

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Title: UPLINK CANCELLATION INDICATION SIGNALING

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 10,986,695 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	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
III.	SUMMARY OF THE '695 PATENT	3
	A. Brief Description.....	3
	B. Prosecution History.....	5
IV.	LEVEL OF ORDINARY SKILL	6
V.	CLAIM CONSTRUCTION—37 C.F.R. §42.104(b)(3)	6
VI.	THE CHALLENGED CLAIMS ARE UNPATENTABLE.....	7
	A. GROUND 1A – Claims 1-20 Are Rendered Obvious by Ying in view of Yang 7	
	1. Ying (EX1004).....	7
	2. Yang (EX1016)	11
	3. Predictable Ying-Yang Combination.....	12
	4. Application to Challenged Claims	17
	B. Ground 1B – Claims 1-20 are Rendered Obvious by Ying.....	42
	1. Obviousness based on Ying	43
	2. Application to Challenged Claims	44
	C. Ground 2 – Claims 1-20 Rendered Obvious by Kim and Boroujeni	48
	1. Kim	48
	2. Boroujeni (EX1008).....	52
	3. Predictable Kim-Boroujeni Combination	54
	4. Application to Challenged Claims	59
VII.	DISCRETIONARY CONSIDERATIONS	77
VIII.	PAYMENT OF FEES – 37 C.F.R. § 42.103.....	77
IX.	MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1).....	78
	A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	78
	B. Related Matters Under 37 C.F.R. § 42.8(b)(2).....	78
	C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3).....	79
	D. Service Information	79

LIST OF EXHIBITS

EX1001	U.S. Patent No. 10,986,695
EX1002	U.S. Patent No. 10,986,695 File History
EX1003	Declaration of Dr. Robert Akl
EX1004	US 11,930,485 (“Ying”)
EX1005	US Provisional Application 62/737,774 filed on 9/27/2018 (“Ying-PROV”)
EX1006	International Publication WO2019/194589A1 (“Kim”) (published 10/10/2019 for PCT Application PCT/KR2019/003970 filed on 4/4/2019)
EX1007	Certified English translation of International Publication of WO2019/194589A1 (“Kim”)
EX1008	US Patent Application Publication 2022/0217736A1 (“Boroujeni”)
EX1009	US Provisional application No. 62/841,021 filed on Apr. 3, 2019 (“Boroujeni-1st-PROV”)
EX1010	US Provisional application No. 62/886,173 filed on Aug. 13, 2019 (“Boroujeni-2nd-PROV”)
EX1011	US 2022/0295350A1 (“Takahashi”) (claiming priority to PCT /JP2019/035050 filed on September 5, 2019)
EX1012	US 2022/0386243A1 (“Liang”) (claiming priority to GB Application 1914396.5 filed on October 4, 2019)
EX1013	US 2019/0246419A1 to Sun et al (“Sun”)

EX1014	TDOC R1-1910225
EX1015	ETSI TS 138 213 V15.4.0 (2019-04)
EX1016	US 2020/0359447A1 to Yang et al (“Yang”)
EX1017	US Provisional Application No. 62/845136 filed May 8, 2019 (“Yang-PROV”)

LISTING OF CLAIMS

Claim 1	
[1.pre]	A method comprising:
[1.a]	receiving, by a wireless device, uplink cancellation configuration parameters comprising:
[1.a1]	a cancellation indication radio network temporary identifier (RNTI); and
[1.a2]	a sequence of serving cell-specific parameters comprising: an identifier of a serving cell; a first parameter indicating a first starting position in a downlink control information (DCI) for the serving cell; and a second parameter indicating a second starting position in a DCI for a supplementary uplink carrier of the serving cell;
[1.b]	receiving a first DCI, associated with the cancellation indication RNTI, comprising cancellation indications;
[1.c]	determining a first cancellation indication, in the cancellation indications, based on:
[1.c1]	the first starting position, in a first number of bit, when a scheduled uplink transmission is for a normal uplink carrier of the serving cell; and
[1.c2]	the second starting position, in a second number of bit, when the scheduled uplink transmission is for the supplementary uplink carrier of the serving cell;
[1.c3]	wherein the first number of bit and the second number of bit are based on a payload size of the first DCI; and
[1.d]	cancelling the scheduled uplink transmission based on the first cancellation indication.

Claim 2	
2.	The method of claim 1, wherein determining the first cancellation indication is further based on a size of the first cancellation indication.
Claim 3	
3.	The method of claim 1, wherein the receiving the first DCI is via a common search space.
Claim 4	
[4.a]	The method of claim 1, wherein: the first number of bit identifies a first bit within a payload of the first DCI; and
[4.b]	the second number of bit identifies a second bit within the payload of the first DCI.
Claim 5	
5.	The method of claim 4, wherein the uplink cancellation configuration parameters further comprise a size parameter indicating the payload size of the first DCI.
Claim 6	
6.	The method of claim 1, wherein the uplink cancellation configuration parameters further comprise a size parameter indicating the payload size of the first DCI.
Claim 7	
7.	The method of claim 1, wherein the scheduled uplink transmission is via a physical uplink shared channel.
Claim 8	
8.	The method of claim 7, wherein the determining the first cancellation indication is further based on a size of the first cancellation indication.

Claim 9	
9.	The method of claim 7, wherein the receiving the first DCI is via a common search space.
Claim 10	
10.	The method of claim 1, wherein the scheduled uplink transmission is a sounding reference signal transmission.
Claim 11	
11.	The method of claim 10, wherein the determining the first cancellation indication is further based on a size of the first cancellation indication.
Claim 12	
12.	The method of claim 10, wherein the receiving the first DCI is via a common search space.
Claim 13	
13.	The method of claim 1, further comprising monitoring a common search space for a DCI associated with the cancellation indication RNTI.
Claim 14	
14.	The method of claim 1, further comprising determining cancelled uplink resources based on the first cancellation indication.
Claim 15	
[15.a]	The method of claim 14, wherein: the sequence of serving cell-specific parameters further comprise an offset parameter indicating an offset, in unit of symbol, from an end of a control channel reception where the wireless device detects the first DCI; and
[15.b]	the determining the cancelled uplink resources is further based on the offset.

Claim 16	
16.	The method of claim 15, wherein the determining the cancelled uplink resources comprises determining a first symbol associated with the cancelled uplink resources based on the offset.
Claim 17	
17.	The method of claim 14, wherein the determining the cancelled uplink resources is further based on a processing time associated with the first DCI.
Claim 18	
18.	The method of claim 14, wherein the receiving the first DCI is via a common search space.
Claim 19	
[19.a]	The method of claim 18, wherein: the first number of bit identifies a first bit within a payload of the first DCI; and
[19.b]	the second number of bit identifies a second bit within the payload of the first DCI.
Claim 20	
20.	The method of claim 19, wherein the uplink cancellation configuration parameters further comprise a size parameter indicating the payload size of the first DCI.

I. INTRODUCTION

Apple Inc. (“Apple” or “Petitioner”) petitions for IPR of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 10,986,695 (“the ’695 patent”).

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

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

Apple Inc. certifies that the ’695 Patent is available for IPR, and that Petitioner is not barred or estopped from requesting IPR. This Petition is being filed within one year of service of a complaint alleging infringement of the ’695 Patent in *Apex Beam Techs. LLC v. Apple Inc.*, No. 6:24-cv-00223 (W.D. Tex. filed Apr. 29, 2024).

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

Petitioner requests IPR of the Challenged Claims on the below grounds. Dr. Robert Akl provides supporting explanations in an expert declaration (EX1003) cited throughout this Petition. EX1003, ¶¶1-183.

Ground	Claims	§103 Basis
1A	1-20	Ying-Yang
1B	1-20	Ying
2	1-20	Kim-Boroujeni

Each reference predates November 7, 2019, the ’695 Patent’s earliest effective date, and thus qualifies as prior art, as shown by the table below.¹

¹ Petitioner reserves the right to challenge the ’695 patent’s priority.

Reference	Prior Art Date	Status
Ying	September 27, 2018 (provisional filing date)	AIA §102(a)(2)
Yang	May 8, 2019 (provisional filing date)	AIA §102(a)(2)
Kim	April 4, 2019 (PCT filing date)	AIA §102(a)(2)
Boroujeni	August 13, 2019 (filing date of 2 nd provisional)	AIA §102(a)(2)

Ying (EX1004) is entitled to its provisional filing date, because Ying and Ying-Provisional share the same figures and virtually identical description. To further confirm Ying-Provisional supports Ying's teachings, EX1005 is cited throughout this Petition when citing Ying (EX1004).

Likewise, Yang (EX1016) is entitled to the filing date of its provisional application (EX1017). Yang (EX1016) and EX1017 are cited in parallel in this Petition.

Similarly, Boroujeni is entitled to at least the filing date of second provisional application (EX1010). Boroujeni and EX1010 are cited in parallel in this Petition.

Ying, Yang, and Boroujeni are prior art for the reasons demonstrated above. Moreover, the provisionals readily support respective claims of Ying, Yang, and Boroujeni, and would have qualified under no-longer-applicable *Dynamic Drinkware* jurisprudence. *Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 (March 10, 2023)), EX1003, ¶¶47, 55-57 (mapping exemplary support for

claims).

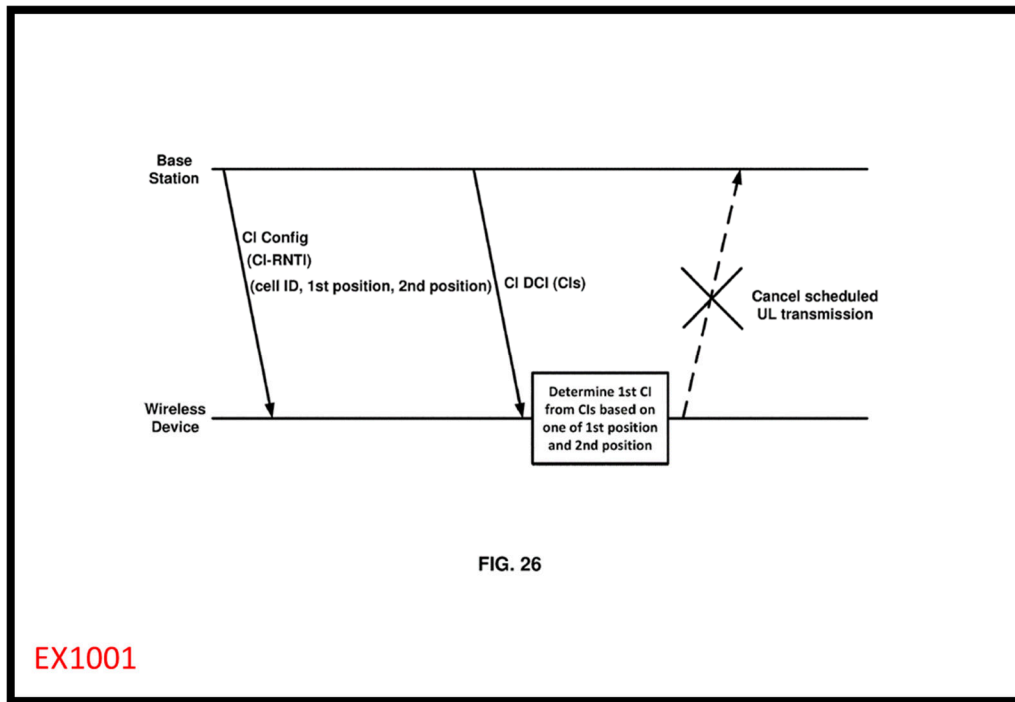
Kim (EX1007) is a certified English translation of WO2019194589A1 (EX1006). The Kim combination is directed to the prior art reference (EX1006), for which the Kim certified translation (EX1007) is cited throughout the petition to identify relevant aspects thereof.

While Yang was applied in an Office Action during prosecution, it is not relied upon here for elements deemed germane to allowance. *Infra*, §VII.A (§325(d)).

III. SUMMARY OF THE '695 PATENT

A. Brief Description

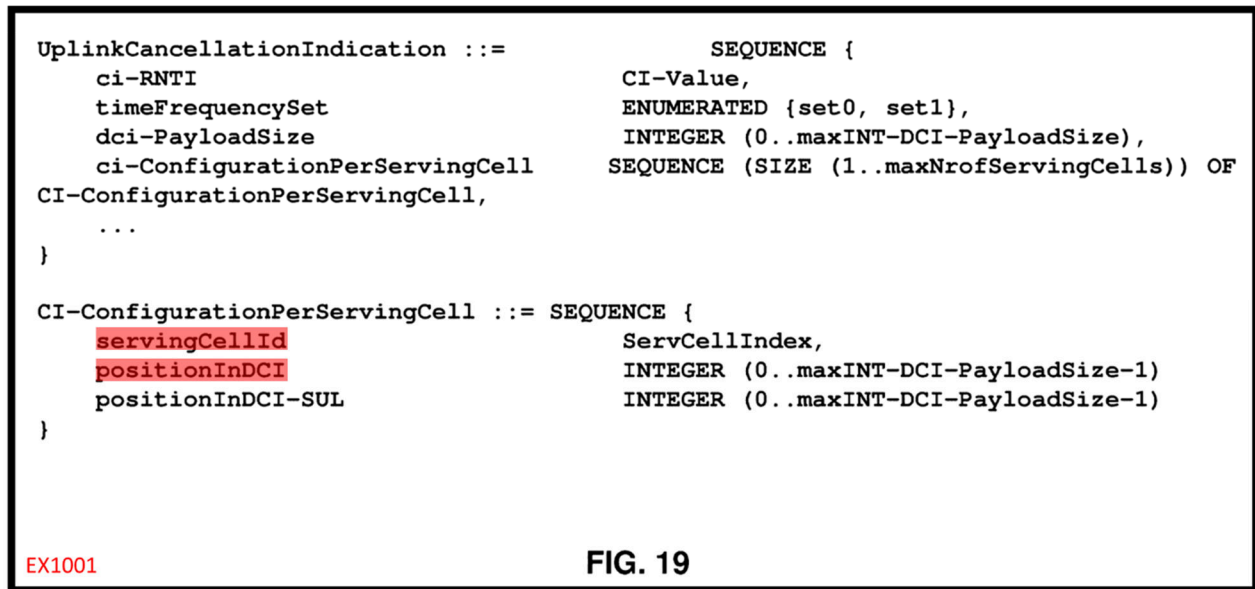
In the context of “wireless communication systems,” the '695 patent purports “to enhance the existing uplink cancellation indication technologies when a serving cell is configured with a plurality of uplink carriers.” EX1001, 3:52-59, 30:24-30, 31-48 (“The plurality of uplink carriers may comprise a normal uplink carrier and a supplementary uplink carrier”).



In FIG. 26 (above), “a wireless device may receive...uplink cancellation configuration parameters” including “a cancellation indication RNTI (e.g., CI-RNTI)” as well as “a sequence of serving cell-specific uplink cancellation indication IE[s],” known as information elements. EX1001, 40:7-46, 30:55-31:20 (FIG. 19).

“A serving cell-specific uplink cancellation indication IE may comprise an identifier of a serving cell (e.g., servingCellId - serving cell index), a first parameter (e.g., a positionInDCI parameter) indicating a first position in a DCI (a cancellation indication DCI) for a serving cell (e.g., a normal uplink (NUL) carrier of a serving cell), a second parameter (e.g., a positionInDCI-ForSUL parameter) indicating a second position in a DCI (a cancellation indication DCI) for a supplementary uplink (SUL) carrier of the serving cell.” *Id.*, 40:7-46; *see also* 31:21-43, FIG. 19

(pseudocode script discussed at 30:55-31:20 and annotated below).



EX1003, ¶56 (EX1001, FIG. 19 (annotated)).

The claims are directed to a method for conveying uplink configuration parameters including the first and second parameters respectively for the NUL and the SUL carriers. EX1003, ¶¶33-37.

B. Prosecution History

The Examiner initially rejected independent claim 1 (along with several dependent claims) as unpatentable over Yang (EX1016) and Fakoorian (US20200351897A1). EX1002, 153-163. In response, Applicant amended claim 1 to recite the first position and the second position respectively as “first starting position [in a first number of bit]” and “second starting position [in a second number of bit],” and further recite “wherein the first number of bit and the second number of bit are based on a payload size of the first DCI.” EX1002, 165-174 (further

asserting “the Examiner agreed that the outstanding rejection would be overcome by the present amendment” but without explaining the distinctions).

The subsequent Notice of Allowance stated: “The closest prior art, either singularly or in combination, fail to anticipate or render the above limitations [of claim 1] obvious.” EX1002, 179-187. But the Examiner allowed these claims prematurely. As demonstrated by this Petition, the Challenged Claims are obvious and would not have issued in their current form had the Examiner considered more pertinent art, such as Ying, Kim, and Boroujeni. EX1003, ¶¶38-40.

IV. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art at the time of the '695 patent (“POSITA”) would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks, including long-term evolution LTE/4G or 5G new radio (NR) cellular technology. EX1003, ¶¶29-32; ¶¶10, 16. Additional years of experience could substitute for an advanced-level degree (and vice versa). *Id.*

V. CLAIM CONSTRUCTION—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

'695 patent specification's examples and the prior art of Grounds 1A-2. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)².

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

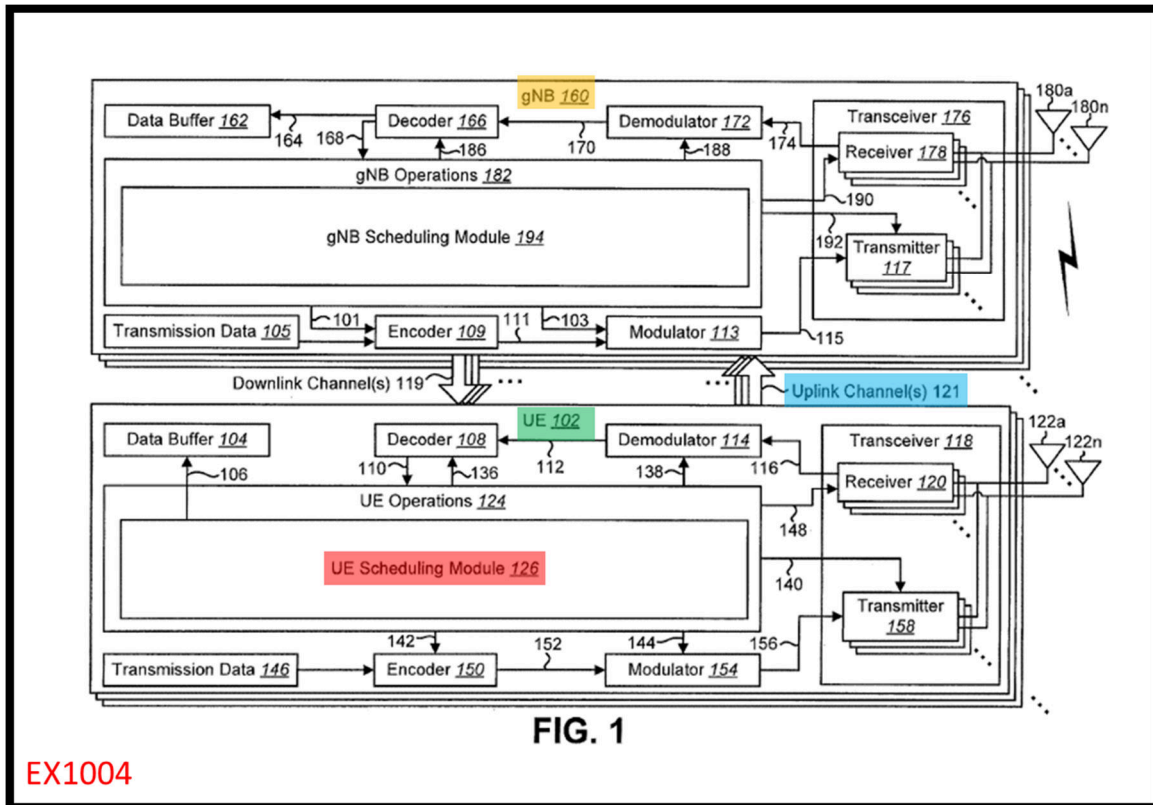
A. GROUND 1A – Claims 1-20 Are Rendered Obvious by Ying in view of Yang

1. Ying (EX1004)

Like the '695 patent, Ying relates to wireless communication technologies for managing transmission/retransmission on a wireless communication network. EX1004/EX1005, Abstract. Specifically, Ying describes “URLLC transmission/retransmission management to meet the latency/reliability requirement” where “the target user plane latency is 0.5 milliseconds (ms) each way for both UL [(uplink)] and DL [(downlink)]” while “the target reliability is $1-10^{-5}$ for X bytes within 1 milliseconds (ms).” EX1004, 6:30-37/EX1005, [0036]. In this context, Ying teaches “PUSCH [(physical uplink shared channel)] transmission can be pre-empted (interrupted, punctured, rate-matched, overridden, superposed) by another PUSCH transmission of the same UE [user equipment] 102 (intra-UE) or a different UE 102 (inter-UE).” EX1004, 28:48-55/EX1005, [0097]. Ying explains:

² 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.

“the UE 102 may abandon (e.g., omit, skip, drop, withdraw, postpone, cancel) the impacted PUSCH.” EX1004, 28:56-29:10/EX1005, [0098].



EX1003, ¶41 (EX1004, FIG. 1 (annotated)).

Referring to FIG. 1 (above): “The UE 102 and the gNB 160 may use one or more channels 119, 121 to communicate with each other.” EX1004, FIG. 1, 7:4-13/EX1005, FIG. 1, [0040]. “Examples of uplink channels 121 include a PUCCH (Physical Uplink Control Channel) and a PUSCH (Physical Uplink Shared Channel), PRACH (Physical Random Access Channel), etc.” *Id.* “The one or more gNBs 160 may also transmit information or data to the one or more UEs 102 using one or more downlink channels 119, for instance.” EX1004, 7:37-

42 (“Examples of downlink channels 119 include a PDCCH, a PDSCH, etc. Other kinds of channels may be used. The PDCCH may be used for transmitting Downlink Control Information (DCI)”)/EX1005, [0044].

As explained in Ying, the UE 102 “includes receiving circuitry configured to monitor a physical downlink control channel (PDCCH) conveying a pre-emption indication that indicates pre-emption of a physical uplink shared channel (PUSCH) transmission.” EX1004, 3:55-4:3/EX1005, [0021]. “The receiving circuitry is also configured to receive radio resource control (RRC) signaling that comprises a configuration for a configured grant and a configuration for grant-based PUSCH.” *Id.* “The UE further includes transmitting circuitry configured to transmit or skip the PUSCH transmission based on the pre-emption indication.” *Id.* The UE’s behavior “may be based on a downlink control information (DCI) format used for scheduling the scheduled retransmission.” EX1004, 4:11-19, 8:17-26; (noting “**UE scheduling module 126** may perform uplink (UL) multiplexing [to] support multiple types of UL transmissions (PUSCH transmissions)” including “PUSCH transmission scheduled by DCI (e.g., DCI format 0_0, DCI format 0_1)”)/EX1005, [0023], [0049]. Ying also provides examples of DCI formats indicating whether the UE is configured with supplemental uplink (SUL) capabilities. EX1004/EX1005, Listing 2 (“UL/SUL indicator”).

Listing 6	
<pre>-- ASN1START -- TAG-ULINKPREEMPTION-START UplinkPreemption ::= int-UL-RNTI timeErequecySet_UL dci-PayloadSize_UL int-ConfigurationPerServingCell_UL INT-ConfigurationPerServingCell, ... } INT-Configuration-UL ::= SEQUENCE { servingCellId ulbwpId positionInDCI } -- TAG-ULINKPREEMPTION-STOP -- ASN1STOP</pre>	
SEQUENCE { RNTI-Value, ENUMERATED {set0, set1}, INTEGER (0..maxINT-DCI-PayloadSize), SEQUENCE (SIZE (1..maxNrofServingCells)) OF	
ServCellIndex, bwp_id INTEGER (0..maxINT-DCI-PayloadSize-1)	

EX1004

EX1003, ¶44 (EX1004, Listing 6 (annotated)).

“In the **UplinkPreemption** field of Listing 6 [above], **dci-PayloadSize** is the total length of the DCI payload scrambled with INT-UL-RNTI. int-Configuration-UL indicates (per serving cell and/or per UL BWP) the position of the X bit INT values inside the DCI payload..” EX1004, 25:52-62/EX1005, [0086].

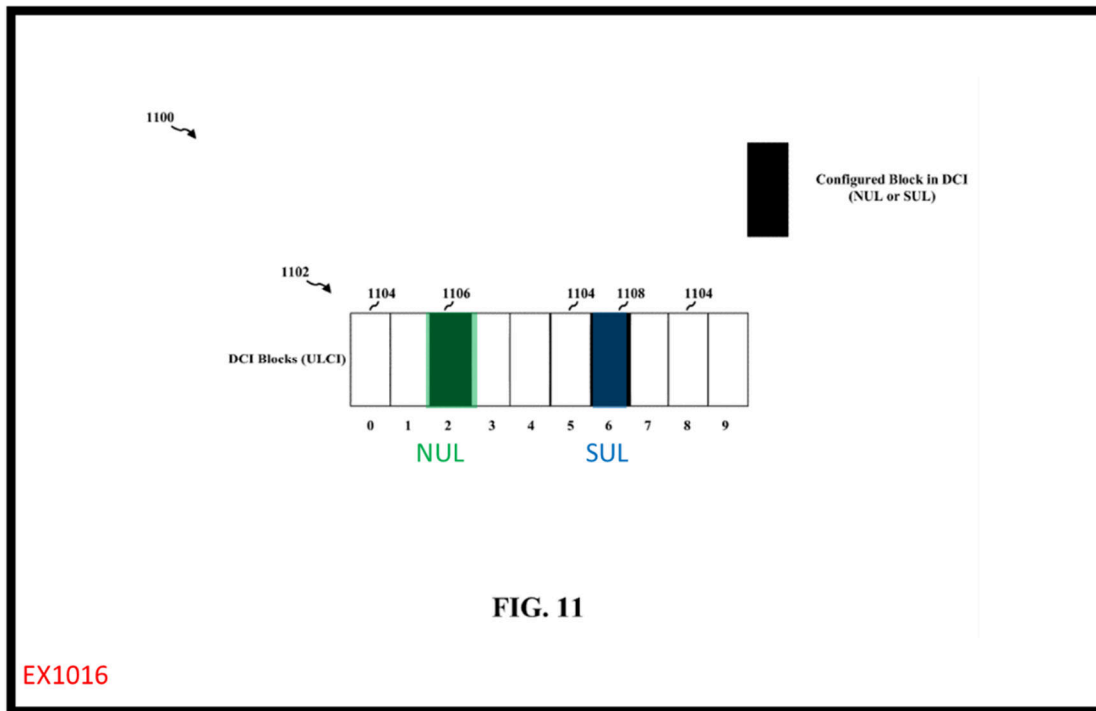
“In the **INT-Configuration-UL** field of Listing 6, **positionInDCI** is the starting position (in number of bit) of the X bit INT value applicable for this serving cell (e.g., servingCellId) and/or this UL BWP (e.g., bwp_id) within the DCI payload.” EX1004, 25:63-67/EX1005, [0087].

Based on the specified pre-emption information, “the UE 102 may perform no transmission in the corresponding part (e.g., the pre-empted part) or the whole

PUSCH resource. For example, DCI format 2_1 (and/or DCI format 2_1*) may be used for notifying (e.g., indicating) the corresponding part (e.g., the PRB(s) and/or OFDM symbol(s)) where the UE 102 may perform no transmission.”); EX1004, 28:56-29:10/EX1005, [0098]. Thus, Ying provides uplink cancellation indications to UEs using DCIs that include the parameter of positioninDCI on a mobile network capable of both conventional uplink and supplemental uplink (SUL) operations. EX1003, ¶¶41-47.

2. Yang (EX1016)

Yang describes “allowing UEs to determine from ULICI [(uplink cancellation indication)] whether canceled uplink transmission are carried on non-supplementary uplink (NUL) carriers or supplementary uplink (SUL) carriers.” EX1016, Abstract, [0010]/EX1017, Abstract, [0009]. Notably, Yang describes “configur[ing] separate blocks in DCI to indicate the UE should apply ULICI to either SUL, NUL, or both.” *Id.* “For example, FIG. 11 [below] illustrates an example frame structure 1100 of [a] DCI” with “multiple blocks 1104” for ULICI “where block two 1106 may be configured to correspond to NUL and block six 1108 may be configured to correspond to SUL (or vice-versa).” *Id.*, [0106], [0108-109] (“UE in FIG. 12 may cancel the transmissions 1206 [“NUL”] and 1208 (“SUL”) when ULICI instructions are received”) /EX1017, [0099], [0101-102], FIGS. 11-12; EX1003, ¶56.



EX1003, ¶56 (EX1016, FIG. 11 (annotated)).

3. Predictable Ying-Yang Combination

A POSITA would have been motivated to include configuration parameters for both the NUL and SUL carriers, as taught in Ying, in a single DCI, as expressly depicted in Yang, to coordinate both normal uplink (NUL) and supplemental uplink (SUL) transmissions in a mobile communication environment, such as “where coverage of an uplink [using NUL carrier alone] is weaker than coverage of a downlink.” EX1003, ¶¶58-59 (citing, e.g., EX1011 (“Takahashi”) at [0088]).

Ying already provides examples to indicate whether a UE is configured with SUL capabilities. EX1004/EX1005, Listings 2&3 (“UL/SUL indicator”). Yang describes application of one DCI to indicate uplink cancellation for both the NUL

and SUL carriers—a teaching already recognized by the Office. EX1003, ¶59. Yang, as cited during original prosecution, discloses: “The base station may configure separate blocks in DCI to indicate the UE should apply ULICI to either SUL, NUL, or both.” EX1016, [0010], [0109] (“UE may be configured with a single block for both NUL and SUL carriers”)/EX1017, [0009], [0102]; EX1002, 157-58 (citing Yang (EX1016) at [0010-12] as disclosing the relevant features, and un rebutted by the Applicant). The combination involves coordinating both carriers already operating in the mobile communication environment by implementing Ying’s DCI example (e.g., in Listing 6) to provide cancellation indications for both the normal uplink (NUL) and the SUL in one DCI. EX1003, ¶59. The predictable result facilitates “improv[ed] communication capacity, speed, flexibility, and/or efficiency,” as stated in Ying. EX1004, 1:31-41/EX1005, [0003-0004]; EX1003, ¶59.

A POSITA would have been motivated to include configuration parameters for both the NUL and SUL carriers in the same DCI to convey cancellation indications for multiple independent reasons to achieve known benefits, as explained below. *Id.*, ¶60.

First, combining the configuration parameters for both the NUL and SUL carriers in the same DCI to coordinate uplink transmission would have predictably reduced communication overhead on a mobile network, which a POSITA would

have appreciated as a facilitating factor “to allow for enhanced mobile broadband (eMBB) communication and ultra-reliable low-latency communication (URLLC) services, as well as massive machine type communication (MMTC) like services,” as aspired by Ying. EX1004, 6:20-29; EX1005, [0035]; EX1003, ¶61. The DCI messages were injected on a mobile network to coordinate communication between the UEs and the base station. *Id.* While the DCI messages required resources (e.g., temporal and spectral usage) on the mobile network, the DCI messages do not carry user data. For this reason, a POSITA would have been prompted to pursue a compact DCI design to include both NUL and SUL carriers for conveying cancellation indications because the compact design, as a general matter, saves communication overhead. *Id.* (citing EX1016, [0010] (“The base station may save signaling overhead by configuring only one block in DCI to indicate the UE should apply ULCI to SUL and NUL”)/EX1017, [0009]). Specifically, in a mobile communication environment “where the terminal [i.e., a user device] is located at the edge of a cell, the fact that coverage of the [normal] uplink is weak” suggests the addition and hence the co-existence of the supplemental uplink carrier. EX1003, ¶¶61 (citing EX1011, [0088]), 59 (noting the normal uplink (NUL) operates typically in the 2.4GHz range or above while the supplemental uplink (SUL) operates typically under 1GHz). To coordinate resource access in the mobile communication environment where both NUL and SUL carriers are present, the

compact DCI design would have saved communication overhead. EX1003, ¶61. In comparison, the alternative of using two DCIs to separately convey cancellation indications for the NUL carrier and the SUL carrier would have been considered to generally increase the overhead because multiple DCIs tend to duplicate, e.g., identifying information in each DCI. *Id.* As illustrated in Ying's Listing 6, each DCI encodes, other than the positionInDCI parameter, the same or similar information of servingCellId and bandwidth part id, to name just a couple. EX1004/EX1005, Listing 6. Such identifying information is shared between multiple DCIs. EX1003, ¶61. Repeated transmission of redundant information would add to the communication overhead. *Id.*

Second, combining the configuration parameters for both the NUL and SUL carriers in the same DCI would have simplified the decoder operation on the UE to allow the UE to expeditiously look up one DCI message and obtain information of the resources where the scheduled uplink transmissions using the NUL and SUL carriers are being cancelled. EX1003, ¶62. Here, Ying already indicates its DCI is configured to indicate whether the "UEs [are] configured with SUL in the cell." *See e.g.*, EX1004, 11 (Listing 3)/EX1005, [0056] (Listing 3). Ying further describes DL control channel monitoring where "a set of PRBs [(known as physical resource blocks)] within which the UE 102 attempts to blindly decode downlink control information [(DCI)]." EX1004, 50:64-51:6/EX1005, [0201]. When using one DCI

to potentially cancel uplink transmission for both the NUL and the SUL carriers, the decoder on the UE can perform the blind decoding to extract the impacted resources “from the set of PRBs.” *Id.*, EX1003, ¶62. This can be achieved by configuring the DCI to deterministically provide a first starting position (i.e., pointing to the resource element where the scheduled NUL transmission is being cancelled) and a second starting position (i.e., pointing to the resource element where the scheduled SUL transmission is being cancelled). *Id.* In comparison, the alternative of using two DCIs to provide the respective positions for the scheduled NUL transmission and the scheduled SUL transmission would have the decoder potentially perform blind decoding twice to extract the impacted resources “from [the] set of PRBs.” EX1004, 50:64-51:6/EX1005, [0201]; EX1003, ¶62.

A POSITA would have a reasonable expectation of success implementing the Ying-Yang combination where the fundamental aspects of Ying’s teaching of using a DCI to convey uplink cancellation indications in its mobile network would remain intact, bolstered by the beneficial aspects of accommodating both NUL and SUL carrier operations for enhanced mobile communication (e.g., reduced overhead, and simplified decoding). EX1003, ¶63. Ying and Yang are analogous art, both seeking “to allow for enhanced mobile broadband (eMBB) communication and ultra-reliable low-latency communication (URLLC) services, as well as massive machine type

communication (MMTC) like services.” EX1004, 6:20-29/EX1005, [0035]; EX1016, [0004], [0006]/EX1007, [0003], [0005]; EX1003, ¶63.

The combination would have been obvious to a POSITA for yet additional reasons including because, when using the DCI data structure, as expressly provided by Listing 6 of Ying, to coordinate uplink transmissions, a POSITA would have recognized a limited set of two readily apparent options, namely, using one DCI to encode both NUL and SUL carriers for potential uplink cancellations, or using two DCIs to separately flag each one of the NUL and SUL carriers for potential uplink cancellations. EX1003, ¶64. Both options provide the same function, namely, to provide cancellation indications for a specific resource block (known as RB) where an uplink transmission has been scheduled. *KSR International Co. v. Teleflex Inc.* 550 U.S. 398, 402-403 (2007). For this independent reason, a POSITA would have found it obvious to choose from two “identified, predictable solutions” with a reasonable expectation of success, both achieving the same function. *Id.*

To be clear, the ’695 patent specification does not describe any criticality of choosing one over the other. EX1003, ¶64. For example, the ’695 patent specification does not provide any reason that using one DCI would have resulted in a different function than using two DCIs. *Id.* Neither does the ’695 specification reveal any unexpected results when using one DCI. *Id.*

4. Application to Challenged Claims

[1.pre]:

To the extent the preamble is limiting, the Ying-Yang combination provides [1.pre]. E.g., EX1004, 4:40-51 (“A method by a UE”), 2:32-55, 3:16-21, 3:45-47, 5:20-39, 6:30-59, 24:21-32:67/EX1005, [0026], [0005], [0019], [0031], [0036-0040], [0078-0117]; §§VI.A.1-3; EX1003, ¶65.

[1.a]:

The Ying-Yang combination provides Element 1.a. As explained *supra* §VI.A.1, Ying teaches a UE (i.e., ***a wireless device***) receiving a set of configuration parameters for uplink pre-emption (i.e., ***uplink cancellation configuration parameters***). EX1004, 24:21-37 (using a RRC message to configure, e.g., “UplinkPreemption,” which is “a configuration(s) of uplink pre-emption indication(s) to be monitored in a serving cell (e.g., a corresponding serving cell, a concerned serving cell) and/or UL bandwidth part(s) (e.g., a corresponding UL BWP(s), a concerned UL BWP(s)).”), 24:21-37, 29:47-65, Listing 6/EX1005, [0082-0087], [0101], Listing 6. Ying explains “pre-emption indication may also be referred to as a cancellation indication since the UE 102 may cancel (part(s) of) the corresponding PUSCH transmission after receiving the information provided by the pre-emption indication (e.g., the UE 102 may be indicated by gNB 160 to cancel part or whole of a previously scheduled UL transmission(s)).” EX1004, 30:30-39,

32:4-22 (“the PUSCH is pre-empted,” including, “cancelled”)/EX1005, [0106], [0114]; EX1003, ¶66.

[1.a1]:

In the Ying-Yang combination, Ying’s configuration parameters include an **INT-UL-RNTI** parameter for indicating “pre-emption information.” EX1004, 29:47-65 (“If a UE 102 is provided higher layer parameter (e.g., UplinkPreemption), the UE 102 may be configured with an RNTI (e.g., **INT-UL-RNTI**)...for monitoring PDCCH conveying DCI (e.g., DCI format 2_1, and/or DCI format 2_1*) which indicates pre-emption information”), 24:21-37 (similar), Listing 6 (showing “**INT-UL-RNTI**”)/EX1005, [0101], [0082], Listing 6.

Listing 6

```
-- ASN1START
-- TAG-ULINKPREEMPTION-START
UplinkPreemption ::= SEQUENCE {
  int-UL-RNTI          RNTI-Value,
  timeErequeencySet_UL  ENUMERATED {set0, set1},
  dci-PayloadSize_UL    INTEGER (0..maxINT-DCI-PayloadSize),
  int-ConfigurationPerServingCell_UL SEQUENCE (SIZE (1..maxNrofServingCells)) OF
  INT-ConfigurationPerServingCell,
  . . .
}
INT-Configuration-UL ::= SEQUENCE {
  servingCellId      ServCellIndex,
  ulbwpIf            bwp_id
  positionInDCI      INTEGER (0..maxINT-DCI-PayloadSize-1)
}
-- TAG-ULINKPREEMPTION-STOP
-- ASN1STOP
```

EX1004

EX1003, ¶67 (EX1004, Listing 6).

The **INT-UL-RNTI** parameter provides *a cancellation indication radio network temporary identifier (RNTI)* because, as Ying explains, “the UE 102 may cancel (part(s) of) the corresponding PUSCH transmission after receiving the information provided by the pre-emption indication (e.g., the UE 102 may be indicated by gNB 160 to cancel part or whole of a previously scheduled UL transmission(s)).” EX1004, 30:30-39, 32:4-22 (“the PUSCH is pre-empted,” including, “cancelled”); EX1005, [0106], [0114]; EX1003, ¶67.

[1.a2]:

The Ying-Yang combination provides *a sequence of cell-specific parameters* (e.g., specific to a serving cell). Here, Ying tabulates an exemplary *sequence of cell-specific parameters* (i.e., “SEQUENCE” tied to “**servingCellId**”) in Listing 6, which is highly similar to the script in FIG. 19 of the ’695 patent. *Compare* EX1004/EX1005, Listing 6 (below) *with* EX1001, FIG. 19 (below); EX1003, ¶68.

Listing 6

```
-- ASN1START
-- TAG-UPLINKPREEMPTION-START
UplinkPreemption ::= SEQUENCE {
  int-UL-RNTI          RNTI-Value,
  timeFrequencySet_UL  ENUMERATED {set0, set1},
  dci-PayloadSize_UL   INTEGER (0..maxINT-DCI-PayloadSize),
  int-ConfigurationPerServingCell_UL SEQUENCE (SIZE (1..maxNrofServingCells)) OF
  INT-ConfigurationPerServingCell,
  ...
}
INT-Configuration-UL ::= SEQUENCE {
  servingCellId      ServCellIndex,
  ulbwpId             bwp_id
  positionInDCI      INTEGER (0..maxINT-DCI-PayloadSize-1)
}
-- TAG-UPLINKPREEMPTION-STOP
-- ASN1STOP
```

EX1004

```
UplinkCancellationIndication ::= SEQUENCE {
  ci-RNTI          CI-Value,
  timeFrequencySet ENUMERATED {set0, set1},
  dci-PayloadSize  INTEGER (0..maxINT-DCI-PayloadSize),
  ci-ConfigurationPerServingCell SEQUENCE (SIZE (1..maxNrofServingCells)) OF
  CI-ConfigurationPerServingCell,
  ...
}
CI-ConfigurationPerServingCell ::= SEQUENCE {
  servingCellId      ServCellIndex,
  positionInDCI      INTEGER (0..maxINT-DCI-PayloadSize-1)
  positionInDCI-SUL   INTEGER (0..maxINT-DCI-PayloadSize-1)
}
```

EX1001

FIG. 19

EX1003, ¶68 (EX1004, Listing 6; EX1001, FIG. 19).

In the sequence of Listing 6 that “determines how the UE interprets the UL preemption DCI payload,” Ying provides parameters such as “positionInDCI” to indicate “**the starting position** (in number of bit)...for this serving cell (e.g.,

servingCellId).” EX1004, 25:52-67/EX1005, [0086-87]; *supra* §V.A.1. As explained *supra* §VI.A.2, Yang describes “configur[ing] separate blocks in DCI to indicate the UE should apply ULCI to either SUL, NUL, or both.” EX1016, [0010], [0106], [0108-109], FIGS. 11-12/EX1017, [0009], [0099], [0101-102], FIGS. 11-12. As explained *supra* §VI.A.3, a POSITA would have found it obvious to adapt Ying’s DCI configuration example of Listing 6 (providing, among others, “positionInDCI”) for the normal uplink carrier (NUL) as well as the **supplemental uplink carrier** (SUL) in one DCI, as expressly depicted in Yang, to pursue the common objective of both Ying and Yang, as well as the known benefits of reduced overhead and simplified decoding. EX1003, ¶¶69-72.

[1.b]:

The Ying-Yang combination provides Element [1.b]. Ying describes, while UE102 is monitoring the PDCCH channel, UE102 receives, from a base station (i.e., one or more gNBs 160), **a first DCI** (Downlink Control Information)) **associated with the cancellation indication RNTI**. EX1003, ¶73. As explained *supra* §V.A.1 & [1a], “the UE 102 may be configured with an RNTI (e.g., INT-UL-RNTI)...for monitoring PDCCH conveying DCI (e.g., DCI format 2_1, and/or DCI format 2_1*) which indicates pre-emption information.” EX1004, 29:47-65 (“based on the RNTI (e.g., INT-RNTI or INT-UL-RNTI), the UE 102 may identify ... single DCI format

is used for notifying of the corresponding UL part (i.e., the corresponding part where the UE 102 performs no transmission from the UE 102)”)/EX1005, [0101].

Ying further suggests the first DCI including multiple ***cancellation indications*** by applying multiple “uplink preemption indication(s)” to multiple “UL bandwidth part(s).” EX1004, 24:21-37; EX1005, [0082]. In an example of “one-to-one mapping,” each of these multiple UL bandwidth parts of Ying is controlled by one of the multiple uplink preemption indications (for controlling e.g., more than one resource block on a resource map). *See e.g.*, EX1004, 26:61-27:15 (“The bits of pre-emption indication field may have a one-to-one mapping with predefined/selected time/frequency resources”)/EX1005, [0089]; EX1003, ¶¶74-75.

[1.c]:

The Ying-Yang combination provides Element [1.c]. Ying describes, after UE102 receives the first DCI (*supra* [1.b]), UE102 determines ***a first cancellation indication*** (e.g., with regard to specific resource blocks) in the first DCI (including multiple cancellation indications). According to Ying, “the DCI format (e.g., DCI format 2_1*) may be used for notifying the PRB(s) and OFDM symbol(s) where a UE 102 may assume the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, cancelled, dropped) or no transmission is intended/allowed for the UE 102 (i.e., the UE 102 may perform no transmission from

the UE 102).” EX1004, 30:40-31:3; *see generally*, Listing 6, 25:33-32:67; EX1005, [0107], Listing 6, [0086-0117]; EX1003, ¶76.

The Ying-Yang combination renders obvious determining the first cancellation indication in accordance with configuration parameters provided *supra* [1.a] so that the determination is based on [1.c1], [1.c2], and [1.c3]. *Supra* §§VI.A.1-3; EX1003, ¶77.

[1.c1] - [1.c2]:

The Ying-Yang combination provides Elements [1.c1] and [1.c2]. When applying the configuration parameter “positionInDCI” to both NUL and SUL carriers in one DCI, as explained *supra* §VI.A.3, [1.a1] & [1.a2], a POSITA would have found it obvious to determine the first cancellation indication based on the first starting position (i.e., when “positionInDCI” is applied to the NUL carrier) and the second starting position (i.e., when “positionInDCI” is applied to the SUL carrier). EX1003, ¶78 (noting ubiquitous use of indexing by further citing EX1013).

[1.c3]:

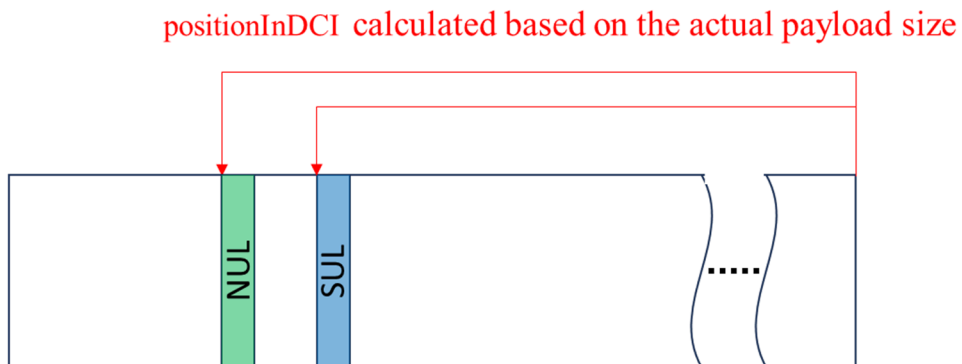
In the context of Elements [1.c1] and [1.c2] and as explained *supra* [1.a1] & [1.a2], the Ying-Yang combination renders obvious [1.c3]. A POSITA would have recognized from Ying’s description, and found obvious, to use the actual payload

size of the first DCI to calculate the first and second number of bits such that the first number of bit and the second number of bit are based on a payload size of the first DCI. EX1003, ¶79; *see also, supra*, Analysis of Elements [1.a1], [1.a2], [1.c1], and [1.c2].

Here, Ying discloses that “dci-PayloadSize [in the UplinkPreemption field of Listing 6] is the total length of the DCI payload,” which can be configured, and hence variable (i.e., depending on the actual use case scenario). EX1004, 26:61-27:15/EX1005, [0089]; EX1003, ¶79. In this DCI payload example, “[t]he size...may be configurable by higher layers up to 126 bits.” EX1004, 26:61-27:15/EX1005, [0089]. Ying further describes that the length and position of each data field in the DCI can be variable. Specifically, Ying explains that “[l]ength(s) and/or position(s) of DCI filed(s) may be...set as one of the configurations” for coordinating uplink access. EX1004, 18:62-19:4 (further discussing “[z]ero padding or truncation may be applied to some bit field(s)”) / EX1005, [0070]. For example, “some parameters (e.g., resourceAllocation, pusch-TimeDomainAllocationList, etc.)...may result in different length(s) and/or position(s) of DCI filed(s) (e.g., Frequency domain resource assignment, Time domain resource assignment, etc.)”). EX1004, 18:37-61/EX1005, [0069].

When using a variable payload size with data fields of variable lengths, a POSITA would have found it apparent, or at least obvious, that each parameter of

positionInDCI in Ying would depend on the actual payload size of the DCI. EX1003, ¶80 (explaining the lengths of these DCI data fields add up to the actual payload size of the DCI, which is often configured, *e.g.*, via RRC signal); EX1004, 26:61-27:15/EX1005, [0089] (“dci-PayloadSize is the total length of the DCI payload”). Because each DCI coordinates wireless traffic, which amounts to a communication overhead, a POSITA would have predictably used the actual payload size (*e.g.*, versus a maximum payload size which can be larger than the actual size), to facilitate reduced overhead and more accurately encode parameters such as positionInDCI. EX1003, ¶80. As observed by Dr. Akl, it would have been obvious to calculate the first and second number of bits (*i.e.*, corresponding to the respective data fields of positionInDCI for the conventional uplink and the supplemental uplink) using the “dci-PayloadSize,” which represents the actual payload size.



DCI payload “size...configurable...up to 126 bits” EX1004,26:61-27:15/EX1005,[0089]

EX1003, ¶80 (annotating an example shown above).

Here, a POSITA would have been prompted to configure each parameter of “positionInDCI” based on the actual payload size, as already provided by Ying’s Listing 6 as “dci-PayloadSize_UL” so that the decoder can identify the corresponding starting position of each uplink cancellation indication in the DCI. *Id.* Doing so would have a reasonable expectation of success, as Ying provides more detail on this point than the ’695 patent itself. *Compare e.g.*, EX1001, 26:56-64 (“DCI format 2_1...up to 126 bits” with “pre-emption indication [of] 14 bits”) *with* EX1004, 26:52-27:15/EX1005, [0086-89] (similar); EX1003, ¶80.

Thus, Ying alone renders obvious that ***the first number of bit and the second number of bit are based on a payload size of the first DCI.*** EX1003, ¶81.

To the extent that Apex argues “based on” be interpreted to be satisfied when a first number of bit and a second number of bit are merely located within the payload (e.g., a theoretical or maximum payload size), then this limitation is additionally disclosed by Ying, which describes that “positionInDCI is the starting position (in number of bit)...within the DCI payload,” and obvious in the Ying-Yang combination. EX1004, 25:63-67/EX1005, [0087]; EX1003, ¶81.

[1.d]:

The Ying-Yang combination provides Element [1.d]. Ying discloses “pre-empting, ***cancelling***, stopping, interrupting, suspending, dropping and/or pausing

(part(s) of) a corresponding PUSCH *transmission* [which was scheduled for transmission] after the UE 102 receives the indication of UL pre-emption, cancellation, continuation and/or re-scheduling.” EX1004, 34:14-29, 32:4-22 (“If a UE 102 detects a UL PI DCI format(s) ... for a serving cell (e.g., and/or a UL BWP) ..., the UE 102 may assume that the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, cancelled and/or dropped) or no transmission from the UE is present in PRBs and in symbols ... that are indicated by the UL PI”)/EX1005, [0123], [0114]; EX1003, ¶¶82-83.

Claim 2.

The Ying-Yang combination renders obvious a method in which a DCI including multiple cancellation indications is received. *Supra* §§VI.A.1-3. With multiple cancellation indications are packed into one DCI (e.g., to save overhead and improve efficiency), each cancellation indication is determined based on its size.

Listing 6	
<pre>-- ASN1START -- TAG-UPLINKPREEMPTION-START UplinkPreemption ::= int-UL-RNTI timeErequenceSet_UL dci-PayloadSize_UL int-ConfigurationPerServingCell_UL INT-ConfigurationPerServingCell, ... } INT-Configuration-UL ::= SEQUENCE { servingCellId ulbwpIf positionInDCI } -- TAG-UPLINKPREEMPTION-STOP -- ASN1STOP</pre>	
size	<pre>SEQUENCE { RNTI-Value, ENUMERATED {set0, set1}, INTEGER (0..maxINT-DCI-PayloadSize), SEQUENCE (SIZE (1..maxNrofServingCells)) OF ServCellIndex, bwp_id INTEGER (0..maxINT-DCI-PayloadSize-1)</pre>

EX1004

EX1003, ¶84 (EX1004, Listing 6).

As annotated in Listing 6 (annotated above), Ying explains that each UplinkPreemption field in the DCI specifying a cancellation indication is provided with a limited size. Accordingly, determining the first cancellation indication is based on the size of the cancellation indication because decoding the first cancellation from the received DCI is size limited as provided in the example of Listing 6, just like the disclosure of the 695 patent (EX1001, 31:12-20,37-43). EX1004, Listing 6/EX1005, Listing 6; EX1003, ¶¶85-86.

Claim 3.

In the context of claim 1, the Ying-Yang combination renders obvious ***receiving the first DCI via a common search space*** because Ying makes clear that “UE 102 may monitor PDCCH conveying DCI ... in the common search space set.” EX1004, 27:16-30, 31:66-32:3 (same), 27:31-57 (“search space set s is either a common search space set or a UE-specific search space set by a higher layer parameter searchSpaceType”), 27:58-28:4, 28:35-47/EX1005, [0090-0092], [0096], [0113]; EX1003, ¶¶87-88.

Claim 4.

[4.a]:

As explained *supra* [1.c1] & [1.c3], the Ying-Yang combination renders obvious Element [4.a]. EX1004, 25:33-62 (“positionInDCI is the starting position (in number of bit)...within the DCI payload.”), Listing 6; EX1005, [0086], Listing 6; EX1003, ¶89.

[4.b]:

As explained *supra* [1.c2] & [1.c3], the Ying-Yang combination renders obvious Element [4.b]. EX1004, 25:33-62, Listing 6; EX1005, [0086], Listing 6; EX1003, ¶90.

Claim 5.

As explained *supra* [1.c3] and claim 4, the Ying-Yang combination renders obvious claim 5 when Ying discloses a “**dci-PayloadSize_UL**” parameter. EX1004, 25:33-62, Listing 6 (annotated below)/EX1005, [0086], Listing 6.

Listing 6

```
-- ASN1START
-- TAG-UPLINKPREEMPTION-START
UplinkPreemption ::=
int-UL-RNTI                SEQUENCE {
timeErequecySet_UL         RNTI-Value,
dci-PayloadSize_UL       ENUMERATED {set0, set1},
int-ConfigurationPerServingCell_UL  INTEGER (0..maxINT-DCI-PayloadSize),
INT-ConfigurationPerServingCell,    SEQUENCE (SIZE (1..maxNrofServingCells)) OF
...
}
INT-Configuration-UL ::= SEQUENCE {
servingCellId              ServCellIndex,
ulbwpIf                    bwp_id
positionInDCI              INTEGER (0..maxINT-DCI-PayloadSize-1)
}
-- TAG-UPLINKPREEMPTION-STOP
-- ASN1STOP
```

EX1004

EX1003, ¶92 (EX1004, Listing 6).

Claim 6.

As explained *supra* [1.c3], the Ying-Yang combination renders obvious claim 6. EX1004, 25:33-62, Listing 6 (annotated above under claim 5 showing “**dci-PayloadSize_UL**”)/EX1005, [0086], Listing 6; EX1003, ¶93.

Claim 7.

The Ying-Yang combination renders obvious that *the scheduled uplink transmission is via a physical uplink shared channel* (e.g., PUSCH) because “the UE 102 may cancel (part(s) of) the corresponding PUSCH transmission [originally scheduled] after receiving the information provided by the pre-emption indication (e.g., the UE 102 may be indicated by gNB 160 to cancel part or whole of a previously scheduled UL transmission(s))”. EX1004, 30:40-31:3, 32:4-22 (“UE 102 may assume that the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, cancelled and/or dropped”), 34:30-35:15 (examples of “UE PUSCH processing time and UE processing time for pre-emption, cancellation, continuation and/or re-scheduling”), 38:38-45:9 (examples of PUSCH scheduled by PDCCH); EX1005, [0107], [0114], [0124-0127], [0138-0154]; EX1003, ¶¶94-95.

Claim 8.

The Ying-Yang combination renders obvious *determining the first cancellation indication is further based on a size of the first cancellation indication*. *Supra* claim 2; EX1004/EX1005, Listing 6; EX1003, ¶¶96-97.

Claim 9.

The Ying-Yang combination renders obvious that ***receiving the first DCI is via a common search space***. *Supra* claim 3; EX1004, 27:16-30, 31:66-32:3, 27:31-57, 27:58-28:4, 28:35-47/EX1005, [0090-0092], [0096], [0113]; EX1003, ¶¶98-99.

Claim 10.

In the context of claim 1, the Ying-Yang combination renders obvious claim 10. EX1003, ¶100. Yang expressly discloses “the UE may monitor an UL CI occasion” for “different types of uplink transmissions,” which “may comprise any of PUSCH, PUCCH, SRS, PRACH, etc.” EX1016, [0090]/EX1017, [0083]; EX1003, ¶100 (further citing EX1016, at [0098], [0100], [0127], [0139]). As explained *supra* §VI.A.3, a POSITA would have found it obvious to combine Ying and Yang to, e.g., “improve communication capacity, speed, flexibility, and/or efficiency.” EX1004, 1:31-41/EX1005, [0003-0004]; EX1003, ¶100.

Claim 11.

In the context of claims 1 and 10, the Ying-Yang combination renders obvious that ***determining the first cancellation indication is further based on a size of the first cancellation indication***. *Supra* claim 2; EX1003, ¶101.

Claim 12.

In the context of claims 1 and 10, the Ying-Yang combination renders obvious that *receiving the first DCI is via a common search space*. *Supra* claim 3; EX1003, ¶102.

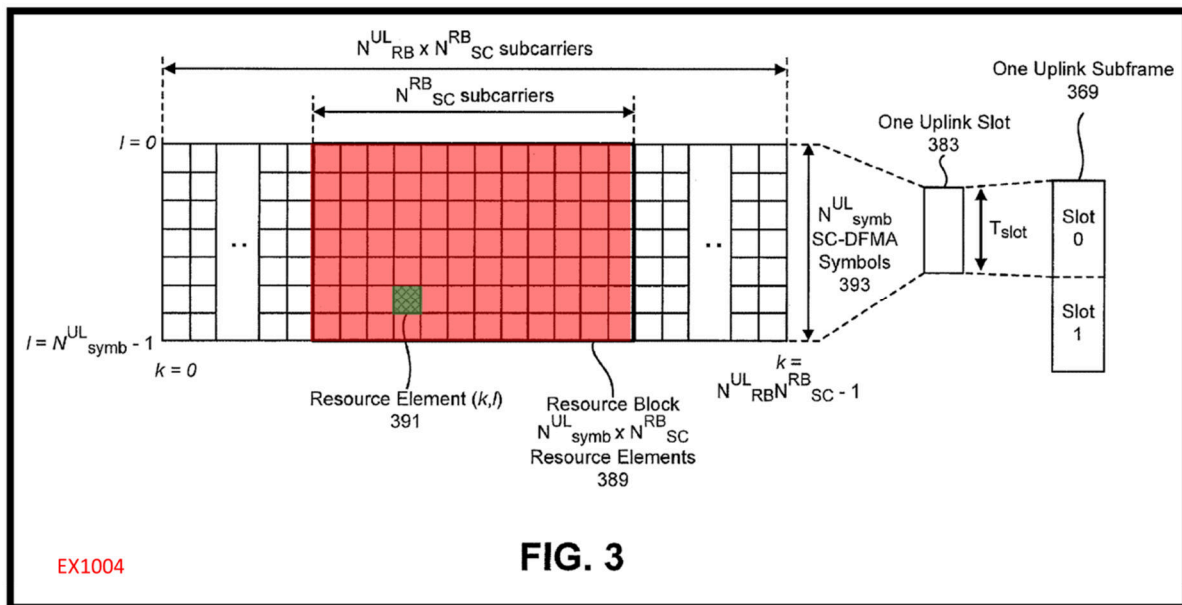
Claim 13.

In the context of claim 1, the Ying-Yang combination renders obvious that *monitoring a common search space for a DCI associated with the cancellation indication RNTI*. *Supra* Element [1.a], claim 3; EX1003, ¶103.

Claim 14.

The Ying-Yang combination renders obvious *determining cancelled uplink resources* (e.g., time/frequency/space resources used by UL transmission) *based on the first cancellation indication*. EX1003, ¶104. Ying describes “the use of time/frequency/space resources to allow for enhanced mobile broadband (eMBB) communication and ultra-reliable low-latency communication (URLLC) services, as well as massive machine type communication (MMTC) like services.” EX1004, 6:20-29/EX1005, [0035]. Referring to FIG. 3 (annotated below), Ying indicates “one example of a resource grid for the uplink” which may include **resource blocks** each including a number of **resource elements (RE)**. EX1004, 48:1-39, 48:18-28

(“The uplink **RB pair** is a unit for assigning uplink radio resources, defined by a predetermined bandwidth (RB bandwidth) and a time slot. The uplink RB pair includes two uplink RBs that are continuous in the time domain.”), FIG. 3/EX1005, [0180-0185], FIG. 3.



EX1003, ¶104 (EX1004, FIG. 3 (annotated)).

Ying teaches that, when cancelling a scheduled UL transmission, the underlying resources for a scheduled UL transmission are specified. EX1003, ¶109. Thus, based on the first cancellation indication, Ying renders obvious determining the cancelled resources, such that the resources are specified and can be re-allocated to other uses. *Id.* In one example, Ying teaches DCI format “for **notifying the PRB(s) [(physical resource block(s))]** and **OFDM symbol(s) [(providing *uplink resources*)]** where a UE 102 may assume the **PUSCH** is pre-empted (interrupted,

punctured, rate-matched, overridden, superposed, **cancelled**, dropped) or no transmission is intended/allowed for the UE 102 (i.e., the UE 102 may perform no transmission from the UE 102).” EX1004, 30:40-31:3, “If a UE 102 detects a DCI..., the UE 102 may assume that **no transmission** to the UE 102 is **present in PRBs and in symbols...**that are **indicated by the DCI**” 24:21-37, 26:52-60 (discussing “DCI...used for **notifying (e.g., indicating) the PRB(s) and/or OFDM symbol(s)** where the UE 102 may assume **no transmission** is intended for the UE 102”), [0102], 29:47-65, 32:4-22 (same)/EX1005, [0107], [0083], [0088], [0111], [0114]; EX1003, ¶¶104-106.

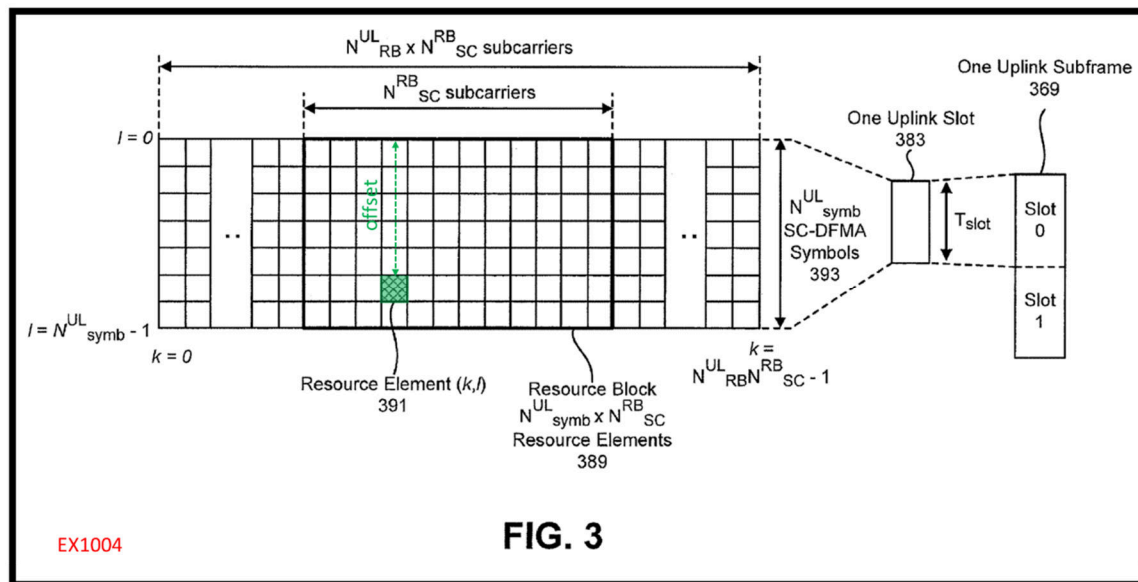
Claim 15.

Element [15.a]:

The Ying-Yang combination renders obvious that the sequence of serving cell-specific parameters includes ***an offset parameter*** (e.g., used by DCI to convey UL/SUL cancellation indications) indicating an offset ***in units of symbols*** (e.g., OFDM symbols). EX1003, ¶107.

Ying teaches using a DCI “for notifying the PRB(s) and OFDM symbol(s) where a UE 102 may assume the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, *cancelled*, dropped).” EX1004, 30:40-31:3, 28:56-29:10, 29:47-65 (similar)/EX1005, [0107], [0098], [0101]. Ying further

teaches the uplink transmission is specified by, e.g., “uplink RB pair for assigning uplink radio sources,” which “may include twelve sub-carriers in frequency domain and seven (for normal CP) or six (for extended CP) OFDM/DFT-S-OFDM symbols in time domain.” EX1004, 48:18-39, FIG. 3 (annotated below showing a resource grid for specifying resource blocks (RB) where uplink transmission is being cancelled)/EX1005, [0184-0185], FIG. 3.



EX1003, ¶108 (EX1004, FIG. 3 (annotated)).

Here, when notifying a resource block (RB) in the resource grid for cancelling a scheduled uplink transmission, the time domain resources are specified to indicate a time domain *offset* in unit of symbols. EX1004, 48:18-39/EX1005, [0184-0185]. A POSITA would have understood, based on Fig. 3, for example, that this time domain offset is *from an end of a control channel reception where the wireless*

device detects the first DCI (i.e., the received DCI) so that the referenced RB is set with respect to, e.g., when the DCI is detected on the PDCCH channel “conveying DCI...which indicates the presence of pre-emption...and/or the pre-empted part (e.g., time domain and/or frequency domain resource impacted by pre-emption from another transmission).” EX1004, 29:11-17, 24:10-37, FIG. 3/EX1005, [0099], [0081-0082], FIG. 3; EX1003, ¶109 (discussing time alignment in wireless communication). Indeed, Ying explains that “if the first uplink symbol (or the first pre-empted symbol) in the PUSCH allocation for a transport block is no earlier than [a processing time limit] after the end of the last symbol of the PDCCH (or other channel, L1 signaling) carrying the indication of UL pre-emption, cancelation, continuation and/or re-scheduling, then the UE 102 may pre-empt, cancel, stop, interrupt, suspend, drop and/or pause (part(s) of) a corresponding PUSCH transmission.” EX1004, 34:44-63/EX1005, [0125]; EX1003, ¶109.

Element [15.b]:

The Ying-Yang combination teaches *determining the cancelled uplink resources is further based on the offset* because the offset (e.g., in units of OFDM symbols) specifies/identifies the resources for the cancelled uplink transmission. EX1003, ¶110. For example, Ying explains using DCI “notifying the PRB(s) and OFDM symbol(s) where a UE 102 may assume the PUSCH is pre-empted

(interrupted, punctured, rate-matched, overridden, superposed, cancelled, dropped).” EX1004, 30:40-31:3, 28:56-29:10, 29:47-65/ EX1005, [0107], [0098], [0101]. In view of the resource grid, as provided by Ying to show resource blocks where uplink transmission can be cancelled, a POSITA would have known, and found obvious from Ying’s description, that the impacted uplink transmission (e.g., the scheduled PUSCH transmission) is identified based on, at least in part, the offset with respect to the time domain resources in the resource grid. EX1004, FIG. 3 (illustrating a resource grid), 28:56-29:10 (“notifying (e.g., indicating) the corresponding part (e.g., the PRB(s) and/or OFDM symbol(s)) where the UE 102 may perform no transmission”)/EX1005, FIG 3, [0098]; EX1003, ¶¶110-111.

Claim 16.

In the context of claim 15, the Ying-Yang combination renders obvious ***determining the first symbol associated with the cancelled uplink resources based on the offset.*** EX1003, ¶112. Ying teaches using DCI “notifying the PRB(s) and OFDM symbol(s) where a UE 102 may assume the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, cancelled, dropped).” EX1004, 30:40-31:3, 28:56-29:10, 29:47-65/EX1005, [0107], [0098], [0101]. Ying further explains that the cancelled uplink resources include a set of OFDM symbols in the time domain. *See e.g.*, EX1004, 48:29-39 (“The uplink RB

may include twelve sub-carriers in frequency domain and seven (for normal CP) or six (for extended CP) OFDM/DFT-S-OFDM symbols in time domain"); EX1005, [0185]. Ying indicates that its set of OFDM symbols in a physical resource block (PRB) flagged for uplink cancellation includes a first symbol, which is ***determined based on the offset*** in the time domain. EX1004, 34:44-63 ("the first uplink symbol (or the first pre-empted symbol) in the PUSCH allocation for a transport block is...after the end of the last symbol of the PDCCH (or other channel, L1 signaling) carrying the indication of UL pre-emption, cancelation, continuation and/or re-scheduling"); EX1005, [0125]; EX1003, ¶¶112-113.

Claim 17.

In the context of claim 14, the Ying-Yang combination renders obvious that ***determining the cancelled uplink resources is further based on processing time associated with the first DCI***. EX1003, ¶118. For example, Ying explains that "UE processing time $T_{proc,PI}$ for the indication of UL pre-emption, cancelation, continuation and/or re-scheduling may be treated as the minimum time required for pre-empting, cancelling, stopping, interrupting, suspending, dropping and/or pausing (part(s) of) a corresponding PUSCH transmission after the UE 102 receives the indication of UL pre-emption, cancelation, continuation and/or re-scheduling." EX1004, 34:44-63; EX1005, [0125]. Ying also teaches that the indication of UL

cancellation is conveyed using a DCI. EX1004, 30:40-31:3 (DCI “for notifying the PRB(s) and OFDM symbol(s) where a UE 102 may assume the PUSCH is pre-empted (interrupted, punctured, rate-matched, overridden, superposed, cancelled, dropped”)/EX1005, [0107]. Hence, a POSITA would have understood the processing time corresponds to a minimum gap “after the end of the last symbol of the PDCCH (or other channel, L1 signaling) carrying the indication of UL pre-emption, cancelation, continuation and/or re-scheduling,” which, if not met, “the UE 102 may ignore the indication” of UL cancellation, such that determining the cancelled uplink resources is further based on a processing time associated with the first DCI. EX1004, 34:44-63/EX1005, [0125]; EX1003, ¶¶114-115.

Claim 18.

In the context of claim 14, the Ying-Yang combination renders obvious *receiving the first DCI is via a common search space*. *Supra*, claim 3; EX1004, 27:16-30, 31:66-32:3, 27:58-28:4, 28:35-47; EX1005, [0090], [0113], [0092], [0096]; EX1003, ¶116.

Element [19.a]

In the context of claim 18, the Ying-Yang combination renders obvious *the first number of bit identifies a first bit within a payload of the first DCI*. *Supra*,

Elements [4.a], [1.c1]; EX1004, 25:33-62, Listing 6/EX1005, [0086], Listing 6; EX1003, ¶117.

Element [19.b] the second number of bit identifies a second bit within the payload of the first DCI.

In the context of claim 18, the Ying-Yang combination renders obvious ***the second number of bit identifies a second bit within the payload of the first DCI.*** *Supra*, Elements [4.b], [1.c2]; EX1004, 25:33-62, Listing 6/EX1005, [0086], Listing 6; EX1003, ¶118.

Claim 20.

In the context of claim 19, the Ying-Yang combination renders obvious that ***the uplink cancellation configuration parameters further comprise a size parameter indicating the payload size of the first DCI.*** *Supra*, claim 5, Element [1c.3]; EX1004, 25:33-62, Listing 6/EX1005, [0086], Listing 6; EX1003, ¶119.

B. Ground 1B – Claims 1-20 are Rendered Obvious by Ying

As explained *supra* §§VI.A.1-3, the Ying-Yang combination renders obvious claims 1-20. Additionally, as Ying alone provides examples of configuring the DCI to convey uplink cancellation indications from a base station to a UE when the UE has both NUL and SUL capabilities, Ying renders claims 1-20 obvious without

reference to Yang. EX1004/EX1005, Listings 6 (DCI example similar to EX1001 at FIG. 19), 2&3 (“UL/SUL indicator”); EX1003, ¶120.

1. Obviousness based on Ying

Based on Ying’s express disclosure, a POSITA would have been motivated to include configuration parameters for both the NUL and SUL carriers, as already disclosed in Ying (e.g., Listings 2&3), in one DCI, an example of which is also shown in Ying (e.g., Listing 6), to convey cancellation indications, at least for the same reasons as articulated *supra* §VI.A.3 (noting known benefits such as “improv[ed] communication capacity, speed, flexibility, and/or efficiency,” as stated in Ying (EX1004, 1:31-41/EX1005, [0003-0004])). EX1003, ¶120 (discussing general knowledge of NUL and SUL carriers by citing EX1011, [0088]); *Koninklijke Philips N.V. v. Google Inc.*, 948 F.3d 1330, 1337 (Fed. Cir. 2020) (internal citations omitted) (“[a]s *KSR* established, the knowledge of such an artisan is part of the store of public knowledge...must be consulted when considering whether a claimed invention would have been obvious.”).

Moreover, combining the relevant aspects of Ying would have been nothing more than integrating complementary teachings from within the same reference, all of which relate to the same technology. EX1003, ¶120. In the combination, the fundamental operations of Ying would have remained intact, while bolstered by the beneficial aspects of accommodating both NUL and SUL carrier operations for

enhanced mobile communication (e.g., reduced overhead, and simplified decoding), with a reasonable expectation of success. *Id.*, *supra* §VI.A.3 (further noting simple design choice).

2. Application to Challenged Claims

Ying renders obvious claims 1-20. Where Yang is not expressly addressed in Ground 1A, the analysis of Ying-Yang combination from Ground 1A applies fully here in Ground 1B. EX1003, ¶¶121, 65-119.

[1.a2]:

As explained *supra* §§VI.A.1&4 (Element [1.a2]), Ying provides *an identifier of the serving cell* (e.g., “**servingCellId**”). EX1004, 25:63-67 (“this serving cell (e.g., **servingCellId**)”)/EX1005, [0087]; EX1003, ¶122. Ying further discloses *a first parameter indicating a first starting position in a downlink control information (DCI) for the serving cell* (e.g., “**position in DCI**”) by noting “positionInDCI is the starting position (in number of bit) of the X bit INT value applicable for this serving cell (e.g., servingCellId) and/or this UL BWP (e.g., bwp_id) within the DCI payload” and it “[m]ust be multiples of X (bit)”. EX1004, 25:63-67, 18:62-19:4 (length and position of DCI fields can be configured), 18:37-61 (noting various examples that “may result in different length(s) and/or position(s) of DCI field(s) (e.g., Frequency domain resource assignment, Time domain resource assignment, etc.)”)/EX1005, [0087], [0069-0070]. Ying’s disclosure thus parallels

those from the '695 patent. EX1001, 40:7-46 (“The first parameter (e.g., the positionInDCI parameter) may indicate a starting position (in number of bit) of a cancellation indication value applicable for this serving cell (servingCellId) within the DCI payload”); EX1003, ¶122.

As explained *supra* §VI.B.1, Ying renders obvious *a second parameter indicating a second starting position in a DCI for a supplementary uplink carrier of the serving cell*. Ying expressly describes SUL operation alongside a normal uplink (NUL) operation. *See e.g.*, EX1004, Listings 2 and 3 (showing examples of DCI format including UL and SUL indicators for “UEs configured with SUL in the cell”)/EX1005, Listings 2 and 3. A POSITA would have recognized the benefits of incorporating SUL operation in Ying’s approach for managing uplink cancellation so that both NUL and SUL carrier operations are coordinated in a wireless communication network to provide seamless coverage to “meet the latency/reliability requirement” for “ultra-reliable low-latency communication (URLLC) services.” *Id.*, 6:20-37/EX1005, [0035-0036]. Therefore, when using both NUL and SUL, a POSITA would have found it obvious to set a second parameter (e.g., mirroring the “positionInDCI” parameter discussed above for the NUL), arranged in similar fashion as the first parameter, based on Ying’s express description of such a parameter (25:63-67 (Listing 6)). The second parameter would thus *indicat[e] a second starting position in a DCI for a supplementary uplink*

carrier of the serving cell (as indicated in Ying at Listings 2 and 3) to achieve the predictable improvements of comprehensive coverage of both the NUL and the SUL carriers. EX1004, 25:63-67, Listings 2, 3, and 6/EX1005, [0087], Listings 2, 3, and 6; EX1003, ¶123.

[1.c], [1c1], [1c2]:

As explained *supra* [1.a1] & [1.a2], Ying expressly discloses the first parameter and renders obvious the second parameter respectively indicating the first and second starting positions in the DCI where the second starting position is particularly for the SUL carrier. Thus, when adapted for managing UE uplink transmissions capable of transmitting on both NUL and SUL carriers, Ying renders obvious that *determining the first cancellation indication is based on the first starting position, in a first number of bit, when a scheduled uplink transmission is for a normal uplink carrier of the serving cell and the second starting position, in a second number of bit, when the scheduled uplink transmission is for the supplementary uplink carrier of the serving cell.* EX1003, ¶¶124, 78 (further corroborating the index notion by citing examples from US20190246419A1 to Sun et al (“Sun,” EX1013) where an index field uses available bit information to encode positions for carrier pre-emption indications (PIs)).

[1.c3]:

As explained *supra* §VI.A.4 (Element [1.c3]), even if not revealed to a POSITA by the description offered by Ying (which it is), a POSITA would have recognized from Ying's description, and found obvious, to use the size of the payload to calculate the first and second number of bits such that the first number of bit and the second number of bit are based on a payload size of the first DCI. EX1003, ¶125.

Claim 10.

Ying generally describes “monitor[ing] the UL pre-emption indication for UL cancelation, continuation, and/or re-scheduling,” (EX1004, 32:33-46, 33:29-50/EX1005, [0116], [0120]), where the “more detailed description of several implementations...is not intended to limit scope,” EX1004, 6:50-59/EX1005, [0038]. Ying indicates the use of SRS, or sounding reference signal, when describing configuration parameters for PUSCH transmissions. EX1004, 8:32-46 (noting “SRS resource indicator”), Listings 1&3 (“SRS resource indicator”)/EX1005, [0051], Listings 1&3; EX1003, ¶126.

It was general knowledge in the context of 5G systems like Ying's that sounding reference signals (SRS) [are transmitted] in the UL direction for use by the base station to estimate UL channel quality over a wider bandwidth. EX1003, ¶127

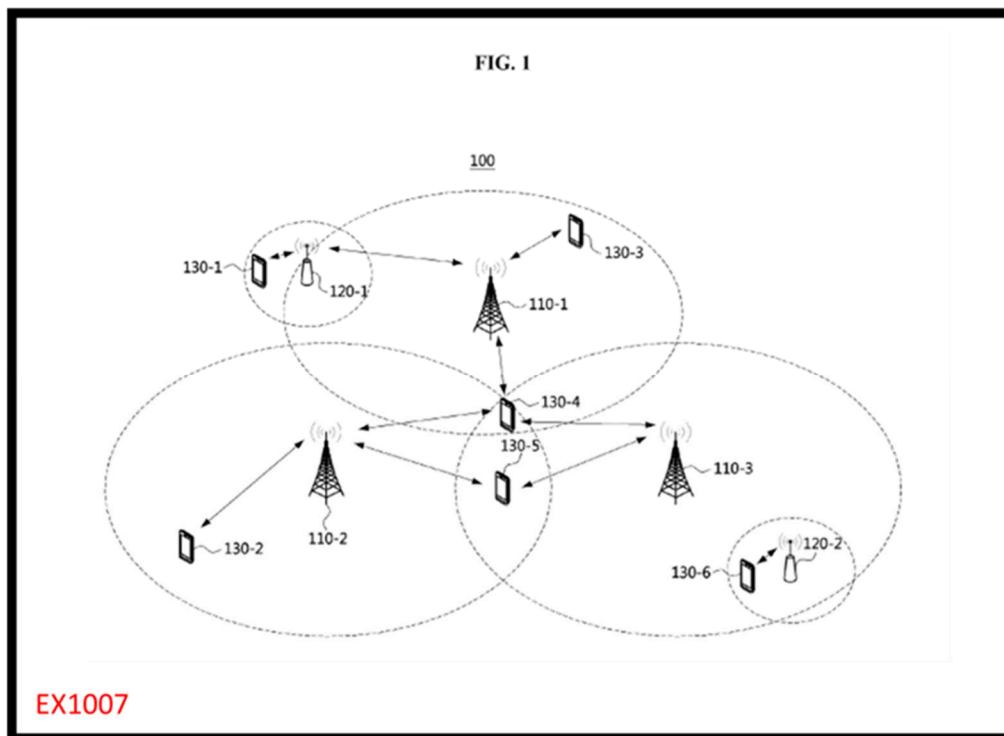
(citing EX1012, [0048])). It was also general knowledge that SRS uplink transmission, along with other forms of uplink transmission, are subject to cancellation indications. EX1003, ¶127 (citing EX1012 at [0055] (“The UL cancellation indication may be applied in respect of any UL transmissions [which] may include, for example...SRS transmissions”), [0122])).

A POSITA would have been motivated to include sounding reference signal (SRS) transmission, as already disclosed in Ying, in the mobile communication environment of Ying, and subject the SRS transmission to cancellation indications, to provide the full complement of available UL cancellations that encompass channel quality control. EX1003, ¶102. Indeed, accommodating SRS transmission for uplink cancellation would have predictably resulted in “improv[ed] communication capacity, speed, flexibility, and/or efficiency,” as stated in Ying. EX1004, 1:31-41/EX1005, [0003-0004]; EX1003, ¶128. Doing so merely involves including *a sounding reference signal transmission* as a type of scheduled uplink transmission subject to cancellation, and would have a reasonable expectation of success. *Id.*

C. Ground 2 – Claims 1-20 Rendered Obvious by Kim and Boroujeni

1. Kim

Like the '695 patent, Kim is directed to “techniques for uplink transmission satisfying reliability requirements in a communication system.” EX1007, [0001]. The communication system, as depicted in FIG. 1 (below), includes “base stations 110-1, 110-2, 110-3, 120-1, and 120-2” (also known as nodes) and “terminals 130-1, 130-2, 130-3, 130-4, 130-5, and 130-6” (each known as “a user equipment (UE)”). *Id.*, [0073-74].

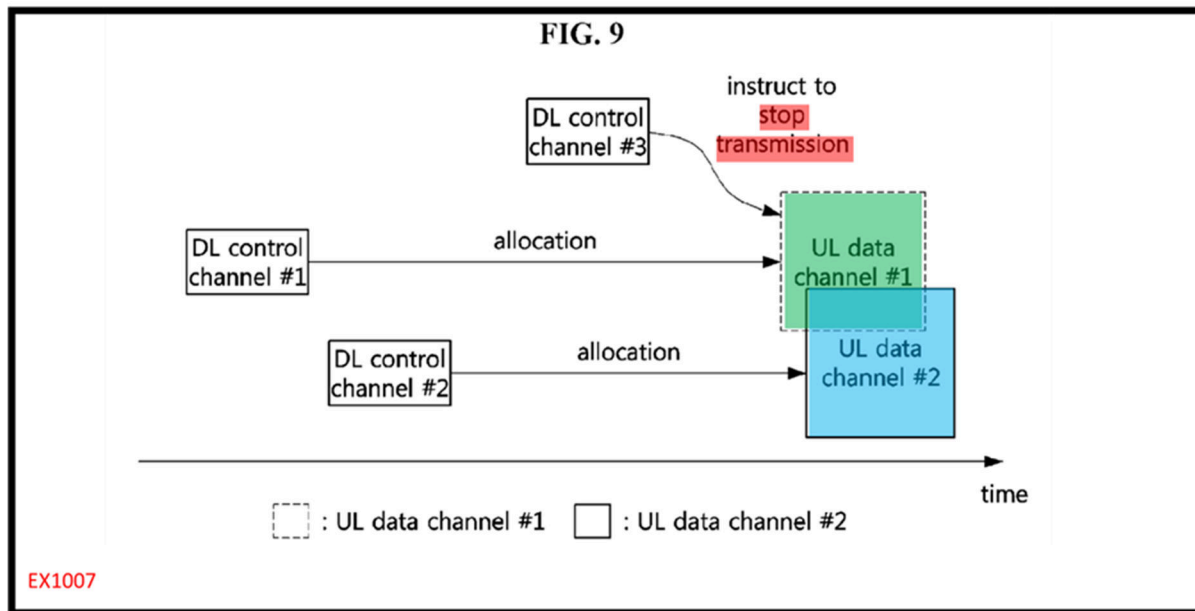


EX1003, ¶48 (EX1007, FIG. 1).

Kim’s communication system includes “enhanced Mobile BroadBand (eMBB), Ultra Reliable Low Latency Communication (URLLC), massive Machine Type Communication (mMTC), and the like.” EX1007, [0003]. In this context, Kim provides detailed disclosure “for stopping transmission of the first transport block”

when “a first physical uplink shared channel (PUSCH)...for [this] first transport block is determined to be used for another purpose.” *Id.*, [0004]; EX1003, ¶49.

Kim specifically teaches using uplink (UL) preemption indication (PI) to achieve dynamic resource reservation/allocation for the conventional uplink (also known as normal uplink (NUL)) as well as the supplemental uplink (SUL). EX1007, [0163-187]. As depicted in FIG. 9, DL control channel #1 and #2 respectively allocate resources for UL data channel #1 and #2. *Id.*, [0165-166] (“Some or all of the UL data channel #1 may overlap with the UL data channel #2”).



EX1003, ¶50 (EX1007, FIG. 9 (annotated)).

According to Kim: “to minimize interference of the UL data channel #2, the base station may control the UL data channel #1 not to be transmitted. For example, the base station may transmit to the terminal #1 a UL control channel #3 including

information instructing the terminal not to transmit the UL data channel #1. The terminal #1 may receive the DL control channel #3, and may not transmit the UL data channel #1 based on the information included in the DL control channel #3. Alternatively, when a part of UL data channel #1 is transmitted before completion of a decoding operation for the DL control channel #3, the terminal #1 may not transmit the remaining part of the UL data channel #1.” EX1007, [0166], FIG. 9 (“stop transmission”). Kim’s “stop transmission” is consistent with the ’695 specification. *See e.g.*, EX1001, 29:49-53 (“a wireless device may be scheduled with an uplink transmission and may stop the uplink transmission due to receiving an uplink cancellation indication indicating radio resources that overlap with the uplink transmission”), 32:28-38, 33:29-40, 34:54-64, 35:43-53; EX1003, ¶51.

Kim explains that “[t]he DL control channel may include not only resource allocation information of the UL data channel but also information indicating a carrier (e.g., conventional UL carrier or SUL carrier) through which the UL data channel is transmitted.” EX1007, [0170]. Kim further explains that “the DL control channel [from the base station] may include a bitmap #1 indicating UL reference resources belonging to the conventional UL carrier and a bitmap #2 indicating UL reference resources belonging to the SUL carrier” so that “the terminal may identify the bitmaps #1 and #2 by receiving one DL control channel, and may determine whether to transmit the UL data channel based on the bitmaps #1 and #2.” *Id.*,

[0171], [0172] (“The bitmap #1 for the conventional UL carrier and the bitmap #2 for the SUL carrier may be included in one DL control channel #3”); EX1003, ¶52.

Kim further explains: “Which carrier (e.g., the conventional UL carrier or the SUL carrier) the bitmap included in the DL control channel #3 corresponds to may be indicated by a higher layer signaling. For example, the terminal may know to which carrier the bitmap should be applied at a specific location of the DL control channel #3. Therefore, the base station may transmit the same DL control channel to several terminal(s), and each terminal may decode the bitmap at a specific location in the received DL control channel.” *Id.*, [0172], [0173-178] (UL PI by SFI), [0179-187] (UL PI along with DL PI in one DCI); EX1003, ¶53.

2. Boroujeni (EX1008)

Similar to the '695 patent, Boroujeni likewise discloses “uplink (UL) multiplexing and prioritization involving cancellation, interruption, or preemption” for scheduled transmissions including, e.g. “an ultra-reliable low latency (URLLC) transmission,” and “an enhanced massive mobile broadband (eMBB) transmission.” EX1008/EX1010, [0002]. Boroujeni particularly describes a “method of UL cancellation indication by GC-DCI [(group-common DCI)]” where its UE (i.e., “WTRU”) is provided with higher layer parameters to specify how each DCI “may be used for notifying the PRB(s) and OFDM symbol(s) where WTRU may assume

no transmission is expected from the WTRU.” EX1008, [0176]/ EX1010, [0175]; EX1003, ¶54.

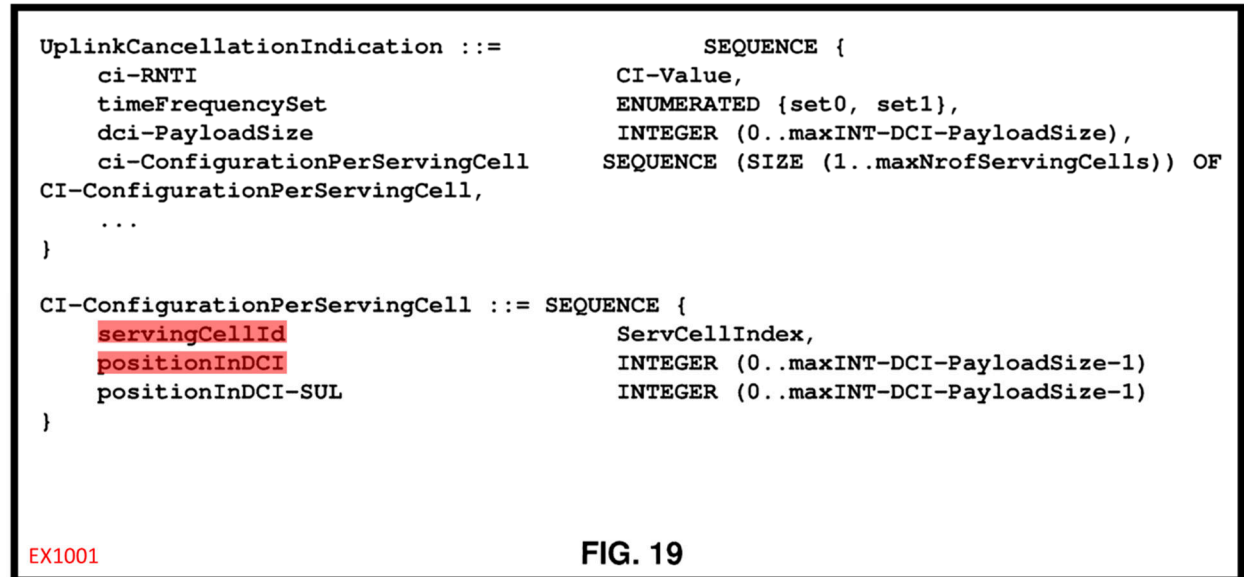
In the same context as the ’695 patent and Kim, Boroujeni particularly teaches using the parameter “positioninDCI” to configure “a corresponding set of locations for fields in DCI format” where “[t]he DCI for UL cancellation may carry a bitfield or bit string which can be mapped to the UL cancelled resources explicitly indicating the frequency and time of the cancelled resources in RBs and OFDM symbols.” EX1008, [0178] (further noting other parameters such as “the payload size of the GC-DCI conveying the UL cancellation indication”)/EX1010, [0177]. Once configured, each WTRU “may receive GC-DCI indicating cancelled UL resources.” EX1008, [0174], [0172] (“cancelled resources may be indicated explicitly by GC-PDCCH carrying GC-DCI”), FIG. 7/EX1010, [0172], [0169], FIG. 6B; EX1003, ¶55.

Significantly, Boroujeni describes:

In the case of being configured for monitoring UL cancellation, the WTRU may be also configured with a set of serving cells by higher layer parameter CAN-ConfigurationPerServingCell that includes a set of serving cell indexes provided by corresponding higher layer parameters **servingCellId** and a corresponding set of locations for fields in DCI format 2_3 by higher layer parameter **positionInDCI**. Also, the payload size of the GC-DCI conveying the UL cancellation indication may be semi-statically configured for the UE.

(EX1008, [0178]/EX1010 [0177])

The above description parallels the CI-ConfigurationPerServingCell example in FIG. 19 of the '695 patent.



EX1003, ¶56 (EX1001, FIG. 19 (annotated)).

3. Predictable Kim-Boroujeni Combination

As explained *supra* §VI.C.1, Kim teaches using one DCI to provide cancellation indications including “a bitmap #1 indicating UL reference resources belonging to the conventional UL carrier and a bitmap #2 indicating UL reference resources belonging to the SUL carrier” so that “the terminal ... may determine whether to transmit the UL data channel based on the bitmaps #1 and #2.” EX1007, [0170], [0171]; EX1003, ¶129.

As explained *supra* §VI.C.2, Boroujeni teaches configuring a terminal using a parameter “positionInDCI” so that “a corresponding set of locations for fields in

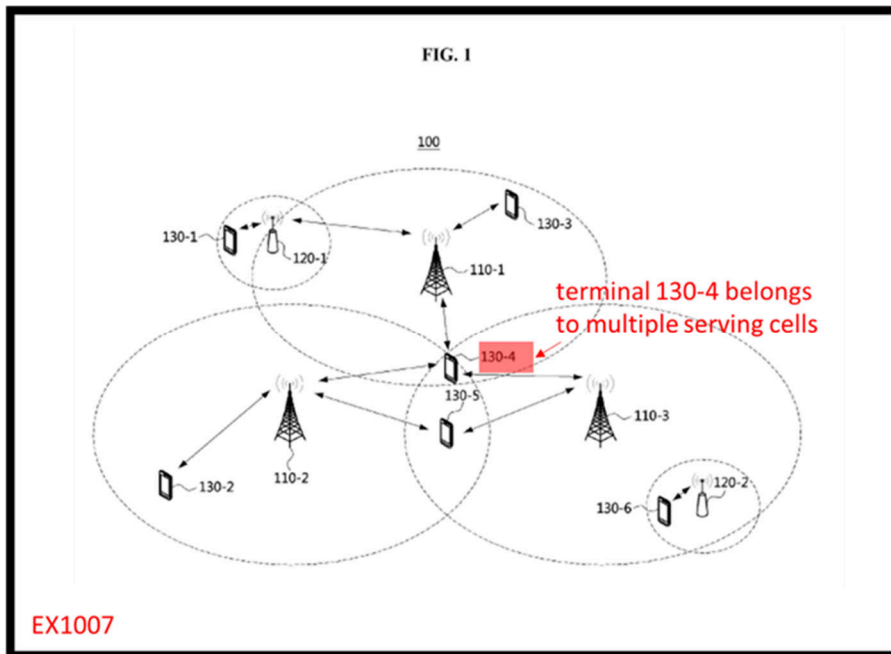
DCI format” can be “mapped to the UL cancelled resources explicitly indicating the frequency and time of the cancelled resources in RBs and OFDM symbols.” EX1008, [0178] (further noting other parameters such as “the payload size of the GC-DCI conveying the UL cancellation indication” and “a set of serving cell indexes provided by ... servingCellId”); EX1010, [0177]; EX1003, ¶130.

A POSITA would have found it obvious to parameterize the information identifying resources through which uplink transmissions are cancelled, as taught in Kim, using parameters in accordance with the examples suggested by Boroujeni. EX1003, ¶126. A POSITA would have been prompted to improve communication efficiency by (i) configuring each DCI carrying cancellation indications, as taught in Kim, to include a servingCellId parameter, in accordance with Boroujeni, and (ii) encoding the respective starting positions in DCI for NUL and SUL carriers using the positioninDCI parameter, in accordance with Boroujeni’s teachings, as further explained below. EX1003, ¶131.

Serving Cell Identifier

A POSITA would have found it obvious to encode an identifier of the serving cell, in accordance with Boroujeni’s teachings, in a DCI of the Kim-Boroujeni combination to convey cancellation indications. Each DCI is provided by a base station to control the behavior of terminals on a specific cell served by the base station. For this reason, it would have been obvious for the base station to identify

(e.g., using an identifier) the specific cell on which the terminals need to coordinate wireless communication over shared resources. EX1003, ¶133. Additionally, a terminal can be served by multiple cells operated by different base stations. As depicted in FIG. 1 (below) of Kim, “[others and] the fourth terminal 130-4 may belong to cell coverage of the first base station 110-1...the fourth terminal 130-4 [and other terminals] may belong to cell coverage of the second base station 110-2...the fourth terminal 130-4 [and other terminals] may belong to cell coverage of the third base station 110-3.” EX1006, [0074]. Hence, providing an identifier of the serving cell would have enabled each receiving terminal (particularly those on multiple serving cells, such as terminal 130-4) to adjust its communication activities accordingly for the identified serving cell.



EX1003, ¶133 (EX1007, FIG. 1 (annotated)).

NUL and SUL Carriers

A POSITA would have found it obvious to encode the starting position for each bitmap of Kim in a DCI using a configuration parameter, in accordance with Boroujeni's suggestions (e.g., Boroujeni's positioninDCI) for at least the following independent reasons. EX1003, ¶134. First, using a positioninDCI parameter to encode the respective starting positions for Kim's bitmaps for the conventional UL carrier and the SUL carrier would have resulted in compact configuration of each DCI where each bitmap is consistently indexed by the positionInDCI parameter (conveying "which part of the DCI...is indicating...UL cancellation indication"). EX1008, [0177-178]/EX1010, [0176-077]; EX1003, ¶135. Hence, a POSITA would have been prompted by the known benefits of consistent indexing inside the compact DCI configuration. *Id.*

Second, it would have been obvious to choose between two identified, predictable solutions, namely, using one DCI to encode both NUL and SUL carriers for potential uplink cancellations, or using two DCIs respectively for flagging each one of the NUL and SUL carriers for potential uplink cancellations. Both solutions perform the same function of providing cancellation indications. EX1003, ¶136. The '695 patent does not identify any criticality or unexpected results of using one DCI. *Id.*; *supra* §VI.A.2.

Third, using one DCI to encode configuration parameters for both the NUL and the SUL carriers can advantageously reduce communication overhead because multiple DCIs tend to duplicate, e.g., identifying information in each DCI as illustrated in EX1004, Listing 6/EX1005, Listing 6. In the Kim-Boroujeni combination, the positionInDCI parameter from Boroujeni encodes the respective starting positions for Kim's bitmaps for the conventional UL carrier and the SUL carrier. Each bitmap of Kim provides a multitude of resource elements subject to cancellation indications. EX1007, [0192]. As explained by Dr. Akl, the multiple resource elements are distributed on both the conventional UL and the SUL. EX1003, ¶137. Kim thus contemplates cancellation indications for both conventional UL (NUL) and SUL carriers that are in need of coordination through, e.g., DCI messages. *Id.* As such identifying information can be redundant between multiple DCIs, repeated transmission would add to the communication overhead. *Id.* Accordingly, a POSITA would have been prompted by the known benefits of reduced overhead to pursue the compact DCI configuration of using one DCI to encode the configuration parameters for both the NUL and the SUL carriers. *Id.*

Fourth, when decoding each DCI to obtain cancellation indications on both the NUL and SUL carriers, the impacted transmission resources through which uplink transmission is scheduled to be transmitted can be efficiently identified (e.g., using the positioninDCI parameter from Boroujeni as an index) and re-allocated to

other uses. EX1003, ¶138. Here, decoding one DCI to extract the impacted resources would have led to a more simplistic decoder design than the alternative of decoding two DCIs. *Id.*; *supra*, §VI.A.3 (citing EX1004, 50:64-51:6/EX1005, [0201]). Hence, a POSITA would have been driven by the known benefits of efficiency and convenience. *Id.*

Combining the relevant aspects of Kim and Boroujeni would have been nothing more than integrating complementary teachings from Kim and Boroujeni, both of which specifically relate to coordinating cancellation indications on a mobile network, just like the '695 patent, and provide analogous subject matter. EX1003, ¶132. The fundamental and synergistic aspects of Kim and Boroujeni would remain intact, bolstered by the beneficial aspects of compact parameterization of cancellation indications for NUL and SUL carriers, as well as efficient identification of the serving cell, with a reasonable expectation of success. EX1003, ¶132; *KSR*, 550 U.S. at 416 (2007).

4. Application to Challenged Claims

(a) Claim 1

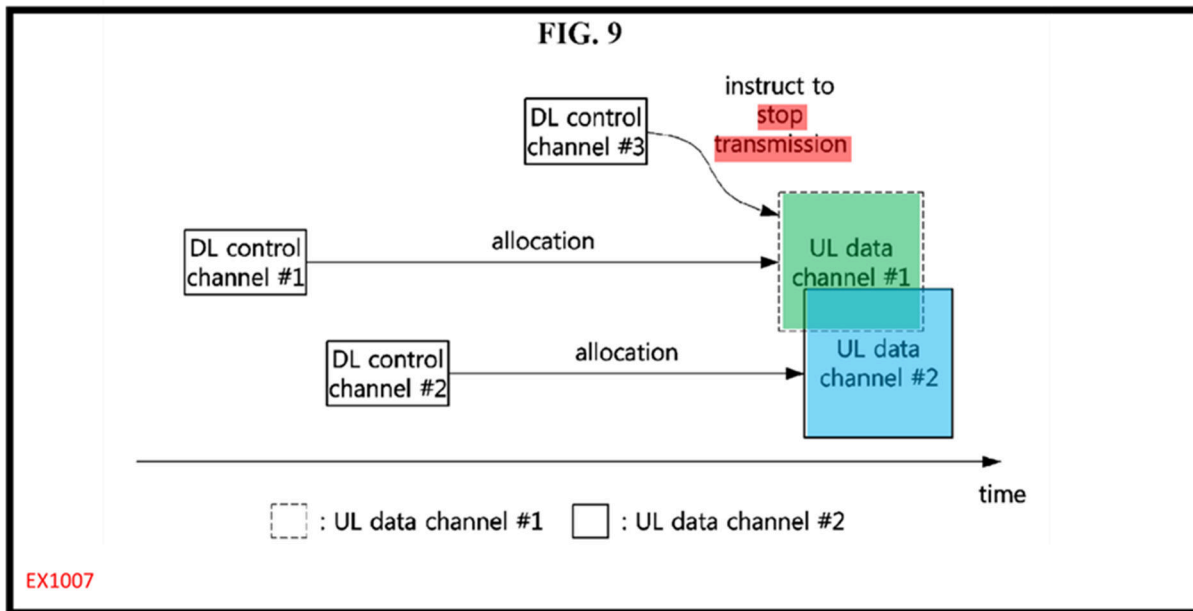
[1.pre]:

To the extent the preamble is limiting, the Kim-Boroujeni combination provides a method. *See e.g.*, EX1007, [0004] (“a method for stopping transmission

of a first transport block”), Abstract, FIG. 9; EX1008, [0176]/EX1010, [0175]; EX1003, ¶139.

[1.a]:

In the Kim-Boroujeni combination, each terminal (i.e., *a wireless device*) in a cell is configured by a base station that provides each terminal with *uplink cancellation configuration parameters* to coordinate uplink transmissions (e.g., UL data channel #1 and UL data channel #2) from the terminals to the base station. EX1003, ¶140. As explained *supra* §VI.C.1, when the terminals of Kim later receive a downlink control (DCI) message (e.g., on DL control channel #3), “each terminal may decode the bitmap [indicating uplink resources for the cancelled UL transmission] at a specific location in the received DL control channel,” e.g., “the terminals know to which carrier the bitmap should be applied at a specific location of the DL control channel #3.” EX1007, [0172], [0167] (“The terminal #1 may receive the DL control channel #3, and may not transmit the UL data channel #1 in resources indicated by the bitmap included in the DL control channel #3”), [0165] (“Some or all of the UL data channel #1 may overlap with the UL data channel #2.”), FIG. 9.



EX1003, ¶140 (EX1007, FIG. 9 (annotated)).

[1.a1]:

In the Kim-Boroujeni combination, “the base station may use a higher layer signaling to transmit the identification information for decoding the DCI to one or more terminals” where the identification information can be “RNTI.” EX1007, [0178], [0168], [0184]. A POSITA would have identified the RNTI as *a cancellation indication radio network temporary identifier (RNTI)* because it is used to configure the terminals for handling cancellation indications. *Supra* §VI.C.1; EX1003, ¶141.

[1.a2]:

To prepare each terminal in the cell for uplink cancellation indications, the Kim-Boroujeni combination provides *a sequence serving cell-specific parameters*.

Serving Cell identifier

For example, Kim generally describes that “the terminal may use the identification information configured by the base station to perform a detection operation in the specific search space for the DL control channel in order to obtain the UL PI.” EX1007, [0184]. The identification information configured by the base station is specific to the serving cell where the terminal “may belong to cell coverage of” the base station. EX1007, [0073], FIG. 1; EX1003, ¶¶142-143. Here, ***an identifier of a serving cell*** would have been an operational requirement found to be obviously present for pairing the terminal with the specific serving cell where uplink transmissions are subject to cancellation indications. *Id.* As evidenced by Boroujeni: “In the case of being configured for monitoring UL cancellation, the WTRU [terminal] may be also configured with a set of serving cells by higher layer parameter CAN-ConfigurationPerServingCell that includes a set of serving cell indexes provided by corresponding higher layer parameters servingCellId....” EX1008, [0178]/EX1010, [0177]; §§VI.C.1-2.

First/Second Starting Position

In the Kim-Boroujeni combination, Kim teaches its “DL control channel may include a bitmap #1 indicating UL reference resources belonging to the conventional UL carrier and a bitmap #2 indicating UL reference resources belonging to the SUL carrier” so that “the terminal may identify the bitmaps #1 and #2 by receiving one

DL control channel, and may determine whether to transmit the UL data channel based on the bitmaps #1 and #2.” EX1007, [0171]. In the Kim-Boroujeni combination, each bit map has a corresponding *starting position in* the downlink control channel (i.e., *a DCI*) so that both bit maps can be packed accordingly. *Supra* §VI.C.3; EX1003, ¶144. Boroujeni particularly teaches using the parameter “positioninDCI” to configure “a corresponding set of locations for fields in DCI format” where “[t]he DCI for UL cancellation may carry a bitfield or bit string which can be mapped to the UL cancelled resources explicitly indicating the frequency and time of the cancelled resources in RBs and OFDM symbols.” EX1008, [0179]/EX1010, [0178]. Boroujeni’s disclosure parallels the script depicted in FIG. 19 of the ’695 patent. *Supra*, §VI.C.2; EX1003, ¶144 (further noting the positioninDCI parameter was ubiquitously known by citing EX1014 (TDOC R1-1910225) at pages 9-11).

As explained *supra* §VI.C.3, a POSITA would have found it obvious to encode the starting position for each bitmap of Kim in a DCI using Boroujeni’s configuration parameter (e.g., positioninDCI) to pursue predictable and known benefits including compact configuration and efficient decoding for improved coordination of uplink transmissions from multiple terminals in a cell. EX1003, ¶145. The combination would have a reasonable expectation of success because doing so merely combines known elements to yield a predictable result: Kim’s

terminal is configured with *a first parameter indicating a first starting position in a downlink control information (DCI)*, which points to “bitmap #1 indicating UL reference resources belonging to the conventional UL carrier” of *the serving cell*; and *a second parameter indicating a second starting position in a DCI*, which points to “bitmap #2 indicating UL reference resources belonging to the supplemental UL carrier” *of the serving cell*. EX1007, [0171]; EX1003, ¶145.

[1.b]:

In the Kim-Boroujeni combination, Kim’s terminal *receives a first DCI* (e.g., in downlink control channel #3) *associated with cancellation indication RNTI* (e.g., “identification information common to the terminals (e.g., slot format indicator (SFI)—radio network temporary identifier (SFI-RNTI), interruption RNTI (INT-RNTI), or a commonly-applied RNTI)”). EX1007, [0168].

In the Kim-Boroujeni combination, the first DCI includes multiple *cancellation indications* (e.g., for cancelling multiple scheduled transmissions on specified resources). *Supra* §VI.C.3. To communicate cancellation indications to terminals, Kim teaches “the DL PI and the UL PI may be included in the same DL control channel (e.g., the same DCI),” for example, “the bitmap(s) for DL reference resources and the bitmap(s) for UL reference resources may be concatenated in one DCI.” EX1007, [0182], [0354] (“the base station may concatenate one or more

pieces of information that the specific terminal should interpret to configure a payload of the DCI”); *see also* EX1008, [0177] (“the WTRU is simultaneously configured with both UL cancellation and DL preemption”)/EX1010, [0176]. In the context of Elements [1.a1] and [1.a2], the positions of the bitmaps within the DCI are parameterized using the positioninDCI example, as taught in Boroujeni. *Supra* §VI.C.3; EX1003, ¶¶146-147.

[1.c]:

In the context of [1.b], when the base station transmits the DCI including, e.g., both the DL PI and the UL PI, the terminal ***determines a first cancellation indication*** corresponding to the UL PI. EX1007, [0182] (“The base station may transmit to the terminal a higher layer message including information indicating location of the bitmap(s) for DL reference resources and location of the bitmap(s) for UL reference resources in the DCI. The terminal may receive the higher layer message from the base station, and may determine the location of the bitmap(s) for DL reference resources and the location of the bitmap(s) for UL reference resources in the DCI”); EX1003, ¶148.

[1.c1], [1.c2]:

In the Kim-Boroujeni combination, Kim teaches that “the terminal...may identify at which position in the DCI the bitmap for UL reference resources

corresponds to the UL carrier (e.g., conventional UL carrier or SUL carrier)"). EX1007, [0182]. Kim already explains that "the DL control channel may include a bitmap #1 indicating UL reference resources belonging to the conventional UL carrier and a bitmap #2 indicating UL reference resources belonging to the SUL carrier" so that "the terminal may identify the bitmaps #1 and #2 by receiving one DL control channel, and may determine whether to transmit the UL data channel based on the bitmaps #1 and #2." *Id.*, [0171]; EX1003, ¶149.

As explained *supra* for Elements [1.a1] and [1.a2], the positions of the bitmaps within one DCI are parameterized using the positioninDCI example, as taught in Boroujeni. EX1003, ¶150. As further explained *supra* §VI.C.3, in the Kim-Boroujeni combination, ***the first starting position***, represented by ***a first number of bits***, points to "bitmap #1 indicating UL reference resources belonging to the conventional UL carrier," and ***the second starting position***, represented by ***a second number of bits***, points to "bitmap #2 indicating UL reference resources belonging to the SUL carrier." EX1007, [0171]; EX1008, [0178] ("a corresponding set of locations for fields in DCI [according to] parameter positioninDCI")/EX1010, [0177]; EX1003, ¶150 (further explaining that ubiquitous use of an index field to indicate the location of pre-empted/cancelled resources by citing EX1013 at FIG. 4 and EX1015 at 92).

[1.c3]:

In the Kim-Boroujeni combination, Boroujeni explains that “the WTRU [(i.e., a terminal)] may determine which part of the DCI...is indicating...UL cancellation indication explicitly based on some higher layer configuration and/or implicitly based on other parameters, for example, the DCI payload size or based on an additional field in the DCI itself.” EX1008, [0177]-[0178], [0093]/EX1010, [0176]-[0177], [0085]. In the Kim-Boroujeni combination, ***the first number of bit and the second number of bit***, respectively representing the first starting position (i.e., the conventional uplink carrier) and the second starting position (i.e., the supplemental uplink carrier), ***are based on a payload size of the first DCI*** of Element [1.c], as expressly disclosed in Boroujeni. EX1003, ¶151.

[1.d]:

In the Kim-Boroujeni combination, Kim’s terminal “may not transmit a UL control channel or a UL data channel,” ***i.e., cancels the scheduled uplink transmission***, “in the UL reference resources indicated by the bitmap included in the DCI,” i.e., ***based on the first cancellation indication***, as provided under Elements [1.c], [1c1]-[1.c3]. EX1007, [0181] (“The base station may generate a DCI including a bitmap (e.g., UL PI) indicating whether to transmit a UL control channel or a UL data channel in time and frequency resources (e.g., UL reference

resources), and transmit the DCI through a DL control channel”), [0180] (“The terminal may receive the DCI through a DL control channel and may not receive a DL control channel or a DL data channel in the DL reference resources indicated by the bitmap included in the DCI”), [0182-187], [0177-177], [0170]; EX1003, ¶¶152-153.

Claim 2.

In the Kim-Boroujeni combination, Kim concatenates multiple cancellation in one DCI. *See e.g.*, EX1007, [0182] (“the bitmap(s) for DL reference resources and the bitmap(s) for UL reference resources may be concatenated in one DCI”); Element [1.b]. In this context, determining the UL cancellation indication (i.e., ***the first cancellation indication*** under Element [1.c]) involves obtaining the full content of the UL cancellation indication from the received DCI, which is ***based on a size of*** the UL cancellation indication just like the disclosure of the ’695 patent (EX1001, 31:12-20,37-43). EX1007, [0170-172], [0177], [0181-184], [0354], [0359-363] (FIG. 27); EX1003, ¶¶154-155.

Claim 3.

In the Kim-Boroujeni combination, Kim provides ***receiving the first DCI*** (i.e., the UL cancellation indication) ***via a common search space*** when “the search space

for the UL PI (e.g., control resource set (CORESET) to which the search space belongs) may be the same as the search space for the DL PI (e.g., CORESET to which the search space belongs).” EX1007, [0187], [0359-361], [0188-190] (explaining search spaces illustrated in FIGS. 10-11); EX1003, ¶¶156-157.

Claim 4.

Element [4.a]:

For at least the same reasons as explained *supra* [1.c1] & [1.c3], the Kim-Boroujeni combination renders obvious Element [4.a]. *See e.g.*, EX1007, [0182], [0171-172], [0179], [0167-170], FIG. 9; EX1008, [0178]/EX1010, [0177]; EX1003, ¶158.

Element [4.b]:

For at least the same reasons as explained *supra* [1.c2] & [1.c3], the Kim-Boroujeni combination renders obvious Element [4.b]. *See e.g.*, EX1007, [0182], [0171-172], [0179], [0167-170], FIG. 9; EX1008, [0178]/EX1010, [0177]; EX1003, ¶159.

Claim 5.

For at least the same reasons as explained *supra* [1.c3] and claim 4, the Kim-Boroujeni combination provides claim 5. *See e.g.*, EX1008, [0177-78], [0093]/EX1010, [0176]-[0177], [0085]; EX1007, [0120-122], [0124]; EX1003, ¶160.

Claim 6.

For at least the same reasons as explained *supra* [1.c3], the Kim-Boroujeni combination renders obvious claim 6. *See e.g.*, EX1008, [0177-78], [0093]/EX1010, [0176]-[0177], [0085]; EX1007, [0120-122], [0124]; EX1003, ¶161.

Claim 7.

The Kim-Boroujeni combination renders obvious claim 7. Kim describes “a method for stopping transmission of the first transport block in the first PUSCH,” which refers to ***a physical uplink shared channel***. EX1007, [0004], [0017-18]; *see also* EX1008, [0168] (“an embodiment for indication of PUSCH cancellation by group-common DCI is to explicitly indicate the cancelled/interrupted resources by the GC-DCI and have a procedure for the eMBB WTRU to determine the cancellation of its PUSCH”), [0200] (“the WTRU may be specified to cancel a PUSCH transmission”), [0203],/ EX1010, [0168], [0199], [0204]; EX1003, ¶162.

Claim 8.

In the context of claims 1 and 7, the Kim-Boroujeni combination renders obvious claim 8. *See e.g.*, EX1007, [0170-172], [0177], [0181-184], [0354], [0359-363] (FIG. 27); *supra* claim 2; EX1003, ¶163.

Claim 9.

In the context of claims 1 and 7, the Kim-Boroujeni combination renders obvious claim 9. *See e.g.*, EX1007, [0187], [0359-361], [0188-190] (explaining search spaces illustrated in FIGS. 10-11); *supra* claim 3; EX1003, ¶164.

Claim 10.

The Kim-Boroujeni combination renders obvious that ***the scheduled uplink transmission is a sounding reference signal transmission*** (also known as SRS transmission). EX1003, ¶160. Kim describes “[t]he terminal may transmit SRSs periodically or non-periodically,” for example, “using UL symbol(s) included in a slot.” EX1007, [0341-363], [0370-372] (“The terminal may transmit SRS according to the SRS configuration information”), FIG. 27. Boroujeni similarly describes “an alternative to the PUSCH” can include “a physical random access channel (PRACH), a sounding reference signal (SRS).” EX1008, [0102], [0185] (“a WTRU may be scheduled to perform a PUSCH, PRACH, PUCCH or SRS transmission”),

[0293]/EX1010, [0094], [0185], [0282]. It would have been obvious to include *a sounding reference signal transmission*, as described in both Kim and Boroujeni, to provide an estimate of uplink channel quality, which was general knowledge to a POSITA. EX1003, ¶165 (citing Liang at [0048], [0055], [0122]).

Claim 11.

In the context of claims 1 and 10, the Kim-Boroujeni combination renders obvious claim 11. *See e.g.*, EX1007, [0170-172], [0177], [0181-184], [0354], [0359-363] (FIG. 27); *supra* claim 2; EX1003, ¶166.

Claim 12.

In the context of claims 1 and 10, the Kim-Boroujeni combination renders obvious claim 12. *Supra* claim 3; EX1007, [0187], [0359-361], [0188-190]; EX1003, ¶167.

Claim 13.

In the context of claims 1 and 10, the Kim-Boroujeni combination renders obvious claim 13. *Supra* claim 3; EX1007, [0187], [0359-361], [0188-190]; EX1003, ¶168.

Claim 14.

As explained *supra* [1c], Kim teaches “the DL control channel may include a bitmap #1 indicating UL reference resources belonging to the conventional UL carrier and a bitmap #2 indicating UL reference resources belonging to the SUL carrier” to mark the UL reference resources where scheduled UL transmissions are being cancelled. EX1007, [0171]. Kim further explains “the terminal may identify the bitmaps #1 and #2 by receiving one DL control channel, and may determine whether to transmit the UL data channel based on the bitmaps #1 and #2.” *Id.*, [0170] (“a bitmap indicating resources through which the UL data channel is not transmitted”); EX1003, ¶169.

The Kim-Boroujeni combination thus renders obvious ***determining cancelled uplink resources*** (e.g., the impacted UL reference resources) ***based on the first cancellation indication*** (as provided under [1.c]). *See also* EX1007, [0201-206] (additional examples of UL reference resources as depicted in FIGS. 12-13); EX1003, ¶170.

Claim 15.

Element [15.a]:

In the context of claims 1 and 14, the Kim-Boroujeni combination renders obvious that the sequence of serving cell-specific parameters includes ***an offset***

parameter (e.g., used by DCI to convey UL/SUL cancellation indications) indicating an offset *in units of symbols* (e.g., temporal symbols) *from an end of a control channel reception where the wireless device detects the first DCI* (e.g., from the end of the DL control channel where the first DCI was received, which is also characterized as “the minimum time required for processing operations based on the DL control channel”). EX1007, [0136]; EX1003, ¶171.

Kim describes examples of configuring its UL PI as a bitmap where “[e]ach bit in the bitmap may indicate a UL reference resource (e.g., time and frequency domain),” which “may belong to an active bandwidth part (BWP) of the terminal, and may be composed of B resource blocks and T symbols.” EX1007, [0192] (“B and T may be configured by the base station”). Kim also explains that “the UL reference resource indicated by the UL PI may be composed of a small number of symbols (e.g., short time) and a wide bandwidth.” *Id.*, [0196].

In the above context, Kim explains “a processing time for UL transmission at the terminal may be required,” for example, “for decoding the DL control channel” so that the terminal “may determine the location of the bitmap(s) for DL reference resources and the location of the bitmap(s) for UL reference resources in the DCI.” EX1007, [0134], [0182]. Kim particularly explains “the minimum time required for processing operations based on the DL control channel.” *Id.*, [0136], [0134] (“In case that the base station allocates a time that is too short to the terminal, the terminal

may not be able to perform all the procedures according to its processing capability”). According to Kim, “the minimum required time may be configured in units of symbols.” *Id.*, [0136].

A POSITA, when reviewing the above passages, would have recognized that Kim teaches *an offset parameter indicating an offset*, which corresponds to the minimum required time expressed in units of symbols, so that the base station can configure a terminal accordingly. *Id.*, [0136] (“The base station may perform an initial access procedure with the terminal, and may identify the processing capability of the terminal in the initial access procedure”); EX1003, ¶¶172-174.

Element [15.b]:

The Kim-Boroujeni combination renders obvious Element [15.b] because the offset, as explained *supra* [15.a], indicates the minimum required time (i.e., a gap) from receiving the DCI to the moment the cancellation indication is decoded from the received DCI. EX1007, [0136], [0132], [0182], [0196]; EX1003, ¶¶175-176.

Claim 16.

The Kim-Boroujeni combination renders obvious claim 16 because Kim teaches *determining the first symbol of the uplink resources* (through which the cancelled UL transmission was scheduled for transmission) based on the offset, as

explained *supra* claim 15. *See e.g.*, EX1007, FIGS. 12-13, [0191-198], [0136]; EX1003, ¶177.

Claim 17.

The Kim-Boroujeni combination renders obvious claim 17. EX1003, ¶178. As explained *supra* Element [15.a], Kim discloses that “a processing time for UL transmission at the terminal may be required,” for example, “for decoding the DL control channel” so that the terminal “may determine the location of the bitmap(s) for DL reference resources and the location of the bitmap(s) for UL reference resources in the DCI.” EX1007, [0134], [0182], [0136].

Claim 18.

The Kim-Boroujeni combination renders obvious claim 18. *Supra*, claim 3; EX1007, [0187], [0359-361], [0188-190], FIGS. 10-11; EX1003, ¶179.

Claim 19.

Element [19.a]

The Kim-Boroujeni combination renders obvious Element [19.a]. *Supra*, Elements [4.a], [1.c1] & [1.c3]; EX1007, [0182], [0171-72], [0179], [0167-170], FIG. 9; EX1008, [0178]/EX1010, [0177]; EX1003, ¶180.

Element [19.b]

The Kim-Boroujeni combination renders obvious Element [19.b]. *Supra*, Elements [4.b], [1.c2] & [1.c3]; EX1007, [0182], [0171-172], [0179], [0167-170], FIG. 9; EX1008, [0178]/EX1010, [0177]; EX1003, ¶181.

Claim 20.

The Kim-Boroujeni combination renders obvious claim 20. *Supra*, claim 5, Element [1.c3]; EX1008, [0177-0178], [0093]/ EX1010, [0176-0177], [0085]; EX1007, [0121-125]; EX1003, ¶182.

VII. 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).

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

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

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

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

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

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

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for inter partes review for the '695 Patent. The '695 patent is the subject of a number of civil actions including: *Apex Beam Technologies LLC v. Apple Inc*, 6-24-cv-00223 (WDTX), filed April 29, 2024; *Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al*, 2-24-cv-00203 (EDTX), filed March 20, 2024.

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

Petitioner provides the following designation of counsel.

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D. Service Information

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

Petitioner consents to electronic service by email at IPR50095-0239IP1@fr.com.

Respectfully submitted,

Dated: April 25, 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 13,325 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: April 25, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on April 25, 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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