a first semi-persistent scheduling (SPS) configuration that indicates a first HARQ codebook

identifier. APPLE-1003, ¶¶177-182; *see infra*, Ground 2A, Analysis of Limitation [1e] (incorporated here).

A first configuration parameter of a first SPS configuration

Fakoorian-2's Fig. 4 (reproduced below), and related descriptions, teaches a configuration parameter (e.g., transmission parameter) of at least a first SPS configuration. APPLE-1005, Fig. 4/APPLE-1009, Fig. 4; APPLE-1003, ¶178.

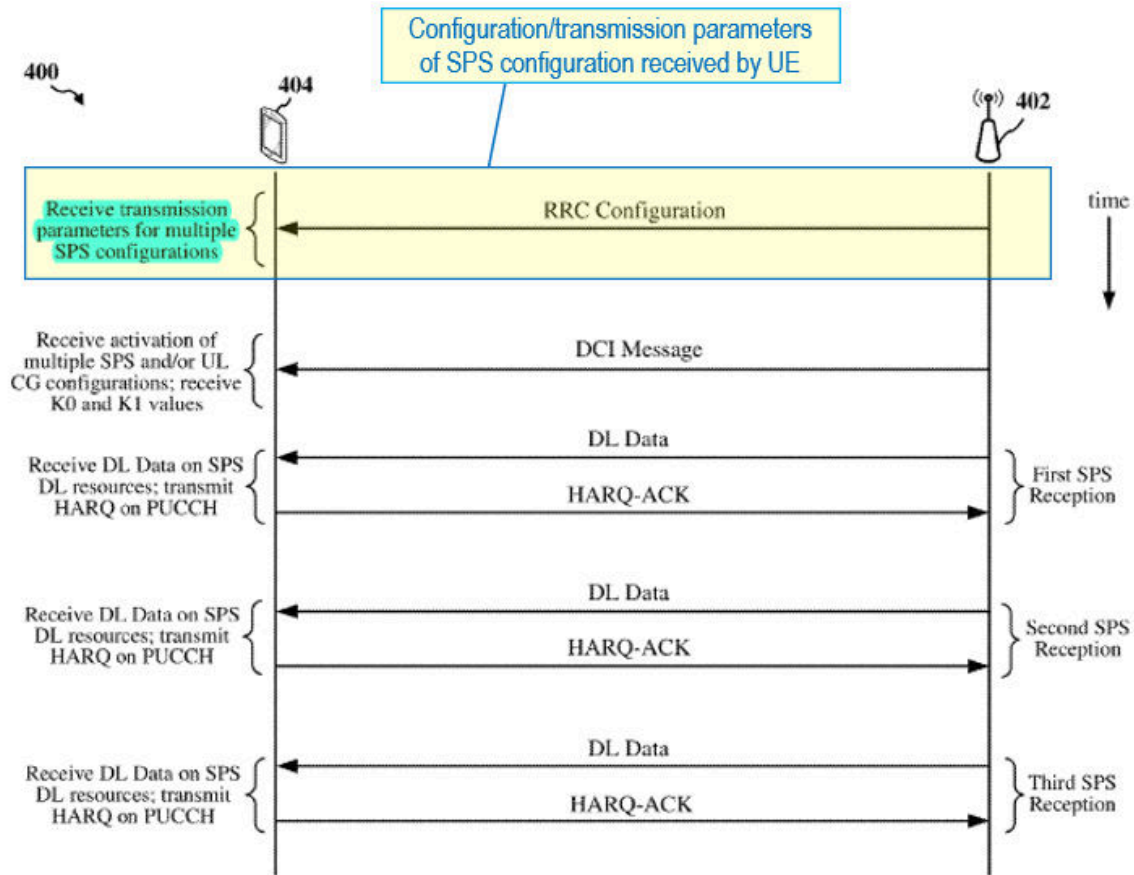


Figure 4

APPLE-1003, ¶178 (APPLE-1005, Fig. 4/APPLE-1009, Fig. 4 (annotated))

For example, as shown, Fakoorian-2's "UE 404" receives an "RRC Configuration" message comprising "transmission **parameters for multiple SPS configurations.**" APPLE-1005, Fig. 4/APPLE-1009, Fig. 4. Thus, Fakoorian-2 provides an RRC message comprising at least a first configuration parameter of a first SPS configuration. APPLE-1003, ¶179. For example, Fakoorian-2's "SPS1" is a first SPS configuration. *Id.*, Fig. 5; *Id.*, Fig. 5; APPLE-1003, ¶179. A POSITA would have recognized that Fakoorian-2's "transmission parameters" include the claimed first and second configuration parameters, which are conveyed to the UE in an RRC configuration message. APPLE-1003, ¶179; *see infra*, Ground 2A, Analysis of Limitation [1e].

First configuration parameter indicating a first HARQ codebook identifier

Fakoorian-2 discloses "the **CS-RNTI, the periodicity, the number of HARQ processes, [and] the PUCCH resources ... for the SPS configuration are [] indicated to the UE via RRC configuration.**" APPLE-1005, 13:40-43/APPLE-1009, ¶[0051]. To be clear, any one of Fakoorian-2's **CS-RNTI, periodicity, and number of HARQ processes** can represent a first configuration parameter, a second configuration parameter, or both (*e.g.*, across first and second SPS configurations). APPLE-1003, ¶180. Notably, this is consistent with the '639 Patent, which establishes each of these items as a configuration parameter of an SPS configuration. APPLE-1001, 33:12-15 ("DL SPS configuration may comprise

a first parameter indicating a periodicity, a second parameter indicating a number of HARQ processes associated with the DL SPS configurations”), *Id.*, 33:53-34:7 (“first DL SPS configuration parameters may indicate a *first periodicity* and/or a *first number of HARQ processes* and/or a *first configuration index*” and “second DL SPS configuration parameters may indicate a *second periodicity* and/or a *second number of HARQ processes* and/or a *second configuration index*”); APPLE-1003, ¶180.

In reviewing Fakoorian-2, a POSITA would have recognized that “the number of HARQ processes” is a configuration parameter indicating a HARQ codebook identifier (ID). APPLE-1003, ¶181. For example, Fakoorian-2’s HARQ “processes may be used to acknowledge reception of UL data and DL data transmitted on SPS resources.” APPLE-1005, 12:67-13:1/APPLE-1009, ¶[0048]. As explained by Dr. Mandayam, the number of HARQ processes represents a configuration that indicates at least an identifier for the HARQ codebook to be used by the UE to implement HARQ processes that include transmitting the acknowledgment. APPLE-1003, ¶¶181-182; *see infra*, Ground 2A, Analysis of Limitation [1i] (incorporated here).

[1e]

Fakoorian-2 discloses a second configuration parameter of a second semi-

persistent scheduling (SPS) configuration, with the second configuration parameter indicating a second HARQ codebook identifier that is the same as the first HARQ codebook identifier. APPLE-1003, ¶¶183-186; *supra*, Ground 2A, Analysis of Limitation [1d] (incorporated here).

A second configuration parameter of a second SPS configuration

In Fakoorian-2's Fig. 4, the UE receives an "RRC Configuration" message comprising "transmission **parameters for multiple SPS configurations.**" APPLE-1005, Fig. 4/APPLE-1009, Fig. 4. For example, Fakoorian-2 expressly describes "a first SPS configuration (SPS1) and a second SPS configuration (SPS2)." *Id.*, Fig. 5/*Id.*, Fig. 5; APPLE-1003, ¶184. Fakoorian-2's UE is provided with "**up to sixteen (16) different downlink SPS configurations,**" which are conveyed to the UE via one or more "RRC Configuration" messages. APPLE-1005, 13:65-14:3, *see* Fig. 4/APPLE-1009, ¶[0052], *see* Fig. 4; APPLE-1003, ¶184. Thus, Fakoorian-2 discloses at least a "first SPS configuration" and "second SPS configuration." APPLE-1003, ¶184.

Second configuration parameter indicating a second HARQ codebook identifier that is the same as the first HARQ codebook identifier

As discussed at Limitation [1d] (Ground 2A), any one of Fakoorian-2's **CS-RNTI, the periodicity, the number of HARQ processes** can represent a first and/or second configuration parameter. For example, Fakoorian-2's "**number of**

HARQ processes” represents a configuration parameter (*e.g.*, a second configuration parameter) of a second SPS configuration received by the UE via the RRC Configuration message. APPLE-1005, 13:40-43/APPLE-1009, ¶[0051]; APPLE-1003, ¶185. Again, this is consistent with descriptions of “configuration parameters” in the ’639 Patent. APPLE-1001, 37:33-37 (“Configuration parameters of a DL SPS may indicate **periodicity** and/or **number of HARQ processes** and/or **configuration index** and/or a group (*e.g.*, group of DL SPS configurations) identifier, etc.”); *supra*, Ground 2A, Analysis of Limitation [1d] (Ground 1) (incorporated here).

Indeed, a POSITA would have recognized “**the number of HARQ processes**” as a configuration parameter indicating a HARQ codebook identifier (ID). APPLE-1003, ¶186; APPLE-1001, 47:63-66 (“first HARQ codebook identifier may indicate a first HARQ codebook ... for transmission of HARQ feedback (HARQ ACK/NACK)”). Fakoorian-2’s UE “**may multiplex the HARQ feedback information for the first and second SPS configurations**” with **one codebook**. APPLE-1005, 21:44-46/APPLE-1009, ¶[0084]. As explained by Dr. Mandayam, reviewing Fakoorian-2, it would have been apparent to a POSITA that the second HARQ codebook identifier indicated by the second configuration parameter would have been the same as the first HARQ codebook identifier indicated by the first configuration parameters. APPLE-1003, ¶186.

[1f]

Fakoorian-2 teaches a configuration parameter indicating a **state** that is mapped to at least two (*e.g.*, first and second) SPS configurations. APPLE-1003, ¶¶187-192; *infra*, Ground 2A, Analysis of Limitation [1g] (incorporated here).

Fakoorian-2 configures SPS resources at its UE via RRC signaling, which defines a third configuration parameter represented by “CS-RNTI.” APPLE-1003, ¶188. Specifically, Fakoorian-2’s “CS-RNTI” that is “associated with multiple downlink SPS configurations” provides the third configuration parameter. *Id.*; APPLE-1005, 15:4-5/APPLE-1009, ¶[0055]. For example, Fakoorian-2 provides one CS-RNTI (*e.g.*, a single CS-RNTI) that corresponds to a unique identification for the UE that is used to manage resources associated with downlink SPS configurations. APPLE-1005, 15:6-9/APPLE-1009, ¶[0055]. This aspect of Fakoorian-2’s CS-RNTI establishes it as a third configuration parameter that indicates “a state” (*i.e.*, a single state) that is mapped to its first and second DL SPS configurations. APPLE-1003, ¶188.

Fakoorian-2’s CS-RNTI is also included in an RRC configuration message received by its UE. APPLE-1005, 15:9-10/APPLE-1009, ¶[0055] (“RRC may define ... a CS-RNTI” indicating one (or a single) CS-RNTI in RRC messaging to the UE); APPLE-1003, ¶189. For example, Fakoorian-2’s RRC “define[s] a periodicity of a downlink SPS configuration, and a PDCCH **addressed to the CS-**

RNTI can” “release the downlink SPS configuration.” APPLE-1005, 15:10-12/APPLE-1009, ¶[0055]; APPLE-1003, ¶189.

In Fakoorian-2, one or more configuration sets “can be associated with different CS-RNTIs,” and **the SPS configurations that are jointly “released may be constrained to those configurations that are associated with the same CS-RNTI.”** APPLE-1005, 15:17-21/APPLE-1009, ¶[0056]. For example, Fakoorian-2’s “UE may be associated with multiple CS-RNTIs, and each CS-RNTI may correspond to a particular configuration set that contains one or more multiple [SPS] configurations that can be jointly” “released.” *Id.*, 15:22-26/*Id.*, ¶[0056]. These aspects of Fakoorian-2 indicate “a state” (*i.e.*, **release**) that is mapped to the multiple SPS configurations (*e.g.*, the first & second SPS configurations) in the configuration set, as claimed. APPLE-1003, ¶¶190-192.

[1g]

Fakoorian-2 renders obvious a wireless device (or UE) that receives a DCI, wherein a value of one or more bits of a HARQ process number field of the DCI indicates the state mapped to the SPS configurations. APPLE-1003, ¶¶193-195; *supra*, Ground 2A, Analysis of Limitation [1f] (incorporated here); *infra*, Analysis of Limitation [1h] (incorporated here).

Fakoorian-2's UE **"receiv[es] the DCI message"** and determines, for each SPS configuration, a number of time slots associated with **"the received DCI message"** based on a first value contained in the DCI message. APPLE-1005, Abstract/APPLE-1009, ¶¶[0089], [0093], [0094], cl. 1. Fakoorian-2's single DCI message includes **"an existing DCI field (e.g., a HARQ process number)"** that is **"used to indicate which [SPS] configurations"** are to be released, thereby avoiding a need to introduce a new DCI field to indicate which configurations are to be released. *Id.*, 14:66-15:3, *see* 27:46-50/*Id.*, ¶[0054], *see* ¶[00112].

Additionally, Fakoorian-2's different SPS configurations **"associated with a UE may be divided or otherwise grouped into different sets, and a bit sequence in a single DCI message can be used to indicate multiple SPS configurations"** that are to be jointly released. *Id.*, 14:30-35/*Id.*, ¶[0053]. A POSITA would have readily recognized the bit sequence is associated with the **HARQ process number**, and one or more binary values of the bit sequence indicating SPS configurations to be jointly released also **"indicates the state"** mapped to those SPS configurations, as claimed. APPLE-1003, ¶¶194-195.

[1h]

Fakoorian-2 renders obvious a wireless device (or UE) that deactivates the first and second SPS configurations in response to receiving the DCI. APPLE-

1003, ¶¶196-197; *supra*, Ground 2A, Analysis of Limitation [1g] (incorporated here).

Fakoorian-2's "[d]ownlink SPS resources" may be "**released using downlink control information (DCI) messages** transmitted on the PDCCH." APPLE-1005, 13:23-25/APPLE-1009, ¶[0050]. Indeed, aspects of Fakoorian-2's disclosure "**allow a single DCI message to ... jointly release multiple downlink SPS configurations.**" *Id.*, 14:27-29/*Id.*, ¶[0053]. Fakoorian-2 describes "**jointly releasing multiple downlink SPS configurations ... using a single DCI message,**" which "may conserve **network resources, base station resources,** and UE resources." *Id.*, 26:61-66/*Id.*, ¶[00109].

[1i]

Fakoorian-2 discloses that its UE transmits an acknowledgment. APPLE-1003, ¶¶198-199.

Fakoorian-2's UE "**transmit[s] a hybrid automatic repeat request acknowledgement (HARQ-ACK)**" based on the DCI message. APPLE-1005, Abstract/APPLE-1009, ¶¶[00108], [0051], [0057], [0063], [0064], Fig. 8, cl. 1. For example, the UE "transmit[s] a message (to the base station 402) that jointly **acknowledges** all SPS configurations" that were released by the DCI message. *Id.*, 16:66-17:3/*Id.*, ¶[0063]. For an SPS configuration that is released, the UE

acknowledges the “release by transmitting the acknowledgement in a codebook through a PUCCH resource.” *Id.*, 17:3-7/*Id.*, ¶[0063]. Fakoorian-2 also discloses “transmitting [a] plurality of HARQ-ACKs corresponding to the plurality of SPS configurations on the PUCCH at the determined instances in time.” APPLE-1005, cl. 19/APPLE-1009, cl. 1, cl. 5, cl. 7.

[2a]

Fakoorian-2 discloses deactivating (*i.e.*, releasing) resources associated with the first and second SPS configurations. APPLE-1003, ¶¶200-201; *supra*, Ground 2A, Analysis of Limitation [1h] (incorporated here). For example, Fakoorian-2 discloses that jointly “releasing multiple downlink SPS configurations” using a single DCI message “conserve[s] network **resources**, base station **resources**, UE resources” relative to current approaches that use multiple DCIs to release the multiple downlink SPS configurations. APPLE-1005, 14:51-55/APPLE-1009, ¶[0054].

[2b]

Fakoorian-2 discloses deactivating (*i.e.*, releasing) resources associated with the first and second SPS configurations. APPLE-1003, ¶202; *supra*, Ground 2A, Analysis of Limitation [2a] (incorporated here).

[3a]

Infra, Analysis of Limitation [3b] and Claim [4] (incorporated here).

Fakoorian-2 discloses a DCI comprising the PDSCH-to-HARQ feedback timing field. APPLE-1003, ¶¶203-204. For example, Fakoorian-2's "DCI message typically includes a frequency domain resource assignment (FDRA), a time domain resource assignment (FDRA), and a **PDSCH-to-HARQ feedback timer** for the single SPS configuration." APPLE-1005, 13:44-47/APPLE-1009, ¶[0051]. It would have been apparent and obvious to a POSITA that Fakoorian-2's "PDSCH-to-HARQ feedback timer" corresponds to a PDSCH-to-HARQ feedback **timing field** of the DCI message, *e.g.*, where that timing field indicates a value for the PDSCH-to-HARQ feedback timer. APPLE-1003, ¶204.

[3b]

Fakoorian-2 discloses a value of the timing field indicates a time duration between the DCI and the acknowledgement. APPLE-1003, ¶¶205-206; *supra*, Ground 2A, Analysis of Limitation [3a] (incorporated here).

For example, Fakoorian-2's "PDSCH-to-HARQ feedback timer may be used **to determine a K1 value that indicates the number of slots between the end of the PDSCH and a beginning of the PUCCH upon which the HARQ-ACK is transmitted** (*e.g.*, the time period between the instance at which the UE received the last symbol of the DL data on the PDSCH **and the instance at which the UE is to begin transmitting HARQ feedback information on the PUCCH**).” APPLE-

1005, 13:57-64/APPLE-1009, ¶[0051].

[4]

Fakoorian-2 discloses determining a timing of the acknowledgement based on a first timing of the DCI and the value of the PDSCH-to-HARQ feedback timing field. APPLE-1003, ¶¶207-209; *supra*, Ground 2A, Analysis of Limitations [1a], [1b], [3a], [3b] (incorporated here).

For example, Fakoorian-2's UE "may use values carried in the DCI message (such as K0 and K1 values) **to determine timing information for receiving DL data on the PDSCH and for transmitting HARQ feedback information** (*e.g.*, ACKs and NACKs) on the PUCCH for each of the activated SPS configurations." APPLE-1005, 17:15-20/APPLE-1009, ¶[0064].

Fakoorian-2's **transmitting HARQ feedback information** corresponds to transmitting an acknowledgment. APPLE-1003, ¶209. Thus, Fakoorian-2's discloses that its UE can "determine timing information" for transmitting HARQ feedback and, therefore, teaches that instructions executed by a processor of the UE cause the UE to determine the timing of the acknowledgement, as claimed. APPLE-1003, ¶209; APPLE-1005, cl. 19, cl. 21/APPLE-1009, cl. 1, cl. 5, cl. 7.

[5a]

Fakoorian-2's first HARQ codebook identifier indicates a first HARQ

feedback codebook for transmission of an acknowledgement associated with releasing the first SPS configuration. APPLE-1003, ¶¶210-212; *supra*, Ground 2A, Analysis of Limitations [1d], [1e], [1h], [1i] (incorporated here).

For the first SPS configuration, Fakoorian-2's "**HARQ process number**" represents a first configuration parameter that indicates the first HARQ codebook identifier. APPLE-1003, ¶211; *supra*, Analysis of Limitation [1d]. A POSITA would have recognized that Fakoorian-2's "**HARQ process number**" corresponds to the first HARQ codebook identifier, which indicates (or identifies) a first HARQ feedback codebook. APPLE-1003, ¶211. As explained by Dr. Mandayam, the HARQ feedback codebook generally defines a format used to signal a set of HARQ acknowledgements to a base station (*e.g.*, gNB). *Id.*

Fakoorian-2's first HARQ feedback codebook is for transmission of an acknowledgement associated with releasing its first SPS configuration. APPLE-1003, ¶212. For example, Fakoorian-2's UE "**transmit[s]** a message (to the base station 402) that jointly **acknowledges all SPS configurations**" that were **released** by the DCI message. APPLE-1005, 16:66-17:3/APPLE-1009, ¶[0063]. Fakoorian-2 describes that, for an SPS configuration that is released, its UE **acknowledges the** "**release by transmitting the acknowledgement in a codebook.**" *Id.*, 17:3-7/*Id.*, ¶[0063]. Notably, Fakoorian-2's "HARQ process number" can also indicate the SPS configurations to be released. *Id.*, 14:66-15:3 ("an existing DCI field (*e.g.*, a

HARQ process number) may be **used to indicate** which **[SPS] configurations** are to be ... released”), *see* 27:46-50/*Id.*, ¶[0054], *see* ¶[00112].

[5b]

Fakoorian-2 second HARQ codebook identifier indicates a second HARQ feedback codebook for transmission of an acknowledgement associated with releasing the second SPS configuration. APPLE-1003, ¶¶213-214; *supra*, Ground 2A, Analysis of Limitations [1d], [1e], [1h], [1i], [5a] (incorporated here).

For its second SPS configuration, Fakoorian-2’s “**HARQ process number**” represents a second configuration parameter that indicates the first HARQ codebook identifier. APPLE-1003, ¶214; *supra*, Analysis of Limitation [1d]. A POSITA would have recognized that Fakoorian-2’s “**HARQ process number**” corresponds to the first HARQ codebook identifier, which indicates (or identifies) a first HARQ feedback codebook. APPLE-1003, ¶214. As explained by Dr. Mandayam, the HARQ feedback codebook generally defines a format used to signal a set of HARQ acknowledgements to a base station (*e.g.*, gNB). *Id.*

[5c]

Supra, Ground 2A, Analysis of Limitations [1e], [5a], [5b] (incorporated here). APPLE-1003, ¶215.

[6]

Fakoorian-2's "state" is associated with multiple configuration indexes comprising a configuration index of the first SPS configuration and a configuration index of the second SPS configuration. APPLE-1003, ¶¶216-218; *supra*, Ground 2A, Analysis of Limitation [1f] (incorporated here).

Fakoorian-2's SPS configurations received by its UE may be "grouped into different sets, and a bit sequence in a single DCI message can be used to indicate multiple SPS configurations" to be jointly released. APPLE-1005, 14:30-35/APPLE-1009, ¶[0053]. Fakoorian-2's **"bit sequence" includes a "codepoint that indicates an index associated with a particular SPS configuration" to be released**, "and all SPS configurations ... that are members of the set that includes the particular SPS configuration" can be jointly "released by the single DCI message." *Id.*, 14:36-42/*Id.*, ¶[0053]. Fakoorian-2's "index" and multiple different configuration sets that correspond to the state (*e.g.*, release") discloses the state as being associated with a plurality of configuration indexes. APPLE-1003, ¶217.

The "bit sequence may include a bitmap" where "each individual bit" of the bitmap "corresponds to a particular configuration set, which can be used to indicate **multiple sets** that are to be jointly ... released." *Id.*, 14:42-46/*Id.*, ¶[0053]. From Fakoorian-2's disclosure, a POSITA would have readily understood that the SPS configurations of each configuration set is represented by the configuration index. APPLE-1003, ¶218. And Fakoorian-2's disclosure of "multiple sets" corresponds

to a plurality of configuration indexes, comprising at least a first and second configuration index, as claimed. *Id.*

[7]

Fakoorian-2 discloses the acknowledgement is transmitted in response to the DCI indicating release (or deactivation) of the first and second SPS configurations. APPLE-1003, ¶¶219-220; *supra*, Ground 2A, Analysis of Limitation [1i] (incorporated here).

[8]

Fakoorian-2 discloses a fourth configuration parameter indicating a Configured Scheduling Radio Network Temporary Identifier (“CS-RNTI”). APPLE-1003, ¶¶221-225.

Fakoorian-2’s UE is “provided with multiple downlink SPS configurations” that are conveyed to the UE via one or more RRC messages. APPLE-1005, 13:65-14:3/APPLE-1009, ¶[0052]; APPLE-1003, ¶222. Like “the number of HARQ processes,” Fakoorian-2’s “CS-RNTI” can represent a configuration parameter (*e.g.*, a fourth configuration parameter) of an SPS configuration received by the UE via the RRC Configuration message. APPLE-1005, 13:40-43, 15:10-12/APPLE-1009, ¶[0051], [0055]; APPLE-1005, 15:4-9/APPLE-1009, ¶[0055]; APPLE-1003, ¶222-¶223; *supra*, Ground 2A, Analysis of Limitation [1e].

Fakoorian-2's "UE may be associated with" a CS-RNTI, which "correspond[s] to a particular configuration set that contains" multiple SPS configurations that can be "jointly activated or released." *Id.*, 15:17-26/*Id.*, ¶[0056]. In this example, the multiple SPS configurations to be jointly released "may be constrained to" the particular configuration set corresponding the CS-RNTI. *Id.*; APPLE-1003, ¶224. Fakoorian-2's teaches **"a bit sequence in a single DCI message can be used to indicate multiple SPS configurations" to be jointly released.** APPLE-1005, 26:55-58/APPLE-1009, ¶[00109].

The "bit sequence may include a bitmap," an individual bit of the bitmap can correspond to the particular configuration set, and the bitmap can be used to indicate multiple configuration sets to be jointly released in response to receiving the single DCI message. *Id.*, 26:58-61/*Id.*, ¶[00109]. Referencing the above example, Fakoorian-2's multiple configuration sets can include the particular configuration set corresponding to the CS-RNTI. *See id.*, 15:26-30/*See id.*, ¶[0056]. Thus, the DCI message that includes the bit sequence (and bitmap) is associated with the CS-RNTI, as claimed. APPLE-1003, ¶225.

[9a]

Fakoorian-2 receives a first activation DCI indicating activation of resources associated with the first SPS configuration. APPLE-1003, ¶¶226-229; *supra*,

Ground 2A, Analysis of Limitations [1a], [1b] (incorporated here).

Fakoorian-2's "[d]ownlink **SPS resources**" "may be **activated** and released **using downlink control information (DCI) messages transmitted on the PDCCH**" and received by the UE. APPLE-1005, 13:23-26/APPLE-1009, ¶[0050]. To be clear, Fakoorian-2's "[d]ownlink **SPS resources**" are a plurality of resources, and these **resources** are associated with a first and/or second SPS configuration. APPLE-1003, ¶227. And Fakoorian-2's DCI message that activates an SPS configuration is an activation DCI. *Id.*

Notably, Fakoorian-2 describes transmitting/receiving multiple DCI messages and multiple SPS configurations. *See* APPLE-1005, 13:27-28 ("the RRC may periodically transmit **DCI messages to activate downlink SPS configurations**")/*See* APPLE-1009, ¶[0050]. It would have been obvious to a POSITA that Fakoorian-2's descriptions of multiple DCI messages provide at least a first activation DCI activating a first SPS configuration and a second activation DCI activating a second SPS configuration. APPLE-1003, ¶228.

When the "UE receives a DCI that activates a downlink SPS configuration, the UE may receive DL data from the base station on the PDSCH according to the activated downlink SPS configuration." APPLE-1005, 13:30-33/APPLE-1009, ¶[0050]. Fakoorian-2's PDSCH represents a first plurality of resources associated with the downlink SPS configuration being activated. APPLE-1003, ¶229.

Fakoorian-2 also describes an example configuration type where “**activation by a DCI message is needed** for the UE [] **to use the SPS resources.**” *Id.*, 16:45-47/*Id.*, ¶[0061].

[9b]

Fakoorian-2 receives a second activation DCI indicating activation of resources associated with the second SPS configuration. APPLE-1003, ¶¶230-231; *supra*, Ground 2A, Analysis of Limitation [9a] (incorporated here).

Fakoorian-2’s gNB “transmits a DCI message” “that *jointly* **activates a first SPS configuration (SPS1) and a second SPS configuration (SPS2).**” APPLE-1005, 17:60-62/APPLE-1009, ¶[0068]. Relatedly, Fakoorian-2 describes that, in an example prior art embodiment, “**to activate a number *N* of SPS configurations**, the base station needs to send the same **number *N* of DCI messages to a UE.**” APPLE-1005, 14:9-13/APPLE-1009, ¶[0052]; APPLE-1003, ¶231. From these descriptions, a POSITA would have recognized that Fakoorian-2’s UE receives at least: i) a first activation DCI to activate resources associated with a first SPS configuration, and ii) a second activation DCI to activate resources associated with a second SPS configuration. APPLE-1003, ¶231.

[10]

Fakoorian-2 renders obvious RRC messages that comprise fourth

configuration parameters of a bandwidth part of a cell, where the first and second SPS configurations are for the bandwidth part. APPLE-1003, ¶¶232-234; *supra*, Ground 2A, Analysis of Limitations [1c]-[1f] (incorporated here).

Fakoorian-2's "UE may be provided with multiple downlink SPS configurations ... for a given bandwidth part (BWP) of a serving cell." APPLE-1005, 13:65-14:1/APPLE-1009, ¶[0052]. Fakoorian-2's multiple downlink SPS configurations that are provided to its UE **for a given BWP of a serving cell** would have included configuration parameters (*e.g.*, fourth configuration parameters) of the given BWP of that serving cell. APPLE-1003, ¶234. These downlink "SPS configurations" are indicated to the UE **in an "RRC Configuration,"** which is conveyed to the UE via one or more RRC messages. APPLE-1003, ¶234; APPLE-1005, 13:40-43/APPLE-1009, ¶[0051].

[11a]

Supra, Ground 2A, Analysis of Limitation [3a] (incorporated here). APPLE-1003, ¶235.

[11b]

Supra, Ground 2A, Analysis of Limitation [3b] (incorporated here). APPLE-1003, ¶236.

*[12]*⁸

Supra, Ground 2A, Analysis of Claim [4] (incorporated here). APPLE-1003, ¶237.

[13]

Supra, Ground 2A, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶238.

[14a]

Supra, Ground 2A, Analysis of Claim [5a] (incorporated here). APPLE-1003, ¶239.

[14b]

Supra, Ground 2A, Analysis of Claim [5b] (incorporated here). APPLE-1003, ¶240.

[14c]

Supra, Ground 2A, Analysis of Claim [5c] (incorporated here). APPLE-

⁸ Claim 12 improperly requires both apparatus and method limitations. *IPXL Holdings, LLC v. Amazon.com, Inc.*, 430 F.3d 1377 (Fed. Cir. 2005). Yet, unpatentability of claim 12 can be determined here, because the prior art discloses both the apparatus and method limitations.

1003, ¶241.

[15]

Supra, Ground 2A, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶242.

[16]

Supra, Ground 2A, Analysis of Claim [6] (incorporated here). APPLE-1003, ¶243.

[17]

Supra, Ground 2A, Analysis of Claim [7] (incorporated here). APPLE-1003, ¶244.

[18]

Supra, Ground 2A, Analysis of Claim [8] (incorporated here). APPLE-1003, ¶245.

[19a]

Supra, Ground 2A, Analysis of Limitation [9a] (incorporated here). APPLE-1003, ¶246.

[19b]

Supra, Ground 2A, Analysis of Limitation [9b] (incorporated here). APPLE-

1003, ¶247.

[20]

Supra, Ground 2A, Analysis of Claim [10] (incorporated here). APPLE-1003, ¶248.

C. GROUND 2B – Claims 1-20 are obvious over Fakoorian-2 and Takahashi

1. Predictable Combination of Fakoorian-2 & Takahashi

A POSITA would have been motivated to combine Fakoorian-2 and Takahashi to utilize first and second configuration parameters of corresponding first and second SPS configurations, where the first and second configuration parameters indicate the same HARQ codebook identifier, as suggested by Takahashi. A POSITA would have been motivated to look to Takahashi when implementing techniques for efficient release of multiple SPS configurations, including acknowledgement of that release, consistent with Fakoorian-1's teachings. APPLE-1006, ¶¶[0028]-[0046]; APPLE-1003, ¶¶249-251.

For example, each of Fakoorian-2 and Takahashi provides SPS configurations to its UE via RRC signaling that convey RRC configuration messages to the UE. APPLE-1003, ¶253; APPLE-1005, 13:23-24/APPLE-1009, ¶[0050] ("SPS configurations" "initially indicated to the UE in an RRC configuration"); APPLE-1006, ¶¶[0019]-[0020] ("SPS setting" "set in the UE"

“using higher layer signaling,” *e.g.*, “radio resource control (RRC) signaling”).

Takahashi’s “HARQ-ACK codebook” “may be set in the UE by using a higher layer **parameter**” *e.g.*, a configuration parameter. APPLE-1006, ¶[0031]. Indeed, Takahashi’s “UE may **determine which codebook to use based on**” “**the RRC parameter.**” *Id.*, ¶[0059].

Notably, a POSITA would have been motivated to combine the teachings of Fakoorian-2 and Takahashi to achieve common advantages articulated by each of Fakoorian-2 and Takahashi. APPLE-1003, ¶254. For example, a POSITA would have predictably combined Fakoorian-2’s joint release of multiple SPS configurations in a single DCI with Takahashi’s techniques for transmitting acknowledgements (HARQ-ACK) of the released SPS configurations using one codebook. APPLE-1005, 14:51-56/APPLE-1009, ¶[0054] (“jointly releasing multiple downlink SPS configurations” “using a single DCI message” “may conserve network resources” “and UE resources”); APPLE-1003, ¶¶254-255.

A POSITA would have been motivated to combine Fakoorian-2 and Takahashi to achieve the benefit of reduced network overhead by using the one (*i.e.*, the same) HARQ codebook to transmit HARQ acknowledgements (ACK) for at least two SPS configurations, as taught by Takahashi. APPLE-1006, ¶[0045] (“more than one set of HARQ-ACK information for multiple SPSs” can be “included in one HARQ-ACK codebook.”); APPLE-1005, 14:62-65/APPLE-1009,

¶[0054] (“avoid incurring additional overhead by ensuring” “joint release of multiple SPS configurations” “do not increase the size of the DCI message”); APPLE-1003, ¶¶254-255.

It would have been apparent to a POSITA, based on Takahashi’s disclosure, that Fakoorian-2’s HARQ feedback (*e.g.*, HARQ-ACK) for multiple SPS configurations, including SPS PDSCH release, may be transmitted using the same HARQ feedback codebook, as taught by Takahashi. APPLE-1003, ¶256. For example, Takahashi discloses that **“more than one set of HARQ-ACK information for multiple SPSs”** can be **“included in one HARQ-ACK codebook.”** APPLE-1006, ¶[0045]. Fakoorian-2 and Takahashi are analogous art⁹ to the claimed invention of the ’639 Patent and, given the extensive overlap in subject matter between them, a POSITA would have had reason to consult Takahashi when assessing Fakoorian-2, and would have had a reasonable expectation of success in making the proposed modifications. APPLE-1003, ¶256.

2. Application to Challenged Claims

The Fakoorian-2-Takahashi combination renders the Challenged Claims obvious as set forth below. APPLE-1003, ¶¶249-257. Specifically, Takahashi offers additional disclosure that supplements and expands the analysis of

⁹ *Supra*, Ground 1, fn. 4.

Fakoorian-2 above and further supports obviousness of at least limitations [1e], [1f] and claim [6] (Ground 2A). APPLE-1003, ¶¶249-251.

In particular, the analysis of other claim features (*i.e.*, limitations) in Ground 2A (Fakoorian-2) apply equally to Ground 2B and the analysis of limitations [1e], [1f] and claim [6] in Ground 1 (Takahashi) apply equally to Ground 2B, but are supported and supplemented by additional teachings, suggestions, and motivations from the Fakoorian-2-Takahashi combination as set forth below. APPLE-1003, ¶¶251, 257.

[1e]

The Fakoorian-2-Takahashi combination provides a second configuration parameter, of a second SPS configuration, indicating a second HARQ codebook identifier that is the same as the first HARQ codebook identifier. APPLE-1003, ¶258.

A second configuration parameter of a second SPS configuration

As discussed at [1e] (Ground 2A), *supra*, in the Fakoorian-2-Takahashi combination any one of Fakoorian-2's **CS-RNTI, periodicity, number of HARQ processes** provides a first and/or second configuration parameter. APPLE-1003, ¶259; *see* APPLE-1005, 13:40-43/APPLE-1009, ¶[0051]. For example, Fakoorian-2's “**periodicity**” is a second configuration parameter of a second SPS

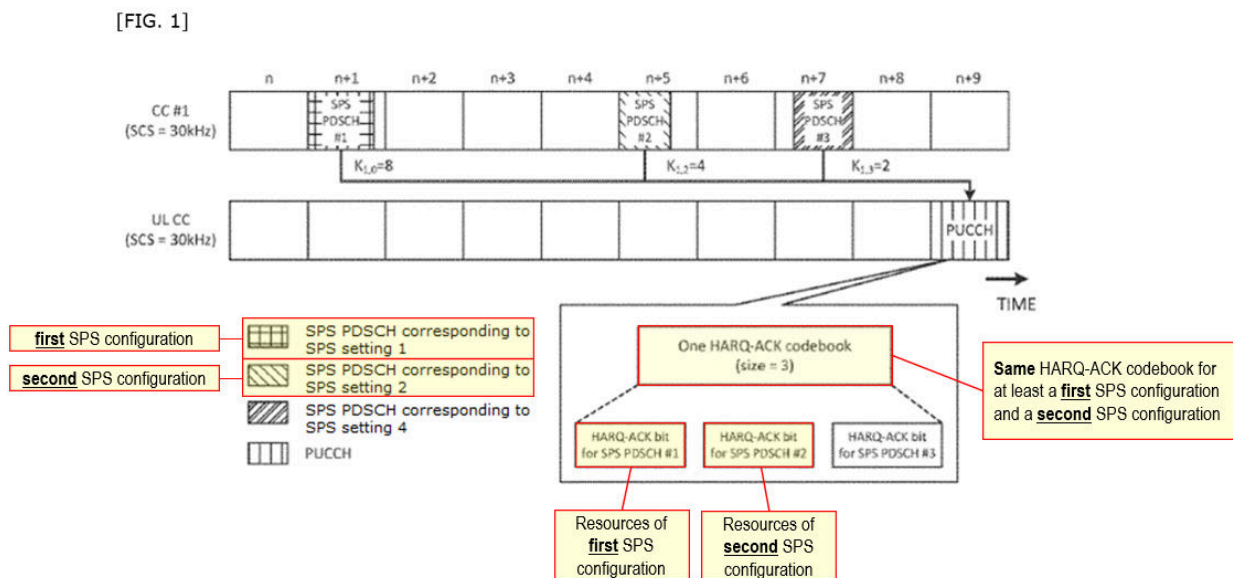
configuration received by the combination's UE via RRC signaling (e.g., message).
APPLE-1003, ¶259.

Second configuration parameter indicating a second HARQ codebook
identifier that is the same as the first HARQ codebook identifier

In the combination, Fakoorian-2's "**periodicity**" is a configuration parameter indicating a HARQ codebook identifier, and is also received at the combination's UE via an RRC message. APPLE-1003, ¶260. Fakoorian-2's "RRC may define a **periodicity** of a downlink SPS configuration," which establishes the periodicity as a configuration parameter received and defined at the UE via an RRC message. APPLE-1005, 15:10-11/APPLE-1009, ¶[0055].

For example, Fakoorian-2's SPS configuration with "the longest **periodicity**" can be a reference for "determin[ing] **transmit times for HARQ feedback information**. *Id.* 20:66-21:2, *Id.*, ¶[0082]. This establishes Fakoorian-2's periodicity as a configuration parameter indicating a HARQ codebook identifier. APPLE-1003, ¶261. In the combination, Fakoorian-2's UE receives, "from a radio resource controller (RRC)," "**periodicity for each SPS configuration**," and this would include at least a first periodicity (first configuration parameter) of a first SPS configuration and a second periodicity (second configuration parameter) of a second SPS configuration. APPLE-1005, cl. 12 /APPLE-1009, cl. 19; APPLE-1003, ¶261.

Beyond Fakoorian-2's express disclosure, Limitation [1e] is additionally provided in the combination's UE based on Takahashi's teachings. APPLE-1003, ¶262. Takahashi provides "multiple SPS settings" and describes that "[p]arameters (the SPS period, etc.) of each SPS setting **may be the same.**" APPLE-1006, ¶[0063]. In the combination, Takahashi's UE determines which "**HARQ-ACK codebook to use**" "based on at least one of an SPS index, the **SPS period**, etc.," where "SPS period" is a configuration parameter corresponding to periodicity. *Id.*, ¶[0062]; APPLE-1003, ¶262. In particular, Takahashi provides that "more than one set of HARQ-ACK information **for multiple SPSs**" are "**included in one HARQ-ACK codebook.**" APPLE-1006, ¶[0045]; Fig. 1 (reproduced below).



APPLE-1003, ¶262 (APPLE-1006, Fig. 1 (annotated))

This describes that HARQ-ACK information for at least a first **and** second SPS configuration is included in one (*i.e.*, the **same**) HARQ codebook. APPLE-1003, ¶262.

[1f]

The Fakoorian-2-Takahashi combination renders obvious a third configuration parameter (*e.g.*, Fakoorian-2's HARQ process number) indicating a **state** that is mapped to at least two (*e.g.*, first and second) SPS configurations. APPLE-1005, 14:66-17:1/APPLE-1009, ¶[0054] (“a HARQ process number” “**used to indicate which [SPS] configurations** are to be activated **and/or released**”); APPLE-1003, ¶263.

[6]

The Fakoorian-2-Takahashi combination's UE provides a “state” associated with multiple configuration indexes comprising a configuration index of the first SPS configuration and a configuration index of the second SPS configuration. APPLE-1003, ¶264. In the combination Takahashi's “setting information for the SPS” can be “an ‘SPS-Config’ information element for RRC” and may include **an index (SPS index)** for identifying the SPS. APPLE-1006, ¶¶[0022], [0015]; APPLE-1003, ¶264-265.

V. DISCRETIONARY CONSIDERATIONS

Petitioner believes that discretionary denial is unwarranted, and yet, Petitioner intends to utilize the bifurcated briefing process contemplated by the March 26, 2025, Stewart Memorandum to rebut contentions if offered by Patent Owner to the contrary. *See, e.g. Learn about the new interim processes relating to institution in AIA proceedings* (available at <https://www.uspto.gov/about-us/events/learn-about-new-interim-processes-relating-institution-aia-proceedings>, April 24, 2025); <https://uspto.cosocloud.com/p9xpz6s4jn75/> (Video).

VI. PAYMENT OF FEES – 37 C.F.R. § 42.103

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 06-1050.

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

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

Petitioner, Apple Inc. is the real party-in-interest.

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

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for inter partes review for the '639 Patent. The '639 Patent is the subject of a number of civil actions including: *Apex Beam Technologies LLC v. Apple Inc*, 6-24-cv-00223 (WDTX); *Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al*, 2-24-cv-00203 (EDTX), filed March 20, 2024.

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

Petitioner provides the following designation of counsel.

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D. Service Information

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

Petitioner consents to electronic service by email at IPR50095-0238IP1@fr.com.

Respectfully submitted,

Dated: May 5, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter partes* Review totals 13,978 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: May 5, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on May 5, 2025, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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