

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC, CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, T-MOBILE USA, INC., AT&T SERVICES, INC., NOKIA OF AMERICA, CORP.,
AND ERICSSON INC.

Petitioners

v.

KT CORPORATION (Patent Owner) and
PEGASUS WIRELESS INNOVATION LLC (Exclusive Licensee)

Case No. IPR2025-00292

Patent 9,894,644

**PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 9,894,644**

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I. INTRODUCTION

Google LLC, Cellco Partnership d/b/a Verizon Wireless, Nokia of America Corp., Ericsson Inc., AT&T Services, Inc., and T-Mobile USA, Inc., (collectively, “Petitioners”) respectfully request *inter partes* review of Claims 1-3 (“Challenged Claims”) of U.S. Patent No. 9,894,644 (“’644 Patent”) (EX1001) under 35 U.S.C. §§311-319 and 37 C.F.R. §42.100 *et seq.*

The ’644 Patent purports to enhance coverage of Machine Type Communication (“MTC”) terminals based on repeated allocation of downlink control channels in a plurality of subframes. *See* EX1001, 1:15-22, 1:25-62. The Challenged Claims encompass receiving by a terminal and transmitting by a base station downlink control channels repeatedly allocated in a plurality of subframes. The terminal receives the downlink control channels repeatedly allocated in the plurality of subframes, and combines the downlink control channels to extract downlink control information (“DCI”). Information on a start subframe of the plurality of subframes is transmitted to the terminal via configuration information (e.g., through higher layer signaling), and information on the number of the plurality of subframes is transmitted via DCI. The ’644 Patent states that such transmission may allow for the terminal to “know subframes where the DCI is repeatedly transmitted”. EX1001, 12:18-24.

The USPTO erred in allowing the Challenged Claims because the alleged novelty was known. The prior art cited herein discloses and suggests repeatedly allocating downlink control channels in a plurality of subframes to enhance coverage of MTC terminals in a coverage enhancement mode, where information on the number of plurality of subframes and information on a start subframe are received by the terminal separately via different operations (higher layer signaling versus DCI)—the alleged novelty of the '644 Patent. The Challenged Claims are therefore unpatentable. *See* EX1006, EX1007, EX1016 in their entireties.

II. MANDATORY NOTICES PURSUANT TO 37 C.F.R. §42.8(a)(1)

A. Real Party-In-Interest

Pursuant to 37 C.F.R. §42.8(b)(1), Petitioners certify that the real parties in interest are Google LLC¹, Cellco Partnership d/b/a Verizon Wireless, Verizon Business Network Services LLC, Verizon Corporate Services Group Inc., TracFone Wireless, Inc., AT&T Corp., AT&T Services, Inc., AT&T Mobility LLC, AT&T Mobility II LLC, New Cingular Wireless PCS, LLC, Cricket Wireless LLC, T-

¹ Google LLC is a subsidiary of XXVI Holdings Inc. which is a subsidiary of Alphabet Inc. XXVI Holdings Inc. and Alphabet Inc. are not real parties-in-interest to this proceeding.

Mobile USA, Inc., Sprint Solutions LLC, Sprint Spectrum LLC, Ericsson Inc., Telefonaktiebolaget LM Ericsson, and Nokia of America Corporation.

Out of an abundance of caution, Petitioners identify all current defendants in the below cases, as well as additional involved, as potential real parties in interest only for the purpose of this proceeding and only to the extent that Patent Owner contends that these separate legal entities should be named real parties in interest in this IPR. Petitioners do so to avoid the potential expenditure of resources to resolve such a challenge. Petitioners also acknowledge that each petitioner has a number of affiliates. No unnamed entity is funding, controlling, or otherwise has an opportunity to control or direct this Petition or Petitioners' participation in any resulting IPR. Petitioners are also not aware of any affiliate that would be barred from filing this Petition under 35 U.S.C. §315(e).

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

The following is a list of any judicial or administrative matters that would affect, or be affected by, a decision in this proceeding:

Related District Court Matters ("Related Litigations")

1. *Pegasus Wireless Innovation LLC v. AT&T Inc. et al.*, Civ. Action No. 2:23-cv-00638 (EDTX) filed on December 29, 2023 (consolidated with 2:23-cv-00640) ("the '638 Litigation");

2. *Pegasus Wireless Innovation LLC v. T-Mobile US, Inc. et al.*, Civ. Action No. 2:23-cv-00639 (EDTX) filed on December 29, 2023 (consolidated with 2:23-cv-00640) (“the ’639 Litigation”); and

3. *Pegasus Wireless Innovation LLC v. Verizon Communications Inc. et al.*, Civ. Action No. 2:23-cv-00640 (EDTX) filed on December 29, 2023 (pending) (“the ’640 Litigation”).

Related Applications

The ’644 Patent issued from U.S. Patent Application No. 15/024,862, filed on March 25, 2016 which is a U.S. National Stage of PCT/KR2014/008216, filed on September 2, 2014 and claims priority to Korean Patent Application No. 10-2014-0007262, filed on January 21, 2014 and Korean Patent Application No. 10-2013-0114759, filed on September 26, 2013.

C. Lead and Backup Counsel

Pursuant to 37 C.F.R. §42.8(b)(3) and §42.10(a), Petitioners hereby identify its lead and backup counsel as follows:

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Powers of Attorney are being filed concurrently herewith in accordance with 37 C.F.R. §42.10(b).

D. Service Information Under 37 C.F.R. §42.8(b)(4)

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

III. FEES

The undersigned authorizes the Office to charge Deposit Account 02-4800 for fees required by 37 C.F.R. §42.15(a).

IV. REQUIREMENTS UNDER 37 C.F.R. §42.104

A. Grounds for Standing

Petitioners certify that the '644 Patent is available for IPR and Petitioners are not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified herein. 37 C.F.R. §42.104(a).

B. Identification of Challenges and Precise Relief Requested

Petitioners challenge Claims 1-3 of the '644 Patent and requests that these claims be found unpatentable for the reasons set forth in Petitioners' Grounds as follows:

Ground	Reference(s)	Basis	Claims
1	WO 2014/055878 to Lee et al. ("Lee") (EX1006)	§102	1-3
2	Lee	§103	1-3
3	Lee in view of U.S. Patent App. Pub. No. 2016/0353420 to You et al. ("You") (EX1007) and Zhuang (EX1016)	§103	1-3

Petitioners also rely upon the evidence listed in the Exhibit List, including the Declaration and *Curriculum Vitae* of Sumit Roy (EX1008, ¶¶1-313; EX1009) and the Declaration and *Curriculum Vitae* of Craig Bishop (EX1023, ¶¶1-68; EX1024).

C. Prior Art Qualification of Asserted References

For this Petition, Petitioner assumes the earliest effective filing date of the '644 Patent is September 26, 2013—the filing date of priority Korean Patent

Application No. 10-2013-0114759.² This is the earliest filing date claimed by the '644 Patent. Thus, the '644 Patent is subject to AIA 35 U.S.C. §§102 and 103.

Lee (EX1006), filed October 4, 2013 as International Application No. PCT/US2013/063481 and published April 10, 2014 as WO2014/055878, claims priority to U.S. Provisional Application No. 61/863,223 (EX1010, “Lee Priority Application”) filed August 7, 2013.³

Lee is prior art at least under AIA §§102(a)(2), 102(d)(2), and 119. “[F]or prior-art determinations under AIA §102, ‘there is no need to evaluate whether any claim of [a reference] patent document is actually entitled to priority or benefit under 35 U.S.C. 119, 120.’” *Penumbra, Inc. v. Rapidpulse, Inc.*, IPR2021-01466, Paper 34

² Petitioners do not concede that any challenged claim is entitled to an effective filing date of September 26, 2013.

³ Lee claims the benefit of three additional provisional applications; U.S. Provisional Application No. 61/807,945 filed April 3, 2013 (EX1011); U.S. Provisional Application No. 61/753,263 filed January 16, 2013 (EX1012); and U.S. Provisional Application No. 61/710,315 filed October 5, 2012 (EX1013). Lee’s Priority Application (EX1010) fully supports the subject matter of Lee (EX1006) discussed herein.

at 32 (PTAB Mar. 10, 2023) (quoting M.P.E.P. §2154.01(b)). The requirement that the Lee Priority Application “describe the subject matter” that Petitioners rely upon in Lee is met. The disclosures of the Lee Priority Application and Lee are nearly identical, with immaterial differences in some phrasing. The below table confirms disclosures of Lee (EX1006) that correspond to disclosures of the Lee Priority Application (EX1010):

Lee (EX1006)	Lee Priority Application (EX1010)
[0001]-[0322]	[0001]-[0308]
[0323]-[0428]	n/a (not relied on in this Petition)
[0429]	[0309]
Figs. 1-13	Figs. 1-13

The table demonstrates that each citation to Lee (EX1006) in this Petition and Dr. Roy’s Declaration bears corresponding disclosure in the Lee Priority Application (EX1010) of the same subject matter.

Lee is entitled to the filing date of Lee Priority Application, and constitutes prior art at least under §102(a)(2). Lee fulfills the requirements of: (1) containing a priority or benefit claim to the prior-filed application; (2) being filed within the applicable filing period requirement (copending with or within twelve months of the earlier filing, as applicable); and (3) having a common inventor or being by the same applicant. *See* M.P.E.P. §2154.01(b).

You (EX1007), filed August 9, 2016 as U.S. Application No. 15/232,500 and issued August 21, 2018 as U.S. Patent No. 10,057,897, claims priority to U.S.

Provisional Application No. 61/862,518 (“You Priority Application”) filed August 6, 2013, and constitutes prior art at least under Section 102(a)(2). You is entitled to the filing date of You Priority Application and constitutes prior art at least under §102(a)(2). You fulfills the requirements of: (1) containing a priority or benefit claim to the prior-filed application; (2) being filed within the applicable filing period requirement (copending with or within twelve months of the earlier filing, as applicable); and (3) having a common inventor or being by the same applicant. *See* M.P.E.P. §2154.01(b).

Zhuang (EX1016), filed August 9, 2013 as International Application No. PCT/CN2013/0081200 and published February 12, 2015 as WO2015/018075, is prior art at least under AIA §§102(a)(2), 102(d)(2), and 119.

V. BACKGROUND

A. The ’644 Patent

The ’644 Patent describes transmitting signals from a base station to a terminal including downlink control channels repeatedly allocated in a plurality of subframes. EX1001, 1:66-2:45. The ’644 Patent states “[a]n MTC terminal may be installed in a place having a bad electric wave environment as compared with a normal terminal. Therefore, the coverage of the MTC terminal should be improved to about 20 dB or higher as compared with the coverage the normal terminal.” *Id.*, 1:39-43. The ’644 Patent suggests improving MTC terminal coverage by “receiv[ing] downlink control

channels through a plurality of subframes and acquir[ing] scheduling information of downlink data channel and/or uplink data channel transmission resources.” *Id.*, 1:59-62. EX1008, ¶30.

The ’644 Patent indicates that the terminal should be aware of : (1) a start subframe of the plurality of a subframes; and (2) a number of subframes of the plurality of subframes. EX1001, 9:51-59. The DCI carries information on the number of the plurality of subframes; information on the start subframe is received via higher layer signaling:

The terminal can know subframes where the DCI is repeatedly transmitted, on the basis of the information, which is received through higher layer signaling, on the start subframe of a plurality of subframes where the DCI is repeatedly transmitted and the information, which is included in the DCI, on the number of a plurality of subframes where the DCI is repeatedly transmitted.

EX1001, 12:15-26. The Challenged Claims purport to enhance coverage of an MTC terminal by repeating DCI in a plurality of subframes, where information on a start subframe and information on the number of the plurality of subframes is received by the terminal via different signaling mechanisms, e.g., DCI versus higher layer signaling. *See* EX1002, pp.68-69. EX1008, ¶31.

To enhance coverage of MTC User Equipment (UE), a base station sends repeating transmissions (e.g., repeating subframes including downlink control channels carrying DCI) to the UE. EX1001, 1:25-62; 8:1-7. To receive DCI, the UE combines DCI based on configuration information. *Id.*, 10:28-32. Figure 9 illustrates repeatedly allocating downlink control channels (Physical Downlink Control Channels, “PDCCHs”) in a plurality of subframes:

FIG. 9

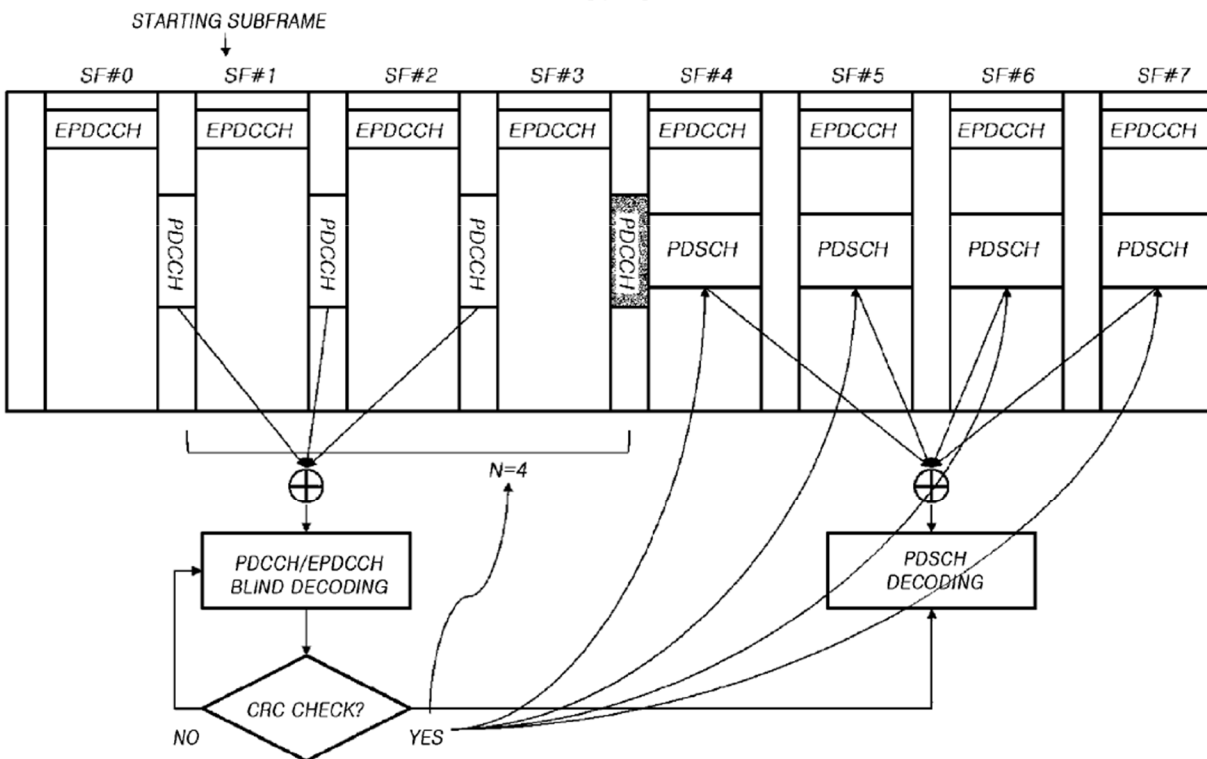


Fig. 9 of '644 Patent

These allegedly novel techniques of the '644 Patent were well known. The prior art (Lee, You, Zhuang) had addressed MTC terminal coverage enhancement by providing enhanced coverage modes for MTC UEs using repeated subframes

where: (1) a start subframe of the plurality of subframes; and (2) a number of subframes of the plurality of subframes are received through different operations (e.g., high layer signaling and DCI). *See* §VII. EX1008, ¶¶32-33.

B. Examination History

During prosecution, the claims were rejected under §102 as anticipated by You. EX1002, p.73. You discloses a subframe bundle as a plurality of subframes (EX1007, ¶[0146]; EX1019, pp.43-44) and the Examiner cited You's subframe bundle as disclosing downlink control channels repeatedly allocated in the plurality of subframes. EX1002, p.76. Applicant did not dispute this determination. *See id.*, pp.67-70. EX1008, ¶¶35-37.

In response, Applicant amended the three independent claims to recite “wherein: the configuration information comprises information on a start subframe of the plurality of subframes; and the downlink control information comprises information on the number of the plurality of subframes.” *Id.*, pp.64-66. Applicant argued that You “do[es] **not** disclose that the start subframe information and the information on the number of subframes are **separately** obtained **through different operations**.” *Id.*, p.68 (emphasis in original). EX1008, ¶38.

A Notice of Allowance issues based on Applicant's response regarding You. *Id.*, p.53. EX1008, ¶39.

C. The Prior Art

1. Lee (EX1006)

Lee discloses enhancing coverage of MTC UE devices. *See* EX1006, Title, ¶¶[0003]-[0005]; EX1010, Title, ¶¶[0001], [0076]. Lee describes techniques including subframe bundling (e.g., TTI bundling) for (E)PDCCHs for coverage enhancement. EX1006, ¶¶[0092], [0111]-[0127], [0139]-[0152]; EX1010, ¶¶[0086], [0105]-[0121], [0134]-[0145]. Lee discloses subframe bundling as repeatedly transmitting consecutive subframes with the same data to a UE [to effectively extend the transmission, thereby enhancing coverage]. EX1006, ¶¶[0103]-[0104], [0107], [0111], [0145]-[0153]; EX1010, ¶¶[0097]-[0098], [0101], [0105], [0141]-[0145]. According to Lee, “subframe, TTI and ms may be used interchangeably.” *Id.*, ¶[0106]. EX1008, ¶48.

Lee discloses transmitting a plurality of subframes for downlink transmission including repeatedly allocated downlink control channels carrying DCI. *See* EX1006, ¶¶[0113]-[0115]. Lee’s DCI includes information on the number of the plurality of subframes (N_{TTI}). *Id.*, ¶[0114]. Lee’s N_{TTI} refers to a number of repetitions of a single subframe to constitute a plurality of subframes. *Id.* EX1008, ¶49.

Lee discloses an additional layer of coverage enhancement by repeatedly transmitting the entire plurality of subframes over time defined by a repetition rate (N_{rep}). EX1006, ¶[0104]. Lee demonstrates that a plurality of subframes can be

defined by a first number of a plurality of subframes (N_{TTI}), and further defined by a number of repetitions (N_{rep}) of the first number of the plurality subframes, resulting in a total number of subframes (e.g., a plurality of subframes). *Id.* Lee teaches that both the first number of the plurality of subframes (N_{TTI}) and the number of repetitions of the plurality of subframes (N_{rep}) are transmitted through DCI. *Id.*, ¶[0104]. Lee's N_{TTI} is a subset of the number of repetitions N_{rep} because Lee demonstrates that applying the number of repetitions for the plurality of subframes further enhances coverage of an MTC UE. *Id.* EX1008, ¶50.

2. You (EX1007)

You discloses enhancing coverage of MTC UE devices. *See* EX1007, ¶[0150]; EX1019, pp.43-48. You discloses repeatedly transmitting a PDCCH in a subframe bundle comprising a plurality of subframes (EX1007, Abs.; EX1019, p.43) where multiple subframes are bundled and transmitted to a UE for the UE to successfully receive repeatedly transmitted PDCCH signals. EX1007, ¶[0150]; EX1019, pp.43-44. You expressly states that a subframe bundle is a plurality of subframes. EX1007, ¶[0146]; *see* EX1019, pp.43-44. EX1008, ¶51.

You demonstrates that the PDCCH is repeatedly transmitted over a bundle of N subframes (e.g., a number of the repeated subframes). EX1007, ¶[0146]; *see* EX1019, pp.43-44. You's UE successfully receives the PDCCH using at least a subset n of the N subframes (e.g., $1 \leq n \leq N$). *Id.* You indicates that "a transmission

start subframe location of a PDCCH” is defined as a fixed value transmitted to the UE through higher layer signaling. EX1007, ¶[0153]; EX1019, p.44. EX1008, ¶52.

You’s plurality of subframes including repeatedly allocated PDCCHs apply directly to enhanced coverage modes for MTC UE devices. *See* EX1007, ¶[0150]; *see* EX1019, p.43. *See also* EX1007, ¶¶[0147]-[0180]; EX1019, pp.43-48. EX1008, ¶53.

3. Zhuang (EX1016)

Zhuang is directed to MTC communications. EX1016, 1:9-14. Zhuang describes standardization work directed to coverage improvement and cost reduction for MTC devices, noting that “some potential solutions have been identified such as repetition of the physical channels to improve coverage.” *Id.*, 1:14-17; *see also id.*, 4:20-24. EX1008, ¶54.

Zhuang explains that “[t]he control channel is PDCCH or EPDCCH in LTE system.” *Id.*, 4:29-32. Zhuang indicates that the mobile station “gets the downlink of uplink scheduling information from a physical downlink control channel (PDCCH) or enhanced physical downlink control channel (EPDCCH).” *Id.*, 3:27-30. “The downlink or uplink scheduling information and the other control information, carried by the PDCCH, is referred to as downlink control information (DCI).” *Id.*, 3:30-31. EX1008, ¶55.

Zhuang is directed to “[a] method for a mobile station to determine the starting subframe of a data channel.” *Id.*, 1:26-27. Zhuang teaches that, “[t]he repetitions number (or the number of subframes occupied by data channel or control channel) may or may not be the same” and therefore “a method to determine the starting subframe of data channel reception or transmission is necessary.” *Id.*, 4:20-24. Zhuang discloses “detecting number of subframes occupied by the decoded control channel; and determining the starting subframe of the data channel based on the detected number of subframes occupied by the decoded control [channel] and a known gap from the starting subframe of the data channel to the end subframe of the decoded control channel.” *Id.*, 2:3-7; *see also id.*, Fig. 4. EX1008, ¶¶56-57.

Zhuang discloses “the number of subframes occupied is indicated in the decoded control channel.” *Id.*, 6:19-20. Zhuang discloses a “subframe indicator in the decoded control channel” that “signal[s] the number of subframes occupied by the control channel that contains the subframe indicator.” *Id.*, 6:21-7:6; *see also id.*, 10:22-11:13, Figs. 5, 7, Table 1. Zhuang discloses that the “subframe indicator can be carried in control information in the decoded control channel.” *Id.*, 12:4-10; *see also id.*, Fig. 8. EX1008, ¶¶58-60.

D. Person of Ordinary Skill in the Art (“POSITA”)

A person of ordinary skill in the art (“POSITA”) pertinent to the ’644 Patent would have had a bachelor’s degree in electrical engineering, computer engineering,

or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. *Id.* A person with less than 2 years of experience working in a field involving wireless communications could still qualify if the person has additional education that compensates for their lesser experience. *Id.* EX1008, ¶40.

VI. CLAIM CONSTRUCTION

Claim terms are interpreted according to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*), and its progeny.

The Board only construes the claims when necessary to resolve the underlying controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In Related Litigation, the parties proposed that certain claim terms should be given their plain and ordinary meaning. *See* EX1014, pp.13-14 (Plaintiff's initial proposed constructions); EX1015, pp.40-43 (Defendants' preliminary claim constructions). Defendants proposed that the plain and ordinary meaning of "configured to" in claim 3 means "actually configured to and not merely capable of performing the claimed function". EX1015, p.42. Defendants also proposed that the preambles are limiting. *See id.*, pp.40-43. Defendants and Plaintiffs agreed the

preambles of the Challenged Claims are limiting. Petitioners apply the constructions proposed in the Related Litigation in the Grounds below. While the proper metes and bounds of the claims are disputed in the Related Litigation, the cited prior art falls within these bounds whatever they may be. The Challenged Claims are unpatentable under all potential constructions. EX1008, ¶¶42-47.

VII. PETITIONERS HAVE A REASONABLE LIKELIHOOD OF PREVAILING

The Challenged Claims are unpatentable over the prior art. EX1008, ¶¶61, 313.

A. Claims 1-3 Are Anticipated by Lee (Ground 1)

The following sections reference where elements of Claims 1-3 are anticipated by the prior art. EX1008, ¶¶34, 62.

1. Claim 1 (Preamble): “A method for receiving, by a terminal, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes, the method comprising:”

Lee discloses the Preamble. Lee discloses a method for receiving, by a UE, DCI through downlink control channels (e.g., PDCCHs) repeatedly allocated in a plurality of subframes. Lee’s WTRU constitutes a terminal. EX1006, ¶¶[0005], [0033]-[0042]; EX1010, ¶¶[0031]-[0039]. Lee’s WTRUs are configured to receive DCI through downlink control channels (e.g., PDCCHs). EX1006, ¶[0096]; EX1010, ¶[0090]. The ’644 Patent indicates that downlink control channels include “PDCCHs or EPDCCHs”. EX1001, 2:1-2. EX1008, ¶¶63-65.

Lee recognizes that “[i]n order to improve the coverage of channels such as the enhanced PDCCH (EPDCCH) ... repetitive transmission may be considered as a coverage enhancement technique.” EX1006, ¶[0092]; EX1010, ¶[0086]. Lee’s WTRUs “transmit/receive data N_{TTI} times” where N_{TTI} is a number indicating a plurality of subframes. EX1006, ¶¶[0104]-[0114]; EX1010, ¶¶[0098]-[0108]. Lee’s WTRUs also transmit/receive “repeatedly transmitted” pluralities of subframes. *See* EX1006, ¶¶[0104]-[0105]; EX1010, ¶¶[0098]-[0099]. Thus, Lee’s WTRU receiving a single subframe repeated N_{TTI} times within a subframe bundle, and Lee’s WTRU receiving repeatedly transmitted bundled subframes, each constitute methods for receiving, by a terminal, DCI through PDCCHs repeatedly allocated in a plurality of subframes. EX1008, ¶¶66-69.

Repeated allocation is accomplished through “TTI bundling”, “where the number of subframes for TTI bundling may be predefined or configured.” EX1006, ¶[0104]; EX1010, ¶[0098]. Using TTI bundling, the same data may be transmitted in multiple consecutive TTIs (e.g., subframes) where “all TTIs within a TTI bundle may be treated as a single resource”. EX1006, ¶[0001]; EX1010, ¶[0001]. *See* EX1006, ¶¶[0051], [0106]-[0107]; EX1010, ¶¶[0001], [0100]-[0101]. Lee’s multiple consecutive TTIs (e.g., subframes) carrying the same data constitute a plurality of subframes with repeatedly allocated downlink control channels. EX1008, ¶¶70-72.

Additionally, Lee's "bundled subframes may be repetitively transmitted over the time" to achieve further coverage enhancement. EX1006, ¶[0104], EX1010, ¶[0098]. Lee's WTRU receives consecutive N_{TTI} subframes that are "repeatedly transmitted (N_{rep})" resulting in " $N_{TTI} \times N_{rep}$ subframes [] used, effectively, in total." EX1006, ¶[0104], EX1010, ¶[0098]. Thus, Lee's bundle of N_{TTI} subframes is repeated to produce a plurality of subframe bundles. Lee's N_{TTI} subframes (e.g., a single subframe repeated N_{TTI} times to constitute a plurality of subframes) that are repeatedly transmitted N_{rep} times (e.g., a bundle of repeated subframes further repeated N_{rep} times) also constitute a plurality of subframes. EX1008, ¶¶73-74.

Lee discloses DCI transmitted through (E)PDCCHs repeatedly allocated in Lee's plurality of subframes. EX1006, ¶¶[0139], [0143], [0182]-[0186] ("In order to improve the coverage, DCI format-x may be transmitted repetitively for multiple subframes which may, for example, be consecutive DL [*downlink*] subframes."), [0290]-[0292]; EX1010, ¶¶[0134], [0139], [0160]-[0164], [0276]-[0278]. *See also* EX1006, ¶[0114], Fig. 13; EX1010, ¶[0108], Fig. 13. EX1008, ¶75.

Thus, Lee discloses repeatedly allocating PDCCHs including DCI in consecutive N_{TTI} subframes, and repeatedly allocating (e.g., repeatedly transmitting N_{rep} times) groups of N_{TTI} subframes (e.g., bundles). EX1008, ¶69, ¶¶76-77.

a. [1.1]: “receiving configuration information relating to the plurality of subframes through higher layer signaling;”

Lee discloses Element [1.1]. Lee discloses that a “window size (N_{window}) may be defined and/or the subset of subframes for TTI bundling may be indicated by using a bitmap within the window, and the bitmap may be informed via higher layer signaling.” EX1006, ¶[0111]; EX1010, ¶[0105]. At least Lee’s window size, subset of subframes for TTI bundling, and the bitmap each constitute “configuration information relating to the plurality of subframes” that are received through higher layer signaling. Thus, Lee discloses the WTRU receiving configuration information relating to a plurality of subframes through higher layer signaling. *Id.* EX1008, ¶¶78-82.

b. [1.2]: “receiving downlink control channels repeatedly allocated in the plurality of subframes and combining the received downlink control channels on the basis of the configuration information; and”

Lee discloses Element [1.2]. Lee discloses PDCCHs repeatedly allocated N_{TTI} times in a plurality of subframes (e.g., repeated subframes). *See* EX1006, ¶¶[0103]-[0107], *see id.*, ¶[0107]. *See* EX1010, ¶¶[0097]-[0101], *see id.*, ¶[0101]. Lee’s repeated consecutive subframes with PDCCHs, repeated N_{TTI} times, constitute the WTRU receiving downlink control channels repeatedly allocated in the plurality of subframes. *See* EX1006, ¶¶[0139]-[0151]; EX1010, ¶¶[0133]-[0145]. Lee also discloses repeatedly allocating N_{TTI} repeated subframes, (e.g., repeating a subframe

bundle N_{rep} number of times). See EX1006, ¶¶[0104]-[0107]; EX1010, ¶¶[0098]-[0101]. Thus, Lee discloses PDCCHs repeatedly allocated in a plurality of subframes in three ways. EX1008, ¶¶83-87.

Lee discloses (1): a subframe bundle, where the single subframe bundle (e.g., defined by N_{TTI}) constitutes repeatedly allocating downlink control channels in the plurality of subframes. EX1006, ¶¶[0104]-[0117], EX1010, ¶¶[0098]-[0111]. EX1008, ¶81. Lee discloses (2): PDCCHs repeatedly allocated in the single subframe bundle where the single subframe bundle itself is also repeated (e.g., defined by N_{rep}) to transmit multiple subframe bundles for reception by the WTRU. EX1006, ¶¶[0104]-[0117], EX1010, ¶¶[0098]-[0111]. EX1008, ¶82. Lee discloses: (3) the total amount of subframes defined by $N_{\text{TTI}} \times N_{\text{rep}}$. EX1006, ¶[0104]; EX1010, ¶[0098]. See EX1006, ¶[0151]; EX1010, ¶[0145] (“The subframes may be bundled for an (E)PDCCH transmission in the (E)PDCCH coverage extension mode.”). EX1008, ¶¶88-90.

Lee discloses combining (e.g., soft combining) the received repeatedly allocated PDCCHs on the basis of configuration information. See EX1006, ¶¶[0208]-[0212], [0224]-[0225]; EX1010, ¶¶[0186]-[0211]. Lee’s WTRU “attempt[s] to receive and/or decode the signal in one or more subframes of a frame” and “*combine[s]* (e.g., integrate) signals *from multiple such subframes* within a frame in which the signal was transmitted”. EX1006, ¶[0208]; EX1010 ¶[0189]

(emphasis added). *See also* EX1006, ¶¶[0208]-[0212], [0224]-[0225], [0295]; EX1010, ¶¶[0189]-[0193], [0210]-[0212], [0281]. EX1008, ¶¶91-92.

Lee's WTRU combines the PDCCHs received in the plurality of subframes on the basis of the configuration information and based on at least Lee's set of TTI bundling cases, window size, subset of subframes, the start subframe, and/or a bitmap which each constitute "configuration information relating to the plurality of subframes" that are received through higher layer signaling. EX1006, ¶[0111]; EX1010, ¶[0105]. EX1006, ¶[0208]; EX1010 ¶[0189]. EX1008, ¶93.

Lee discloses combining PDCCHs in a plurality of subframes repeatedly allocated. EX1006, ¶¶[0105], [0208]; EX1006, ¶¶[0099], [0189] ("The WTRU may combine (e.g., integrate)", on the basis of a bitmap defining the subframe bundle (see EX1006, ¶[0111]; EX1010, ¶[0105]), and on the basis of the control channel element ("CCE") number.). *See also* EX1006, ¶[0152]; EX1010, ¶[0145]. At least each of the bitmap, and the CCE number constitute "configuration information" that is configured via higher layer signaling. *See* EX1006, ¶¶[0105]-[0140]; EX1010, ¶¶[0099]-[0134]. *See also id.*, EX1006, ¶[0185]; EX1010, ¶[0163]. EX1008, ¶¶94-95.

c. [1.3]: "extracting the downlink control information from the combined downlink control channels, wherein:"

Lee discloses Element [1.3]. Lee's PDCCHs are combined, and the WTRU "use[s] that combination to *successfully receive and/or decode* the signal". EX1006,

¶[0208]; EX1010, ¶[0189]. Lee’s ***successfully receiving and/or decoding*** DCI from combined PDCCHs constitutes extracting DCI from the combined PDCCHs. EX1006, ¶¶[0208]-[0212], [0224]-[0225], [0321]; EX1010, ¶¶[0189]-[0193], [0210]-[0212], [0307]. Lee discloses combining downlink control channels (*see* §VII.A.1.b., *supra*) and “successfully receiving and decoding DCI”. *Id.* EX1008, ¶¶96-99.

The ’644 Patent states: “the terminal performs soft combining and then blind decoding on a DCI value” and “[i]f the blind decoding is successful, the terminal extracts, from DCI, information on the number of subframes”. EX1001, 12:34-39. “When the terminal ***succeeds*** in the blind decoding, the terminal acquires scheduling information”. *Id.*, 10:35-36 (emphasis added). Lee discloses that DCI is extracted because Lee describes data that is successfully received (and thus extracted) by the WTRU: “the DCI for a DL transmission transmitted in the (E)PDCCH window may include the subframe information as well as the frequency resource information”. EX1006, ¶[0311]; EX1010, ¶[0298]. Thus, Lee discloses that DCI is extracted from the combined (e.g., integrated) (E)PDCCHs in the plurality of subframes by successfully receiving and/or decoding DCI. *See also* EX1006, ¶¶[0183]-[0186]; EX1010, ¶¶[0161]-[0164]. EX1008, ¶¶100-102.

d. [1.4]: “the configuration information comprises information on a start subframe of the plurality of subframes; and”

Lee discloses Element [1.4]. Each of Lee’s bitmap, and the CCE number constitute “configuration information”. See §§VII.A.1.a-VII.A.1.b., *supra*. Lee’s bitmap includes information on a start subframe of the plurality of subframes. EX1008, ¶¶103-104.

Lee discloses PDCCHs repeatedly allocated in the plurality of subframes within a subframe window 905 in Figure 9. Lee’s Figure 9 shows that repeated subframes within the window 905 include subframes #0, #1, #2, #3, #6 and #7. In Lee’s Figure 9, both subframe #0 and subframe #6 constitute “start subframes” because these subframes include a subframe index (or subframe number) indicating a start point of a plurality of subframes (repeated subframes #0 starting at a first subframe #0) or a subset of the plurality of subframes (repeated subframes #0 starting at a second subframe #6). EX1006, Fig. 9, ¶¶[0111]-[0122]; EX1010, Fig. 9, ¶¶[0105]-[0116]. The ’644 Patent discloses that information on a start subframe is “a value of a particular subframe index (or subframe number) indicating a start point”. EX1001, 10:2-6.

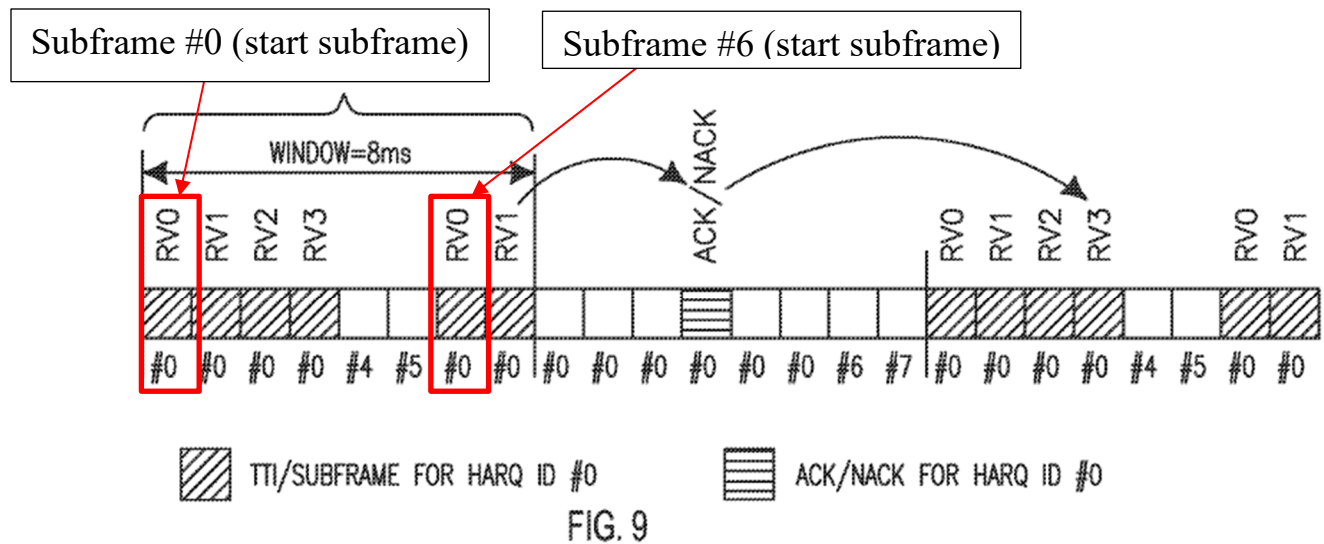


Fig. 9 of Lee (Annotated)

EX1008, ¶¶105-106.

Lee's Figure 9 uses a "bitmap indication" where a subset of the plurality of subframes are indicated using a bitmap. EX1006, ¶¶[0111]-[0122]; EX1010, ¶¶[0105]-[0116]. Thus, Lee's information on a start subframe (e.g., each of subframe #0 and subframe #6 in Figure 9) is included as a bitmap indication in Lee's bitmap. Lee states: "the bitmap may be informed by higher layer signaling." EX1006, ¶[0111]; EX1010, ¶[0105]. Thus, Lee's bitmap is configuration information including information on a start subframe of the plurality of subframes. *See* EX1006, ¶¶[0111]-[0115]; EX1010, ¶¶[0105]-[0109]. Lee's bitmap includes an indication at least for the starting subframe (subframe #6) of the subset of the plurality of subframes. Lee discloses information on a start subframe equivalent to the '644

Patent. EX1001, 10:7-22 (“the information indicating the subframe index [*e.g., of a start subframe*] may be a bitmap”). EX1008, ¶¶107-110.

e. [1.5]: “the downlink control information comprises information on the number of the plurality of subframes.”

Lee discloses Element [1.5]. Lee discloses the number of the plurality of subframes in at least three ways. *See* §VII.A.1.b., *supra*. Lee discloses the number of the plurality of subframes as: (1) N_{TTI} ; (2) the N_{TTI} subframes in a bundle that are repeated subframes (N_{rep}), where a subframe bundle includes a single subframe (N_{rep} = the information on the number of the plurality of subframes, where $N_{TTI} = 1$, such that $N_{TTI} \times N_{rep} = N_{rep}$); and (3) the total number of subframes equal to $N_{TTI} \times N_{rep}$ ($N_{TTI} \times N_{rep}$ = the information on the number of the plurality of subframes). EX1006, ¶[0104]; EX1010, ¶[0098]. These three pieces of information are disclosed and/or understood by a POSITA to be transmitted via Lee’s DCI. EX1008, ¶¶111-114.

Lee discloses that N_{TTI} is transmitted via DCI. “In the new DCI format, indication bits for TTI bundling may be included so that, for each DL/UL [*downlink/uplink*] data transmission, *the N_{TTI} may be defined so that a WTRU may transmit/receive data N_{TTI} times according to the indication.*” EX1006, ¶[0114]; EX1010, ¶[0108] (emphasis added). Lee discloses information on the number of the plurality of subframes as “indication bits” defining N_{TTI} that are included in DCI.

Lee's "indication bits" are included in DCI in any of Lee's disclosed embodiments. EX1006, ¶¶[0139], [0302]; EX1010, ¶[0135]. EX1008, ¶115.

Where Lee discloses that N_{TTI} is transmitted via DCI and N_{rep} is transmitted via higher layer signaling, the total number of subframes $N_{TTI} \times N_{rep}$ is informed at least in part by N_{TTI} transmitted via DCI. EX1006, ¶¶[0104]-[0105]. Thus, at least some of Lee's information on the number of plurality of subframes (e.g., N_{TTI}) is transmitted via DCI where there is a total number of subframes defined by $N_{TTI} \times N_{rep}$. *Id.* EX1008, ¶¶116-117.

Lee discloses that the information for N_{TTI} is transmitted via DCI because Lee expressly describes the coverage enhancement mode with regard to N_{TTI} . *See* EX1006, ¶¶[0105], [0128]; EX1010, ¶¶[0099], [0122]. Lee discloses:

a default value of ***bundling size*** [N_{TTI}] ***and/or repetition rate*** [N_{rep}] for coverage enhancement mode may be defined, and the default value may be used if a WTRU is configured for or falls under coverage enhancement mode until the WTRU receives ***WTRU-specific configuration of a bundling size and/or a repetition rate***.

EX1006, ¶[0105]; EX1010, ¶[0099] (emphasis added). Lee's default value for N_{TTI} and/or N_{rep} is used by the WTRU to receive/decode the plurality of subframes until the WTRU receives WTRU-specific configuration for N_{TTI} and/or N_{rep} . Lee is clear that at least " N_{TTI} may be configured by an eNB in a dynamic manner." EX1006,

¶[0114]; EX1010, ¶[0108]. Lee’s dynamic configuration of N_{TTI} uses “indication bits” for N_{TTI} transmitted in a new DCI format. *Id.* Lee provides an example of how “indication bits” are used in the new DCI format. *See* EX1006, ¶[0115]; EX1010, ¶[0109]. A set of default values is defined by higher layer signaling and “*the indication bits in the DCI format*” may indicate one of the bundling sizes within the set” of default values. *Id.* (emphasis added). Lee’s “indication bits” transmitted via DCI therefore serve as the WTRU-specific configuration. *Id.* *See also* EX1006, ¶[0128]; EX1010, ¶[0122]. EX1008, ¶¶118-121.

Because Lee discloses: (1) “indication bits” transmitted via DCI for dynamically configuring N_{TTI} (EX1006, ¶¶[0114]-[0115]; EX1010, ¶¶[0108]-[0109]), (2) that bundling size and/or repetition rate can be configured via higher layers with the transmission mode configuration, and (3) coverage enhancement mode including dynamically configuring both N_{TTI} and N_{rep} (EX1006, ¶¶[0104]-[0105]; EX1010, ¶¶[0098]-[0099]), a POSITA would have understood that Lee contemplates transmitting “indication bits” via DCI for dynamically configuring N_{rep} (a number of repetitions) as evidenced by a POSITA’s understanding of “indication bits” based on the operation of well-known techniques of transmitting dynamic configuration indications for a UE via DCI. *See Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015). This is because throughout Lee’s description, Lee describes details of dynamic configuration for various types

of information evidencing that transmitting information relating to repetition rate, *e.g.*, N_{rep} , would have been understood by the POSITA. *See, e.g.*, EX1006, ¶¶[0060], [0114]-[0115], [0128]-[0154]; EX1010, ¶¶[0056], [0108]-[0109], [0122]-[0147]). EX1008, ¶122. *In re Baxter TravenolLabs.*, 952 F.2d 388, 21 USPQ2d 1281 (Fed. Cir. 1991) (“Testimony from those skilled in the art, through depositions and declarations, and [Patent Owner’s] own admissions ... leads to the unmistakable conclusion that the claims at issue were anticipated.”).

2. Claim 2 (Preamble): “A method of transmitting, by a base station, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes, the method comprising:”

Lee discloses the Preamble. *See* §VII.A.1., *supra*. Lee’s method of receiving DCI through downlink control channel repeatedly allocated in a plurality of subframes is performed by the WTRU, while the method of transmitting is performed by a base station. EX1006, ¶¶[0024]-[0030], [0034]-[0036], [0105]-[0115], [0189], [0206], Figs. 1A, 1C.; EX1010, ¶¶[0021]-[0027], [0031]-[0033], [0099]-[0109], [0187], Figs. 1A, 1C. EX1008, ¶¶123-124.

a. [2.1]: “transmitting configuration information relating to the plurality of subframes through higher layer signaling; and”

Lee discloses Element [2.1]. *See* §VII.A.1.a., *supra*; EX1006, ¶¶[0036], [0105]-[0106] (“ N_{TTI} subframes may be configured by an eNB”); EX1010, ¶¶[0033], [0099]-[0100], [0105]. EX1008, ¶125.

- b. [2.2]: “transmitting the downlink control information through the downlink control channels repeatedly allocated in the plurality of subframes, wherein”**

Lee discloses Element [2.2]. *See* §VII.A.1.b., §§VII.A.2.-VII.A.2.a., *supra*. EX1008, ¶126.

- c. [2.3]: “the configuration information comprises information on a start subframe of the plurality of subframes; and”**

Lee discloses Element [2.3]. *See* §VII.A.1.d., *supra*. EX1008, ¶127.

- d. [2.4]: “the downlink control information comprises information on the number of the plurality of subframes.”**

Lee discloses Element [2.4]. *See* §VII.A.1.e., *supra*. EX1008, ¶128.

- 3. Claim 3 (Preamble): “A terminal for receiving downlink control information through downlink control channels repeatedly allocated in plurality of subframes, the terminal comprising:”**

Lee discloses the Preamble. *See* §VII.A.1., *supra*. Lee discloses a LC-MTC [low-cost machine-type-communication] WTRU that is “configured to transmit and/or receive wireless signals” including “user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a smartphone, a laptop, a netbook, a personal computer, a wireless sensor, consumer electronics, and the like.” EX1006, ¶¶[0023]-[0042]; EX1010, ¶¶[0020]-[0039]. *See id.*, Figs. 1A-1C. EX1008, ¶¶129-130.

- a. [3.1]: “a receiver configured to receive configuration information comprising information on a start subframe of the plurality of subframes through higher layer signaling, to receive the downlink control channels repeatedly allocated in the plurality of subframes, and to combine the received downlink control channels based on the configuration information; and”

Lee discloses Element [3.1]. See §§VII.A.1.a.-VII.A.1.b., *supra*. Lee’s WTRU includes a transceiver 120 and a transmit/receive element 122. EX1006, ¶[0034], Fig. 1B; EX1010, ¶[0031], Fig. 1B. Lee’s transmit/receive element 122 is “configured to transmit signals to, or receive signals from, a base station” including “any combination of wireless signals.” EX1006, ¶[0036]; EX1010, ¶[0033]. See also EX1006, ¶¶[0149], [0156] (“DL signal reception at a WTRU receiver”), EX1010, ¶[0149], claim 37 (“The WTRU of claim 36, further comprising a receiver”). EX1008, ¶¶131-133.

Lee’s WTRU includes a receiver configured to perform the functions of Element [3.1] at least because Lee discloses a WTRU including a receiver where the WTRU performs the claimed functions. See §§VII.A.1.a.-VII.A.1.b., *supra*. Thus, Lee discloses a receiver “configured to” under Petitioners’ construction (i.e., “actually configured to and not merely capable of performing the claimed function”). EX1015, p.37. Lee also discloses a WTRU including a receiver configured to perform the functions of Element [3.1] under a plain and ordinary meaning of “configured to”. EX1008, ¶¶134-136.

b. [3.2]: “a controller configured to extract downlink control information from the combined downlink control channels,”

Lee discloses Element [3.2]. *See* §VII.A.1.c., *supra*. Lee’s WTRU includes processor 118 that includes “a controller” configured to “perform signal coding, data processing, power control, input/output processing, and/or any other functionality that enables the WTRU 102 to operate in a wireless environment.” EX1006, ¶[0035]; EX1010, ¶[0032]. *See id.*, Fig. 1B. Such functionality disclosed in Lee includes extracting DCI from combined PDCCHs. *See* §VII.A.1.c., *supra*. Thus, Lee discloses a WTRU including a controller configured to extract DCI from the combined downlink control channels. EX1008, ¶¶137-140.

Lee’s WTRU includes a controller that is configured to extract DCI at least because Lee’s WTRU includes a controller where the WTRU performs the extracting. *See* §§VII.A.1.c., *supra*. Thus, Lee discloses a controller “configured to” under Petitioners’ construction which means “actually configured to and not merely capable of performing the claimed function”. EX1015, p.37. Lee also discloses a WTRU including a controller configured to perform the functions of Element [3.2] under a plain and ordinary meaning of “configured to”. EX1008, ¶¶141-143.

c. [3.3]: “wherein the downlink control information comprises information on the number of the plurality of subframes.”

Lee discloses Element [3.3]. *See* §VII.A.1.e., *supra*. EX1008, ¶144.

B. Claims 1-3 Would Have Been Obvious Over Lee (Ground 2)

1. Unpatentability of Claims 1-3 is Supported by POSITA Knowledge

The Challenged Claims are anticipated by Lee. *See* §VII.A., *supra*. To the extent any minor differences exist between Lee and features of the Challenged Claims, they would have been obvious. Further, to the extent any expert testimony is interpretive of Lee, any minor differences would have been obvious to a POSITA to be taught by Lee. Thus, the Challenged Claims are obvious over Lee. EX1008, ¶¶145-147.

To the extent Lee does not constitute an anticipation because Lee does not disclose a single specific embodiment containing all elements of the Challenged Claims, such an assertion is untenable. “Anticipation occurs when a prior art reference discloses each element of the claimed invention, not only where a particular embodiment within a reference discloses each element of the claimed invention.” *In re AT&T Intellectual Property II, L.P.*, 856 F.3d 991, 996 (Fed. Cir. 2017) (citing *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1341 (Fed. Cir. 2016)). *See also Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1382 (Fed. Cir. 2015). EX1008, ¶148.

a. Preambles and Elements [1.2], [2.2], and [3.1]

Lee discloses “applications for using a coverage enhancement mode. *A WTRU may apply all embodiments and examples herein individually or in*

combination as part of a coverage enhancement mode of operation.” EX1006, ¶[0302] (emphasis added). *See also id.*, ¶¶[0082], [0106], [0139], [0145]. *See* EX1010, ¶[0287]. *See also id.*, ¶¶[0077], [0100], [0134], [0141]. EX1008, ¶149.

A POSITA would have been motivated to apply Lee’s techniques of “coverage enhancement” at least to a MTC UE because Lee discloses coverage enhancement solutions for MTC UEs. EX1006, ¶¶[0004], [0081]; EX1010, ¶[0076]. EX1008, ¶142. Lee discloses applicability of coverage enhancement techniques to MTC devices. EX1006, ¶[0093]; EX1010, ¶[0087]. A POSITA would have been motivated to use Lee’s repetitive transmission (e.g., using N_{TTI} and N_{rep}) as a solution for coverage enhancement of downlink control channels like the (E)PDCCH (or other downlink channels), because Lee tells one to do so. EX1006, ¶¶[0092]-[0093], [0103]-[0105], [0145]; EX1010, ¶¶[0086], [0098]-[0099], [0141], [0295]. EX1008, ¶¶143-144. Lee discloses that “subframes may be bundled for an (E)PDCCH transmission in the (E)PDCCH coverage enhancement mode” where “(E)PDCCH coverage enhancement mode may be used irrespective of the transmission.” EX1006, ¶[0152]; EX1010, ¶[0145]. EX1008, ¶¶150-153.

Lee informs a POSITA to use repetitive transmission of downlink control channels for coverage enhancement mode, and that this mode can be used irrespective of the transmission. EX1006, ¶¶[0146], [0152]; EX1010, ¶¶[0142], [0145]. Lee discloses that “[i]n order to improve the coverage of channels such as

the enhanced PDCCH (EPDCCH) . . . repetitive transmission may be considered as a coverage enhancement technique.” EX1006, ¶[0092]; *see* EX1010, ¶[0086]. A POSITA would have been motivated to apply Lee’s coverage enhancement mode, using repetitive transmission of EPDCCH subframes, to enhance coverage of downlink control channels in order to improve signal reception of MTC UEs. A POSITA would have had a reasonable expectation of success given Lee’s details for implementing coverage enhancement mode and Lee’s indication of MTC UE requirements, including supporting of low data rates and relaxed throughput requirements. *See* EX1006, ¶¶[0082], [0087], [0093], [0099], [0194]; EX1010, ¶¶[0077], [0081], [0087], [0093], [0175]. EX1008, ¶¶154-157.

b. Elements [1.4]-[1.5], [2.3]-[2.4], [3.1], and [3.3]

Lee’s disclosure teaches that one or both of the information for N_{TTI} and N_{rep} is transmitted via DCI, because Lee expressly describes the coverage enhancement mode with regard to N_{TTI} and N_{rep} . *See* EX1006, ¶¶[0105], [0128]; EX1010, ¶¶[0099], [0122]. As discussed above, Lee discloses:

a default value of ***bundling size*** [N_{TTI}] ***and/or repetition rate*** [N_{rep}] for coverage enhancement mode may be defined, and the default value may be used if a WTRU is configured for or falls under coverage enhancement mode until the WTRU receives ***WTRU-specific configuration of a bundling size and/or a repetition rate***.

EX1006, ¶[0105]; EX1010, ¶[0099] (emphasis added). EX1008, ¶¶158-159. Lee's default value for N_{TTI} and/or N_{rep} is used by the WTRU to receive/decode the plurality of subframes until the WTRU receives WTRU-specific configuration for N_{TTI} and/or N_{rep} . Lee is clear that at least " N_{TTI} may be configured by an eNB in a dynamic manner." EX1006, ¶[0114]; EX1010, ¶[0108]. Lee's dynamic configuration of N_{TTI} uses "indication bits" for N_{TTI} transmitted in a new DCI format. *Id.* Lee also provides an example of how the "indication bits" are used in the new DCI format. *See* EX1006, ¶[0115]; EX1010, ¶[0109]. Lee discloses that a set of default values is defined by higher layer signaling and "***the indication bits in the DCI format*** may indicate one of the bundling sizes within the set" of default values. *Id.* (emphasis added). Accordingly, Lee's "indication bits" transmitted via DCI serve as the WTRU-specific configuration. *Id.* *See also* EX1006, ¶[0128]; EX1010, ¶[0122]. At a minimum, Lee teaches and suggests transmitting N_{rep} via DCI because throughout Lee's description, Lee turns to details of 3GPP (including Release 11) to further articulate specific implementations of Lee's process (*see, e.g.*, EX1007, ¶¶[0072], [0234], [0263], [0303], [0310]-[0311]; EX1010, ¶¶[0221], [0288]-[0289], [0295], [0297]-[0298]), and the transmission of N_{rep} via the DCI is no different. *See* EX1021, pp.34-39, §7.1.6; p.36 (DCI includes "a resource indication value (RIV) corresponding to a starting resource block (RB_{start}) and a length in terms of virtually

contiguously allocated resource blocks”). *See also id.*, pp.122-123; EX1022, pp.42-43, §9.4. *See* EX1023, ¶¶25-66. EX1008, ¶¶160-162.

A POSITA would have been motivated in view of Lee to transmit the start of the subframe repetitions (e.g., a bitmap) via higher layer signaling in the configuration information and to transmit N_{TTI} and/or N_{rep} via DCI. A POSITA would have been motivated to transmit information on the start subframe in the configuration information so that the UE knows where/when to find the repeated (E)PDCCHs. EX1006, ¶[0128]; EX1010, ¶[0122]. A POSITA would have been motivated to transmit the information on the number of plurality of subframes in DCI (such that the information on the number of plurality of subframes is transmitted implicitly and decoded at the UE) in order to reduce the amount of data transmitted by configuration information and to further enhance coverage where throughput of configuration information may be reduced due to reduced coverage for an MTC UE. Where coverage is reduced for an MTC UE, signals transmitted via higher layers are not repeated, whereas signals including PDCCHs carrying DCI are repeated in view of Lee. A POSITA would understand that, in a reduced coverage scenario, it would be beneficial to transmit some information (e.g., the information on the number of the plurality of subframes) via DCI in the coverage enhancement mode so that information is more likely to be received by the MTC UE. A POSITA would recognize that repetitively transmitting N_{TTI} and/or N_{rep} may provide more reliable

reception of the number of the plurality of subframes than if the same information were transmitted via higher layer signaling. A POSITA would have also understood that an MTC UE would use the information on the number of subframes to skip decoding (e.g., blind decoding) of redundant repeated subframes and locate when/where different data signals are transmitted. EX1008, ¶¶163-167.

A POSITA would have had a reasonable expectation of success given Lee's details for implementing coverage enhancement mode and Lee's indication of MTC UE requirements, including supporting of low data rates and relaxed throughput requirements. *See* EX1006, ¶¶[0082], [0087], [0093], [0099], [0194]; EX1010, ¶¶[0077], [0081], [0087], [0093], [0175]. EX1008, ¶168.

Given express disclosure and the fact that the components and functionalities of Lee discussed in §VII.A. are clearly compatible and applicable to each another, it would have been apparent to a POSITA that Lee discloses the combined use of such components and functionalities. Furthermore, it would have been obvious to combine the components and functionalities of Lee discussed in §VII.A given Lee's express suggestion and teaching to combine its embodiments. EX1006, ¶[0302]; EX1010, ¶[0287]. Such a modification would have been predictable, and a POSITA would have had a reasonable expectation of success, given Lee's disclosed applicability of such modifications, components and functionalities to base station

transmission and MTC UE operation for enhancing coverage of a MTC UE. EX1008, ¶¶169-171.

2. Lee’s Number of Subframes in a “Subframe Bundle” and Number of Repetitions of a “Subframe Bundle” Read on the Plain and Ordinary Meaning of Elements [1.5], [2.4], and [3.3]

a. Preambles and Elements [1.2], [2.2], and [3.1]

Ground 1 reads on the plain and ordinary meaning of the Challenged Claims where Lee includes information on the number of plurality of subframes (N_{TTI}) in a “subframe bundle” within DCI.⁴ It would have been obvious to a POSITA that Lee’s repetitions of “subframe bundles” (N_{rep}) constitute “downlink control channels repeatedly allocated in a plurality of subframes” under the plain and ordinary meaning of the claim term. EX1008, ¶¶172-173.

b. Elements [1.4]-[1.5], [2.3]-[2.4], [3.1], and [3.3]

A POSITA reading Lee’s disclosure regarding “a default value of bundling size [N_{TTI}] *and/or repetition rate* [N_{rep}]” (EX1006, ¶[0105]; EX1010, ¶[0099]) and Lee’s example disclosure regarding dynamic configuration using “indication bits”

⁴ During prosecution, the Examiner cited You’s (EX1007) “subframe bundle” as disclosing “downlink control channels repeatedly allocated in the plurality of subframes”. Applicant did not dispute this finding. *See* EX1002, pp.67-76.

for N_{TTI} would have fully appreciated that the dynamic configuration and “indication bits” transmitted via DCI would be used for not only N_{TTI} , but also N_{rep} . Lee discloses that N_{TTI} and/or N_{rep} use default values (configured by higher layer signaling) and WTRU-specific values that are transmitted in DCI as “indication bits” to configure the WTRU dynamically in a coverage enhancement mode. EX1006, ¶¶[0105]-[0115]; EX1010, ¶¶[0099]-[0109]. *See also* EX1006, ¶[0302]; EX1010, ¶[0287]; §VII.A.1.e., *supra*. EX1008, ¶¶174-175.

A POSITA would have understood Lee’s transmission of dynamic “indication bits” within DCI would have been used to signal N_{rep} . Given Lee’s disclosure on dynamic configuration of both N_{TTI} and N_{rep} , a POSITA would have understood that, not only can N_{TTI} be transmitted via Lee’s “new DCI format,” but also that N_{rep} would be transmitted via the “new DCI format” for dynamic configuration of the number of repetitions of subframe bundles. EX1006, ¶[0114]; EX1010, ¶[0108]. A POSITA would have understood both N_{TTI} and N_{rep} would be transmitted via DCI simultaneously. Therefore, Lee teaches that (1) N_{TTI} alone, (2) N_{rep} alone, and (3) both N_{TTI} and N_{rep} where total number of subframes = $N_{TTI} \times N_{rep}$ would have been transmitted via DCI, which a POSITA would have fully appreciated. EX1008, ¶¶176-178.

A POSITA would have a reasonable expectation of success of transmitting N_{rep} via DCI given Lee’s disclosure of dynamic configuration of N_{TTI} . EX1006,

¶[0114]; EX1010, ¶[0108]. Dynamic configuration of N_{rep} would use a same or similar operation because N_{rep} could also be represented as an integer and could be dynamically indicated using Lee's "indication bits" in DCI. EX1006, ¶¶[0104]-[0115]; EX1010, ¶[0098]-[0109]. *See also* EX1006, ¶¶[0140]-[0144]; EX1010, ¶¶[0136]-[0140]. EX1008, ¶¶179-180.

C. Claims 1-3 Would Have Been Obvious Over Lee in View of You and Zhuang (Ground 3)

The Challenged Claims would have been obvious over Lee in view of You and Zhuang. Lee anticipates and renders obvious the Challenged Claims (*see* §§VII.A., VII.B.). To the extent any minor differences are alleged between the Challenged Claims and Lee, they would have been obvious in view of the detailed disclosure provided in You and Zhuang. For example, You discloses at least the Preamble and Elements [1.1] to [1.4], and similar elements of claims 2 and 3. Zhuang discloses at least the Preamble and Elements [1.2], [1.3], and [1.5], and similar elements of claims 2 and 3. EX1008, ¶¶181-185.

The Examiner considered You during the '644 Patent's prosecution. *See* §V.B., *supra*. Applicant amended the Challenged Claims to recite Element [1.5] as the asserted basis for patentability over You. EX1002, pp.68-69. Applicant did not dispute that You discloses the Preamble, Elements [1.1]- [1.4], and corresponding elements of claims 2 and 3. *See* EX1002, pp.53-79. EX1008, ¶186.

A POSITA would have had been motivated to reference You's specific teachings for implementing Lee's processes/techniques with repeatedly allocated (E)PDCCHs in a plurality of subframes. For example, Lee generally discloses that "[i]n order to improve the coverage of channels such as the enhanced PDCCH (EPDCCH), the PDSCH, and the PUCCH, *repetitive transmission* may be considered as a coverage enhancement technique." EX1006, ¶[0092] (emphasis added); *see* EX1010, ¶[0086]. Thus, to the extent Lee is found to lack express disclosure of specific details for at least each of Element[1.1] to Element[1.4] as applied to the (E)PDCCH, a POSITA would have been motivated to combine You's disclosure of subframe repetition for the (E)PDCCH to the subframe repetition techniques disclosed by Lee. Such combination would have been a routine combination of prior art elements according to known methods of subframe repetition to yield predictable results of repeatedly allocating (E)PDCCHs in a plurality of subframes. A POSITA would have had a reasonable expectation of success given that You's and Lee's techniques are both solutions for enhancing coverage of an MTC UE. EX1008, ¶¶187-191.

Lee recognizes applicability of You's disclosure of repeated transmission of downlink control channels in a plurality of subframes to its techniques and Lee adopts similar subframe repetition implementations as those described in You. EX1006, ¶¶[0092], [0145]; EX1010, ¶¶[0086], [0141]; *see* EX1007, ¶[0150];

EX1019, pp.43-44. Lee recognizes a need for enhancing coverage of MTC UE devices, including by enhancing coverage up to 20dB (e.g., *see* EX1006, Title, ¶¶[0003]-[0005]; *see* EX1010, ¶¶[0076], [0078], [0084]). You describes a mechanism for enhancing coverage of MTC devices, for example, by repeatedly allocating downlink control channels (PDCCHs) in a plurality of subframes:

[T]he present invention proposes that the eNB apply a coverage enhancement scheme such as subframe repetition (repetition of a subframe with a signal) or subframe bundling upon transmission of a signal to the MTC UE having a coverage issue so that the MTC UE can effectively receive a signal transmitted by the eNB. For example, the PDCCH and PDSCH may be transmitted to the MTC UE having the coverage issue in a plurality of subframes (e.g. about 100 subframes).

EX1007, ¶[0145]; *see* EX1019, p.43. *See* EX1007, ¶¶[0147]-[0180]; EX1019, pp.43-48. EX1008, ¶¶192-193. You's implementation improves "efficiency to reduce production cost and battery consumption of UEs for MTC [] according to data transmission rate" recognizing that for MTC UEs, "the amount of transmission data is small". EX1007, ¶[0144]; *see* EX1019, p.43. You's systems are applied to a MTC UE "operating in a coverage enhancement mode." EX1007, ¶[0145]; EX1019, p.43. EX1008, ¶¶194-195.

Because both Lee and You enhance coverage of an MTC UE device using repeated PDCCHs in a plurality of subframes, a POSITA would have been motivated to apply express teachings of You's repeated PDCCHs in plural subframes to the disclosure of Lee to further refine techniques for enhancing coverage of MTC devices using repeated subframes. *See* EX1006, ¶¶[0092]-[0114]; EX1010, ¶¶[0086]-[0108]; EX1007, ¶¶[0147]-[0180]; EX1019, pp.43-48. Applying You's teachings to Lee would have been a straightforward combination of prior art elements according to known methods taught by both Lee and You yielding predictable results. EX1008, ¶¶196-197.

The '644 Patent, like Lee and You, all seek to provide enhanced coverage of MTC devices. The '644 Patent, like Lee, suggests "coverage of the MTC terminal should be improved to about 20 dB or higher as compared with the coverage the normal terminal." EX1001, 1:41-43. The '644 Patent provides the same solution as Lee and You, in that "control information and/or data of each physical channel transmitted in a unit of only one subframe may be required to be repeatedly transmitted in a plurality of subframes." *Id.*, 1:44-9. EX1008, ¶¶198-199.

A POSITA would have been similarly motivated to turn to Zhuang for additional details on subframe repetition for the PDCCH. Like Lee and You, Zhuang also discloses "coverage improvement and cost reduction for [] MTC devices in coverage hole scenario[s]," including "repetition of the physical channels to improve

the coverage.” EX1016, 1:14-16. Specifically, Zhuang teaches repetition of the PDCCH or EPDCCH. *Id.*, 4:20-21 (“For coverage hole devices, PDCCH or EPDCCH may need repetitions across multiple subframes.”). A POSITA would have understood subframe repetition to be a known technique in the field of telecommunications for improvement of coverage of MTC devices, and subframe repetition would have yielded predictable results. EX1008, ¶¶200-202.

Lee teaches dynamic configuration of N_{TTI} and N_{rep} using “indication bits” transmitted via DCI, and a POSITA would have been motivated to reference Zhuang for additional details on implementing the “indication bits.” Zhuang confirms that “[t]he number of the plurality of subframes occupied by [] each control channel candidate may be unknown to the mobile station before successfully decod[ing] one or more of the control channel candidates (i.e., the decoded control channel intended for the mobile station).” EX1016, 5:28-30. Zhuang discloses that information on the number of subframes occupied by the decoded control channel ((E)PDCCH) can be transmitted as a “subframe indicator in the decoded control channel.” *Id.*, 2:3-11. Zhuang teaches that the information in a “subframe indicator” can be used to find the start subframe of the data channel (PDSCH). *Id.* Zhuang teaches that this would improve the function of MTC UE’s because “there may be misunderstanding between base station and mobile station on the start time of the transmission of some physical channels” and “it is important to have a method to determine the start

subframe of the physical channels.” *Id.*, 1:21-22. The combination of Lee, You, and Zhuang would have been a straightforward combination of prior art elements (e.g., repeated subframes, PDCCHs, and DCI) according to known methods that would have yielded predictable results of transmitting information on a start subframe and information on the number of the plurality of subframes through different operations. EX1008, ¶¶203-208.

To the extent Lee lacks specific details of elements of the Challenged Claims, You expressly discloses specific details of the same features of the Challenged Claims as applied to PDCCHs and DCI. EX1008, ¶¶209-210.

The following sections reference where elements of Claims 1-3 are rendered obvious by the prior art. EX1008, ¶211.

1. Claim 1 (Preamble)

Lee discloses the Preamble. *See* §VII.A.1., *supra*. To the extent Lee does not disclose the preamble, You expressly discloses a method for receiving, by a terminal, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes. EX1008, ¶¶212-213.

You discloses receiving, by a UE, “a physical downlink control channel (PDCCH) during a first subframe bundle comprising a plurality of subframes, and [receiving] a PDSCH related to the PDCCH.” EX1007, Abs. 11.2-6; *see* EX1019, pp.43-47. A PDCCH carries DCI. EX1007, ¶¶[0053], [0081]; EX1019, p.4. You’s

Figure 10 shows transmitting/receiving DCI through a plurality of subframes. EX1007, Fig. 10; EX1019, p.44, Fig. 11. *See also* EX1007, ¶[0150]; EX1019, pp.43-44. You states: a “subframe bundle” is “a set of subframes in which PDCCHs carrying the same DCI can be transmitted” to a UE. EX1007, ¶[0146]; EX1019, pp.43-44.

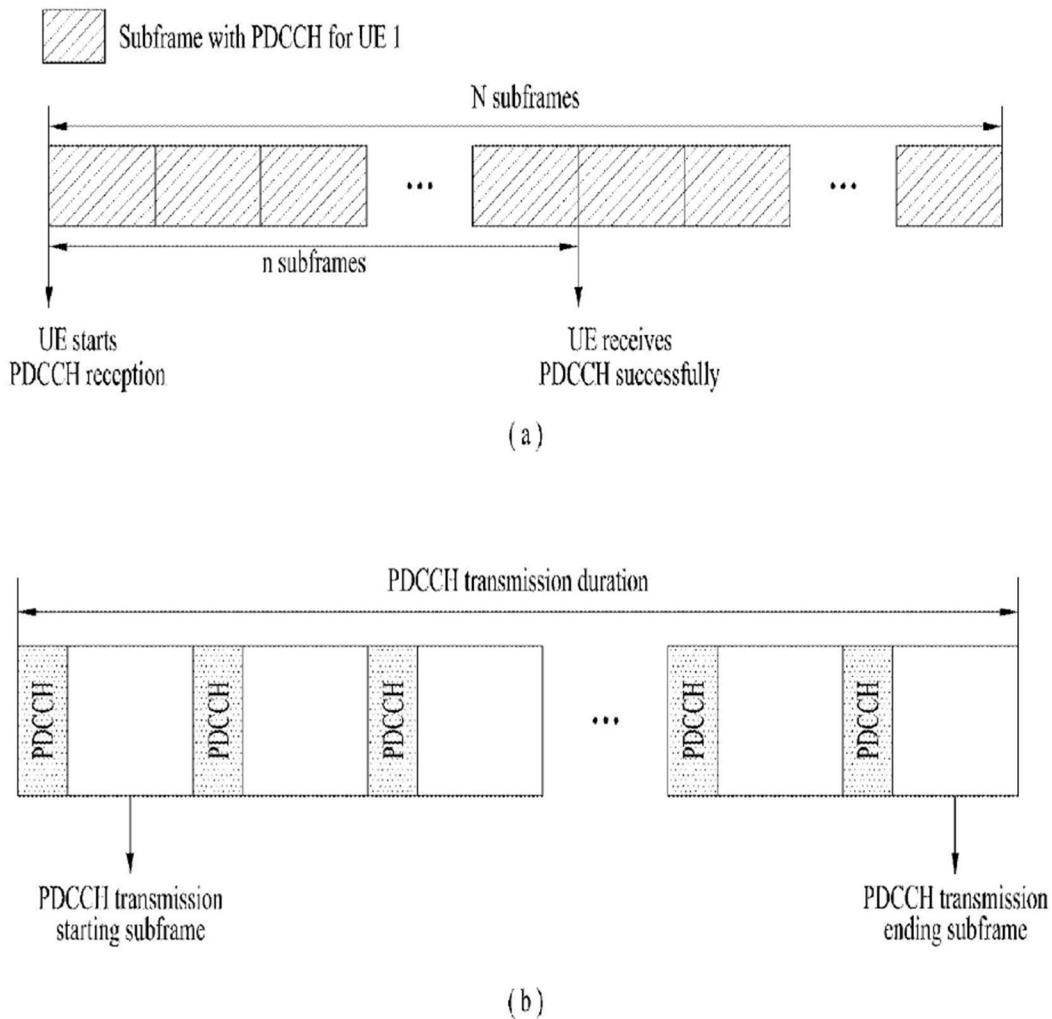


Fig. 10 of You

EX1008, ¶¶214-216.

Zhuang discloses a method for receiving, by a terminal, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes. Zhuang discloses that “PDCCH or EPDCCH may need repetitions across multiple subframes.” EX1016, 4:20-21; *see also id.*, 7:24-25. Zhuang discloses that “the downlink or uplink scheduling information and the other control information, carried by PDCCH, is referred to as downlink control information (DCI).” *Id.*, 3:30-31. Zhuang confirms the teachings of Lee and You regarding the Preamble. EX1008, ¶217.

a. Element [1.1]

Lee discloses Element [1.1]. *See* §VII.A.1.a., *supra*. To the extent Lee does not expressly disclose Element [1.1], You discloses receiving configuration information relating to the plurality of subframes through higher layer signaling. You discloses that the “eNB [*base station*] processor may control the eNB RF [*radio frequency*] unit so that ***configuration information of a subframe bundle***” such as a start subframe “may be transmitted for repetitive transmission of the PDCCH”. EX1007, ¶[0238] (emphasis added); EX1019, p. 44 (“the information about the subframe location in which transmission of PDCCH bundle may start may be configured via higher-layer signals such as RRC.”). You discloses configuration information relating to the plurality of subframes including at least a start subframe. Thus, You discloses transmitting configuration information relating to the plurality

of subframes (at least a start subframe) through higher layer signaling. For the reasons discussed above, it would have been obvious to combine You with Lee to arrive at Element [1.1]. EX1008, ¶¶218-223.

b. Element [1.2]

Lee discloses Element [1.2]. *See* §VII.A.1.b., *supra*. To the extent Lee does not disclose Element [1.2], You discloses receiving downlink control channels repeatedly allocated in the plurality of subframes and combining the received downlink control channels on the basis of the configuration information. You discloses that the UE “repeatedly receive[s] the PDCCH [*downlink control channels*] in a subframe bundle [*in the plurality of subframes*] in which multiple subframes are bundled and successfully receive[s] the PDCCH using repeatedly received PDCCH signals [*repeatedly allocated*] in the multiple subframes.” EX1007, ¶[0150], Fig. 10; *see* EX1019, pp.43-44, Figs. 1, 11. You’s Figure 10 shows the UE “successfully receive[s] the PDCCH using n ($1 < n < N$) subframes among the N subframes.” *Id.* Figure 10 shows the downlink control channels repeatedly allocated in the plurality of subframes.

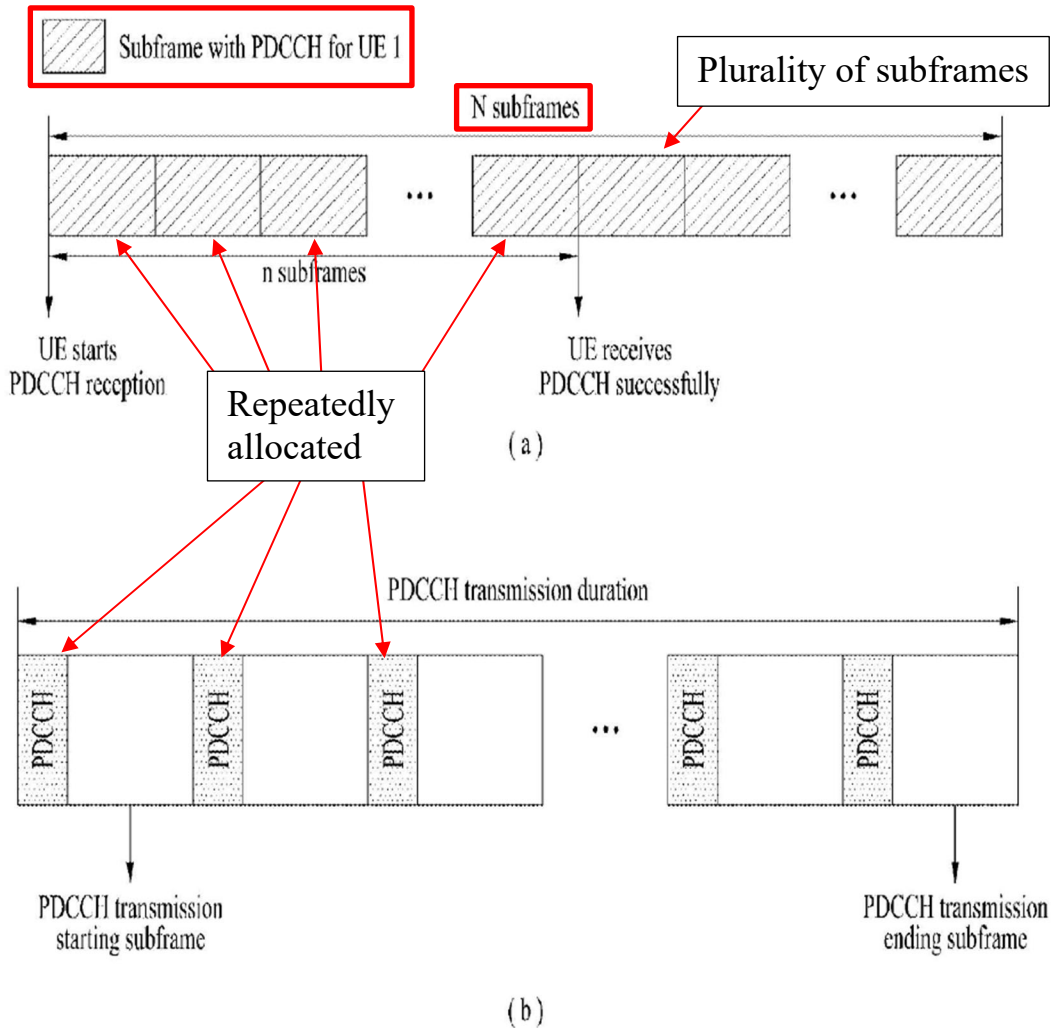


Fig. 10 of You (Annotated)

EX1008, ¶¶224-227.

You discloses combining the received PDCCHs on the basis of the configuration information. EX1007, ¶[0239]; EX1019, pp.16, 46. You discloses that when transmitting a subframe bundle of PDCCHs, “physical channels of multiple subframes in a corresponding bundle carry information/data/content that are identical or *can be combined*” and that the “UE processor may (*combine* and) decode the repeatedly received PDCCH and/or PDSCH.” EX1007, ¶¶[0146],

[0239]; *see* EX1019, p.43, Fig. 1. You discloses decoding of the received PDCCHs occurs once the PDCCHs in multiple subframes are combined. EX1007, ¶[0146]; EX1019, p.16. EX1008, ¶¶228-230.

You discloses that configuration information of a subframe bundle (e.g., a plurality of subframes) includes at least a start subframe . EX1007, ¶[0239]; EX1019, p.43; VII.C.1.b., *supra*. You’s UE “attempt[s] to receive and/or decode a corresponding PDCCH during N subframes starting from a transmission start subframe of the PDCCH bundle based on the information (e.g. offset and/or N) about the transmission start subframe location of the PDCCH bundle.” EX1007, ¶[0153]; *see* EX1019, pp.43-44, Fig. 1. Thus, You discloses combining the received downlink control channels on the basis of the configuration information. EX1008, ¶¶231-233.

Zhuang also discloses Element [1.2]. *See* §VII.C.1., *supra*. EX1008, ¶234.

c. Element [1.3]

Lee discloses Element [1.3]. *See* §VII.A.1.c., *supra*. To the extent Lee does not disclose Element [1.3], You discloses extracting DCI from the combined downlink control channels. You discloses that the repeated PDCCHs in a subframe bundle are combined and then “decoded together and restored into one piece of information/data.” EX1007, ¶[0146]; *see* EX1019, pp.43-47. Once PDCCHs are combined, You’s UE uses “decodes and demodulates the radio signals [*e.g., including PDCCHs*] received through the receive antennas and *restores* [*e.g.,*

extracts] data [*DCI*] that the transmitting device 10 intended to transmit.” EX1007, ¶[0129]; EX1019, pp.43-47. EX1008, ¶¶235-237.

You discloses the UE receiving the repeated PDCCHs, combining the repeated PDCCHs, and receiving and/or decoding the combined PDCCHs to extract and obtain the information/data/content (e.g., DCI) that are carried by the PDCCHs. *See* EX1007, ¶¶[0146], [0153]; ¶[0053] (“a physical downlink control channel (PDCCH) . . . refer[s] to a set of time-frequency resources or resource elements (REs) carrying downlink control information (DCI)”); *see* EX1019, pp.43-48. EX1008, ¶238.

Zhuang discloses Element [1.3]. Zhuang discloses “decod[ing] a control channel intended for the mobile station” and extracting information “from the decoded control channel.” *Id.*, 1:28-31. Zhuang discloses that the “decoded control channel” can include “the number of subframes occupied by the decoded control channel” (*id.*, 2:3-7) and “a subframe indicator in the decoded control channel” (*id.*, 2:8-11). Zhuang discloses that the MTC UE “attempts to decode the control channel and it may early successfully decode the control channel.” *Id.*, 10:34-11:1; *see also id.*, Fig. 7. Zhuang confirms the teachings of Lee and You regarding Element [1.3]. EX1008, ¶¶239-241.

d. Element [1.4]

Lee discloses Element[1.4]. *See* §VII.A.1.d., *supra*. To the extent Lee does not disclose Element [1.4], You discloses the configuration information comprising information on a start subframe of the plurality of subframes. You discloses that “information about the subframe location at which transmission of the PDCCH bundle may be started may be preconfigured through *a higher layer signal* [e.g., *including configuration information*] such as an RRC signal.” EX1007, ¶[0153]; EX1019, p.44. Thus, You discloses configuration information transmitted to the UE through higher layer signaling includes information on a start subframe of the subframe bundle. *See* EX1007, ¶¶[0153], [0175], claim 3; EX1019, pp.43-48. EX1008, ¶¶242-245.

Zhuang confirms that “it is important to have a method to determine the start subframe of physical channels.” EX1016, 1:21:22. Zhuang itself does not disclose a method for determining the start subframe of the PDCCH or EPDCCH, but that would have been within the skill of a POSITA. It would have been obvious to a POSITA to transmit information on a start subframe in configuration information (e.g., higher layer signaling) ahead of the PDCCH or EPDCCH. *Id.* This is confirmed by Lee and You. EX1006, ¶¶[0111]-[0113], Fig. 9; EX1010, ¶¶[0105]-[0107], Fig. 9; EX1007, ¶[0153]; EX1019, pp.43-44. EX1008, ¶¶246-247.

e. Element [1.5]

Lee discloses Element [1.5]. See §VII.A.1.e., *supra*. EX1008, ¶248.

During the ‘644 Patent prosecution, the Examiner rejected the Challenged Claims over You. EX1002, pp.76-79. Applicant amended the Challenged Claims to recite Element [1.5] (from a rejected dependent claim) and argued in favor of Element [1.5] over You. *Id.*, pp.68-69. Applicant did not dispute the rejection over You for the preamble, Elements [1.1]-[1.4], and corresponding elements of claims 2 and 3. See EX1002, pp.53-79. Applicant asserted that You “merely disclose[s] typical information included in downlink control information (DCI)” including “‘resource allocation information’ such as DL scheduling information (or DL grant) and UL scheduling information (or UL grant).” *Id.*, p.68. Applicant argued:

the cited part ([0153]) of ***You*** merely discloses that information (e.g., a transmission start subframe location, the number of subframes) on a subframe bundle associated with a PDCCH transmission is transmitted to user equipment and is used to receive a PDCCH. However, the cited parts ([0081], [0082], [0153]) of ***You*** do **not** disclose that the start subframe information and the information on the number of subframes are **separately** obtained **through different operations**.

Id. Applicant effectively admitted that You discloses information on a start subframe and information on the number of plurality of subframes as information on a

subframe bundle. Applicant only argued that these pieces of information must be obtained through separate operations: higher layer signaling and DCI. *Id.* EX1008, ¶¶249-251.

A POSITA would have recognized the teachings of You would have been directly applicable to the disclosure of Lee, as both set out to improve coverage enhancement of MTC devices. *See* EX1007, ¶¶[0145], [0150]; EX1019, p.43; EX1006, ¶¶[0004]-[0005]; EX1010, ¶[0002]. Additionally, both You and Lee arrive at the same solution of applying subframe repetition and/or subframe bundling. *See* EX1007, ¶[0145]; EX1019, p.43; EX1006, ¶¶[0084], [0103]; EX1010, ¶¶[0078], [0097]. EX1008, ¶¶252-253.

Lee discloses the UE receiving information on the number of the plurality of subframes via DCI using a “new DCI (e.g., DCI format 1E)”. EX1006, ¶[0114]. Lee’s new DCI format includes “indication bits for TTI bundling ... for each DL/UL data transmission” where “the N_{TTI} may be defined so that a WTRU [*e.g.*, *UE*] may transmit/receive data N_{TTI} times according to the indication.” *Id.* You recognizes that different DCI formats can be used for PDCCH transmission to a UE:

The size and usage of the DCI carried by one PDCCH are varied depending on DCI formats. The size of the DCI may be varied depending on a coding rate. In the current 3GPP LTE system, various formats are defined, wherein

formats 0 and 4 are defined for a UL, and formats 1, 1A, 1B, 1C, 1D, 2, 2A, 2B, 3 and 3A are defined for a DL.

EX1007, ¶[0081]; EX1019, pp.17, 41. You does not disclose using a new DCI format 1E. A POSITA would have been motivated to improve upon You with Lee's new DCI format 1E. EX1008, ¶¶254-256.

Lee's new DCI format is used to carry "indication bits" for dynamic configuration of a UE (e.g., WTRU) using dynamic subframe bundling. EX1006, ¶[0114]; EX1010, ¶[0108]. You does not disclose the use of dynamic bundling for its subframe bundles. Thus, A POSITA would have been motivated to apply Lee's dynamic bundling (and use of DCI to transmit subframe information) with You's subframe bundling methods for enhancing coverage of MTC UEs in a dynamic coverage enhancement mode for situations where You recognizes a UE would have difficulty successfully receiving data over PDCCH/PDSCH. EX1007, ¶[0228]; EX1019, pp.43-44. EX1008, ¶¶257-258.

A POSITA would have had a reasonable expectation of success in applying You's related methods for subframe bundling to Lee's TTI bundling methods, and including You's information on the number of the plurality of subframes (EX1007, ¶¶[0151]-[0152]; EX1019, pp.43-44) in Lee's new DCI format. EX1006, ¶[0114]; EX1010, ¶[0108]. EX1008, ¶259.

A POSITA would have been motivated to apply You's teachings with Lee's new DCI format for indicating the number of subframes in a subframe bundle to a UE. A POSITA would have had a reasonable expectation of success given that Lee had applied the new DCI format and "indication bits" in DCI for indicating the number of subframes in its application of coverage enhancement using repeated/bundled subframes transmitted to the UE. *Id.*, ¶¶[0092]-[0114]. The new DCI format disclosed in Lee would have benefited from combining the detailed subframe bundling techniques for PDCCHs described in You, and would have been a simple modification, combining methods and elements of subframe bundling disclosed in both Lee and You to yield predictable results of transmitting the information for the number of plurality of subframes included in DCI (e.g., Lee's new DCI format) rather than via higher layer signaling. EX1008, ¶¶260-262.

Zhuang discloses Element [1.5]. Zhuang discloses that "the number of subframes occupied [by the control channel] is indicated in the decoded control channel." EX1016, 6:11-20. Zhuang discloses a "subframe indicator in the decoded control channel" where "the subframe indicator can be some information field in downlink control information (DCI) format." *Id.*, 12:5-6; *see id.*, 6:24-26. Zhuang's subframe indicator "signal[s] the number of subframes occupied by the control channel that contains the subframe indicator." *Id.*, 6:21-7:6. Zhuang's UE obtains the subframe indicator after decoding the control channel and extracting DCI

(including the subframe indicator) in the decoded control channel. *Id.*, 1:28-31, 2:3-11, 10:34-11:1; *see also id.*, Fig. 7; *see* §VII.C.1.c., *supra*. EX1008, ¶¶263-265.

Zhuang’s Figure 7 shows “obtain[ing] the subframe indicator 731 in the decoded control channel 723.” *Id.*, 10:22-28. Zhuang discloses that “the subframe indicator 731 signals the number of subframes 701 occupied by the control channel 721 intended for the mobile station.” *Id.*, 10:29-30. Zhuang states: “[t]he control channel [is] repeated in multiple subframes and each subframe carries full information of the control channel.” *Id.*, 10:30-34.

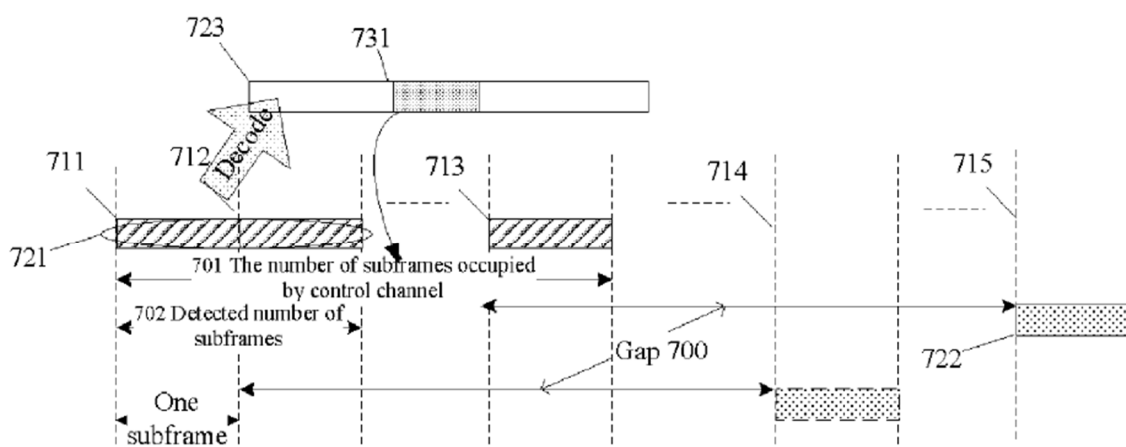


Fig. 7 of Zhuang

Zhuang explains that “[a]fter the mobile station decode[s] the control channel, the mobile station knows the number 701 of subframes occupied by the control channel via the subframe indicator in the decoded control channel” and “[t]herefore, the mobile station can calculate the end subframe of the decoded control channel, e.g., subframe 713 shown in Figure 7.” *Id.*, 11:6-7. Zhuang discloses: (1) “some

original field 811 in DCI format 801 can be redefined as the subframe indicator 821” or (2) “the subframe indicator 822 in new field 812 is added to a new DCI format 802.” *Id.*, 12:8-10. EX1008, ¶¶266-268.

Zhuang is further evidence that Lee, and Lee in combination with You, disclose Element [1.5]. Lee discloses “indication bits” transmitted via DCI, similar to Zhuang’s “subframe indicator.” EX1006, ¶[0114]; EX1010, ¶[0108]. *See* EX1016, 12:4-10. Transmitting the number of the plurality of subframes in DCI would have been obvious over Lee and You in combination, as further evidenced by Zhuang. EX1008, ¶¶269-270.

2. Claim 2 (Preamble)

Lee discloses the Preamble. *See* §VII.A.2. To the extent Lee does not disclose the preamble of claim 2, You and Zhuang disclose a method for receiving, by a UE, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes. *See* §VII.B.1., *supra*. You and Zhuang contemplate the method of receiving being performed by the UE while the method of transmitting is performed by a base station. EX1007, Abs., ¶¶[0045]-[0046], claims 1, 5, 9, 13, Fig. 8; EX1019, p.43; EX1016, Abs., 3:8-4:4. EX1008, ¶¶271-273.

a. Element [2.1]

Lee discloses Element [2.1]. *See* §VII.A.2.a. To the extent Lee does not disclose Element [1.2], You discloses the base station transmitting configuration information relating to the plurality of subframes through higher layer signaling. *See* §VII.B.1.a., *supra*; EX1007, ¶¶[0152]-[0154], claim 6 (“transmitting, by the base station, a higher layer signal including information on a maximum number of repetitions for the PDCCH”); *see* EX1019, pp.43-48. EX1008, ¶¶274-275.

b. Element [2.2]

Lee discloses Element [2.2]. *See* §VII.A.2.b. To the extent Lee does not disclose Element [2.2], You and Zhuang disclose the base station transmitting the downlink control information through the downlink control channels repeatedly allocated in the plurality of subframes. *See* §VII.C.1.b., §§VII.C.2.-VII.B.2.a., *supra*. EX1008, ¶¶276-277.

c. Element [2.3]

Lee discloses Element [2.3]. *See* §VII.A.2.c. To the extent Lee does not disclose Element [2.3], You discloses Element [2.3]. *See* §VII.B.1.d., *supra*. EX1008, ¶¶278-279.

d. Element [2.4]

Lee discloses Element [2.4]. *See* §VII.A.2.d. To the extent Lee does not disclose Element [2.4], Zhuang discloses Element [2.4]. *See* §VII.C.1.e., *supra*. EX1008, ¶¶280-281.

3. Claim 3 (Preamble)

Lee discloses the Preamble. *See* §VII.A.3. To the extent Lee does not disclose the Preamble, You discloses a terminal for receiving downlink control information through downlink control channels repeatedly allocated in a plurality of subframes. *See* §VII.B.1., *supra*. Lee discloses a MTC UE that is configured to “transmit and receive data and/or control information scheduled on a prescribed time unit basis, e.g. on a subframe basis.” You’s UE includes “a terminal equipment (TE), a mobile station (MS), a mobile terminal (MT), a user terminal (UT), a subscriber station (SS), a wireless device, a personal digital assistant (PDA), a wireless modem, a handheld device, etc.” *Id.*, ¶[0045], ¶¶[0144]-[0146]. *See id.*, Fig. 8, ¶[0131] (“a UE operates as the transmitting device 10 in UL and as the receiving device 20 in DL” and “an eNB operates as the receiving device 20 in UL and as the transmitting device 10 in DL.”).

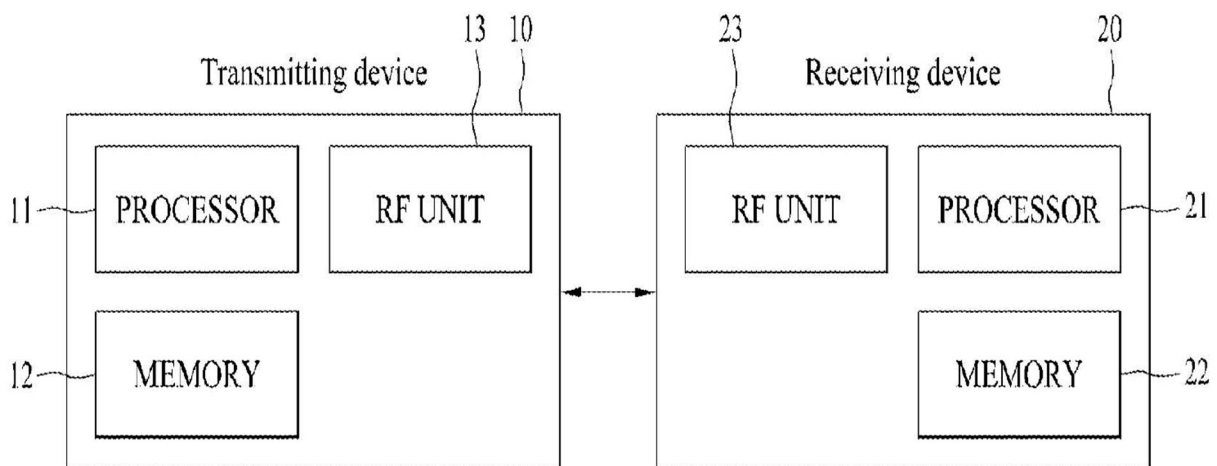


Fig. 8 of You

EX1008, ¶¶282-285.

Zhuang discloses the Preamble. *See* §VII.C.1., *supra*. Zhuang discloses “mobile station 911” that “may be fixed or mobile user terminals” or “may also be referred to as subscriber units, users, terminals, remote units, subscriber stations, user equipment (UE), user terminals, or by other terminology used in the art.” EX1016, 12:14-17. A POSITA would have understood Zhuang’s “mobile stations” to be a terminal. EX1008, ¶¶286-288.

a. Element [3.1]

Lee discloses Element [3.1]. *See* §VII.A.3.a. To the extent Lee does not disclose Element [3.1], You and Zhuang disclose a terminal including a receiver configured to receive configuration information comprising information on a start subframe of the plurality of subframes through higher layer signaling, to receive the downlink control channels repeatedly allocated in the plurality of subframes, and to combine the received downlink control channels based on the configuration information. *See* §§VII.B.1.a.-VII.B.1.b., *supra*. You discloses the UE (e.g., as receiving device 20 in Figure 8) including a RF unit 23 for “transmitting and receiving radio signals carrying information, data, signals, and/or messages” and configured to “receive[] radio signals transmitted by the transmitting device 10” including configuration information and PDCCHs repeatedly transmitted in a

plurality of subframes. EX1007, ¶¶[0125], [0129], Fig. 8; EX1019, pp.5, 43-48, Fig. 5. EX1008, ¶¶289-291.

Zhuang discloses Element [3.1]. Zhuang's "mobile station 911" includes "antenna 917 [that] transmits and receives RF signals." EX1016, 12:28-29. "RF transceiver module 916, coupled with the antenna, receives RF signals from the antenna, converts them to baseband signals and sends them to processor 913." *Id.*, 12:29-29. Zhuang further discloses that "[m]obile station 911 receives the control channels and data channels by transceiver 916 via antenna 917." *Id.*, 13:14-15. EX1008, ¶¶292-293.

You's UE and Zhuang's UE include a receiver that is configured to perform the functions recited in Element [3.1] at least because You and Zhuang disclose a UE including a receiver where the UE performs the claimed functions. Thus, You and Zhuang each disclose a receiver "configured to" under Petitioners' construction which means "actually configured to and not merely capable of performing the claimed function". EX1015, p.37. You and Zhuang also each disclose a UE including a receiver configured to perform the functions of Element [3.1] under a plain and ordinary meaning of "configured to". EX1007, ¶¶[0125], [0129], Fig. 8; EX1019, p.5, 43-48, Fig. 5. EX1008, ¶294.

b. Element [3.2]

Lee discloses Element [3.2]. *See* §VII.A.3.a. To the extent Lee does not disclose Element [3.2], You and Zhuang disclose a terminal including a controller configured to extract downlink control information from the combined downlink control channels. *See* §VII.B.1.c., *supra*. You discloses the UE (e.g., as receiving device 20) including processor 21 that includes “controllers, microcontrollers, microprocessors, or microcomputers.” EX1007, ¶[0127], Fig. 8; EX1019, pp.5, 43-48, Fig. 5. You’s processor 21 is configured to “control the overall operation of various modules in the transmitting device and the receiving device” including “perform[ing] various control functions to implement” You’s teachings. *Id.* Such control functions disclosed in You include extracting DCI from combined PDCCHs. *See* §VII.B.1.c., *supra*. EX1008, ¶¶295-298.

Zhuang discloses Element [3.2]. Zhuang discloses “[p]rocessor 913 [that] processes the received baseband signals and invokes different functional modules to perform features in mobile station 911.” *Id.*, 12:32-33. Zhuang discloses that “different functional modules can be implemented by software, firmware, hardware, or any combination thereof.” *Id.*, 13:4-5. Zhuang discloses that “[m]obile station 911 monitors the control channel candidates, decodes a control channel intended for mobile station 911.” *Id.*, 13:15-16. Zhuang’s “mobile station 911 obtains the [subframe] indicator in the decoded control channel via processors 913.” *Id.*, 13:18-

20. Zhuang therefore discloses a controller configured to extract downlink control information. EX1008, ¶¶299-303.

You's UE and Zhuang's UE include a controller that is configured to extract DCI at least because You and Zhuang each disclose a UE including a controller where the UE performs the extracting. Thus, You and Zhuang each disclose a controller "configured to" under Petitioners' construction which means "actually configured to and not merely capable of performing the claimed function". EX1015, p.37. You and Zhuang also each disclose a UE including a controller configured to perform the functions of Element [3.2] under a plain and ordinary meaning of "configured to". EX1007, ¶[0127], Fig. 8; EX1019, pp.5, 43-48, Fig. 5. EX1008, ¶¶304-306.

c. Element [3.3]

Lee discloses Element [3.3]. *See* §VII.A.3.b. Lee in combination with You discloses DCI comprising information on the number of the plurality of subframes, and Zhuang discloses DCI including information on the number of the plurality of subframes. *See* §VII.C.1.e., *supra*. EX1008, ¶¶307-308.

VIII. OTHER CONSIDERATIONS

A. Secondary Considerations

Petitioner is not aware of any secondary considerations evidence bearing any nexus to the purported claimed invention. Any purported evidence of secondary considerations that Owner may present in this proceeding would be insufficient to

overcome the strong evidence of obviousness of the Challenged Claims. EX1008, ¶¶309-312.

B. Discretion to Institute

1. The Board should not deny this Petition under §314(a)

The '644 Patent has not been challenged in any prior AIA trial proceeding, and this Petition is not a “follow-on” petition. Events in Related Litigations do not warrant denial, and application of the *Fintiv* factors weighs against discretionary denial as explained below.

a. Factor 1: Whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted

Factor 1 weighs against discretionary denial. In the district court litigation, third party defendant and patent owner KT Corporation (“KT”) has disputed jurisdiction. The parties are engaged in jurisdictional discovery, and the Court has granted KT a protective order from non-jurisdictional discovery during the jurisdictional discovery period. EX1018, EX1017. This could extend the district court trial date, which “allays concerns about inefficiency and duplication of efforts” in the PTAB. *Fintiv* at 8.

b. Factor 2: Proximity of the court’s trial date to the Panel’s projected statutory deadline for a final written decision

Factor 2 should be considered at least neutral because jury selection is far in the future and is not set to begin until at least September 8, 2025. Even if jury

selection were to proceed on September 8, 2025, jury selection would proceed with respect to only one of the three cases (*e.g.*, the '638 Litigation, the '639 Litigation, or the '640 Litigation). Each of the defendant Petitioners are entitled to separate trials, which will necessarily proceed on separate dates. As such, there are explicit and inherent uncertainties for this case given the number of parties involved and the number of trials regarding this patent. In addition, and because much can change in ten months, the current trial date does not support denial. *See DISH Network v. Broadband iTV*, IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021) (“We cannot ignore the fact that the currently scheduled trial date is more than nine months away and much can change during this time”).⁵

Moreover, given the existence of three cases each with multiple parties, to include multiple intervenors, the likelihood that any trials will be scheduled serially, the potential length of the trials given the number of patents at issue (11) and claims at issue, and post-trial motions, it is likely that the district court proceedings will not be complete before the final written decision in this matter. Indeed, these cases additionally will likely be delayed (as explained earlier) because third party

⁵ For these reasons, the “statistics on median time-to-trial for civil actions in the district court in which the parallel litigation resides” are not illuminating, given the number of cases and number of defendants.

defendant and patent owner KT has disputed jurisdiction, has yet to file an Answer, and the Court has granted KT a protective order from (or stay of) non-jurisdictional discovery. EX1017.

Altogether, this factor weighs against discretionary denial.

c. Factor 3: Investment in the parallel proceeding by the court and the parties

Factor 3 weighs against discretionary denial. The district court cases are in their early stages and the district court has not issued any substantive rulings in either case with respect to the '644 Patent. Specifically, infringement contentions were served on March 18, 2024, invalidity contentions were served on May 17, 2024, and the claim construction hearing is not scheduled until March 11, 2025. EX1004, EX1005. In addition, third party defendant and patent owner, KT Corporation has not yet filed an answer, which will likely further delay progress on the merits.

Altogether, there is much work to be done in the district court and most, if not all, of the work will be well in the future. Accordingly, the district court will not invest significant resources related to the challenged patent prior to the issuance of an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12; *DISH Network*, IPR2020-01280, Paper 17 at 18-21.

d. Factor 4: Overlap between issues raised in the petition and in the parallel proceeding

Factor 4 favors institution. Indeed, there will not be complete overlap between this IPR and the district court cases because there are 3 claims asserted in this case and a total of 113 asserted in the related district court cases. The district court will likely reduce the asserted claims prior to trial including some of the 3 claims at issue here. This factor thus weighs against the Board exercising its discretion to deny.

e. Factor 5: Whether the petitioner and the defendant in the parallel proceeding are the same party

Factor 5 is neutral as it is “far from an unusual circumstance that a petitioner in inter partes review and a defendant in a parallel district court proceeding are the same.” *Sand Revolution*, IPR2019-01393, Paper 24 at 12-13.

f. Factor 6: Other circumstances that impact the Panel’s exercise of discretion, including the merits

Factor 6 weighs strongly against discretionary denial. As detailed herein, this is a compelling case, and the merits of the Petition are strong. The challenges presented in this Petition are particularly compelling given that Ground 1 is anticipatory, *i.e.*, Lee discloses all of the elements of all Challenged Claims. Ground 2 is a straightforward obviousness challenge based on Lee’s express teachings. Ground 3 is a straightforward obvious challenge based on Lee and You. Grounds 1-3 are straightforward and very strong as demonstrated above in Section VII and thus constitute compelling merits. *See, e.g., SRAM, LLC v. FOX Factory, Inc.*, IPR2024-

00216, Paper 11 (PTAB Jun. 7, 2024) at p. 55 (finding compelling merits where the anticipation ground is “seemingly straightforward”), *Inergy Tech., Inc. v. Force Mos Tech., Co., Ltd.*, IPR2024-00094, Paper 9 (PTAB May 21, 2024) at p. 36 (finding compelling merits where the obviousness ground is “seemingly straightforward” and “Petitioner’s motivation for this modification comes from an express teaching in [the cited reference]”). None of the grounds asserted herein were previously considered by either the Office or the district courts, also favoring institution. *See Comcast Cable Comm’n’s, LLC v. Rovi Guides, Inc.*, IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019) (obviousness challenges not “previously considered by the Office or any court” weigh in favor of not denying institution). Moreover, the ’644 Patent is currently asserted in three district court cases. Institution of this IPR would simplify the litigations for the district court.

2. The Board should not deny this Petition under §325(d)

Lee (Grounds 1-3) was neither considered nor substantively discussed by the Patent Office during prosecution of the ’644 Patent. Denial under §325(d) is unwarranted for this reason alone. Zhuang (Ground 3) was also not considered. Clearly, this Petition does not rely on the same or substantially the same art previous before the Office.

You (only Ground 3) was applied during prosecution to reject, for example, Element[1.1] to Element[1.4] and Element [1.5], which was recited in a dependent

claim (and the similar limitations of independent claims 2 and 3). *See* §V.B., *supra*. EX1002, pp.63-79. Applicant amended the Challenged Claims to include Element [1.5]. *Id.*, pp.64-69. In its response, Applicant's argument based patentability on Element [1.5] and Applicant did not dispute the Office's finding that You disclosed the preamble and Elements [1.1]-[1.4]. *Id.*, pp.68-69. The Office did not consider Lee alone or in combination with You and Zhuang (Grounds 1-3) in addressing the Challenged Claims. Accordingly, the Board should not exercise its discretion to deny this petition under §325(d).

The *Becton, Dickinson* factors weigh in favor of institution. The Patent Office's prior examination constituted "material error" under *Advanced Bionics* because the Patent Office overlooked the disclosures of Lee, You, and Zhuang discussed above that impact patentability of the Challenged Claims. The Board has consistently declined to discretionarily deny institution under similar facts. *See, e.g., DISH Network LLC v. Sound View Innovations, LLC*, IPR2020-01041, Paper 13, 22 (PTAB Jan 19, 2021); *Roku, Inc. v. Universal Electronics, Inc.*, IPR2019-01615 (PTAB April 17, 2020); *Trans Ova Genetics, LC v. XY, LLC*, IPR2018-00250, Paper 9, 18-19 (PTAB June 27, 2018).

With respect to factor (f), the Petition is supported by an expert declaration by Dr. Roy explaining how a POSITA would have understood Lee and You. *See, e.g.,* EX1008, ¶¶29-288. This new evidence also weighs against discretionary denial. *See,*

e.g., Puma N. Am., Inc. v. Nike, Inc., IPR2019-01058, Paper 10, 19 (PTAB Oct. 31, 2019) (instituting where petition presented “new non-cumulative evidence.... probative to issues of patentability and helpful to our consideration of a prior art combination that was not before the Examiner”).

IX. CONCLUSION

Petitioners have shown a reasonable likelihood of success. Therefore, this Petition should be granted and the Board should institute trial.

Date: December 31, 2024

Respectfully submitted,

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APPENDIX A - LIST OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 9,894,644, issued on February 13, 2018 (“the ’644 Patent”)
1002	File History of U.S. Patent Application No. 15/024,862, filed on March 25, 2016 (“the ’862 Application”)
1003	<i>Not assigned</i>
1004	Order modifying case deadlines for District Court Case Nos. 2:23-cv-00638, 2:23-cv-00639, 2:23-cv-00640
1005	First Amended Docket Control Order for District Court Case Nos. 2:23-cv-00638, 2:23-cv-00639, 2:23-cv-00640
1006	PCT International Publication No. WO 2014/055878, published on April 10, 2014 (“Lee”)
1007	U.S. Patent Publication No. 2016/0353420, published on December 1, 2016 (“You”)
1008	Declaration of Sumit Roy
1009	<i>Curriculum Vitae</i> of Sumit Roy
1010	U.S. Provisional Patent Application No. 61/863,223, filed August 7, 2013 (“Lee Priority Application”)
1011	U.S. Provisional Patent Application No. 61/807,945 filed April 3, 2013
1012	U.S. Provisional Patent Application No. 61/753,263 filed January 16, 2013
1013	U.S. Provisional Patent Application No. 61/710,315 filed October 5, 2012

Exhibit No.	Description
1014	Plaintiff and Counterclaim-Defendant Pegasus Wireless Innovation LLC’s Initial Proposed Constructions dated December 4, 2024, <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1015	Defendants and Intervenor’s P.R. 4-2 Preliminary Claim Constructions and Extrinsic Evidence dated December 4, 2024, <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1016	PCT International Publication No. WO 2015/018075, filed August 9, 2013 and published on February 12, 2015 (“Zhuang”)
1017	Memorandum Opinion and Order, filed on December 12, 2024 in <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1018	Counterclaim-Defendant KT Corporation’s Motion for Protective Order from Non-Jurisdictional Discovery, filed October 4, 2024 in <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1019	Certified Translation of U.S. Provisional Patent Application No. 61/862,518 (“You Priority Application”)
1020	U.S. Provisional Patent Application No. 61/862,518
1021	3GPP TS 36.213 v11.1.0 (2012-12) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures; (Release 11) (“3GPP 36.213”)

Petition for *Inter Partes* Review of U.S. Patent No. 9,894,644

Exhibit No.	Description
1022	3GPP TR 36.888 v12.0.0 (2013-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on provision of low-cost MTC UEs based on LTE; (Release 12) (“3GPP 36.888”)
1023	Declaration of Craig Bishop
1024	<i>Curriculum Vitae</i> of Craig Bishop

CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. §42.24

The undersigned hereby certifies that the foregoing Petition totals 13,991 words, excluding the parts which are exempted by 37 C.F.R. §42.24(a)(1).

Date: December 31, 2024

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this 31st day of December, 2024, a true and correct copy of the foregoing **PETITION FOR *INTER PARTES* REVIEW FOR U.S. PATENT NO. 9,894,644 and EXHIBITS 1001, 1002, 1004-1024, and Petitioners' Powers of Attorney** are being served upon the Patent Owner at the following correspondence address of record via USPS Priority Mail:

IP LEGAL SERVICES, LLC
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