

UNITED STATES PATENT AND TRADEMARK OFFICE

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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SAMSUNG ELECTRONICS CO., LTD.  
Petitioner

v.

TELEFONAKTIEBOLAGET LM ERICSSON  
Patent Owner

**U.S. PATENT NO. 10,476,722**

Case IPR2021-TBD

**PETITION FOR *INTER PARTES* REVIEW  
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

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## LIST OF EXHIBITS

Exhibit No.	Description
<b>1001</b>	U.S. Patent No. 10,476,722
<b>1002</b>	File History of U.S. Patent No. 10,476,722
<b>1003</b>	Declaration of Dr. Matthew C. Valenti for <i>Inter Partes</i> Review of U.S. Patent No. 10,476,722
<b>1004</b>	U.S. Patent No. 10,568,102 (“Luo”)
<b>1005</b>	Provisional Application No. 62/246,872, filed February 23, 2017 (“Luo Provisional”)
<b>1006</b>	U.S. Patent No. 10,194,410 (“Ly”)
<b>1007</b>	Provisional Application No. 62/459,973, filed February 16, 2017 (“Ly ’973 Provisional”)
<b>1008</b>	Provisional Application No. 62/462,258, filed February 22, 2017 (“Ly ’258 Provisional”)
<b>1009</b>	“4G, <i>LTE / LTE-Advanced For Mobile Broadband</i> ,” Erik Dahlman <i>et al.</i> (2011) (“Dahlman LTE”)
<b>1010</b>	“5G NR, <i>The Next Generation Wireless Access Technology</i> ,” Erik Dahlman <i>et al.</i> (1st Edition, 2018) (“Dahlman 5G”)

Samsung Electronics Co., Ltd. (“Samsung” or “Petitioner”) requests *inter partes* review (“IPR”) of claims 1, 7, 8, 9, 11, 12, 13, 17, 18, 24, 25, 26 and 27 (“the Challenged Claims”) of U.S. Patent No. 10,476,722 (the “’722 Patent”) (Ex. 1001.)

## **I. INTRODUCTION**

The ’722 Patent is directed to methods and devices for transmitting system information in a synchronization signal block, or SS block, to improve the initial access and synchronization of a wireless device (such as a cellular phone) with a network node (such as a base station) in a wireless communication system (such as a cellular network). The ’722 Patent purports to achieve this improvement by a scheme that includes transmission of an SS block that includes system information and information that provides a time index. According to the ’722 Patent, this scheme improves over the prior art because it allows the information that provides a time index to be checked for accuracy early in the initial access procedure and thus prevents unnecessary delays. This Petition, however, demonstrates that such a scheme was known and obvious to a person of ordinary skill in the art (“POSITA”) at the time of the alleged invention in March 2017. Accordingly, and for the reasons discussed herein, Petitioner respectfully requests that the Challenged Claims be canceled.

## II. MANDATORY NOTICES

### A. Real Party-In-Interest

Petitioner identifies the following real parties-in-interest: Samsung Electronics Co., Ltd.; Samsung Electronics America, Inc.; and Samsung Research America, Inc.

### B. Related Matters

There are no matters related to this IPR at this time.

### C. Counsel and Service Information

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Samsung concurrently submits a Power of Attorney, 37 C.F.R. § 42.10(b), and consents to electronic service directed to the following email address: Samsung\_Ericsson\_IPR@kirkland.com.

### **III. PAYMENT OF FEES UNDER 37 C.F.R. § 42.103**

The undersigned authorizes the Office to charge the fee set forth in 37 C.F.R. § 42.15(a)(1) for this Petition to Deposit Account No. 506092. Review of thirteen (13) claims is requested, and thus no excess claim fees are required. The undersigned further authorizes payment for any additional fees that may be due in connection with this Petition to be charged to the above-referenced deposit account.

### **IV. CERTIFICATION OF GROUNDS FOR STANDING**

Samsung certifies pursuant to Rule 42.104(a) that the '722 Patent is available for IPR and that Samsung is not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified in this Petition. Samsung certifies: (1) Samsung is not the owner of the '722 Patent; (2) Samsung (or any real party-in-interest) has not filed a civil action challenging the validity of any claim of the '722 Patent; (3) Samsung has not been served with a complaint asserting infringement of the '722 Patent; (4) estoppel provisions of 35 U.S.C. § 315(e)(1) do not prohibit this IPR; and (5) this Petition is filed after the '722 Patent was granted.

## **V. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED**

Petitioner challenges the patentability of the Challenged Claims and requests that they be canceled.

### **A. Prior Art Patents and Printed Publications**

Petitioner's challenge is based on the following prior art references:

- **Luo** (“Ex. 1004, “Luo”) - U.S. Patent No. 10,568,102 to Luo, filed November 2, 2017, and claiming priority to provisional application No. 62/246,872, filed February 23, 2017 (Ex. 1005, “Luo Provisional”). Luo issued on February 18, 2020, and is prior art under at least 35 U.S.C. § 102(a) and (d).<sup>1</sup>
- **Ly** (“Ex. 1006, “Ly”) - U.S. Patent No. 10,194,410 to Ly *et. al.*, filed February 15, 2018, and claiming priority to provisional application No. 62/459,973 filed February 16, 2017 (Ex. 1007, “Ly ’973 Provisional”), and provisional application No. 62/462,258 filed February 22, 2017 (Ex. 1008, “Ly ’258 Provisional”). Ly issued on January 29, 2019, and is prior art under at least 35 U.S.C. § 102(a) and (d).

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<sup>1</sup> Because the application for the ’722 Patent was filed after March 16, 2013, the post-AIA version of § 102 applies. All citations to the applicable statutes in this petition refer to the post-AIA version.

The effective filing dates of Luo and Ly predate the effective filing date of the '722 Patent, which claims priority to a PCT application filed on March 24, 2017.<sup>2</sup> Luo and Ly were not before the Patent Office during prosecution of the '722 Patent.

## **B. Relief Requested**

Petitioner requests cancellation of the Challenged Claims as unpatentable under 35 U.S.C. § 103. The specific grounds of the challenge are set forth below, and are supported by the declaration of Dr. Matthew C. Valenti (Ex. 1003).

<b>Ground</b>	<b>Claims</b>	<b>Proposed Statutory Rejection</b>
I	1, 7, 8, 9, 11, 12, 13, 17, 18, 24, 25, 26, 27	Obvious under § 103 in view of Luo.
II	1, 7, 8, 9, 11, 12, 13, 17, 18, 24, 25, 26, 27	Obvious under § 103 in view of Luo in combination with Ly.

## **VI. OVERVIEW OF THE TECHNOLOGY**

Dr. Valenti provides an overview of the background technology in his Declaration. The '722 Patent is directed to synchronization of wireless devices with wireless communication systems, including in connection with the 5G New Radio (NR) Access technology. Ex. 1001, 1:6-9, 3:64-4:28, 6:27-34.

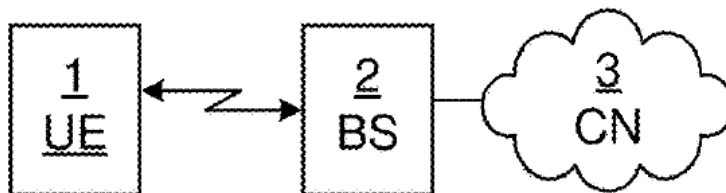
As Dr. Valenti explains, the Long-Term Evolution (LTE) technology, also known as 4G LTE, is currently the most widespread wireless mobile broadband

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<sup>2</sup> Petitioner reserves the right to challenge this or any other alleged priority date.

technology deployed across the world. Ex. 1003 ¶ 41; Ex. 1010, xv. Although 4G LTE is still expected to be used in the future, a new technology known as 5G New Radio (NR) has been standardized by the Third-Generation Partnership Project (3GPP) to meet future requirements. Ex. 1003 ¶ 41; Ex. 1010, xv. Because both 4G LTE and 5G NR have been developed by 3GPP, they have a common background and share several technology components. Ex. 1003 ¶ 41; Ex. 1010, xv.

Dr. Valenti further explains that a wireless communication system, such as 4G LTE and 5G NR, generally comprises a wireless device referred to as User Equipment (UE), such as a cellular phone, and a network node, such as a Base Station (BS), which is connected to the core network (CN), as shown, for example, in Figure 1 from the '722 Patent:



As described in the background section of the '722 Patent, “[w]hen a wireless device (or UE) first accesses a wireless communication system, it must synchronize to the system” for “the UE to know when the network will transmit various signals such as broadcast of system information (SI).” Ex. 1001, 1:34-38; *see also* Ex. 1009, 301-302. As Dr. Valenti explains, system information includes information about how the wireless communication system is configured and is repeatedly broadcast

by the network to the UEs to enable them to access and, in general, operate properly within the network. Ex. 1003 ¶ 43; Ex. 1009, 305. In 4G LTE technology, two synchronization signals are used: a *Primary Synchronization Signal* (PSS) and a *Secondary Synchronization Signal* (SSS). A UE obtains both the PSS and SSS from a BS and uses them to synchronize with the BS. Ex. 1001, 1:52-62; *see also* Ex. 1009, 301-302. Once the UE synchronizes with the BS, it can read system information broadcast by the BS. Ex. 1009, 304-305. In 4G LTE, as explained by Dr. Valenti, system information is delivered by two different mechanisms relying on two different transport channels. *First*, a limited amount of system information is carried in a *Master-Information Block* (MIB) and is transmitted over a *Physical Broadcast Channel* (PBCH). Ex. 1003 ¶ 45; Ex. 1009, 305; *see also* Ex. 1001, 1:62-67. The PBCH is a block of information transmitted from a BS to a UE. The MIB, carried by the PBCH, provides the UE with the minimum information needed to acquire further system information broadcast by the network. Ex. 1003 ¶ 45; Ex. 1009, 305-306. *Second*, the remaining part of the system information is carried in *System-Information Blocks* (SIBs) and is transmitted over a *Downlink Shared Channel* (DL-SCH). Ex. 1003 ¶ 45; Ex. 1009, 305. The system information carried by the SIBs includes, for example, information that UEs need to be able to access a cell, and that indicates whether a specific UE is allowed to camp on a specific cell. Ex. 1003 ¶ 45; Ex. 1009, 308.

In 5G NR technology, as Dr. Valenti further explains, PSSs and SSSs are similarly used to provide initial synchronization. However, although conceptually the same, the structure of the signals is different in 5G NR, and the new versions are referred to as NR-PSS and NR-SSS. Ex. 1001, 2:1-3; Ex. 1003 ¶ 46. In addition, in 5G NR technology, a physical broadcast channel referred to as *NR Physical Broadcast Channel* (NR-PBCH) is defined, which carries a part of minimum system information in a MIB. Ex. 1001, 2:7-14; Ex. 1003 ¶ 46; Ex. 1010, 87, 319. The NR-PBCH also includes a *Cyclic Redundancy Check* (CRC), which, as Dr. Valenti explains, is an error-detecting code commonly used in digital networks to detect errors that inevitably and inadvertently arise during transmission. Ex. 1003 ¶ 46; Ex. 1010, 320-321. A CRC is used, for example, by a UE to calculate whether a received value is incorrect, which would indicate a transmission error. Ex. 1003 ¶ 46. In 5G NR technology, the NR-PSS, NR-SSS, and NR-PBCH are combined to form an SS block, which is a collection of synchronization signals and broadcast system information transmitted from a BS to a UE. Ex. 1001, 2:41-45; Ex. 1003 ¶ 46; Ex. 1010, 311-321.

The SS block is transmitted on a set of time/frequency resources, meaning the BS multiplexes the NR-PSS, NR-SSS, and NR-PBCH in the frequency and/or time domain. Ex. 1003 ¶ 47; Ex. 1010, 311-321; *see also* Ex. 1001, 3:10-13. However,

as the '722 Patent notes in the background section, “multiplexing other signals within an SS block is not precluded.” Ex. 1001, 2:45-46.

In 5G NR technology, one or multiple SS block(s) compose an SS burst, and one or multiple SS burst(s) further compose an SS burst set. *Id.*, 2:53-55; Ex. 1003 ¶ 48; Ex. 1010, 315-317. To determine the relative location of a particular SS block within the set of possible SS-block locations in a transmission from a BS to a UE, a “time index” is provided in the SS block that provides the relative location of the SS block within the sequence of possible SS-block locations in the SS burst set. Ex. 1003 ¶ 48; Ex. 1010, 317, 319. According to the '722 Patent, different ways of providing the SS block time index were under discussion in 3GPP, including a synchronization signal in the SS block referred to as *NR Tertiary Synchronization Signal* (NR-TSS). Ex. 1001, 3:20-25.

For ease of reference, the following is a list of abbreviations and acronyms used in the petition:

<b>LTE</b>	Long-Term Evolution
<b>NR</b>	New Radio
<b>3GPP</b>	Third-Generation Partnership Project
<b>UE</b>	User Equipment
<b>BS</b>	Base Station
<b>SI</b>	System Information
<b>SS</b>	Synchronization Signal

<b>PSS</b>	Primary Synchronization Signal
<b>SSS</b>	Secondary Synchronization Signal
<b>TSS</b>	Tertiary Synchronization Signal
<b>DMRS</b>	Demodulation Reference Signal
<b>PBCH</b>	Physical Broadcast Channel
<b>DL-SCH</b>	Downlink Shared Channel
<b>MIB</b>	Master-Information Block
<b>SIB</b>	System Information Block

## **VII. THE '722 PATENT**

The '722 Patent issued on November 12, 2019, from U.S. Application No. 16/204,265 filed on November 29, 2018, and claims priority to a PCT application (PCT/CN2017/078102) filed on March 24, 2017. *See* Ex. 1002. Samsung uses March 24, 2017 as the priority date of the '722 Patent for purposes of this Petition.

### **A. Claims**

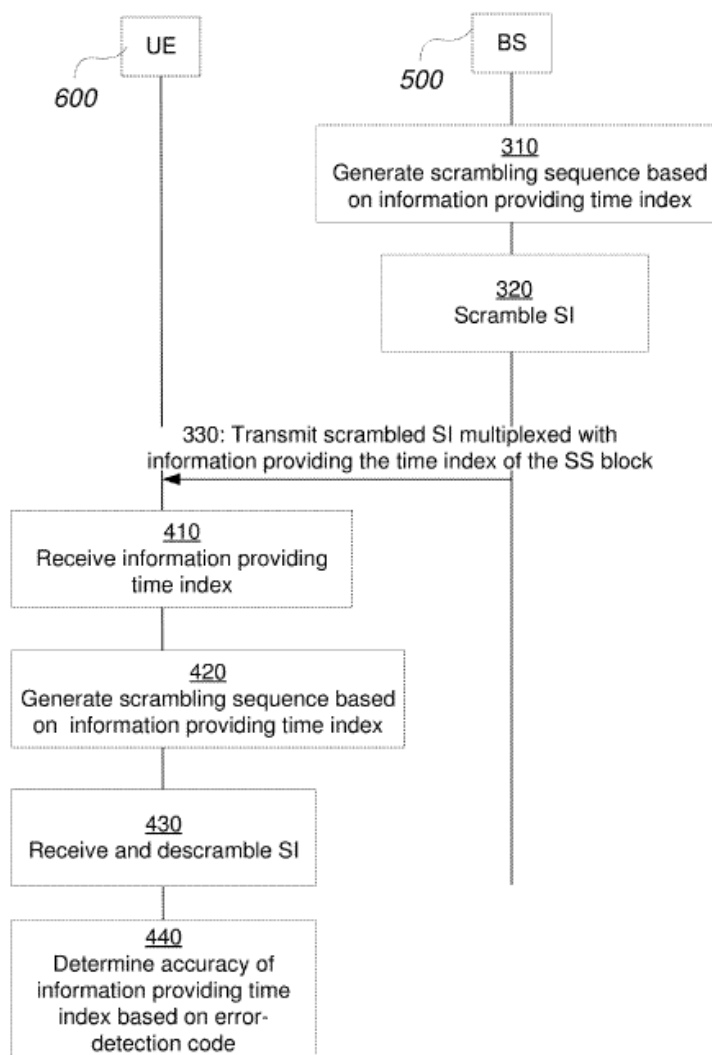
The '722 Patent has 30 claims, including four independent claims (claims 1, 7, 13, and 25) and 26 dependent claims. Independent claims 1, 7, 13 and 25, as well as dependent claims 8, 9, 11, 12, 17, 18, 24, 26 and 27, are the Challenged Claims.

### **B. Summary of the Specification**

The '722 Patent is directed to “methods for transmitting system information in a synchronization signal block,” as well as to a wireless device and a network node that implement the claimed methods. Ex. 1001, 1:6-9.

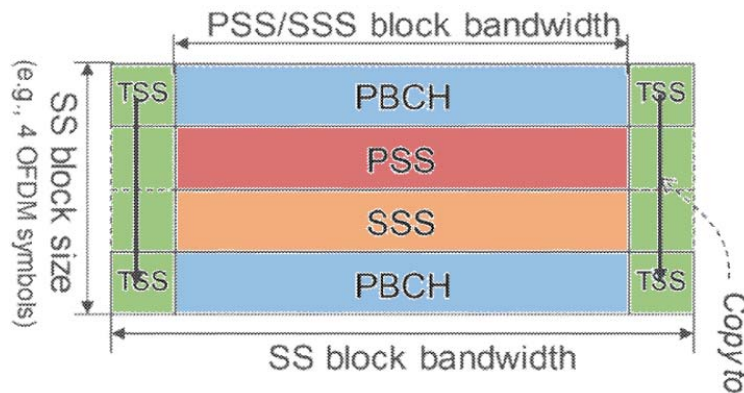
According to the '722 Patent, in standardized 5G NR technology, “[t]he synchronization signals, including NR-PSS and NR-SSS,” as well as the “NR-PBCH” which includes “part of system information,” will be transmitted in an SS block. *Id.*, 3:1-9. The '722 Patent further states that “[i]t has been agreed to multiplex the NR-PSS, NR-SSS and NR-PBCH in the time domain, *i.e.*, time division multiplexing (TDM) of NR-PSS, NR-SSS and NR-PBCH, in an SS block.” *Id.*, 3:10-13. Further, according to the '722 Patent, an NR-TSS signal as proposed by 3GPP “would provide the time index of an SS block in an SS burst or SS burst set,” which is also multiplexed in the SS block and can be used by the UE to “indicate which SS block of an SS burst or SS burst set that has been detected.” *Id.*, 3:14-25.

The '722 Patent further contends that because the NR-TSS signal is delivered without a CRC attachment—*i.e.*, without an error detection code—its use can lead to “delays related to the process of receiving system information and performing initial access, introduced due to errors in the received NR-TSS of the SS block.” *Id.*, 6:26-28. The '722 Patent purports to solve this through a scheme that allows the UE “to know as soon as possible whether the detected or received value of the time index, *e.g.* derived from NR-TSS, is correct or not, in order to avoid unnecessary overhead and delay with regards to the initial access procedure.” *Id.*, 3:58-63; 7:48-54. The proposed scheme includes several steps performed by a BS and a UE in this regard is shown in Figure 7 of the '722 Patent:



First, as shown in figure 7, the BS generates a scrambling sequence, meaning a code used to scramble certain information, where the sequence is based on information providing a time index (*e.g.*, the NR-TSS signal) (*Id.*, Fig. 7, step 310). Second, the BS scrambles the system information carried by the NR-PBCH for transmission to the UE using the scrambling sequence (*Id.*, Fig. 7, step 320), where a CRC is attached to the system information (*Id.*, 7:27-30; Fig. 2c, step 240). Third, the BS transmits the scrambled system information (*e.g.*, within the PBCH)

multiplexed with information providing the time index (*e.g.*, NR-TSS), together with other synchronization signals, in an SS block (*Id.*, Fig. 7, step 330). Specifically, the system information included in the NR-PBCH, the NR-TSS payload or bits, and the NR-PSS and NR-SSS, are multiplexed in an SS block in the frequency and time domains, as shown in Figure 2a of the '722 Patent (annotated):



Fourth, the UE receives the information providing the time index within the SS block. (*Id.*, Fig. 7, step 410). Fifth, the UE generates a scrambling sequence based on the information providing the time index it has received in the SS block (*Id.*, Fig. 7, step 420). Sixth, the UE uses the scrambling sequence to descramble the system information contained in the NR-PBCH (and CRC bits attached) (*Id.*, Fig. 7, step 430). Lastly, the UE performs the CRC check on the received system information, to determine the accuracy of the information providing a time index (*e.g.*, NR-TSS) (*Id.*, Fig. 7, step 440; *see also id.*, 8:22-51, 10:1-3). If there is an error, the procedure of initial access would be stopped as soon as the CRC check

indicates an error, and a new SS block could then be detected, thus avoiding unnecessary delay. *Id.*, 7:48-51.

As explained in further detail below, a POSITA reading the specification of the '722 Patent would have understood in March 2017 that this scheme is at least obvious in view of the prior art. Ex. 1003 ¶¶ 37-38, 66-125.

### **C. Summary of the Prosecution History**

The patent application that issued as the '722 Patent was filed on November 29, 2018, and included the same 30 claims that were included in the issued '722 Patent. Ex. 1002, 188-94. On March 22, 2019, the Examiner issued an Office Action rejecting the claims under 35 U.S.C. § 103 as being unpatentable over Jung (U.S. Pub. No. 2018/0324623) in view of Tamaki (U.S. Pub. No. 2013/0301618). *Id.*, 45. In its April 23, 2019 response to the Office Action, applicant stated that “the present application has an effective filing date of 24 March 2017, by virtue of a priority claim to PCT/CN/2017/078102, filed on that date,” and that the “earliest possible effective filing date for any of the subject matter disclosed in Jung, on the other hand, is 5 May 2017.” Accordingly, applicant argued that “Jung does not qualify as prior art with respect to the pending claims.” *Id.*, 41. No other Office Actions were issued by the examiner. A Notice of Allowance was issued on August 1, 2019. *Id.*, 8.

**D. Person of Ordinary Skill in the Art**

As Dr. Valenti explains, a POSITA at the time of the '722 Patent would have had a Master's degree in Electrical Engineering, Computer Science, Physics or equivalent and three to five years of experience working with wireless digital communication systems including physical layer of such systems. Ex. 1003 ¶ 34. Additional education might compensate for less experience, and vice-versa. *Id.*

**VIII. CLAIM CONSTRUCTION**

Claim terms “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b).” 37 C.F.R. § 42.100(b) (2018); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Petitioner submits that the Board does not need to construe any claim term for purposes of evaluating the prior art in this Petition.

**IX. OVERVIEW OF THE PRIOR ART**

**A. Overview of Luo**

Luo was filed on November 2, 2017, claiming priority to a provisional application filed February 23, 2017. Ex. 1004. Luo was not cited or considered during the prosecution of the '722 Patent.

Similar to the '722 Patent, Luo is generally directed to the initial access process and transmission of synchronization signals and system information in an SS block in a 5G network, and teaches a method of using “synchronization signal

block index for scrambling,” that aims to provide “improvements in 5G NR technology.” *Id.*, 1:1-2, 1:17-19, 1:48-52.

Specifically, Luo teaches a scheme similar to the scheme described by the ’722 Patent, in which a base station scrambles system information based on an SS block index. *Id.*, 1:65-2:2 (“a base station/user equipment (UE) that scramble/descramble information based on at least a portion of an SS block index, where the SS block index indexes a particular SS block within an SS burst within an SS burst set.”). Luo further teaches that the information that is scrambled can include system information for NR-PBCH, which also includes a CRC that can also be scrambled based on the SS block index. *Id.*, 12:25-37 (“[i]n one configuration, ... the broadcast information is for a PBCH. When the information includes a scrambled CRC, the control information associated with the scrambled CRC may or may not be scrambled itself based on the SS block index.”). Luo further teaches that the scrambled information may include “at least one of a reference signal” (*Id.*, 12:25-28) that includes time index information, and that the reference signal may be a DMRS for PBCH. *Id.*, 12:28-31. Luo further discloses that “[t]he SS block may include the scrambled information.” *Id.*, 13:13-14.

Luo further teaches that the SS block transmitted by the BS includes “the PSS, SSS, and the PBCH (including the MIB),” and that “[e]ach SS block has a corresponding SS block index.” *Id.*, 10:44-46, 10:52-53. Luo further discloses that

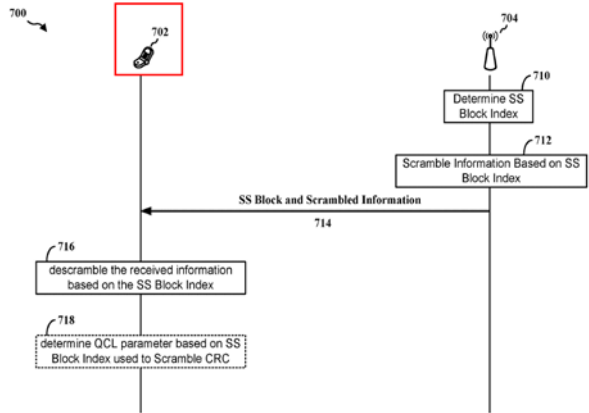
“[t]he PSS, SSS, and PBCH may be time division multiplexed and/or frequency division multiplexed with the SS block,” and that “[t]he SS block may include other signals/channels, and therefore other signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block.” *Id.*, 10:54-65.

Luo further discloses that the SS block and the scrambled information (which may be system information and may include a CRC) that is scrambled based on SS block index is transmitted to the UE, which “descrambles the scrambled information based on the SS block index.” *Id.*, 13:12-14, 13:51-55. Luo also teaches that after descrambling the system information, the UE can then perform CRC decoding (*i.e.*, apply the error-detecting code) on the received system information to determine the accuracy of the time index. *Id.*, 13:62-14:2.

For Luo to be entitled to the February 23, 2017 filing date of the Luo Provisional, the Luo Provisional must provide written description support for at least one claim of Luo to enable a POSITA to practice the invention claimed in that claim. *See Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1381 (Fed. Cir. 2015); *Amazon.com, Inc. v. CustomPlay, LLC*, No. IPR2018-01496, Paper 34 at 40-47 (P.T.A.B. March 4, 2020). The table below, taken from Dr. Valenti’s Declaration (Ex. 1003), provides exemplary citations showing where claims 1 and 9 of Luo are described in the Luo Provisional. Ex. 1003 ¶ 61. Further, Dr. Valenti explains in his declaration that the Luo Provisional enables a POSITA to practice

claims 1 and 9 of Luo. Further, as set forth in Section X below, the Luo Provisional contains disclosures that correspond to the relevant disclosures in the Luo specification.

Luo U.S. 10,568,102 (Ex. 1004)	Luo Provisional (Ex. 1005)
<p><b>Preamble 1:</b> A method of wireless communication of a base station, comprising:</p>	<p>Luo Provisional discloses a method performed by a base station 704 of a wireless communication system. <i>See, e.g.</i>, Figure 7:</p> <p><i>See also id.</i> ¶¶ 0005-6, 0049-55.</p>
<p><b>Claim 1.1:</b> determining a synchronization signal (SS) block index associated with an SS block for transmission;</p>	<p><i>See, e.g.</i>, ¶ 0049: “As illustrated in FIG. 7, at 710, the base station 704 determines an SS block index associated with an SS block for transmission at 714.”</p>
<p><b>Claim 1.2:</b> scrambling information based on a SS block index portion comprising at least a portion of the determined SS block index,</p>	<p><i>See, e.g.</i>, ¶ 0050: “At 712, the base station 704 scrambles information based on the determined SS block index. The base station 704 may scramble the information by generating a scrambling</p>

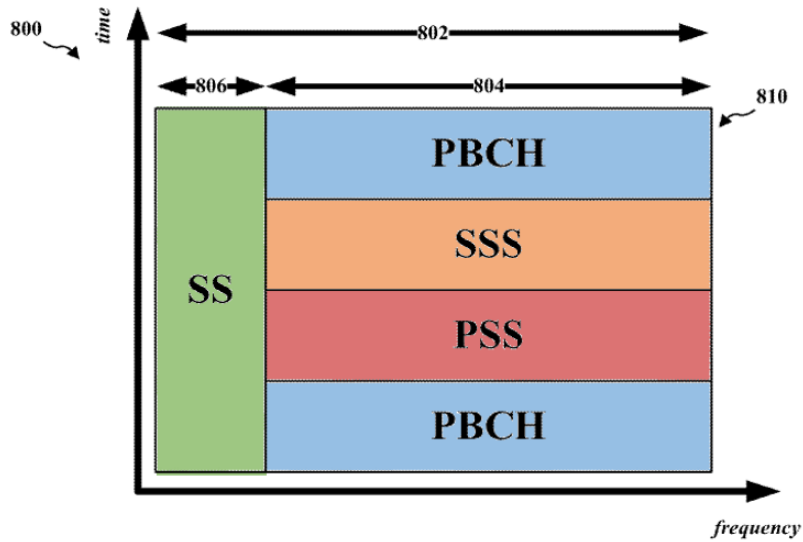
	sequence based on a sequence initialization that is based at least in part on the SS block index.”
<b>Claim 1.3:</b> the information including at least one of data, paging information, control information, or a cyclic redundancy check (CRC) associated with control information; and	<i>See, e.g.</i> , ¶ 0050: “The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information.”
<b>Claim 1.4:</b> transmitting the SS block and the scrambled information.	<i>See, e.g.</i> , ¶ 0051: “At 714, the base station 704 transmits the SS block and the scrambled information to the UE 702.”
<b>Preamble 9:</b> A method of wireless communication of a user equipment (UE), comprising:	<p>Luo Provisional discloses a method performed by a user equipment (UE 702) of a wireless communication system. <i>See, e.g.</i>, Figure 7:</p>  <p><i>See also id.</i> ¶¶ 0005-7, 0049-55.</p>

<p><b>Claim 9.1:</b> receiving a synchronization signal (SS) block and information scrambled based on a SS block index portion comprising at least a portion of an SS block index associated with the SS block,</p>	<p><i>See, e.g., ¶ 0053:</i> “At 714, the UE receives the SS block including information scrambled based on the SS block index associated with the SS block.”</p> <p><i>See, e.g., ¶ 0050:</i> “At 712, the base station 704 scrambles information based on the determined SS block index. The base station 704 may scramble the information by generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index.”</p>
<p><b>Claim 9.2:</b> the information including at least one of a data, paging information, control information, or a cyclic redundancy check (CRC) associated with control information; and</p>	<p><i>See, e.g., ¶ 0050:</i> “The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information.”</p>
<p><b>Claim 9.3:</b> descrambling the scrambled information based on the SS block index portion.</p>	<p><i>See, e.g., ¶ 0054:</i> “At 716, the UE 702 descrambles the scrambled information based on the SS block index.”</p>

**B. Overview of Ly**

Ly was filed by the same applicant of Luo (Qualcomm, Inc.), is assigned to the same assignee (Qualcomm, Inc.), and both Ly and Luo share a common named inventor, Tao Luo. Ly was filed on February 15, 2018, claiming priority to provisional applications filed on February 16, 2017 and on February 22, 2017, just several days before the provisional application that led to the Luo patent was filed.

Like Luo and the '722 Patent, Ly is directed to “improvements in 5G NR technology” that relate to the transmission of SS blocks, and specifically addresses “synchronization signal (SS) blocks that include beam index information.” Ex. 1006, 1:19-21, 1:48-52. Ly similarly discloses “multiplex[ing] a plurality of synchronization signals, including a PSS, a SSS, or a PBCH, for transmission in a SS block.” *Id.*, 6:64-66. Ly further teaches an “SS block index which may be carried in one or more synchronization signals.” *Id.*, 16:39-40. Consistent with Luo’s disclosure that “signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block” (Ex. 1004, 10:54-65), Ly discloses that an “SS block index may be carried in a synchronization signal (*e.g., the TSS or other SS*) which may be frequency division multiplexed with the other synchronization signals of the SS block” (Ex. 1006, 16:44-48 (emphasis added)), as shown, for example, in Figure 8 (annotated):

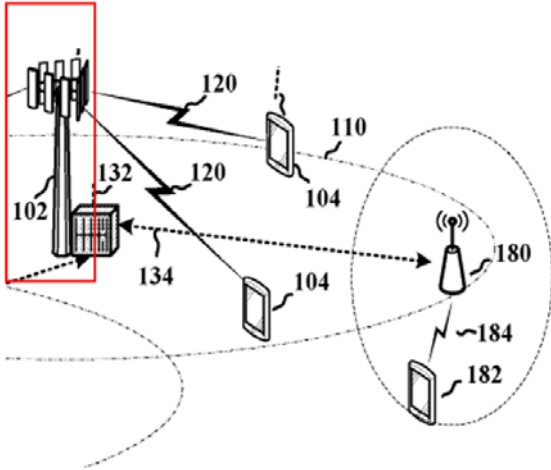


Ly, therefore, discloses “a plurality of synchronization signals that are multiplexed together. The plurality of synchronization signals may include one or more of a PSS, an SSS, a TSS, or a PBCH.” *Id.*, 16:6-9; *see also id.*, 16:25-26 (“the SS signal may convey index information for the SS block.”).

For Ly to be entitled to the February 16, 2017 filing date of the Ly ’973 Provisional and/or the February 22, 2017 filing date of the Ly ’258 Provisional, the Ly ’973 Provisional and Ly ’258 Provisional must provide written description support for at least one claim of Ly to enable a POSITA to practice the invention claimed in that claim. *See Dynamic Drinkware, LLC.*, 800 F.3d at 1381; *Amazon.com, Inc.*, No. IPR2018-01496, Paper 34 at 40-47. The table below, taken from Dr. Valenti’s Declaration (Ex. 1003), provides exemplary citations showing where claims 1 and 3 of Ly are described in the Ly ’973 and ’258 Provisionals. Further, Dr. Valenti explains in his declaration that the Ly

Provisionals enable a POSITA to practice claims 1 and 3 of Ly. Ex. 1003 ¶ 64.

Further, as set forth in Section X below, the Ly Provisionals contain disclosures that correspond to the relevant disclosures in the Luo specification.

<b>Ly U.S. 10,194,410 (Ex. 1006)</b>	<b>Ly '973 Provisional (Ex. 1007)</b> <b>Ly '258 Provisional (Ex. 1008)</b>
<b>Preamble 1:</b> A method of wireless communication by a base station, comprising:	Ly '973 Provisional (Ex. 1007) discloses a method performed by a base station ( <i>e.g.</i> , eNB/gNB 102) of a wireless communication system, shown, for example, in an excerpt of Figure 1 (annotated):   <p>See also <i>id.</i>, ¶¶ 0007, 0027-29, 0034-35, 0051, 0054, 00107-00131. Ly '258 Provisional discloses the same. See, <i>e.g.</i>, Ex. 1008, Fig. 1; see also <i>id.</i> ¶¶ 0007, 0027-29, 0036-37, 00129-158.</p>

<p><b>Claim 1.1:</b> determining a synchronization signal (SS) index for a SS block, the SS block comprising a plurality of synchronization signals multiplexed for transmission on predetermined resources;</p>	<p>Ly '973 Provisional discloses that the base station (<i>e.g.</i>, eNB/gNB) determines a synchronization signal (SS) index (<i>e.g.</i>, a block index for the SS block). <i>See, e.g.</i>, Ex. 1007 ¶ 00116: “the eNB/gNB may determine a block index for the SS block. For example, the eNB/gNB (102, 310, 402) determines a block index for the SS block (610, 710, 810, 910).” Ly '258 Provisional (Ex. 1008) discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 00140.</p> <p>Ly '973 Provisional further discloses that the SS block comprising a plurality of synchronization signals (<i>e.g.</i>, a TSS, a PSS, a SSS, and/or a PBCH) multiplexed for transmission on predetermined resources. <i>See, e.g.</i>, Ex. 1007 ¶ 0035: “in certain aspects, the eNB/gNB 102 may be configured to multiplex a TSS with at least one of a PSS, a SSS, or a PBCH for transmission in a SS block, and transmitting the SS block including the TSS, the PSS, the SSS, and the PBCH (196).” Ly '258</p>
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	Provisional discloses the same. <i>See, e.g.,</i> Ex. 1008 ¶ 0037.
<b>Claim 1.2:</b> generating a first SS of the plurality of synchronization signals using the SS index;	<p>Ly '973 Provisional discloses that a BS generates a first SS (<i>e.g.</i>, TSS signal) of the plurality of synchronization signals. <i>See, e.g.,</i> Ex. 1007 ¶ 0006: “Some systems may also include a TSS. The TSS may need to be transmitted, <i>e.g.</i>, from a base station to a user equipment (UE).” Ly '258 Provisional discloses the same. <i>See, e.g.,</i> Ex. 1008 ¶ 0006.</p> <p>Ly '973 Provisional discloses that the TSS is generated using the SS block index. <i>See, e.g.,</i> Ex. 1007 ¶ 0036: “The TSS may provide a block index that may be used to determine a beam direction.” <i>See also, e.g., id.</i> ¶ 0076: “the TSS signal may convey index information that relates to beams, <i>e.g.</i>, the beam index or indices of SS block repetitions within a beam ... the TSS may be used to provide the beam index and/or SS block repetition index to a UE. Decoding the TSS may provide the beam index and/or SS block repetition index to the UE.”; <i>id.</i> ¶ 0039: “In NR</p>

	<p>systems, the TSS may be used to SS block indices to facilitate beams, mmWave commination.” Ly ’258 Provisional discloses the same. <i>See, e.g.,</i> Ex. 1008 ¶¶ 0006, 0041.</p>
<p><b>Claim 1.3:</b> frequency division multiplexing the first SS with at least a second synchronization signal (SSS) of the SS block, wherein the SSS comprises a secondary synchronization signal that carries information about a physical layer cell identity group number for the base station; and</p>	<p>Ly ’973 Provisional discloses that the BS multiplexes the first SS (<i>e.g.</i>, TSS signal) with at least second synchronization signal (SSS) of the SS block (<i>e.g.</i>, SSS signal). <i>See, e.g.,</i> Ex. 1007 ¶ 0107: “At block 1202, the eNB/gNB multiplexes a TSS with at least one of a PSS, an SSS, or a PBCH for transmission in an SS block.” Ly ’258 Provisional discloses the same. <i>See, e.g.,</i> Ex. 1008 ¶ 00129.</p> <p>Ly ’973 Provisional further discloses that the multiplexing of the first SS with at least a second synchronization signal is frequency division multiplexing. <i>See, e.g.,</i> Ex. 1007 ¶ 0077: “FIG. 6 is a diagram illustrating an example of frequency-division multiplexing ... illustrat[ing] an example placement of the PSS, the SSS, the TSS (TSS1, TSS2),</p>

	<p>and the PBCH (two PBCHs) in time and frequency.” <i>See also id.</i>, Figures 6-9. Ly ’258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 0079, Figures 8-9.</p> <p>Ly ’973 Provisional further discloses that the SSS signal carries information about a physical layer cell identity group number for the base station. <i>See, e.g.</i>, Ex. 1007 ¶ 0039: “The secondary synchronization signal (SSS) ... is used by a UE to determine a physical layer cell identity group number and radio frame timing.” Ly ’258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 0041.</p>
<p><b>Claim 1.4:</b> transmitting the SS block including the first SS generated using the SS index frequency division multiplexed with the SSS on the predetermined resources,</p>	<p>Ly ’973 Provisional discloses that the BS transmits the SS block including the first SS (<i>e.g.</i>, TSS) multiplexed with the SSS on the predetermined resources. <i>See, e.g.</i>, Ex. 1007 ¶ 0108: “At block 1004, the eNB/gNB transmits the SS block including the TSS, the PSS, the SSS, and the PBCH. For example, the eNB/gNB (102, 310, 402) transmits the SS block (610, 710, 810, 910) including</p>

	<p>the TSS ('TSS' FIGS. 6-9), the PSS ('PSS' FIGS. 6-9), the SSS ('SSS' FIGS. 6-9), and the PBCH ('PBCH' FIGS. 6-9)." Ly '258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 00130.</p>
<p><b>Claim 1.5:</b> wherein the first SS is frequency division multiplexed with the SSS in at least one OFDM symbol, and wherein the SS index is conveyed using a shift of a pseudo-noise (PN) sequence of the first SS.</p>	<p>Ly '973 Provisional discloses that the first SS (<i>e.g.</i>, TSS) is frequency division multiplexed with the SSS in at least one OFDM symbol (<i>e.g.</i>, in the same set of OFDM symbols). <i>See, e.g.</i>, Ex. 1007 ¶ 0131: "In an aspect, the TSS may be frequency division multiplexed with the PSS and the SSS in the same set of OFDM symbols." Ly '258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 00155.</p> <p>Ly '973 Provisional discloses that the SS index (or SS block indices) is conveyed (or signaled) using a shift of a pseudo-noise (PN) sequence of the first SS (<i>e.g.</i>, TSS). <i>See, e.g.</i>, Ex. 1007 ¶ 0098: "TSS can be constructed based on pseudo-noise (PN) sequences and cyclic shifts of pseudo-noise (PN) sequences may be used to signal SS block indices."</p>

	Ly '258 Provisional discloses the same. <i>See, e.g.</i> , Ex. 1008 ¶ 77.
<b>Preamble 3:</b> A method of wireless communication by a user equipment (UE), comprising:	Ly '973 Provisional discloses a method performed by a UE. <i>See, e.g.</i> , Ex. 1007 ¶ 00132: “FIG. 11 is a flowchart 1100 of a method of wireless communication in accordance with the systems and methods described herein. The method may be performed by a UE (e.g., the UE 104, 350, 404) such as part of an initial acquisition procedure in which the UE performs cell identification, acquires frame timing, etc.” Ly '258 Provisional discloses the same. <i>See, e.g.</i> , Ex. 1008 ¶ 00159.
<b>Claim 3.1:</b> receiving a synchronization signal (SS) block with a first SS comprising a SS index for the SS block frequency division multiplexed with a second synchronization signal (SSS) on predetermined resources,	Ly '973 Provisional discloses that the UE receives a SS block with a first SS (e.g., TSS) multiplexed with a SSS. <i>See, e.g.</i> , Ex. 1007 ¶ 00132: “At block 1102, the UE receives a SS block comprising a TSS multiplexed with at least one of a PSS, an SSS, or a PBCH.” Ly '258 Provisional discloses the same. <i>See, e.g.</i> , Ex. 1008 ¶ 00159.

	<p>Further, Ly '973 Provisional and Ly '258 Provisional disclose that the TSS and SSS are frequency division multiplexed. <i>See</i> claim element 1.3 above.</p> <p>Ly '973 Provisional further discloses that the first SS (<i>e.g.</i>, TSS) comprising a SS index for the SS block. <i>See, e.g.</i>, Ex. 1007 ¶ 0036: “The TSS may provide a block index that may be used to determine a beam direction.”; <i>see also id.</i> ¶ 0039. Ly '258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶¶ 0038, 0041.</p>
<p><b>Claim 3.2:</b> wherein the SSS comprises a secondary synchronization signal that carries information about a physical layer cell identity group number for a base station, wherein the first SS is frequency division multiplexed with the SSS in at least one OFDM symbol;</p>	<p>Ly '973 Provisional discloses that the SSS comprises a secondary synchronization signal that carries information about a physical layer cell identity group number for a base station. <i>See, e.g.</i>, Ex. 1007 ¶ 0039: “The secondary synchronization signal (SSS) ... is used by a UE to determine a physical layer cell identity group number and radio frame timing.” Ly</p>

	<p>'258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 0041.</p> <p>Further, Ly '973 Provisional and Ly '258 Provisional disclose that the first SS is frequency division multiplexed with the SSS in at least one OFDM symbol. <i>See</i> claim element 1.5 above.</p>
<p><b>Claim 3.3:</b> demultiplexing the first SS and the SSS and obtaining the SS index and the information about the physical layer cell identity group number for the base station,</p>	<p>Ly '973 Provisional discloses that the UE demultiplexes the SS block to obtain the TSS. <i>See, e.g.</i>, Ex. 1007 ¶ 00133: “At block 1104, the UE demultiplexes the SS block to obtain the at least one of the TSS, the PSS, the SSS, and the PBCH.” Ly '258 Provisional discloses the same. <i>See, e.g.</i>, Ex. 1008 ¶ 00160.</p> <p>Further, Ly '973 Provisional and Ly '258 Provisional disclose that the TSS comprises the SS index and the information about the physical layer cell identity group number for the base station. <i>See</i> claim elements 3.1 and 3.2 above.</p>

<b>Claim 3.4:</b> wherein the SS index is conveyed using a shift of a pseudo-noise (PN) sequence of the first SS; and	<i>See</i> claim element 1.5 above.
<b>Claim 3.5:</b> communicating with the base station based on information obtained from the SS block.	Ly '973 Provisional discloses that the UE communicates with the BS based on information obtained from the SS block. <i>See, e.g.,</i> Ex. 1007 ¶ 0027: “The UEs described herein may be able to communicate with various types of base stations and network equipment including macro eNBs, small cell eNBs, gNBs, relay base stations, and the like.” Ly '258 Provisional discloses the same. <i>See, e.g.,</i> Ex. 1008 ¶ 0029.

## **X. SPECIFIC GROUNDS FOR PETITION**

As discussed below, Luo renders obvious the Challenged Claims of the '722 Patent.

### **A. Ground I: Claims 1, 7, 8, 9, 11, 12, 13, 17, 18, 24, 25, 26 and 27 Are Rendered Obvious by Luo**

Claim 1, which is a method claim performed by a “wireless device” (*e.g.*, UE) is substantially identical to claim 13, which claims a “wireless device” (*e.g.*, UE) with generic components that perform the method claimed in claim 1. Ex. 1003 ¶ 65. Similarly, Claims 7, 8 and 9, which are method claims performed by a “network node” (*e.g.*, BS) are substantially identical to claims 25, 26 and 27, which claim a

“network node” (e.g., BS) with generic components that perform the methods claimed in claims 7, 8 and 9. *Id.* The claim chart below compares the method claims to the apparatus claims.

Method Claim	Apparatus Claim
<b>Preamble 1a:</b> A <u>method</u> performed by a <u>wireless device</u> , for <b>receiving system information from a network node of a wireless communication system</b> , the system information being received in a synchronization signal (SS) block of an SS burst set comprising at least one SS block,	<b>Preamble 13a:</b> A <u>wireless device</u> configured to <b>receive system information from a network node of a wireless communication system</b> , the system information being in a synchronization signal (SS) block of an SS burst set comprising at least one SS block,
<b>Preamble 1b:</b> wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS burst set that is being received, the method comprising:	<b>Preamble 13b:</b> wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS burst set that is being received, the wireless device comprising:
	<b>Claim 13.1:</b> a processing circuitry; and
	<b>Claim 13.2:</b> a memory, the memory containing instructions executable by the processing circuitry whereby the wireless device is configured to:

<b>Claim 1.1:</b> receiving, from the network node, the information providing the time index;	<b>Claim 13.3:</b> receive, from the network node, the information providing the time index,
<b>Claim 1.2:</b> receiving the system information, wherein receiving comprises descrambling the system information using a scrambling sequence generated based on the information providing the time index; and	<b>Claim 13.4:</b> receive the system information by descrambling the system information using a scrambling sequence generated based on the information providing the time index, and
<b>Claim 1.3:</b> determining an accuracy of the information providing the time index, based on an error-detection code related to the received system information.	<b>Claim 13.5:</b> determine an accuracy of the information providing the time index, based on an error-detection code related to the received system information.
<b>Preamble 7a:</b> A <u>method</u> performed by a <u>network node</u> of a wireless communication network, for transmitting system information to a wireless device in a synchronization signal (SS) block of an SS burst set comprising at least one SS block,	<b>Preamble 25:</b> A <u>network node</u> of a wireless communication network, the network node comprising:
<b>Preamble 7b:</b> wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS	

burst set that is being transmitted, the method comprising:	
	<b>Claim 25.1:</b> a processing circuitry; and
	<b>Claim 25.2:</b> a memory, the memory comprising instructions executable by the processing circuitry whereby the network node is configured to:
<b>Claim 7.1:</b> scrambling the system information using a scrambling sequence generated based on the information providing the time index, and	<b>Claim 25.3:</b> scramble the system information using a scrambling sequence generated based on the information providing the time index, and
<b>Claim 7.2:</b> transmitting, to the wireless device, the scrambled system information multiplexed with the information providing the time index of the SS block,	<b>Claim 25.4:</b> transmit to the wireless device, in a synchronization signal (SS) block of an SS burst set comprising at least one SS block, the scrambled system information multiplexed with the information providing the time index of the SS block,
<b>Claim 7.3:</b> wherein an error detection code is related to the system information.	<b>Claim 25.5:</b> wherein an error detection code is related to the system information.
<b>Claim 8:</b> The <u>method</u> of claim 7, wherein scrambling the system	<b>Claim 26:</b> The <u>network node</u> of claim 25, wherein the network node is configured to scramble the system

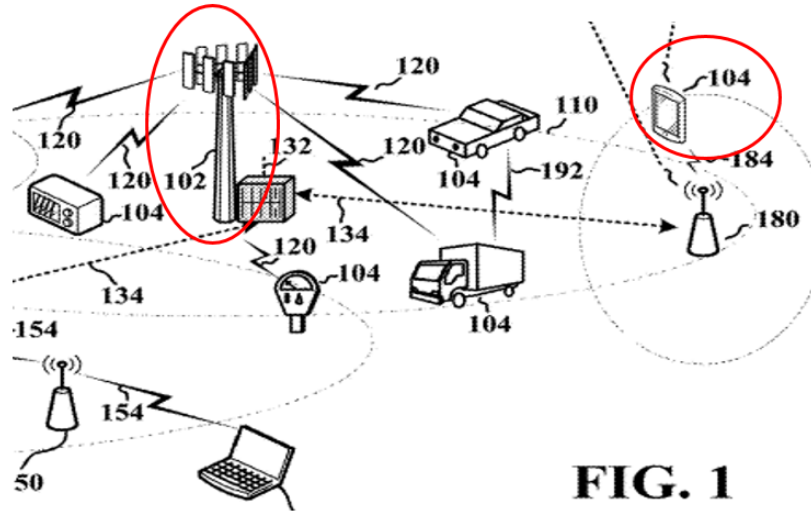
information comprises scrambling coded bits of the system information.	information by scrambling coded bits of the system information.
<b>Claim 9:</b> The <u>method</u> of claim 7, wherein the error detection code is a Cyclic Redundancy Check (CRC) attachment to information bits corresponding to the system information.	<b>Claim 27:</b> The <u>network node</u> of claim 25, wherein the error detection code is a Cyclic Redundancy Check (CRC) attachment to information bits corresponding to the system information.

Because method claim 1 is substantially identical to apparatus claim 13, and because method claims 7, 8 and 9 are substantially identical to apparatus claims 25, 26 and 27 respectively, they are addressed together in this petition.

### 1. Independent Claims 1 and 13

- a) *Preamble [1a]: “A method performed by a wireless device, for receiving system information from a network node of a wireless communication system, the system information being received in a synchronization signal (SS) block of an SS burst set comprising at least one SS block”*
- b) *Preamble [13a]: “A wireless device configured to receive system information from a network node of a wireless communication system, the system information being in a synchronization signal (SS) block of an SS burst set comprising at least one SS block”*

To the extent that these portions of the claim preambles constitute limitations, Luo teaches them. Ex. 1003 ¶ 68. Luo discloses a wireless device (*e.g.*, UE 104) and a network node (*e.g.*, BS 102), as part of a wireless communication system, as shown in the annotated excerpt of Figure 1. Ex. 1004 (Luo), 4:21-25; Ex. 1005 (Luo Provisional) ¶ 0026.



Luo further discloses that the wireless device (UE) receives system information (*e.g.*, information within MIB carried by PBCH) from the network node (BS) in a synchronization signal (SS) block of an SS burst set. Ex. 1004, 10:44-48 (“The base station 402 transmits an SS block including the PSS, SSS, and the PBCH (including the MIB) ... The UE 404 receives the transmission 402 *e* including the PSS, SSS, and PBCH.”); Ex. 1005 ¶ 0045; Ex. 1004, 10:65-11:3 (“One or multiple SS blocks make up an SS burst. ... One or multiple SS bursts make up an SS burst set.”); Ex. 1005 ¶ 0046. *See also* Ex. 1004, 8:37-47 (“FIG. 3 is a block diagram of a base station 310 in communication with a UE 350 in an access network... The controller/processor 375 provides RRC layer functionality associated with broadcasting of system information (*e.g.*, MIB, SIBs).”); Ex. 1005 ¶ 0037.

- c) *Preamble [1b]: “wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS burst set that is being received, the method comprising:”*
- d) *Preamble [13b]: “wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS burst set that is being received, the wireless device comprising:”*

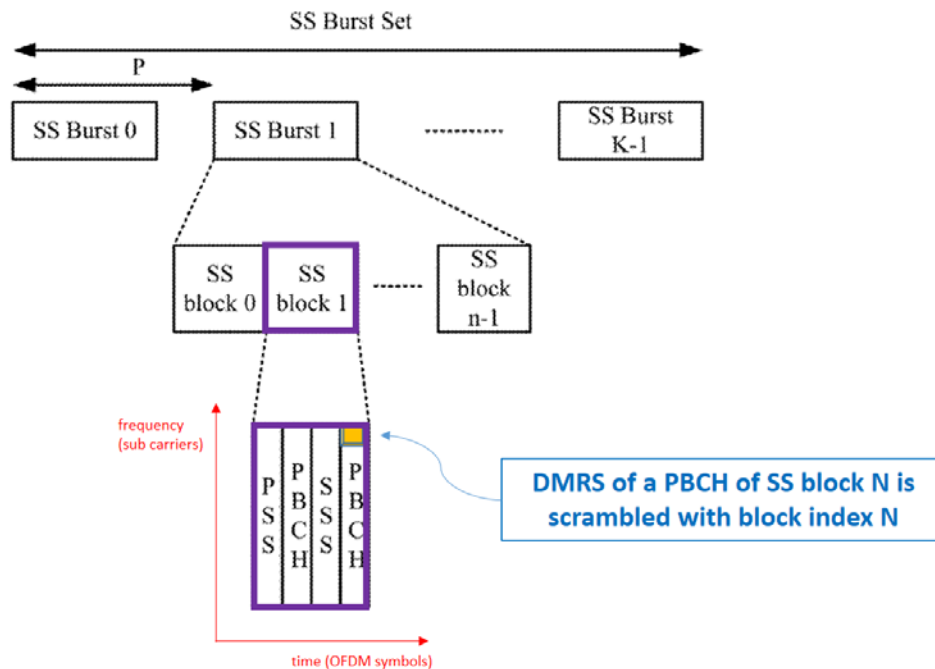
To the extent that these portions of the claim preambles constitute limitations, Luo teaches them. Ex. 1003 ¶ 70. Luo discloses that the BS transmits system information (*e.g.*, information within MIB carried by PBCH) multiplexed with information providing a time index (*e.g.*, a scrambled DMRS in the PBCH) indicating which SS block of the SS burst set is being received.

In Luo, the SS block index corresponds to “a time index” and the scrambled DMRS corresponds to “information providing a time index.” Ex. 1003 ¶ 71. Specifically, Luo discloses that the base station transmits an SS block including the PSS, SSS, and the PBCH (including the MIB) to the UE. Ex. 1004, 11:67-12:1 (“the SS block may include at least one of a PSS, an SSS, or a PBCH.”), 10:44-47, Fig. 4; Ex. 1005 ¶¶ 0045-46, 0051, Fig. 4. Luo further discloses that each SS block includes a corresponding “SS block index.” Ex. 1004, 10:52-54 (“Each SS block has a corresponding SS block index (also referred to as SS/PBCH block index) indicated in FIG. 4 as one of 0, 1, . . . , n-1.”), Fig. 4; Ex. 1005 ¶ 0046, Fig. 4. A POSITA would understand that the SS block index disclosed in Luo is a time index because it indicates a particular SS block within an SS burst within an SS burst set on a time

axis. Ex. 1004, 11:55-57 (“SS block index may refer to one or more indices for indicating an SS block within an SS burst within an SS burst set.”); Ex. 1005 ¶ 0048; Ex. 1004, 11:30-57 (“The time length of the SS burst set may be  $N \times 10$  ms ... [where] the SS block index may be used to indicate an SS block within an SS burst or within an SS burst set.”), Figs. 6A-6B; Ex. 1005 ¶¶ 0047-48, Figs. 6A-6B. The BS will determine an SS block index and will transmit it to the UE. Ex. 1004, 11:64-67; Ex. 1005 ¶ 0049. Luo further discloses a “demodulation reference signal (DMRS),” which is a reference signal for PBCH. Ex. 1004, 12:28-31; Ex. 1005 ¶ 0036; *see also* Ex. 1004, Fig. 2C (disclosing DMRS signal carried in a 5G NR frame structure); Ex. 1005, Fig. 2C (same).

Luo further teaches that the BS provides the SS block index (*i.e.*, the time index) to the UE through scrambling of the DMRS using the SS block index and transmitting the scrambled DMRS, which includes information providing a time index, to the UE. Specifically, Luo teaches that “the base station 704 scrambles information based on the determined SS block index” (Ex. 1004, 12:5-6; Ex. 1005 ¶ 0050), where “[t]he information includes at least one of a reference signal” (Ex. 1004, 12:25-28; Ex. 1005 ¶ 0050), and that the reference signal may be a DMRS for PBCH. Ex. 1004, 12:28-31; Ex. 1005 ¶ 0036. Luo further teaches that the scrambled DMRS is included in the SS block and transmitted to the UE. Ex. 1004, 13:13-14 (“...the base station 704 transmits the SS block and the scrambled information to the

UE 702. The SS block may include the scrambled information.”); Ex. 1005 ¶ 0051. A POSITA would therefore recognize that Luo discloses the scrambled DMRS for PBCH—which conveys information providing a time index—is transmitted within the PBCH field of the SS block (*e.g.*, Fig. 2C discloses DMRS signal carried in a 5G NR frame structure), as shown, for example, in annotated Figure 4. Ex. 1003 ¶ 72.<sup>3</sup>



Luo further discloses that once the DMRS is received by the UE, it is unscrambled to recover the SS block index. Ex. 1004, 12:5-6; Ex. 1005 ¶ 0050. As

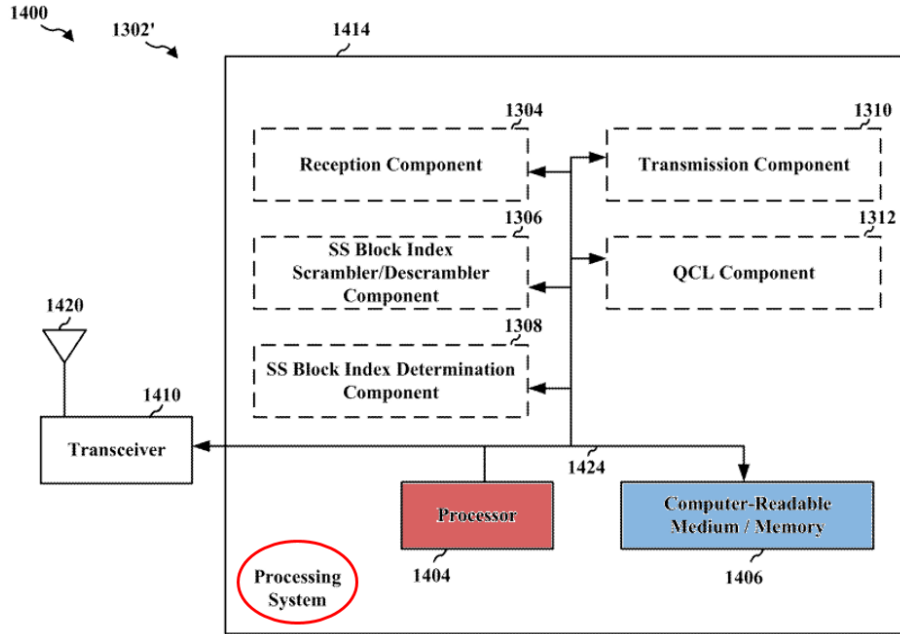
<sup>3</sup> The '722 Patent notes that “the information providing the time index of the SS block may in embodiments correspond to another type of signal than the NR-TSS.” Ex. 1001, 6:19-22.

Dr. Valenti explains, a POSITA would have understood that the scheme disclosed in Luo allows the UE to perform blind decoding to recover the SS block index associated with the SS block, thereby avoiding the need to add an extra signal to the SS block to explicitly convey the SS block index. Ex. 1003 ¶ 73.

Luo further teaches that the system information (information within MIB carried by PBCH) can be multiplexed with information providing a time index (the scrambled DMRS). Specifically, Luo teaches that the system information within MIB carried by PBCH “may be time division multiplexed and/or frequency division multiplexed” in the the SS block (Ex. 1004, 10:51-58, Fig. 4; Ex. 1005 ¶ 0046, Fig. 4), and that the SS block includes the scrambled DMRS (*e.g.*, annotated in orange in figure 4 above), which, as explained above, conveys information providing the time index. Ex. 1004, 13:13-14 (“[t]he SS block may include the scrambled information.”); Ex. 1005 ¶ 0051.

*e) Element [13.1]: “a processing circuitry”*

Luo teaches this claim element. Ex. 1003 ¶ 75. Specifically, Luo discloses an apparatus 1302’ (*e.g.*, UE) employing a “processing system 1414,” that includes a processing circuitry such as “processor 1404,” annotated in red in Figure 14 below. Ex. 1004, 21:7-9, 21:35-39; Ex. 1005 ¶¶ 0024, 0041, Fig. 3.



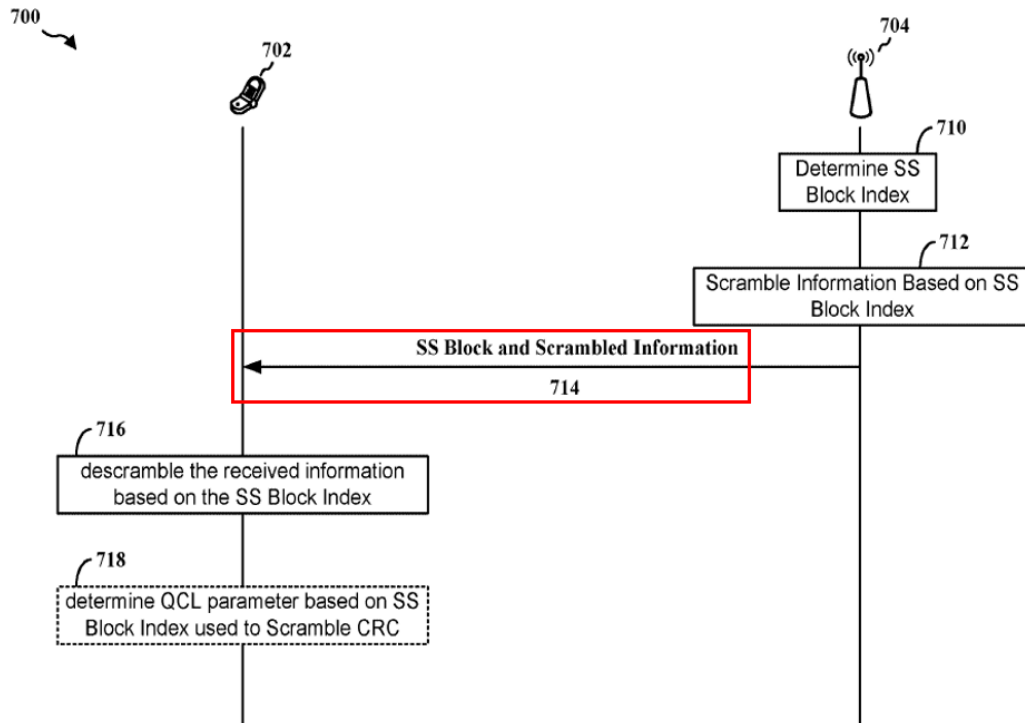
- f) *Element [13.2]: “a memory, the memory containing instructions executable by the processing circuitry whereby the wireless device is configured to:”*

Luo teaches this claim element. Ex. 1003 ¶ 76. Specifically, Luo discloses an apparatus 1302' (e.g., UE) employing a memory, such as “computer-readable medium/memory 1406,” annotated in blue in Figure 14 shown above, where the memory contains instructions executable by the processing circuitry. Ex. 1004, 21:7-9, 21:35-39; Ex. 1005 ¶¶ 0025, 0041, Fig. 3.

- g) *Element [1.1]: “receiving, from the network node, the information providing the time index”*
- h) *Element [13.3]: “receive, from the network node, the information providing the time index”*

Luo teaches these claim elements. Ex. 1003 ¶ 77. Specifically, Luo discloses a UE 702 receiving from a network node (e.g., base station 704) information providing the time index (e.g., scrambled DMRS signal for PBCH), as shown in red

in annotated Figure 7 below. Ex. 1004, 13:51-53 (“[a]t 714, the UE 702 receives the SS block including information scrambled based on the SS block index associated with the SS block.”); Ex. 1005 ¶ 0053.



- i) *Element [1.2]: “receiving the system information, wherein receiving comprises descrambling the system information using a scrambling sequence generated based on the information providing the time index; and”*
- j) *Element [13.4]: “receive the system information by descrambling the system information using a scrambling sequence generated based on the information providing the time index, and”*

Luo teaches these claim elements. Ex. 1003 ¶ 78. *First*, Luo discloses a UE receiving system information (e.g., information within MIB carried by PBCH) from the network node (BS) in an SS block, as described in sections X.A.1.a)/b). Luo further discloses a UE 702 receiving from a network node (e.g., base station 704)

system information, as shown for example in Figure 7. Ex. 1004, Fig. 7, 13:51-53 (“the UE 702 receives the SS block including information scrambled based on the SS block index associated with the SS block.”); Ex. 1005 ¶ 0053.

*Second*, Luo teaches that receiving the system information comprises descrambling the system information using a scrambling sequence generated based on the information providing the time index. Specifically, Luo teaches that “the base station 704 scrambles information based on the determined SS block index” (Ex. 1004, 12:5-6; Ex. 1005 ¶ 0050), where the information includes “broadcast information [] for a PBCH.” Ex. 1004, 12:34-35; Ex. 1005 ¶ 0050; *see also* Ex. 1004, 12:48-49 (“...the information is broadcast information for a PBCH.”); Ex. 1005 ¶ 0050. Luo further teaches that after the UE receives the scrambled system information carried by PBCH, as shown in Figure 7 at 716, the UE descrambles the system information using a scrambling sequence generated based on the SS block index carried by the scrambled DMRS. Ex. 1004, 13:54-55 (“the UE 702 descrambles the scrambled information based on the SS block index.”); Ex. 1005 ¶ 0054.

- k) *Element [1.3]: “determining an accuracy of the information providing the time index, based on an error-detection code related to the received system information.”*
- l) *Element [13.5]: “determine an accuracy of the information providing the time index, based on an error-detection code related to the received system information.”*

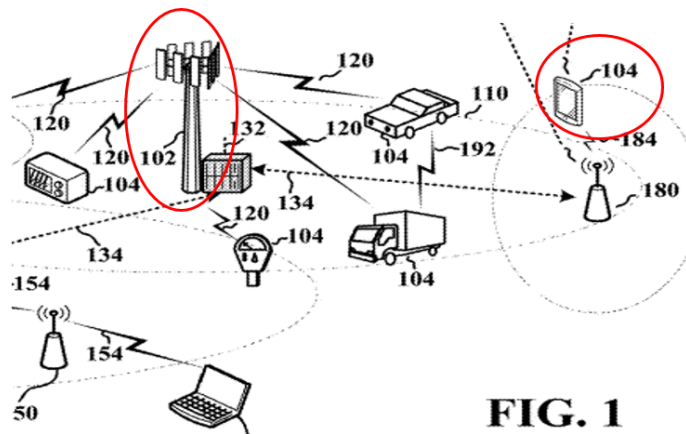
Luo teaches these claim elements. Ex. 1003 ¶ 80. Luo discloses that the UE determines an accuracy of the information providing the time index (*e.g.*, the scrambled DMRS), by applying an error-detection code (*e.g.*, CRC) that is attached, and related to, the system information (*e.g.*, within PBCH). Ex. 1004, 12:25-28, 12:35-37, 13:61-14:8; Ex. 1005 ¶¶ 0050, 0055. Luo teaches that the CRC is descrambled based on a sequence generated based on the information providing the time index. Ex. 1004, 13:54-55 (“the UE 702 descrambles the scrambled information based on the SS block index.”); Ex. 1005 ¶ 0054. Luo further teaches that a CRC check is performed on the system information. Ex. 1004, 13:61-14:8 (“[w]hen the scrambled information 714 includes a CRC scrambled based on an SS block index, the UE 702 may descramble the CRC based on the SS block index, and decode received control information based on the descrambled CRC... to determine whether the control information was decoded/descrambled successfully.”); Ex. 1005 ¶ 0055. Thus, performing a CRC check on the system information (in PBCH) would indicate whether the received information providing a time index is accurate or not, as described by the ’722 Patent. Ex. 1001, 8:9-12 (“a CRC checking for the NR-

PBCH system information performed by the receiving wireless device would indicate whether the received time index is accurate or not.”); Ex. 1003 ¶ 80.

## 2. Independent Claims 7 and 25

- a) *Preamble [7a]: “A method performed by a network node of a wireless communication network, for transmitting system information to a wireless device in a synchronization signal (SS) block of an SS burst set comprising at least one SS block”*
- b) *Preamble [25]: “A network node of a wireless communication network, the network node comprising:”*

To the extent that these claim preambles constitute limitations, Luo teaches them. Ex. 1003 ¶ 81. Luo discloses a network node (*e.g.*, BS 102) and a wireless device (*e.g.*, UE 104), as part of a wireless communication system, as shown in the annotated excerpt of Figure 1. Ex. 1004, 4:21-25; Ex. 1005 ¶ 0026.



Luo further discloses a method performed by network node 102 for transmitting system information to a wireless device (*e.g.*, UE) in a synchronization signal (SS) block of an SS burst set comprising at least one SS block, as described above in sections X.A.1.a)/b) and c)/d).

- c) *Preamble [7b]: “wherein the system information is multiplexed with information providing a time index indicating which SS block of the SS burst set that is being transmitted, the method comprising:”*

To the extent that this claim preamble language constitutes a limitation, Luo teaches it, as explained above in sections X.A.1.c)/d).

- d) *Element [25.1]: “a processing circuitry”*

Luo teaches this claim element, as explained above in section X.A.1.e).

- e) *Element [25.2]: “a memory, the memory comprising instructions executable by the processing circuitry whereby the network node is configured to:”*

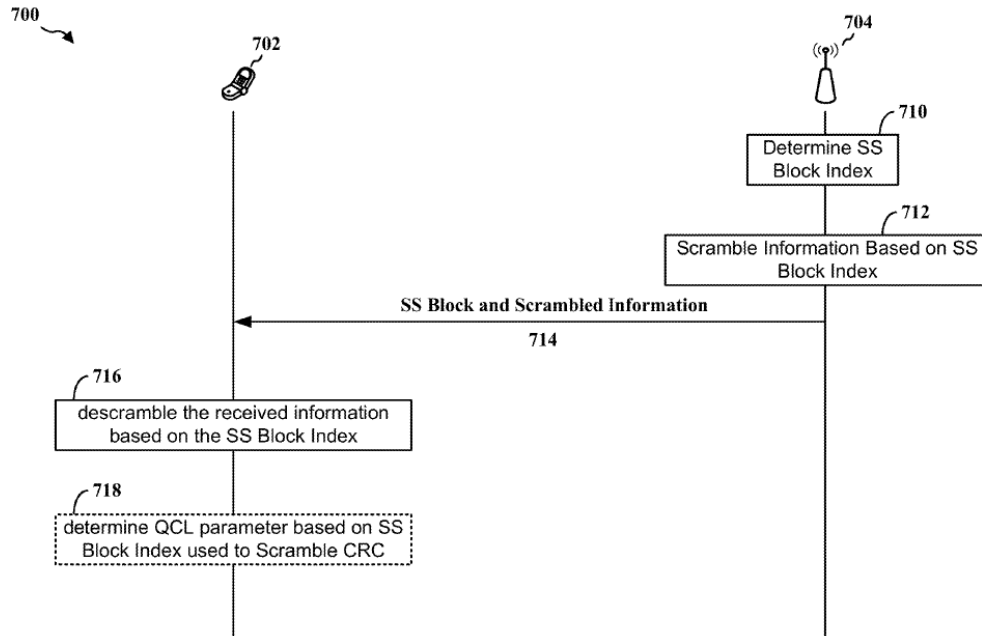
Luo teaches this claim element, as explained above in section X.A.1.f).

- f) *Element [7.1]: “scrambling the system information using a scrambling sequence generated based on the information providing the time index, and”*

- g) *Element [25.3]: “scramble the system information using a scrambling sequence generated based on the information providing the time index, and”*

Luo teaches these claim elements. Ex. 1003 ¶ 86. In Luo, a network node (*e.g.*, base station 704) scrambles system information (*e.g.*, information carried by PBCH) using a scrambling sequence generated based on the information providing a time index (*e.g.*, the scrambled DMRS that conveys the SS block index). Ex. 1004, 12:6-9 (“The base station 704 may scramble the information by generating a scrambling sequence based on a sequence/scrambling initialization that is based at least in part on the SS block index.”); Ex. 1005 ¶ 0050.

Specifically, in Figure 7, Luo discloses a call-flow diagram for a UE 702 and a base station 704, as shown below. Ex. 1004, 11:63-64; Ex. 1005 ¶ 0049.



As shown in Figure 7, “at 710, the base station 704 determines an SS block index associated with an SS block for transmission at 714.” Ex. 1004, 11:64-67; Ex. 1005 ¶ 0049. Luo further discloses that “[a]t 712, the base station 704 scrambles information based on the determined SS block index” using “a sequence/scrambling initialization that is based at least in part on the SS block index” (Ex. 1004, 12:5-9), where “[t]he information includes at least one of a reference signal...broadcast information, or a CRC associated with control information.” Ex. 1004, 12:25-28; Ex. 1005 ¶ 0050. Luo further teaches that the reference signal is a DMRS for PBCH (Ex. 1004, 12:28-31; Ex. 1005 ¶ 0050) and that the broadcast information is for a PBCH. Ex. 1004, 12:31-34; Ex. 1005 ¶ 0050. Luo further teaches that the apparatus 1102’ includes means for scrambling system information based the SS block index. Ex. 1004, 19:8-13 (“the apparatus may include means for scrambling information

based on at least a portion of the determined SS block index, where the information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information.”); Ex. 1005, Claim 41, Fig. 3.

- h) *Element [7.2]: “transmitting, to the wireless device, the scrambled system information multiplexed with the information providing the time index of the SS block”*
- i) *Element [25.4]: “transmit to the wireless device, in a synchronization signal (SS) block of an SS burst set comprising at least one SS block, the scrambled system information multiplexed with the information providing the time index of the SS block”*

Luo teaches these claim elements, as explained above in sections X.A.1.c)/d); *see also* Ex. 1004, 19:13-15; Ex. 1005, Claim 41, Fig. 3 (apparatus 1102’ includes “means for transmitting the SS block and the scrambled information.”).

- j) *Element [7.3]: “wherein an error detection code is related to the system information.”*
- k) *Element [25.5]: “wherein an error detection code is related to the system information.”*

Luo teaches these claim elements. Ex. 1003 ¶ 90. Luo discloses that the system information may include cyclic redundancy check (CRC), *i.e.*, an error detection code that is related to, and associated with, the system information, as explained above in sections X.A.1.k)/l).

**3. Dependent Claims 8 and 26**

- a) *Preamble 8: “The method of claim 7”*
- b) *Preamble 26: “The network node of claim 25”*

Luo renders obvious the method of claim 7 and the network node of claim 25, as discussed above in Section X.A.2.

- c) *Element [8.1]: “wherein scrambling the system information comprises scrambling coded bits of the system information”*
- d) *Element [26.1]: “wherein the network node is configured to scramble the system information by scrambling coded bits of the system information.”*

Luo teaches these elements. Ex. 1003 ¶ 92. Luo discloses that the network node (*e.g.*, BS) scrambles the system information (*e.g.*, the PBCH payload) by scrambling coded bits of the system information. Specifically, Luo teaches that the base station 704 shown in Figure 7 “scramble[s] the PBCH payload,” and “[s]ubsequently, after the encoding/CRC process, the base station 704 may scramble the encoded PBCH based on a scrambling sequence that is based on its cell ID ... and X LSBs of the SS block index,” where “M is the number of bits to be scrambled.” Ex. 1004, 12:48-61; Ex. 1005 ¶ 0050. This also would have been obvious to a POSITA. Ex. 1003 ¶ 92.

**4. Dependent Claims 9 and 27**

- a) *Preamble 9: “The method of claim 7”*
- b) *Preamble 27: “The network node of claim 25”*

Luo renders obvious the method of claim 7 and the network node of claim 25, as discussed above in Section X.A.2.

- c) *Element [9.1]: “wherein the error detection code is a Cyclic Redundancy Check (CRC) attachment to information bits corresponding to the system information.”*
- d) *Element [27.1]: “wherein the error detection code is a Cyclic Redundancy Check (CRC) attachment to information bits corresponding to the system information.”*

Luo teaches these claim elements. Ex. 1003 ¶ 94. Specifically, Lou discloses an error detection code, and specifically Cyclic Redundancy Check (CRC), scrambled with system information (*e.g.*, broadcast information for PBCH). Ex. 1004, 2:10-16 (“The base station scrambles information based on at least a portion of the determined SS block index. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information.”); Ex. 1005 ¶¶ 0005, 0007, 0050. *See also* Ex. 1004, 14:35-39 (“[a]t 814, the UE 804 transmits the scrambled information to a base station 802. When the scrambled information includes a CRC scrambled by the SS block index, the UE 804 may transmit UL control information along with the SS-block-index scrambled CRC.”); Ex. 1005 ¶ 0058. Thus, Luo teaches that the CRC is attached to

the system information (*e.g.*, broadcast information for PBCH) and both are included in the scrambled information. Ex. 1004, 14:35-39; Ex. 1005 ¶ 0058; Ex. 1003 ¶ 94.

## **5. Dependent Claim 11**

### *a) Preamble 11: “The method of claim 7”*

Luo renders obvious the method of claim 7, as discussed above in Section X.A.2.

### *b) Element [11.1]: “wherein the SS block has a certain size in the time dimension during which synchronization signals, the information providing the time index, and system information are transmitted.”*

Luo teaches this element. Ex. 1003 ¶ 96. Luo teaches that the SS block has a certain size in the time dimension during which synchronization signals (*e.g.*, PSS and SSS), the information providing the time index (*e.g.*, scrambled DMRS), and system information (*e.g.*, information carried by PBCH) are transmitted. Specifically, as explained above, Luo teaches that information providing a time index (*e.g.*, the scrambled DMRS) and the system information (*e.g.*, information within MIB carried by PBCH) are transmitted within an SS block. Ex. 1004, 10:51-58, 13:13-14. Luo further teaches that the PBCH and the synchronization signals PSS and SSS “may be time division multiplexed and/or frequency division multiplexed with the SS block.” Ex. 1004, 10:51-58, Fig. 4 (showing the PSS, SSS, and PBCH time division multiplexed within an SS block); Ex. 1005 ¶ 0046, Fig. 4. Thus, a POSITA in March 2017 would have recognized Luo to describe that the information providing a time index (*e.g.*, the scrambled DMRS) is time multiplexed

in the SS block, which has a certain size in the time dimension, with the system information (PBCH) and synchronization signals (PSS and SSS). Ex. 1003 ¶ 96.

**6. Dependent Claim 12**

*a) Preamble 12: “The method of claim 7”*

Luo renders obvious the method of claim 7, as discussed above in Section X.A.2.

*b) Element [12.1]: “wherein the information providing the time index is a tertiary synchronization signal (TSS) in the SS block.”*

Luo teaches this element. Ex. 1003 ¶ 98. Luo discloses an “SS block index” that indexes a particular SS block within an SS burst within an SS burst set. Ex. 1004, 11:55-57 (“SS block index may refer to one or more indices for indicating an SS block within an SS burst within an SS burst set.”); Ex. 1005 ¶ 0048; *see also* Ex. 1004, 2:1-2; Ex. 1005 ¶ 0006. A POSITA in March 2017 would have readily recognized that an SS block index could be conveyed by a TSS signal in the SS block. Ex. 1003 ¶ 98. Indeed, the ’722 Patent itself admits that the use of TSS signal to convey the time index was generally known in the art and “has been under discussion in several 3GPP contributions.” Ex. 1001, 3:21-25.

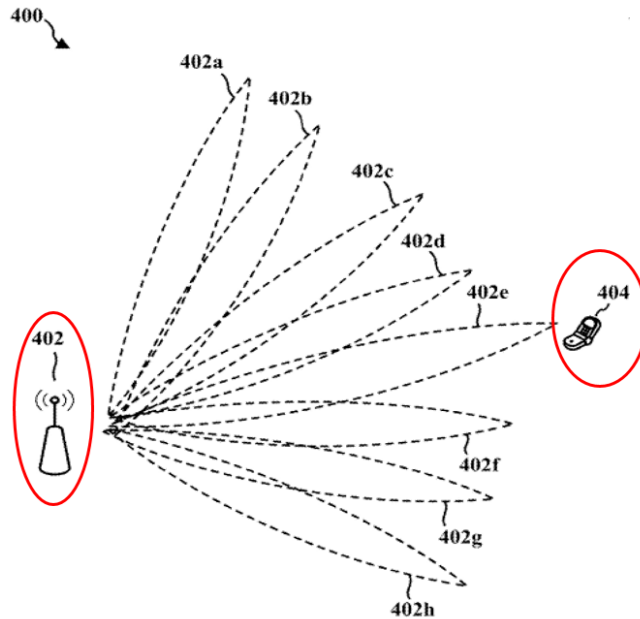
**7. Dependent Claim 17**

*a) Preamble 17: “The wireless device of claim 13, wherein the wireless device is further configured to:”*

Luo renders obvious claim 13, as discussed above in Section X.A.1.

- b) *Element [17.1]: “acquire synchronization with the network node based on the information in the SS block.”*

Luo teaches this element. Ex. 1003 ¶ 100. Luo discloses a wireless device (e.g., UE 404) that acquires synchronization with the network node (e.g., BS 402) based on the information in the SS block (e.g., PSS, SSS, and PBCH including the MIB), as shown in the annotated excerpt of Figure 4 below. Ex. 1004, 10:40-50, Fig. 4; Ex. 1005 ¶ 0045, Fig. 4.



Specifically, Luo teaches that “when the UE 404 turns on, the UE 404 searches for a nearby NR network. **The UE 404 discovers the base station 402**, which belongs to an NR network. The base station 402 transmits an **SS block including the PSS, SSS, and the PBCH (including the MIB)** periodically in different transmit directions 402 a-402 h. The UE 404 receives the transmission 402 e including the PSS, SSS, and PBCH. Based on the received SS

block, *the UE 404 synchronizes to the NR network* and camps on a cell associated with the base station 402.”. Ex. 1004, 10:41-50 (emphasis added); Ex. 1005 ¶ 0045.

## 8. Dependent Claim 18

a) *Preamble 18: “The wireless device of claim 13”*

Luo renders obvious claim 13, as discussed above in Section X.A.1.

b) *Element [18.1]: “wherein the wireless device is configured to descramble the system information by descrambling coded bits of the system information.”*

Luo teaches this element. Ex. 1003 ¶ 103. In Luo, the UE descrambles system information (*e.g.*, the PBCH payload) by descrambling coded bits of the PBCH payload, which constitutes the claimed system information. As explained above in sections X.A.3.c/d), Luo discloses that the network node (*e.g.*, BS) scrambles the PBCH payload by scrambling coded bits of the system information. Ex. 1004, 14:48-61; Ex. 1005 ¶ 0050. Luo further teaches that the wireless device (*e.g.*, UE) is configured to descramble the system information received from the network node (*e.g.*, BS). Ex. 1004, 21:62-64 (“[t]he apparatus may further include means for descrambling the scrambled information based on the at least the portion of the SS block index.”); Ex. 1005, Claim 41, Fig. 3. Since the scrambling of system information described in Luo is performed by scrambling coded bits of system information (Ex. 1004, 14:48-61 (“M is the number of bits to be scrambled...”); Ex. 1005 ¶ 0050), a POSITA in 2017 would have readily recognized that the *descrambling* of system information described in Luo is similarly performed by

descrambling the coded bits of the system information. Ex. 1003 ¶ 103. This also would have been obvious to a POSITA. *Id.*

**9. Dependent Claim 24**

a) *Preamble 18: “The wireless device of claim 13”*

Luo renders obvious claim 13, as discussed above in Section X.A.1.

b) *Element [24.1]: “wherein the wireless device is a User Equipment (UE).”*

Luo discloses that the wireless device is a User Equipment (UE). Ex. 1003 ¶ 105; Ex. 1004, 21:55-56 (“[i]n one configuration, the apparatus 1302/1302’ for wireless communication is a UE.”), Figure 14; Ex. 1005, Claim 36, Fig. 3. *See also* Ex. 1004, 4:21-25, Fig. 1; Ex. 1005 ¶ 0026.

**B. Ground II: Claims 1, 7, 8, 9, 11, 12, 13, 17, 18, 24, 25, 26 and 27 Are Rendered Obvious by Luo In View of Ly**

As discussed below, the Challenged Claims of the ’722 Patent are also rendered obvious in view of Luo in combination with Ly.

**1. Motivation to Combine Luo with Ly**

A POSITA would have been motivated to combine the teachings of Luo with the teachings of Ly, as explained below and in Dr. Valenti’s Declaration. Ex. 1003 ¶¶ 107-112. Combining Luo and Ly would have involved routine implementation, would have posed no technical risks given their related and complementary teachings, and would have successfully achieved the predictable benefits of

providing more flexible support for continuing improvements of 5G wireless communication systems. *Id.*

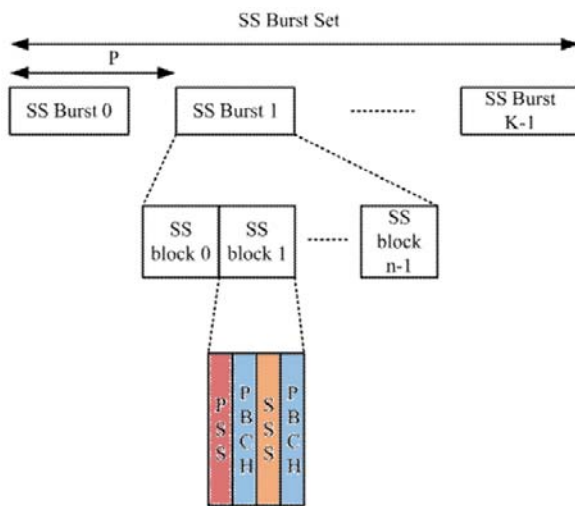
Luo and Ly relate to the same field—*i.e.*, synchronization signal blocks in 5G NR technology—and both seek to address the same problem, *i.e.*, improvement of 5G NR technology with respect to the transmission of SS block index information in an SS block to achieve synchronization between UE and BS in a wireless network. Ex. 1004, Abstract, 1:48-49; Ex. 1006, Abstract, 1:48-49. A POSITA would have been motivated to improve Luo’s scheme of transmission of SS block index information by a BS to a UE (as shown, for example in Figure 7 of Luo) by incorporating Ly’s specific technique of multiplexing a specific signal that carries the time index with other SS signals and the PBCH in a SS block, because simultaneous transmission of this information in the same SS block is more efficient, reduces latencies and delays, and provides a way for the accuracy of the time index to be checked early in the synchronization process. Ex. 1003 ¶ 108. A POSITA would have viewed the addition of Ly’s specific technique of multiplexing PSS, SSS, PBCH, and a TSS (or other SS signal) in a SS block to the scheme described by Luo as the application of a known technique (*e.g.*, multiplexing of SS signals) to a known method and device to yield predictable results (*e.g.*, transmission of SS block time index with system information). *Id.*, ¶ 109.

A POSITA would also have a reasonable expectation of success in arriving at the alleged invention recited in the Challenged Claims of the '722 Patent by combining the teachings of Luo and Ly because, consistent with the teaching of Luo that information providing a time index is transmitted in the SS block, and that other signals may be multiplexed into the SS block, Ly teaches how to multiplex an SS signal that conveys information providing the time index and such implementation would have involved a routine software implementation as explained by Dr. Valenti. Ex. 1003 ¶ 109.

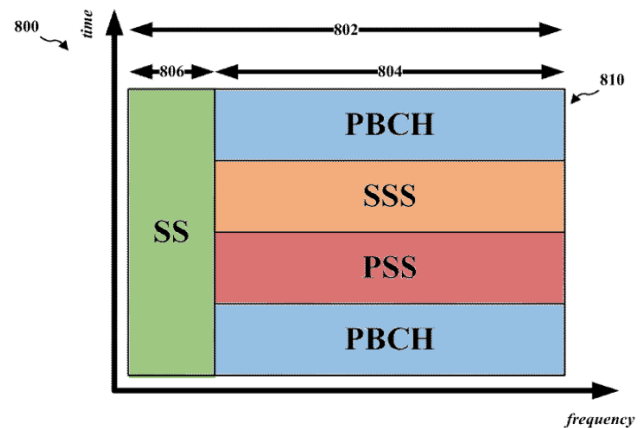
More specifically, Luo teaches that the SS block transmitted by the BS includes “PSS, SSS, and the PBCH (including the MIB).” Ex. 1004, 10:44-46. Luo further teaches that “[t]he PSS, SSS, and PBCH may be time division multiplexed and/or frequency division multiplexed with the SS block,” and specifically notes that “[t]he SS block may include other signals/channels, and therefore other signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block.” Ex. 1004, 10:54-65. Further, Luo discloses that “[e]ach SS block has a corresponding SS block index” (Ex. 1004, 10:52-53) that could be conveyed through a scrambled DMRS signal for PBCH Ex. 1004, 12:5-6, 12:25-31) and that the scrambled DMRS is included in the SS block and transmitted to the UE. Ex. 1004, 13:13-14. Ly provides specific details on how to multiplex the information providing the time index (*e.g.*, the scrambled DMRS) in the SS block. Specifically,

consistent with the disclosure in Luo that “other signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block,” Ly teaches that in addition to PSS, SSS, and PBCH, another SS signal may also be multiplexed in the SS block in order to carry and convey the SS block time index. Ex. 1006, 16:36-48. Ly further teaches that the multiplexed SS signal that conveys the time index could be, for example, a TSS signal, as disclosed in the embodiments of the ’722 patent (Ex. 1006, 16:44-46), or a DMRS signal for PBCH (Ex. 1006, 31:3-4), as disclosed by Luo. A POSITA thus would have been motivated to turn to Ly for the additional disclosure on how to multiplex the information providing time index in the SS block, and would have recognized the benefit of multiplexing another signal (*e.g.*, SS, TSS or DMRS) in the SS block of Luo (in addition to PSS, SSS, and the PBCH) to convey the information providing a time index with the synchronization signals in the SS block. Ex. 1003 ¶ 110. Indeed, such multiplexing in the SS block is more efficient, reduces latencies and delays, and provides a way for the accuracy of the time index to be checked early in the synchronization process. *Id.* Such benefit would have been achieved by applying a known technique (*e.g.*, multiplexing multiple synchronization signals in an SS block) to improve similar devices (*e.g.*, wireless 5G NR devices) in the same way (time/frequency division multiplexing) to yield predictable results (*e.g.*, conveying of information providing a time index in an SS block).

A side-by-side comparison of an annotated excerpt from Figure 4 of Luo (showing the multiplexing of PSS, SSS, and PBCH in SS block) and annotated Figure 8 of Ly (showing that in addition to PSS, SSS, and PBCH an additional SS signal is multiplexed in the SS block) demonstrates that a POSITA would have been encouraged to apply the specific teachings of Ly to improve the disclosure of Luo, in particular, in view of Luo’s explicit disclosure that “other signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block.” Ex. 1004, 10:54-65; Ex. 1003 ¶ 111.



**Luo (Ex. 1004), Fig. 4 (excerpt)**



**Ly (Ex. 1006), Fig. 8**

Luo and Ly were also filed by the same applicant (Qualcomm, Inc.), both are assigned to the same assignee (Qualcomm, Inc.), both share a common named inventor (Tao Luo), and the Ly '973 Provisional was filed on February 16, 2017, just several days before the Luo Provisional was filed on February 23, 2017. Ex. 1003 ¶

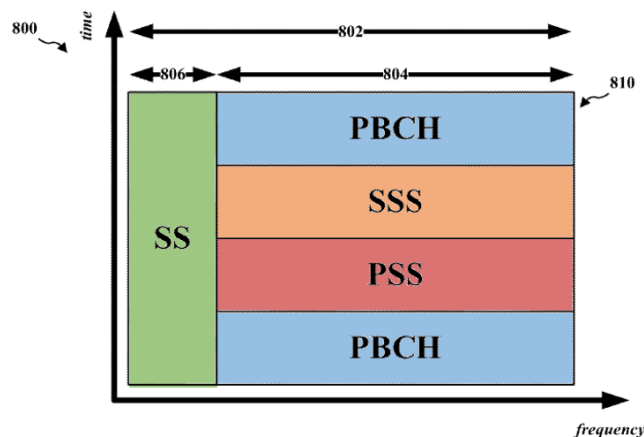
112. Moreover, Luo and Ly share certain common Figures and portion of the specification (*e.g.*, figures 1-3 and portions of the background section). *Id.* A POSITA would have therefore been motivated to consult the specific teaching by the same common inventor of Luo and Ly, that were filed at the same timeframe by the same applicant, to improve the scheme described in Luo with the generally familiar technique of multiplexing SS signals in SS block for accomplishing such an improvement. *Id.*

## **2. Independent Claims 1, 7, 13, and 25**

As explained in section X.A above, Luo at least renders obvious independent claims 1, 7, 13 and 25, and. Ex. 1003 ¶ 113. To the extent Patent Owner contends that Luo by itself does not render obvious the limitation “wherein the system information is multiplexed with information providing a time index” of independent claims 1, 7, and 13, and the limitation “the scrambled system information multiplexed with the information providing the time index” of claim 25, Luo in combination with Ly renders them obvious. Ex. 1003 ¶ 113.

Specifically, similar to Luo, Ly discloses “multiplex[ing] a plurality of synchronization signals, including a PSS, a SSS, or a PBCH, for transmission in a SS block” (Ex. 1006, 6:64-66; Ex. 1007 ¶ 0006), where “the PBCH may be used to signal minimum system information to support a UE in initial access procedures.” Ex. 1006, 16:22-24; Ex. 1007 ¶ 0075. Ly further teaches an “SS block index which

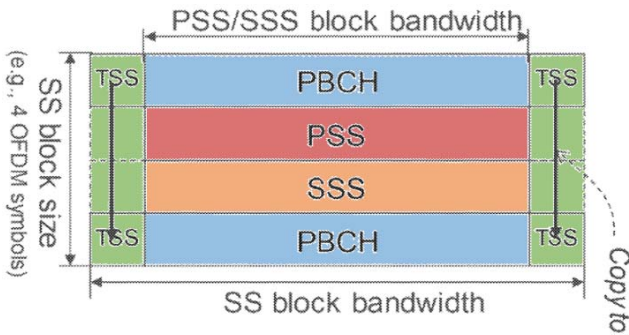
may be carried in one or more synchronization signals.” Ex. 1006, at 16:39-40; Ex. 1007 ¶¶ 0036, 0076, 00159. Specifically, Ly discloses that an “SS block index may be carried in a synchronization signal (*e.g.*, the TSS or other SS)” (Ex. 1006, 16:44-46; Ex. 1007 ¶ 00100), and that the SS signal “may be used to signal SS block indices.” Ex. 1006, 16:18-19; Ex. 1007 ¶ 0075. Ly further discloses that the PBCH (as well as PSS and SSS) may be time/frequency division multiplexed with the SS (that carries the SS block time index) in an SS block, as shown, for example, in annotated Figure 8 below. Ex. 1006, 16:44-48, Ex. 1007 ¶ 00100; *see also* Ex. 1006, 16:6-9 (“a plurality of synchronization signals that are multiplexed together... may include one or more of a PSS, an SSS, a TSS, or a PBCH.”).



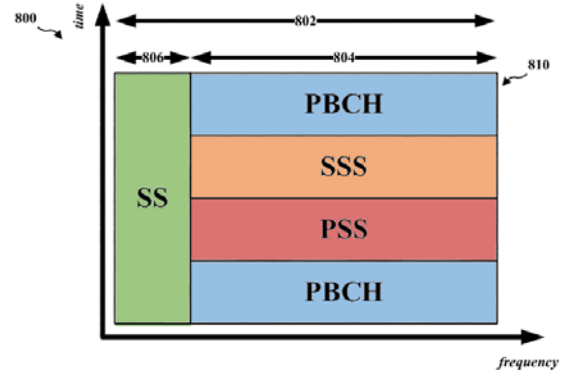
Thus, Ly discloses that the information providing a time index is conveyed through a separate SS signal in the SS block (shown in green), which is consistent with Luo’s teaching that “[t]he SS block may include other signals/channels, and therefore other signals/channels other than the PSS, SSS, and PBCH may be multiplexed into the SS block.” Ex. 1004, 10:54-65; Ex. 1005 ¶ 0046.

Ly also teaches that the information providing a time index may be a TSS signal, as described in the '722 Patent. Ex. 1006, 16:44-46; Ex. 1007 ¶ 00100; Ex. 1001, Fig. 2a. In other embodiments, Ly teaches that the information providing a time index could be other SS signals. Ex. 1006, 16:42-44 (“the one or more synchronization signals in the SS block may include a PBCH, a PSS, an SSS, a TSS, and/or other SS. Different ones of the synchronization signals may convey some or all of the SS block index.”); Ex. 1007 ¶¶ 0076-77. In another embodiment, and consistent with the teaching of Luo, Ly discloses that the SS signal could be, for example, comprised of “a DMRS for a physical broadcast channel PBCH.” Ex. 1006, 31:3-4; Ex. 1007 ¶ 0040; Ex. 1008 ¶ 00118; *see also* Ex. 1006, 22:7-8.

A side-by-side comparison of Figure 8 of Ly (below right, annotated) and Figure 2a of the '722 Patent (below left, annotated) shows that Ly discloses the same concept of multiplexing system information (*e.g.*, information within MIB carried by PBCH) with information providing a time index (*e.g.*, SS, such as TSS, or a DMRS):



**'722 Patent (Ex. 1001), Fig. 2a**



**'410 Ly (Ex. 1006), Fig. 8**

As explained above, a POSITA would have been motivated to combine the teachings of Luo with the teachings of Ly to improve the disclosure of Luo. Ex. 1003 ¶ 118. In particular, as explained above, a POSITA would have recognized the benefit of multiplexing another signal (*e.g.*, SS, TSS or DMRS) in the SS block (in addition to PSS, SSS, and the PBCH) to convey information providing a time index with the synchronization signals in the SS block. *Id.* Such benefit would have been achieved by applying a known technique (*e.g.*, multiplexing multiple synchronization signals in an SS block) to improve similar devices (*e.g.*, wireless 5G NR devices) in the same way (time/frequency division multiplexing) to yield predictable results (*e.g.*, conveying of information providing a time index in an SS block). *Id.*

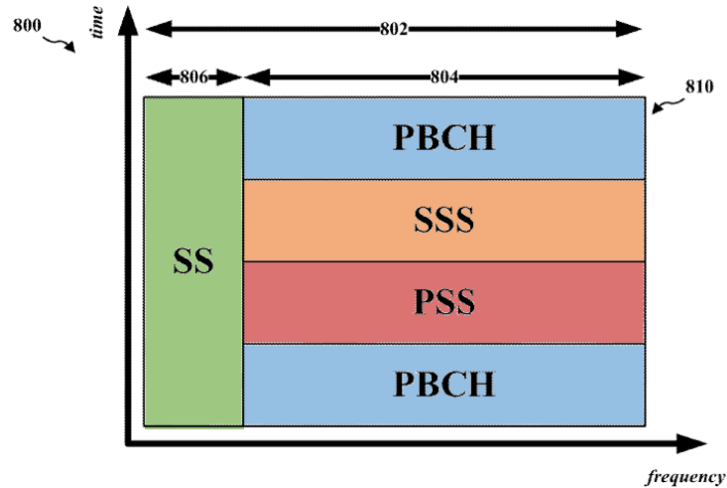
### **3. Dependent Claim 11**

a) *Preamble 11: “The method of claim 7”*

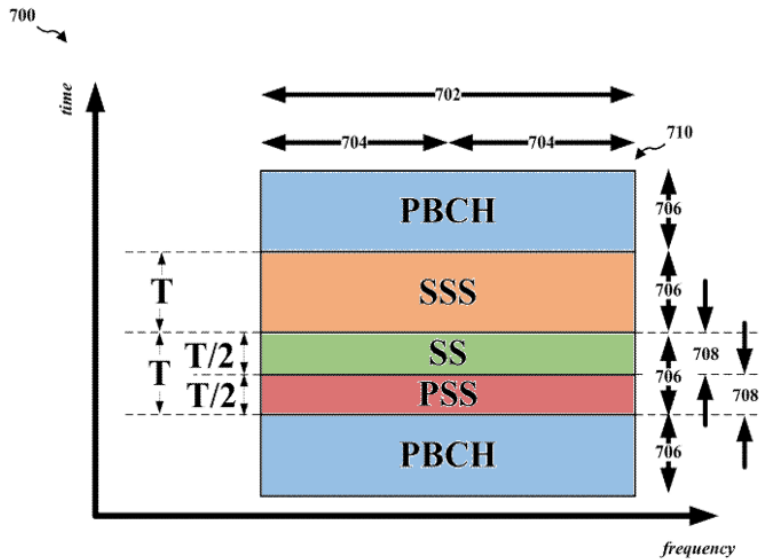
Luo renders obvious claim 7, as discussed above in Section X.A.2.

- b) *Element [11.1]: “wherein the SS block has a certain size in the time dimension during which synchronization signals, the information providing the time index, and system information are transmitted.”*

Ly discloses that the SS block has a certain size in the time dimension during which synchronization signals (*e.g.*, PSS and SSS), the information providing the time index (*e.g.*, SS, TSS or DMRS), and system information (*e.g.*, information carried by PBCH) are transmitted. Specifically, Ly discloses an SS block 810 that has a certain size in the time dimension (shown by the time axis), during which synchronization signals (*e.g.*, PSS and SSS), the information providing the time index (*e.g.*, SS), and system information (*e.g.*, in PBCH) are transmitted, as shown by annotated Figure 8 below. Ex. 1006, 19:51-60 (“FIG. 8 is a diagram illustrating an example of frequency-division multiplexing 800 of a SS with other SS in an SS block 810 ... [t]he time/frequency diagram illustrates an example placement of the PSS, the SSS, the SS, the PSS, and the PBCH (two PBCHs) in time and frequency. The PSS, the SSS, the SS, the PSS, and the PBCH (two PBCHs) may be transmitted as part of an SS block 810.”); Ex. 1007 ¶ 0056.



Ly further discloses “an example of time-division multiplexing 700 of a SS with other SS in an SS block 710” (Ex. 1006, 18:18-20) as shown in annotated Figure 7:



As explained above, a POSITA would have been motivated to combine the teachings of Luo with the teachings of Ly. Ex. 1003 ¶ 122. In particular, a POSITA would have recognized the benefit of transmitting synchronization signals (such as PSS and SSS), the information providing the time index (*e.g.*, SS, TSS or DMRS) and system

information (*e.g.*, in PBCH) in the SS block having a certain size in the time dimension to convey information providing a time index with the synchronization signals in the SS block, because simultaneous transmission of this information in the same SS block is more efficient, reduces latencies and delays, and provides a way for the accuracy of the time index to be checked early in the synchronization process. Ex. 1003 ¶ 122. Thus, a POSITA would have been motivated to apply the teaching of Ly to the disclosure of Luo and time multiplex the scrambled DMRS (or other SS) with the PSS, SSS and PBCH in the SS block to arrive at the claimed invention, as explained in Section X.B.1 above. Ex. 1003 ¶ 122.

#### **4. Dependent Claim 12**

*a) Preamble 12: “The method of claim 7”*

Luo renders obvious claim 7, as discussed above in Section X.A.2.

*b) Element [12.1]: “wherein the information providing the time index is a tertiary synchronization signal (TSS) in the SS block.”*

Ly discloses that the information providing the time index is a tertiary synchronization signal (TSS) in the SS block. Specifically, Ly discloses an “SS block index which may be carried in one or more synchronization signals.” Ex. 1006, at 16:39-40; Ex. 1007 ¶ 0036, 0076, 00159 (emphasis added). Ly teaches that an “SS block index may be carried in a synchronization signal (*e.g.*, the *TSS* or other SS) which may be frequency division multiplexed with the other synchronization signals of the SS block.” Ex. 1006, 16:44-48, Figure 8 (emphasis added); Ex. 1007

¶ 00100; *see also* Ex. 1006, 16:6-9 (“[t]he plurality of synchronization signals may include one or more of a PSS, an SSS, *a TSS*, or a PBCH” (emphasis added)). The TSS signal disclosed in Ly is a *Tertiary Synchronization Signal*, *i.e.*, a third synchronization signal in addition to PSS and SSS. *See, e.g.*, Ex. 1007 (Ly’s ’973 Provisional titled “*Tertiary Synchronization Signal* Design Consideration”) (emphasis added).

**5. Dependent Claims 8, 9, 17, 18, 24, 26 and 27**

As explained in section X.A above, Luo teaches the additional elements of claims 8, 9, 17, 18, 24, 26 and 27. Ex. 1003 ¶ 125. As such, these claims are also rendered obvious by Luo in combination with Ly.

**XI. SECONDARY CONSIDERATIONS**

Petitioner is unaware of any evidence of alleged secondary indicia that would support non-obviousness of the ’722 patent, but to the extent Patent Owner subsequently presents such evidence, Petitioner respectfully requests the right to respond.

**XII. CONCLUSION**

Petitioner requests institution of an IPR and cancellation of the Challenged Claims.

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Respectfully submitted,

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**CERTIFICATE OF COMPLIANCE**

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. § 42.24, totaling 13,640 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/s/ Todd M. Friedman  
Todd M. Friedman

**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that a copy of the foregoing document with accompanying Exhibits 1001 – 1010, as listed in Petitioner’s Exhibit List on page iv of this document, was served on January 29, 2021, via overnight delivery directed to the attorney/agent of record for the patent as identified on USPTO PAIR and associated with USPTO Customer No. 102721 at the following address:

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