

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

HANNIBAL IP, LLC,
Patent Owner

Case IPR2025-01188
Patent No. 11,272,535

PETITION FOR *INTER PARTES* REVIEW

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PETITIONER’S EXHIBIT LIST

Exhibit	Description
Ex. 1001	U.S. Patent No. 11,272,535 to Chen et al. (“’535 patent”)
Ex. 1002	Declaration of Apostolos Kakaes, Ph.D. (“Kakaes”)
Ex. 1003	Prosecution History of the ’535 patent (downloaded from the USPTO’s Patent Center Website)
Ex. 1004	International Patent Application Publication No. WO 2020/087369 to Shi, published May 7, 2020 (“ <i>Shi</i> ”) ¹ , including certified English translation and certification
Ex. 1005	International Patent Application Publication No. WO 2020/045920 to Hong, published March 5, 2020 (“ <i>Hong</i> ”) ² , including certified English translation and certification
Ex. 1006	Korean Patent Application No. 10-2018-0102907 to Hong, filed August 30, 2018 (“ <i>Hong Priority</i> ”) ³ , including certified English translation and certification
Ex. 1007	3GPP TS 38.321 v15.3.0 (“Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification (Release 15)”) (Sept. 2018) (“ <i>TS-38.321</i> ”)
Ex. 1008	International Patent Application Publication No. WO 2019/245779 to Alfarhan et al., published December 26, 2019 (“ <i>Alfarhan</i> ”)
Ex. 1009	U.S. Provisional Application No. 62/735,446 to Alfarhan et al., filed September 24, 2018 (“ <i>Alfarhan Provisional</i> ”)
Ex. 1010	3GPP TSG RAN WG2 NR #103bis Meeting, R2-1813741, Chengdu, China, 8th - 12th October 2018, published in 3GPP website (https://www.3gpp.org/ftp/tsg_ran/wg2_rl2/TSGR2_103bis/Docs/) on September 27, 2018 (“ <i>R2-1813741</i> ”).
Ex. 1011	3GPP TSG RAN WG2 NR #104 Meeting, R2-1816829, Spokane, US, 12th - 16th November 2018, published in 3GPP website (https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_104/Docs) on November 2, 2018 (“ <i>R2-1816829</i> ”).

¹ Citations to *Shi* are made to the English translation.

² Citations to *Hong* are made to the English translation.

³ Citations to *Hong Priority* are made to the English translation.

Exhibit	Description
Ex. 1012	Declaration of Friedhelm Rodermund
Ex. 1013	3GPP TS 38.300 v15.2.0 (“Technical Specification Group Radio Access Network; NR; NR and NG-RAN Overall Description; Stage 2 (Release 15)”) (June 2018) (“ <i>TS-38.300</i> ”)
Ex. 1014	International Patent Application Publication No. WO 2017/136458 to Lim et al., published August 10, 2017 (“ <i>Lim</i> ”)
Ex. 1015	Bertsekas, Dimitri et al., <i>Data Networks</i> (2 nd Edition), Prentice Hall, 1992 (“ <i>Bertsekas</i> ”).
Ex. 1016	U.S. Patent Application Publication No. US 2016/0029413 to Wang et al., published January 28, 2016 (“ <i>Wang</i> ”)
Ex. 1017	3GPP TS 36.300 v8.6.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8)”) (September 2008)
Ex. 1018	3GPP 36.331 V8.7.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) Radio Resource Control (RRC); Protocol specification (Release 8)”) (September 2009)
Ex. 1019	Vincent W.S. Wong et al., <i>Key Technologies for 5G Wireless Systems</i> , Cambridge University Press, 2017 (“ <i>Wong</i> ”)
Ex. 1020	Ali Zaidi et al., <i>5G Physical Layer: Principles, Models and Technology Components</i> , Academic Press, 2018 (“ <i>Zaidi</i> ”)
Ex. 1021	3GPP 38.331 V15.3.0 (“Technical Specification Group Radio Access Network; NR; Radio Resource Control (RRC) protocol specification (Release 15)”) (September 2018)
Ex. 1022	International Patent Application Publication No. WO 2020/069114 to Terry et al., published April 2, 2020 (“ <i>Terry</i> ”)
Ex. 1023	U.S. Provisional Application No. 62/753,579 to Terry et al., filed October 31, 2018 (“ <i>Terry Provisional</i> ”)

I. PRELIMINARY STATEMENT

Petitioners Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (collectively “Samsung”) request *inter partes* review of U.S. Patent No. 11,272,535 (Ex. 1001, “’535 patent”), assigned to Patent Owner Hannibal IP, LLC, and cancellation of claims 1-20.

The ’535 patent is titled “Method and Apparatus for LBT Failure Detection,” and the claims relate to a procedure for detecting a Listen-Before-Talk (LBT) failure and initiating a recovery procedure. LBT is a well-known technique where a device, such as a user equipment (UE), checks for activity on a channel before it starts a transmission. In the claims, when there is a LBT failure indication, the UE increases an LBT failure counter. And when the LBT failure counter is greater than or equal to a threshold, the UE determines that an LBT failure event has occurred and initiates a recovery procedure.

This general procedure, however, was proposed to a standards organization (3GPP) and published a few months before the earliest claimed priority date of the ’535 patent. In addition, multiple patent applications were also filed on this procedure before the earliest claimed priority date of the ’535 patent, including International Patent Publication No. WO 2020/087369 to Shi (“*Shi*”; Ex. 1004) and International Patent Publication No. WO 2020/045920 to Hong (“*Hong*”; Ex. 1005).

As set forth below, claims 1-20 would have been obvious based on *Shi* in combination with other prior art, which the Examiner did not consider during examination. The Board should thus institute review and cancel all challenged claims.

II. STATE OF THE ART

A. Protocol Stack: PHY Layer, MAC Layer, and RRC Layer

The concept of a “protocol stack” in data networks goes back to at least the 1980s, and has been adopted in mobile communications, including in 3G/UMTS systems, 4G/LTE systems, and 5G/NR systems. Kakaes, ¶68. In general, the protocol stack is a hierarchy of communication protocols where each layer in the stack handles certain aspects of data transmission and reception. *Id.*

For example, as shown below, the 5G/NR specifications use the following two protocol stacks for the user plane and the control plane, respectively. Ex. 1013 (3GPP TS 38.300 V15.2.0), 16–17. Kakaes, ¶69.

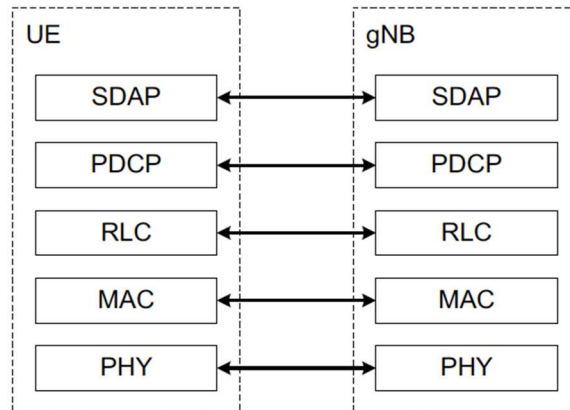


Figure 4.4.1-1: User Plane Protocol Stack

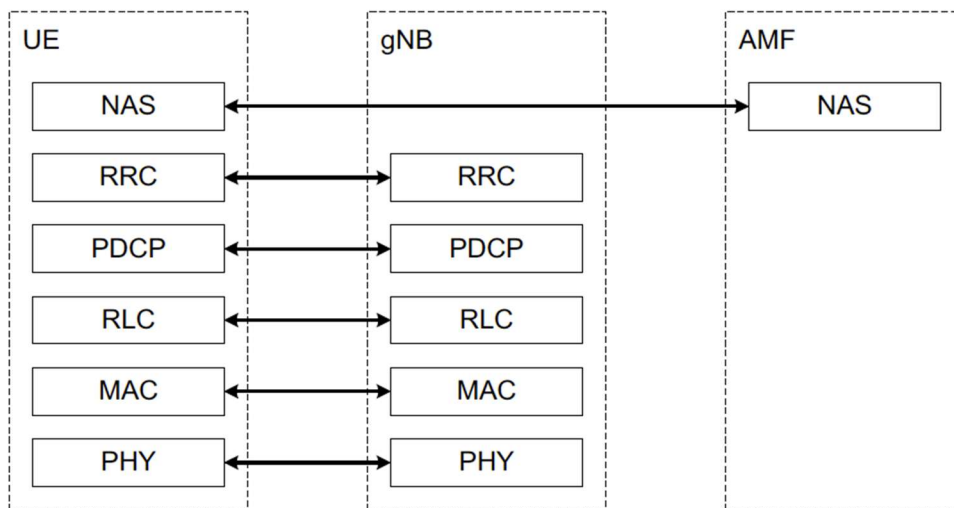


Figure 4.4.2-1: Control Plane Protocol Stack

For example, the “Control Plane Protocol Stack” includes at least a Physical (“PHY”) layer, a Medium Access Control (“MAC”) layer, and a Radio Resource Control (“RRC”) layer. Kakaes, ¶70. As shown above, the PHY layer is the lowest layer, the MAC layer is higher than the PHY layer, and the RRC layer is higher than the MAC layer. *Id.*

The RRC layer generally controls the lower layers and manages the resources of the radio interface. Kakaes, ¶71 (outlining several exemplary functions performed by the RRC layer). Meanwhile, the MAC layer generally controls and manages access to (and from) the physical layer, as its name implies (“medium” refers to the physical medium used for transmission/reception of information). Kakaes, ¶¶72-73 (outlining several exemplary functions performed by the MAC layer). And finally, the PHY layer’s functions include converting information into a permissible form to be transmitted over a transmission medium. Kakaes, ¶74. For example, the PHY layer may convert digital bits into electromagnetic waves at specified frequencies and times and transmit the waves to another device. *Id.* Similarly, the PHY layer may convert electromagnetic waves received from another device into digital bits which are passed to upper layers and are converted to the original information they were intended to represent. *Id.*

The layers communicate with one another and work together to enable communication between devices. Kakaes, ¶¶75-85.

B. Bandwidth Part (BWP)

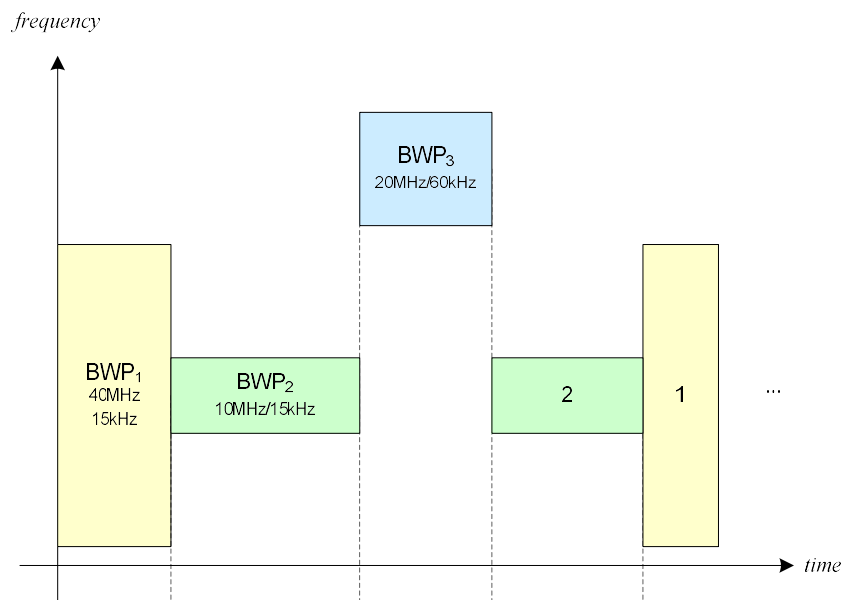
A Bandwidth Part (BWP) is a specific frequency band available to the service provider (e.g., AT&T or Verizon) that the provider can make available to a device to communicate on. Kakaes, ¶86. The “receive and transmit bandwidth of a UE need not be as large as the bandwidth of the cell and can be adjusted.” Ex.

1013, 31. For example, “the width can be ordered to change (e.g. to shrink during period of low activity to save power); the location can move in the frequency domain (e.g. to increase scheduling flexibility); and the subcarrier spacing can be ordered to change (e.g. to allow different services).” *Id.* Thus, a “subset of the total cell bandwidth of a cell is referred to as a Bandwidth Part (BWP).” *Id.*; Kakaes, ¶86.

Figure 6.10-1 below describes a scenario where three different BWPs are configured:

- BWP₁ with a width of 40 MHz and subcarrier spacing of 15 kHz;
- BWP₂ with a width of 10 MHz and subcarrier spacing of 15 kHz;
- BWP₃ with a width of 20 MHz and subcarrier spacing of 60 kHz.

Id., 31-32; Kakaes, ¶87.



As the above TS 38.300 document explains, “Bandwidth Adaptation (BA) is achieved by configuring the UE with BWP(s) and telling the UE which of the configured BWPs is currently the active one.” *Id.*, 31; Kakaes, ¶88. It is common to switch from one BWP to another BWP for both uplink and downlink transmissions. Kakaes, ¶¶88-90 (citing Ex. 1007, 44-46; *see also* Ex. 1004 (*Shi*), 5:35-37⁴; Ex. 1005 (*Hong*), [199]; Ex. 1006 (*Hong Priority*), [0098]).

C. Listen-Before-Talk (LBT)

The basic principle of listening for activity on a channel before transmitting information on the channel is very old. Kakaes, ¶91. It was originally called Carrier Sense Multiple Access (“CSMA”). *Id.* CSMA was known to be particularly useful when there was no entity in control of the communication medium, such as with local area networks, including what are now known as Wi-Fi networks. *Id.*

A textbook titled “Data Networks,” published in 1992, by Dimitri Bertsekas and Robert Gallager (“*Bertsekas*”) (Ex. 1015), explains the basic function of CSMA in Section 4.4 titled “CARRIER SENSING”. Ex. 1015, 304; Kakaes, ¶¶92-93. Specifically, *Bertsekas* explains that, “[i]n many multiaccess systems, such as local area networks, a node can hear whether other nodes are transmitting after a very small propagation and detection delay relative to a packet transmission time.”

⁴ The identified cites are based on *Shi*’s page numbers at the top of the page.

Ex. 1015, 304. *Bertsekas* further explains that, “[i]f nodes can detect idle periods quickly, it is reasonable to terminate idle periods quickly and to allow nodes to initiate packet transmission after such idle detections. This type of strategy, called carrier sense multiple access (CSMA)..., does not necessarily imply the use of a carrier but simply the ability to detect idle periods quickly.” *Id.*

Although about half a century old, this technique has been found viable in 4G and 5G systems primarily because of the introduction of operation in an “unlicensed band,” or a frequency band that is not controlled by any one entity. Kakaes, ¶94. The concepts of CSMA are a natural fit for unlicensed bands, but a new name was needed because “CSMA” refers to a specific protocol. *Id.* The concept of “Listen-Before-Talk,” or LBT, has been used in 4G dating back to 2014 as well as in 5G. Kakaes, ¶¶94-102.

In 5G/NR systems, communications can take place on licensed spectrum or unlicensed spectrum. Kakaes, ¶103. Licensed spectrums are owned and controlled by specific entities (e.g., network operators, sometimes also referred to as “carriers” or “service providers”). *Id.* In contrast, unlicensed spectrums are not controlled by any one entity. *Id.* As a result, there are various protocols associated with communicating on an unlicensed spectrum. *Id.* LBT is one of those protocols. *Id.*

LBT, as with CSMA before it, ensures that a channel is free before it can be used by a device. Kakaes, ¶104. Specifically, the device can perform LBT by listening to the channel and determining whether the channel is busy. Ex. 1014 (“*Lim*”), [0022], [0027]; Kakaes, ¶104. When the channel is busy, the device may not access the channel. *Lim*, [0022], [0027]; Kakaes, ¶104. This is referred to as LBT failure. *Lim*, [0022]; Kakaes, ¶104. On the other hand, when the channel is not busy, this indicates that there is no LBT failure, and the device is able to perform a transmission on the channel, i.e. LBT is successful. *Lim*, [0022]; Kakaes, ¶104. LBT failures can be more frequent when there are many devices operating on the same unlicensed channel. Kakaes, ¶104.

The use of LBT and detecting LBT failures was thus well known before the earliest claimed priority date of the ’535 patent, January 9, 2019.⁵ Kakaes, ¶105.

D. 3GPP Proposed Standard

The 3rd Generation Partnership Project (3GPP) is a well-known organization that develops Technical Specifications (TS) for wireless telecommunications systems, such as 3G/UMTS, 4G/LTE, and 5G/NR. Kakaes, ¶¶57-66, 106. Generally, the 3GPP holds working group meetings several times a year to propose and discuss

⁵ Petitioners reserve the right to challenge the priority date here and/or in other proceedings.

new TSs and/or changes to existing ones. *Id.* The 3GPP materials are generally made available to the public on the 3GPP website. *Id.*

During one particular working group meeting (3GPP TSG RAN WG2 NR) held in Chengdu, China, between October 8-12, 2018, the working group discussed the following proposal:

Proposal 4: When consecutive LBT failure times exceed a certain value, MAC terminates the current RACH procedure and indicates random access failure to upper layer.

Ex. 1010 (“*R2-1813741*”), 4; Rodermund, ¶¶54-62; Kakaes, ¶107.

Specifically, in explaining the need for Proposal 4, the meeting document states that, “[w]hen preamble transmission is dropped due to LBT failure, *PREAMBLE_TRANSMISSION_COUNTER* will not be incremented.” *R2-1813741*, 4. *R2-1813741* further states that “when channel is very busy, UE may have no chance to access the channel for a long time, then RACH procedure will never terminate since *PREAMBLE_TRANSMISSION_COUNTER* will not be incremented.” *Id.* *R2-1813741* recognizes that, “[i]n order to solve this problem, MAC may count LBT consecutive failure times.” *Id.* *R2-1813741* further states that “[w]hen consecutive LBT failure times exceed a certain value, UE may terminate the current RACH procedure and select other carrier, i.e. in this case, MAC should

indicate random access failure to upper layer, and then upper layer initiates reestablishment procedure.” *Id.* *R2-1813741* further states that “[o]nce a preamble transmission happens, LBT failure counter should be reset.” *Id.*

R2-1813741 therefore describes the general procedure of keeping a counter for the number of LBT failures, and when the LBT failure counter reaches a threshold value, determining that LBT failure has occurred and reporting the failure to an upper layer for initiating a recovery procedure. Kakaes, ¶¶108-109. *R2-1813741* was made publicly available on the 3GPP website on September 27, 2018. Rodermund, ¶¶54-62.

The same proposal was again discussed in a later 3GPP meeting held in Spokane, U.S., between November 12-16, 2018, and made publicly available in a meeting document (*R2-1816829*) on the 3GPP website on November 2, 2018. Ex. 1011, 4; Rodermund, ¶¶63-711; Kakaes, ¶¶110-111.

Just a couple months after the proposals from the *R2-1813741* and *R2-1816829* documents were discussed, the alleged priority application of the ’535 patent was filed on January 9, 2019, describing the proposals and other already well-known and common-sense concepts. Kakaes, ¶112.

E. Patent Literature Implementing Proposed Technical Specifications

Around the same time, and before January 9, 2019, several patent applications were filed on the proposals discussed above. Kakaes, ¶¶113-117. For example, *Shi*, which was filed on October 31, 2018, discloses a method in a terminal (e.g., UE) communicating with a network device (e.g., base station), where the number of LBT failures for uplink transmission are counted using a counter. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 8:49-9:9, 9:28-30. *Shi* discloses that the counter can be maintained at the MAC layer. *Shi*, 6:3-5, 4:34-35, 8:21-23, 9:5-9. *Shi* further discloses that, when the counter reaches a preset threshold, an upper layer (e.g., RRC layer) can trigger a recovery procedure in response. *Shi*, 5:31-34, 7:29-39.

For example, *Shi* discloses that the RRC layer may trigger one of the following recovery procedures: (1) RRC connection re-establishment, (2) Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing, or (3) RRC reconfiguration. *Shi*, 5:31-34. As part of the SCG-RLF processing, *Shi* explains that the SCG Media Access Control (MAC) entity may be reset. *Shi*, 5:37-40. *Shi* also discloses that the LBT failure counter may be reset when the count value of the counter has not changed for a period of time. *Shi*, 5:28-30.

As another example, *Hong*, which claims priority to Korean Patent Application No. 10-2018-0102907, filed on August 30, 2018, similarly discloses a method in a terminal (e.g., UE) communicating with a network device (e.g., base station), where a counter is maintained to detect the number of LBT failures. *Hong*, [30], [32]-[33], [43]-[45], [176]-[178]; *Hong Priority*, [0005]-[0007], [0069]-[0074]. For example, in *Hong*, the UE increments the counter by one when it detects an LBT failure. *Hong*, [178]; *Hong Priority*, [0072]. And, according to *Hong*, if the counter value reaches a threshold value, then the UE can indicate this to the upper layer (e.g., RRC layer). *Hong*, [178]; *Hong Priority*, [0073]. The UE can then indicate this LBT failure-related information to the base station and/or initiate a procedure to resolve the failure. *Hong*, [187]; *Hong Priority*, [0087].

For example, *Hong* discloses that the UE can initiate an RRC connection re-establishment/resumption. *Hong*, [195]; *Hong Priority*, [0095]. As part of this RRC connection re-establishment/resumption, the UE resets the MAC and applies a default MAC main configuration. *Hong*, [195]; *Hong Priority*, [0095]. *Hong* also discloses that the LBT failure counter may be reset, for example, upon a new uplink transmission attempt or upon receiving an indication by the upper layer. *Hong*, [178], [187]; *Hong Priority*, [0071].

International Patent Application Publication No. WO 2020/069114 (“*Terry*”; Ex. 1022), which claims priority to U.S. Provisional Application No. 62/753,579

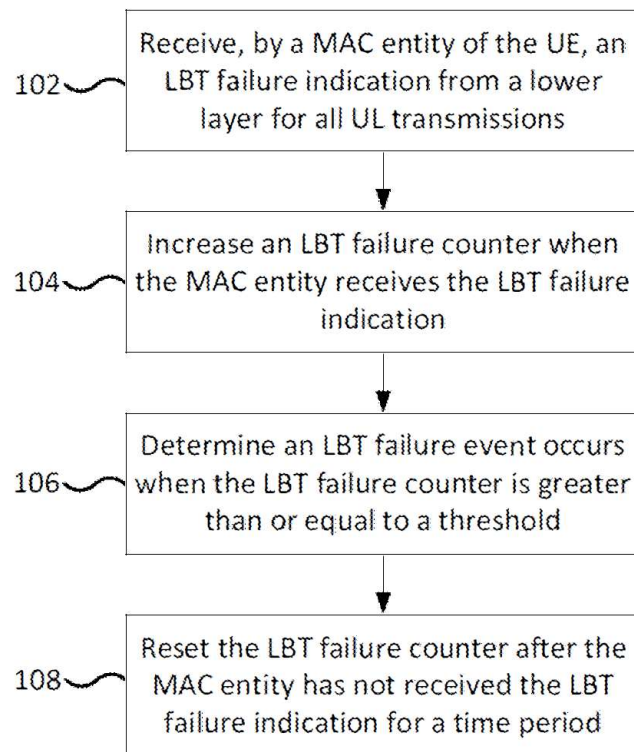
(“*Terry Provisional*”; Ex. 1023), filed October 31, 2018, is yet another example of a patent application filed on the proposals discussed above. Kakaes, ¶117.

III. THE ’535 PATENT

A. Alleged Invention of the ’535 Patent in View of Prior Art

Viewed against this backdrop of the prior art, the ’535 patent simply describes methods and devices for LBT failure detection and recovery that use known procedures. Kakaes, ¶¶52-55, 118-128. Just like *Shi* and *Hong*, the ’535 patent uses an LBT failure counter to count the number of LBT failure indications. ’535 patent, 6:45-50. And just like *Shi* and *Hong*, the ’535 patent contemplates initiating a recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Id.*, 6:51-57, 7:32-48, 8:21-39.

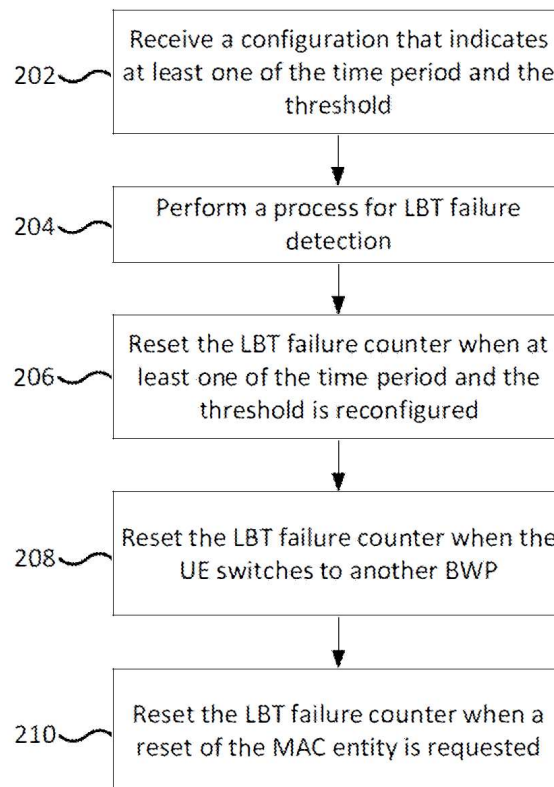
For example, FIG. 1 of the ’535 patent below illustrates an exemplary method for LBT failure detection performed by the UE. *Id.*, 6:30-44.



Id., FIG. 1.

As shown, at step 102, a MAC entity of the UE may receive an LBT failure indication from a lower layer (e.g., the PHY layer) for all UL transmissions. *Id.*, 6:30-44. Then, at step 104, the UE may increase an LBT failure counter when the MAC entity receives the LBT failure indication. *Id.*, 6:45-50. At step 106, the UE may determine an LBT failure event occurs when the LBT failure counter is greater than or equal to a threshold. *Id.*, 6:51-57. At step 108, the UE may reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period. *Id.*, 6:58-67.

The '535 patent also explains that the UE may reset the LBT failure counter based on other well-known and common-sense conditions, for example, as shown in FIG. 2 below. *Id.*, 8:40-67; Kakaes, ¶125.



Id., FIG. 2.

For example, the UE may reset the LBT failure counter when at least one of the time period and the threshold is reconfigured. *Id.*, 8:52-56. The UE may also reset the LBT failure counter when the UE switches to another Bandwidth Part (BWP). *Id.*, 8:56-58. And the UE may reset the LBT failure counter when a reset of the MAC entity is requested. *Id.*, 8:58-59.

As explained in more detail below, nothing differentiates the claims of the '535 patent from the prior art.

B. Prosecution History

During prosecution of the '535 patent, the Examiner rejected the claims, finding that the prior art anticipated many of the original claims, including the independent claims 1 and 11. Ex. 1003, 137-147; Kakaes, ¶¶129-131. The Applicant amended the independent claims by adding the limitation “a reset of the MAC entity is requested by an upper layer of the UE” (*id.*, 126-128, 74-78, 43-47) and argued that the prior art does not disclose the independent claims as amended. *Id.*, 130-132, 79-80, 48-49. Thereafter, the Examiner allowed the claims, but again without the benefit of *Shi*, the prior art applied in this Petition, or any other reference mentioned below. *Id.*, 16-23. As explained above and below, the prior art discloses and renders obvious the limitations the Applicant argued were not in the prior art.

C. Claim Construction

The Board construes claims per *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Claims must be construed only to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad*

Ocean Motor Co., 868 F.3d 1013, 1017 (Fed. Cir. 2017). Here, no terms need construction to resolve the controversy in this forum.⁶

IV. STATEMENT OF PRECISE RELIEF REQUESTED

A. Prior Art

1. *Shi*

Shi, which was filed on October 31, 2018 and designated the U.S., is prior art to the '535 patent under 35 U.S.C. § 102(a)(2).

Shi is analogous art to the '535 patent because *Shi*, like the '535 patent, is directed to a communication system with at least one terminal device (e.g., user equipment) that communicates with at least one network device (e.g., base station). *Shi*, 2:37-3:29, FIG. 1; '535 patent, 3:37-4:30; Kakaes, ¶140. *Shi* is also directed to the same problem as the '535 patent, for example, resolving channel access failure (e.g., LBT failure). *Shi*, 4:16-8:38; '535 patent, 1:17-21, 6:30-11:59; Kakaes, ¶140.

2. *Hong*

Hong, which was filed on August 26, 2019, designated the U.S., and claimed priority to Korean Application No. 10-2018-0102907, filed August 30, 2018, is prior art to the '535 patent under 35 U.S.C. § 102(a)(2). For purposes of applying

⁶ Petitioners reserve the right to argue in an appropriate forum that certain limitations in the challenged claims are indefinite.

Hong as prior art, it is entitled to its Korean priority application filing date of August 30, 2018. Kakaes, ¶¶141-142. Support for each citation relied upon from *Hong* is set forth in the sections above and below, thus substantiating *Hong*'s entitlement to its Korean priority application filing date. *Id.* “[U]nder AIA §§ 102(a)(2) and 102(d), there is no need to evaluate whether any claim of a reference patent document is actually entitled to priority when applying such a reference patent as prior art.” *Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34, 29-30 (P.T.A.B. Mar. 10, 2023) (precedential). Nevertheless, support in the Korean priority application for at least one claim of *Hong* does exist. Kakaes, ¶142.

Hong is analogous art to the '535 patent because *Hong*, like the '535 patent, is directed to a communication system with at least one terminal device (e.g., user equipment) that communicates with at least one network device (e.g., base station). *Hong*, [30], [32]-[33], [43]-[45]; *Hong Priority*, [0005]-[0007]; '535 patent, 3:37-4:30; Kakaes, ¶143. *Hong* is also directed to the same problem as the '535 patent, for example, resolving channel access failure (e.g., LBT failure). *Hong*, [166]-[200]; *Hong Priority*, [0062]-[0100]; '535 patent, 1:17-21, 6:30-11:59; Kakaes, ¶143.

3. TS-38.321

3GPP TS 38.321 v15.3.0, entitled “Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification

(Release 15)” (“*TS-38.321*”; Ex. 1007), was made publicly available not later than September 25, 2018, on 3GPP’s ftp server where it was accessible and known to be found by POSITAs. Rodermund ¶¶72-81. *TS-38.321* is prior art to the ’535 patent under 35 U.S.C. § 102(a)(1).

TS-38.321 is analogous art to the ’535 patent because *TS-38.321*, like the ’535 patent, is directed to a communication system with at least one terminal device (e.g., user equipment) that communicates with at least one network device (e.g., base station). *TS-38.321*, 6-9, 43-44; ’535 patent, 3:37-4:30; Kakaes, ¶145. *TS-38.321* is also directed to a 5G/NR system, which the ’535 patent contemplates as well. *TS-38.321*, 1, 7; ’535 patent, 1:17-47; Kakaes, ¶145. *TS-38.321* is also directed to the same problem as the ’535 patent, for example, taking action in response to some failure event (e.g., resetting a MAC entity). *TS-38.321*, 43-44, 47-48; ’535 patent, 1:17-21, 6:30-11:59; Kakaes, ¶145.

4. *Alfarhan*

International Patent Application Publication No. WO 2019/245779 (“*Alfarhan*”; Ex. 1008), which was filed June 10, 2019 and claimed priority to U.S. Provisional Application No. 62/735,446 (“*Alfarhan Provisional*”; Ex. 1009), filed September 24, 2018, is prior art to the ’535 patent under 35 U.S.C. § 102(a)(2). For purposes of applying *Alfarhan* as prior art, it is entitled to its provisional application filing date of September 24, 2018. Kakaes, ¶¶146-147. Support for

each citation relied upon from *Alfarhan* is set forth in the sections below, thus substantiating *Alfarhan*'s entitlement to its provisional application filing date. *Id.* Further, while not required, support in the provisional application for at least one claim of *Alfarhan* does exist. *Id.*, ¶147.

Alfarhan is analogous art to the '535 patent because *Alfarhan*, like the '535 patent, is directed to a communication system with at least one terminal device (e.g., user equipment) that communicates with at least one network device (e.g., base station). *Alfarhan*, [0006]-[0010]; *Alfarhan Provisional*, [0004]-[0008]; '535 patent, 3:37-4:30; Kakaes, ¶148. *Alfarhan* is also directed to the same problem as the '535 patent, for example, resolving channel access failure (e.g., LBT failure). *Alfarhan*, [0161]-[0165]; *Alfarhan Provisional*, [0154]-[0158]; '535 patent, 1:17-21, 6:30-11:59; Kakaes, ¶148.

5. Terry

International Patent Application Publication No. WO 2020/069114 ("*Terry*"; Ex. 1022), which was filed September 26, 2019 and claimed priority to U.S. Provisional Application No. 62/753,579 ("*Terry Provisional*"; Ex. 1023), filed October 31, 2018, is prior art to the '535 patent under 35 U.S.C. § 102(a)(2). For purposes of applying *Terry* as prior art, it is entitled to its provisional application filing date of October 31, 2018. Kakaes, ¶¶149-150. Support for each citation relied upon from *Terry* is set forth in the sections below, thus substantiating

Terry's entitlement to its provisional application filing date. *Id.* Further, while not required, support in the provisional application for at least one claim of *Terry* does exist. *Id.*, ¶150.

Terry is analogous art to the '535 patent because *Terry*, like the '535 patent, is directed to a communication system with at least one terminal device (e.g., user equipment) that communicates with at least one network device (e.g., base station). *Terry*, [00249]-[00250]; *Terry Provisional*, [00246]-[00247]; '535 patent, 3:37-4:30; Kakaes, ¶151. *Terry* is also directed to the same problem as the '535 patent, for example, resolving channel access failure (e.g., LBT failure). *Terry*, [0050]-[0060]; *Terry Provisional*, [0047]-[0057]; '535 patent, 1:17-21, 6:30-11:59; Kakaes, ¶151.

B. Challenges

Ground	Challenged Claims	Basis	Prior Art
1	1, 3-4, 7-8, 10, 12-13, 16-17, and 19-20	§ 103	<i>Shi</i> and <i>TS-38.321</i>
2	1-8, 10-17, and 19-20	§ 103	<i>Shi</i> , <i>Hong</i> , and <i>TS-38.321</i>

3	2-3 and 11-12	§ 103	<i>Shi</i> , TS-38.321, and <i>Terry</i>
4	9 and 18	§ 103	<i>Shi</i> , Hong, TS-38.321, and <i>Alfarhan</i>

V. LEVEL OF ORDINARY SKILL IN THE ART

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

Kakaes, ¶¶136-137.

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART

A. Ground 1: Claims 1, 3-4, 7-8, 10, 12-13, 16-17, and 19-20 Are Obvious over *Shi* in view of TS-38.321

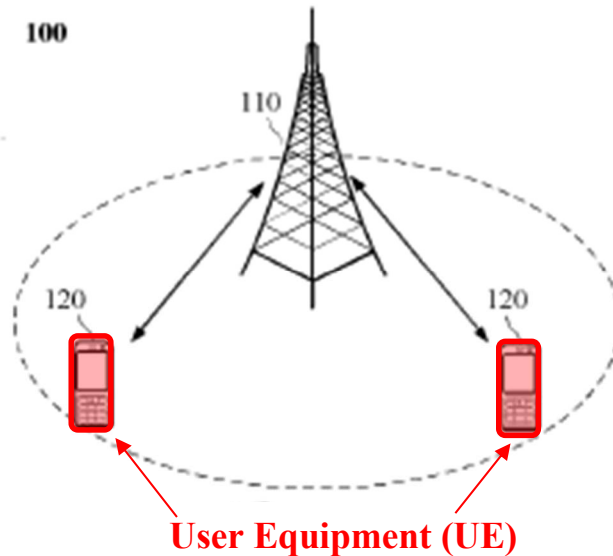
Shi in view of TS-38.321 renders obvious claims 1, 3-4, 7-8, 10, 12-13, 16-17, and 19-20. Kakaes, ¶¶155-211.

1. Independent Claim 1

a. [1pre]: “A user equipment (UE) comprising:”

To the extent the preamble is limiting, *Shi* discloses a user equipment (UE). Kakaes, ¶¶156-159.

For example, as shown in FIG. 1 below, *Shi* discloses a “communication system 100” comprising “a network device 110” and “at least one **terminal device 120** located within the coverage area of the network device 110.” *Shi*, 2:37-3:29.⁷



Id., FIG. 1.

According to *Shi*, the “**terminal device** may refer to an access terminal, **user equipment** (terminal equipment), user unit, user station, mobile station, mobile platform, remote station, remote terminal, mobile device, user terminal, terminal,

⁷ All emphasis is added unless noted otherwise. Also, all figures in this Petition containing color are annotated relative to the original figures in the patent or prior art and all text in color is added.

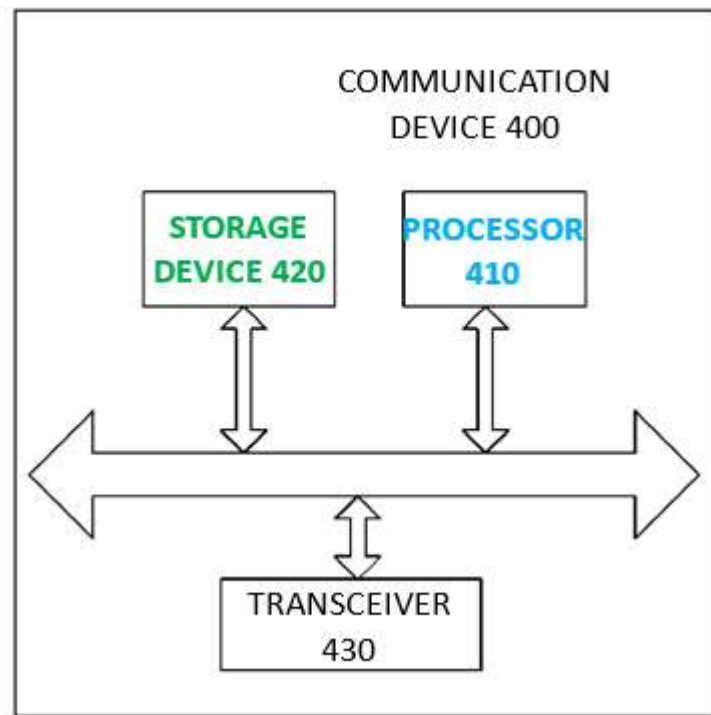
wireless communication device, user agent, or user apparatus.” *Id.*, 3:21-24;

Kakaes, ¶159.

- b. [1a]: “one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:”

Shi discloses one or more non-transitory computer-readable media having computer-executable instructions embodied thereon, and at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor being configured to execute the computer-executable instructions to perform limitations [1b]-[1e]. Kakaes, ¶¶160-162.

For example, *Shi* discloses that the terminal device (UE) comprises “a **processor** and a **storage device**,” in which the “**storage device** is used for storing a computer program, and the **processor** is used for invoking and running the computer program stored in the storage device” for executing various implementations of methods described in *Shi*. *Shi*, 1:28-31. As shown below, FIG. 4 illustrates an exemplary terminal device (communication device 400) that includes a **processor** 410 coupled to a **storage device** 420. *Id.*, 13:14-38, 16:25-34.



Id., FIG. 4.

A POSITA would have understood that *Shi*’s **storage device** is a non-transitory computer readable medium. Kakaes, ¶¶161-162. For example, *Shi* explains that the **storage device** “may be volatile memory or non-volatile memory, or may comprise both volatile and non-volatile memory,” such as, for example, a “Read-Only Memory (ROM)” or a “Random-Access Memory (RAM).” *Shi*, 14:39-15:15. Further, a POSITA would have understood that *Shi*’s **processor** is coupled to the **storage device** because *Shi* discloses that “the **processor 410** can invoke and run a computer program from the **storage device** to implement the method of embodiments of the present application” in the **storage device** 420. *Shi*, 13:14-23, FIG. 4; Kakaes, ¶162. A POSITA would have also understood that *Shi*’s **processor**

is configured to execute computer-executable instructions because it is used to run computer programs “for causing a computer device (which may be a personal computer, server, or network device, etc.) to execute all or some of the steps of the method described by each of the embodiments of [*Shi*].” *Shi*, 16:25-34; Kakaes, ¶162.

- c. [1b]: “receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;”

Shi discloses limitation [1b]. Kakaes, ¶¶163-166.

For example, *Shi* discloses “a counting method applicable to a terminal device” (e.g., UE). *Shi*, 4:16-22, 8:40-45 (providing a terminal device (e.g., UE) for executing the counting method). According to *Shi*, “in the event of an LBT failure, the first indication information sent by a physical layer (PHY) can be received, **the first indication information being used for indicating LBT failure.**” *Shi*, 4:26-28, 6:34-43, 8:49-9:1. *Shi* further discloses that “**the first indication information sent via the physical layer** may also be information received from the network side and **transmitted to the MAC layer** or RRC layer via the physical layer, after which the RRC layer or MAC layer maintains the global counter and/or at least one counter for at least one uplink transmission.” *Id.*, 4:32-35, 9:5-9. Thus, *Shi* discloses that first indication information indicating LBT

failure is transmitted from a physical layer to a MAC layer, where the MAC layer maintains a global counter for uplink transmission. Kakaes, ¶164.

A POSITA would have understood that *Shi*'s physical layer is a "lower layer" because the '535 patent specifically provides a physical layer as an example of a lower layer relative to the MAC layer. '535 patent, 6:1-29; Kakaes, ¶165. Further, it was well known that the physical layer is the lowest layer in the protocol stack. Kakaes, ¶165 (citing Ex. 1013, 16-17). A POSITA would have also understood that *Shi*'s MAC layer includes at least one MAC entity. *Id.* (citing Ex. 1007, 9-10). Therefore, *Shi*'s disclosure of the MAC layer receiving the indication of LBT failure means that at least one MAC entity of the UE receives the indication of LBT failure.

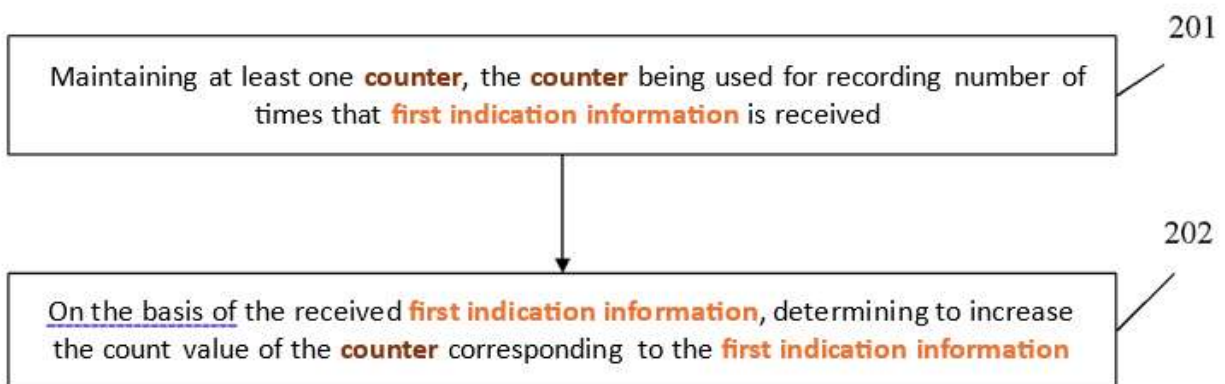
A POSITA would have further understood that *Shi*'s LBT failure indication is for "all uplink (UL) transmissions" because *Shi* discloses a "global counter." Kakaes, ¶166. Specifically, *Shi* explains that the first indication information includes "the count value of the global counter," which "will be increased **regardless of which type of uplink transmission** fails." *Shi*, 5:6-8, 9:28-30. This is in contrast to another embodiment in *Shi*, where there is "at least one counter for at least one uplink transmission," meaning that "a corresponding counter may be maintained for each uplink transmission, or a counter may be maintained for a first

portion of the uplink transmissions and another counter maintained for the remainder of the uplink transmissions.” *Id.*, 6:8-14, 10:31-37.

d. [1c]: “increase an LBT failure counter when the MAC entity receives the LBT failure indication;”

Shi discloses limitation [1c]. Kakaes, ¶¶167-168.

For example, as discussed for limitation [1b], *Shi* discloses that the MAC layer (at least one MAC entity) receives the **LBT failure indication**. *Shi* further discloses that “the **global counter** may be maintained at the MAC layer of the terminal device.” *Shi*, 6:3-5, 4:32-35, 8:21-23, 9:5-9. As shown in FIG. 2, *Shi* discloses that, when the first indication information (LBT failure indication) is received, it is determined “to **increase the count value** of the **counter**.” *Id.*, 4:41-43, 5:2-5, 6:34-43, 9:15-17, 9:26-27; Kakaes, ¶168.



Id., FIG. 2.

- e. [1d]: “determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and”

Shi discloses limitation [1d]. Kakaes, ¶¶169-172.

For example, *Shi* discloses “configuring at least one **threshold value** for the at least one counter for at least one uplink transmission.” *Shi*, 7:27-28. The preset threshold value “may be a threshold value that is set according to actual conditions; for example, it may be set to 10; of course, it may also be set to other values.” *Shi*, 5:41-43, 8:4-6, 10:15-17.

Shi further discloses that, “when the global counter reaches a preset threshold value, the Radio Resource Control (RRC) layer triggers one of the following processes: RRC connection re-establishment; Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing; and RRC reconfiguration.” *Id.*, 5:31-34. Similarly, *Shi* discloses that one or more of the following actions are taken when the count value exceeds a threshold value:

notifying the RRC layer to trigger RRC re-establishment;

notifying the RRC layer to trigger RRC reconfiguration;

...

notifying the network side of the number of LBT failures; and

notifying the network side of an event that triggers LBT.

Id., 7:29-39.

A POSITA would have understood that *Shi*'s UE determines that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold. Kakaes, ¶¶170-172. For example, each of the actions triggered in response to exceeding the LBT-relevant threshold value (e.g., RRC re-establishment, RRC reconfiguration, Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing) indicates that an LBT failure event has occurred, and some action is being taken to recover from that failure. *Id.*, ¶172. Thus, a POSITA would have understood that the UE determines an LBT failure event before triggering the subsequent recovery procedure. *Id.*

- f. **[1e]: “reset the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.”**

Shi in view of *TS-38.321* renders obvious limitation [1e]. Kakaes, ¶¶173-183.

For example, as discussed for limitations [1c] and [1d], *Shi* discloses a global counter for counting the number of LBT failures and triggering a recovery procedure in response to the counter being greater than or equal to a threshold value. *Shi* further discloses one of the following recovery procedures is triggered by the RRC layer: “RRC connection re-establishment; Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing; and RRC reconfiguration.” *Shi*, 5:31-34.

Shi discloses that the SCG-RLF processing includes, among other things, “reset[ting] the SCG Media Access Control (MAC) address entity.” *Shi*, 5:37-40.

A POSITA would have understood that *Shi*’s RRC layer is an “upper layer” because the ’535 patent specifically provides an RRC layer as an example of an upper layer relative to the MAC layer. ’535 patent, 7:32-34. Further, it was well known that the RRC layer is above the MAC layer in the protocol stack. Kakaes, ¶176 (citing Ex. 1013, 16-17). *Shi* therefore discloses resetting a MAC entity (SCG MAC address entity) in response to a request from an upper layer (RRC layer) of the UE. *Id.*

A POSITA would have found it obvious that *Shi*’s resetting of the MAC entity would include resetting the global counter (LBT failure counter) because, as discussed for limitation [1c], the global counter is maintained at the MAC layer. Kakaes, ¶177. It was well known to a POSITA that resetting a MAC entity includes, for example, resetting counters associated with the MAC entity. *Id.* (citing Ex. 1007 (*TS-38.321*), 43-44; Ex. 1016, [0009], [0051], [0073], [0078], [0083]); Rodermund, ¶¶72-81. For example, *TS-38.321* discloses that, “[i]f a reset of the MAC entity is requested by upper layers, the MAC entity shall,” among other things, “reset *BFI_COUNTER*.” *TS-38.321*, 43-44. Similar to the LBT failure counter, a “*BFI_COUNTER*” counts the number of beam failure instance

indications and triggers a recovery procedure when the counter reaches a threshold value. *TS-38.321*, 47-48; Kakaes, ¶177.

A POSITA would have been motivated to incorporate *TS-38.321*'s teachings of resetting a failure counter when resetting a MAC entity into *Shi*'s method. Kakaes, ¶178. Both *Shi* and *TS-38.321* disclose wireless communication systems where a reset of the MAC entity is requested by an upper layer. *Shi*, 5:31-40; *TS-38.321*, 43-44. And *TS-38.321* further discloses that a failure counter is reset in response to resetting the MAC entity. *TS-38.321*, 43-44.

A POSITA would therefore have found it obvious to combine *Shi* and *TS-38.321* by implementing *TS-38.321*'s teachings of resetting a failure counter when resetting a MAC entity into *Shi*'s method, because this was a well-known, conventional procedure, as taught by *TS-38.321*. Kakaes, ¶179. A POSITA would have understood that *TS-38.321*'s disclosure simply provides additional details and explanation about the details of *Shi*'s reset of a MAC entity, and, thus, would have found it obvious to look to the conventional procedure described in *TS-38.321* to understand and implement the details not expressly described in *Shi*'s method. *Id.*

A POSITA would have been motivated to implement *TS-38.321*'s teachings of resetting a failure counter when resetting a MAC entity into *Shi*'s method because the purpose of resetting the MAC entity is to reset it to its default configurations. Kakaes, ¶180. For example, resetting the MAC entity involves

clearing any data or recorded values and restarting any timers or counters. *Id.* A POSITA would have understood that, if the upper layer requests that the MAC entity be reset, then all of the configurations associated with the MAC entity would be reset, and not just some configurations, in order to improve the chances of resolving the issue that is causing the need to reset the MAC entity (e.g., LBT failure). *Id.*

A POSITA would have been motivated to reset the LBT failure counter in particular because, with the MAC entity being reset, it also would make sense to restart the LBT failure counter, as the UE attempts to retry the LBT process. Kakaes, ¶181. According to Dr. Kakaes, it would not make sense to use the existing LBT failure counter, after an LBT failure event has already occurred. *Id.* For example, if the threshold was set to 10, an LBT failure count of 10 would trigger an LBT failure event, which would lead to resetting the MAC entity. *Id.* Then, after the MAC has been reset, if there is another LBT failure indication, the counter would increase to 11, which would again detect an LBT failure event, even though it was the first LBT attempt after the MAC was reset. *Id.* A POSITA therefore would have been motivated to reset the LBT failure counter when the MAC entity has been reset to clear the count and start the counting from the beginning. *Id.* As discussed above, this would avoid premature detection of an LBT failure event after the MAC entity is reset. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *TS-38.321*'s teachings of resetting a failure counter when resetting a MAC entity in *Shi*'s method. Kakaes, ¶182. In fact, *Shi* already teaches how to reset the LBT failure counter under certain circumstances. *Shi*, 5:29-30 (“when the count value of the global counter has not changed for a very long period of time, it is possible to restart the counting of the global counter.”). Thus, it would simply be a matter of changing the condition or adding another condition upon which *Shi*'s method resets the LBT failure counter. Kakaes, ¶182. Further, as mentioned above, *Shi* and *TS-38.321* include similar components that perform similar functions. *TS-38.321* simply provides additional details and explanation about how *Shi*'s MAC reset occurs. *Id.* Thus, it would have been straightforward to implement *TS-38.321*'s teachings of resetting a failure counter when resetting a MAC entity into *Shi*'s method. *Id.*

Therefore, *Shi* and *TS-38.321* render obvious limitation [1e]. Kakaes, ¶¶173-183.

2. Claim 3

- a. “The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: indicate, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.”**

Shi discloses or renders obvious the additional limitations of claim 3.

Kakaes, ¶¶184-188.

For example, as explained for limitation [1d], *Shi* discloses determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold. *Shi* also discloses “notifying the RRC layer” to trigger one or more actions in response to the counter being greater than or equal to the threshold value. *Shi*, 7:29-34. As discussed for limitation [1e], a POSITA would have understood that *Shi*’s RRC layer is an “upper layer of the UE.” ’535 patent, 7:32-34; Kakaes, ¶185 (citing Ex. 1013, 16–17).

Further, as discussed for limitation [1b], *Shi*’s LBT failure counter is maintained at the MAC layer. Thus, a POSITA would have understood that a MAC entity in the MAC layer indicates to (“notif[ies]”) the RRC layer the LBT failure problem after the MAC entity determines that the LBT failure event has occurred. Kakaes, ¶186.

To the extent Patent Owner argues that *Shi* does not disclose this limitation, it would have been obvious in view of *Shi*. Kakaes, ¶187. For example, because *Shi*'s MAC layer maintains the counter to determine when there has been an LBT failure event, and because its RRC layer triggers the recovery procedure, it would have been obvious for the MAC layer to indicate whether there is an LBT failure problem to the RRC layer, so that the RRC layer can promptly trigger the recovery procedure. *Id.* Indeed, a POSITA would have recognized that it would be most efficient for the MAC layer to communicate the LBT failure problem directly from the MAC layer to the RRC layer. *Id.* Thus, a POSITA would have been motivated to modify *Shi*'s MAC layer to indicate whether there is an LBT failure problem to its RRC layer, to the extent it is not disclosed already. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to modify *Shi*'s MAC layer to indicate whether there is an LBT failure problem to its RRC layer, to the extent it is not disclosed already. Kakaes, ¶188. Because *Shi*'s MAC layer and RRC layer are already in communication (*Shi*, 5:35-37; Ex. 1013, 16–17), it would have been a straightforward modification for the MAC layer to indicate to the RRC layer that there is an LBT failure problem. Kakaes, ¶188.

3. Claim 4

- a. **“The UE of claim 3, wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a Radio Link Failure (RLF) recovery procedure.”**

Shi discloses the additional limitations of claim 4. Kakaes, ¶¶189-190.

For example, *Shi* discloses that “when the global counter reaches a preset threshold value, the Radio Resource Control (RRC) layer triggers one of the following processes: RRC connection re-establishment; **Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing**; and RRC reconfiguration.” *Shi*, 5:31-34. As discussed for limitation [1e], *Shi*’s SCG-RLF processing is a RLF recovery procedure. Kakaes, ¶190. Indeed, the ’535 patent specifically provides an SCG RLF recovery procedure as an example of an RLF recovery procedure. ’535 patent, 10:11-16.

4. Claim 7

- a. **“The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: receive a configuration that indicates the threshold.”**

Shi discloses the additional limitations of claim 7. Kakaes, ¶191-192.

For example, *Shi* discloses “configuring at least one **threshold value** for the at least one counter for at least one uplink transmission.” *Shi*, 7:27-28. The preset threshold value “may be a threshold value that is set according to actual conditions;

for example, it may be set to 10; of course, it may also be set to other values.” *Shi*, 5:41-43, 8:4-6, 10:15-17, 12:22-24. Thus, a POSITA would have understood that *Shi*’s UE receives a configuration that indicates the threshold value. Kakaes, ¶192.

5. Claim 8

- a. **“The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the threshold is reconfigured.”**

Shi and *TS-38.321* render obvious the additional limitations of claim 8. Kakaes, ¶¶193-198.

For example, as discussed for limitation [1e], *Shi* discloses resetting the LBT failure counter in certain circumstances. *Shi*, 5:28-30, 10:2-4, 12:1-3, 17:32-34, 19:4-5. Also, as discussed for claim 7, *Shi* discloses configuring a threshold for the LBT failure counter. *Shi*, 5:41-43, 7:27-28, 8:4-6, 10:15-17, 12:22-24.

The ’535 patent states that “the UE may reset the LBT failure counter when at least one of the time period and the threshold is reconfigured (e.g., when the UE receives an RRC reconfiguration message that changes at least one of the time period and the threshold).” ’535 patent, 8:52-56. Similarly, *Shi* discloses that when the “global counter reaches a preset threshold value, the Radio Resource Control (RRC) layer triggers ... RRC reconfiguration.” *Shi*, 5:31-34. *Shi* further discloses that “the RRC reconfiguration may be at least one of the following: reconfiguring

the uplink BWP, or reconfiguring PRACH resources, reconfiguring PUCCH resources, reconfiguring PUSCH resources, reconfiguring the uplink carrier, etc.” *Shi*, 5:35-37.

A POSITA would have found it obvious that the RRC reconfiguration also reconfigures the threshold value for the LBT failure counter. Kakaes, ¶¶194-196. For example, *TS-38.321* discloses that “[w]hen a reconfiguration of the MAC entity is requested by upper layers [e.g., an RRC layer], the MAC entity shall: ... **apply the new maximum parameter value when counters are initialized.**” *TS-38.321*, 43. A POSITA would have found it obvious that, when the threshold for LBT failure is reconfigured, the LBT failure counter should be reset as well. Kakaes, ¶196. For example, if the threshold is reconfigured to be lower than the current LBT counter value, it would make sense to reset the LBT failure counter. *Id.*

A POSITA would have been motivated to incorporate *TS-38.321*’s teachings of reconfiguring a counter threshold. Kakaes, ¶197. *Shi* discloses a 5G system, which is also referred to as a New Radio (NR) system (*Shi*, 3:32-33) that uses a MAC protocol, and *TS-38.321* is a technical specification that specifies the NR MAC protocol (*TS-38.321*, 7). Kakaes, ¶197. Thus, a POSITA would have been motivated to implement *TS-38.321*’s NR MAC protocol in *Shi*’s system with a reasonable expectation of success. *Id.* Moreover, a POSITA would have been

motivated to implement resetting the LBT counter when the threshold is reconfigured in *Shi*'s MAC protocol. *Id.* For example, if the threshold is reconfigured to be smaller than the current LBT counter value, it would make sense to reset the LBT failure counter. *Id.* Otherwise, the reconfiguration of the threshold is meaningless as the threshold is already exceeded. *Id.* Similarly, if the threshold is reconfigured to be larger than the current LBT counter value, continuing with the current value of the counter would not make sense either as that would not allow for the larger value of the threshold to be applicable. *Id.* According to Dr. Kakaes, it is common sense and would have been obvious to a POSITA to reset the counter when the threshold is reconfigured.

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement resetting a counter when the threshold is reconfigured in *Shi*'s method. Kakaes, ¶198. In fact, *Shi* already teaches how to reset the LBT failure counter under certain circumstances. *Shi*, 5:29-30. Thus, it would simply be a matter of changing the condition or adding another condition upon which *Shi*'s method resets the LBT failure counter. Kakaes, ¶198. Thus, it would have been straightforward to implement *TS-38.321*'s teachings and a POSITA's knowledge in *Shi*'s existing LBT method. *Id.*

6. Independent Claim 10

- a. [10pre]: “A method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE), the method comprising:”**

To the extent the preamble is limiting, *Shi* discloses a method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE) for the reasons discussed for [1pre]-[1e]. Kakaes, ¶199.

- b. [10a]: “receiving, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;”**

As discussed for limitation [1b], *Shi* discloses this limitation. Kakaes, ¶200.

- c. [10b]: “increasing an LBT failure counter when the MAC entity receives the LBT failure indication;”**

As discussed for limitation [1c], *Shi* discloses this limitation. Kakaes, ¶201.

- d. [10c]: “determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and”**

As discussed for limitation [1d], *Shi* discloses this limitation. Kakaes, ¶202.

- e. [10d]: “resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.”**

As discussed for limitation [1e], *Shi* in combination with *TS-38.321* renders this limitation obvious. Kakaes, ¶203.

7. Claim 12

- a. “The method of claim 10, further comprising:
indicating, by the MAC entity of the UE, to the upper
layer of the UE an LBT failure problem after
determining that the LBT failure event has
occurred.”**

As discussed for claim 3, *Shi* discloses or renders obvious the additional limitations of claim 12. Kakaes, ¶204.

8. Claim 13

- a. “The method of claim 12, further comprising:
performing a Radio Link Failure (RLF) recovery
procedure.”**

As discussed for claim 4, *Shi* discloses the additional limitations of claim 13. Kakaes, ¶205.

9. Claim 16

- a. “The method of claim 10, further comprising:
receiving a configuration that indicates the
threshold.”**

As discussed for claim 7, *Shi* discloses the additional limitations of claim 16. Kakaes, ¶206.

10. Claim 17

- a. **“The method of claim 10, further comprising:
resetting the LBT failure counter when the threshold
is reconfigured.”**

As discussed for claim 8, *Shi* and *TS-38.321* render obvious the additional limitations of claim 17. Kakaes, ¶207.

11. Claim 19

- a. **“The user equipment (UE) of claim 1, wherein the at
least one processor is further configured to execute
the computer-executable instructions to: reset the
LBT failure counter after the MAC entity has not
received the LBT failure indication for a time
period.”**

Shi discloses the additional limitations of claim 19. Kakaes, ¶¶208-210.

For example, *Shi* discloses that a global timer may be added, such that “it is possible to reset the global counter when the global timer times out.” *Shi*, 5:28. That is, “when the count value of the global counter has not changed for a very long period of time, it is possible to restart the counting of the global counter.” *Shi*, 5:29-30.

As discussed for limitation [1b], *Shi* discloses that first indication information indicating LBT failure is transmitted from a physical layer to a MAC layer, where the MAC layer maintains a global counter for uplink transmission. Thus, a POSITA would have understood that *Shi*’s disclosure of the “global timer

times out” and “the global counter has not changed for a very long period of time” to mean that the MAC entity within its MAC layer has not received the LBT failure indication for a time period. Kakaes, ¶¶209-210.

12. Claim 20

- a. **“The method of claim 10, further comprising: resetting the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.”**

As discussed for claim 19, *Shi* discloses the additional limitations of claim 20. Kakaes, ¶211.

B. Ground 2: Claims 1-8, 10-17, and 19-20 Are Obvious over *Shi* in View of *Hong* and *TS-38.321*

Shi in view of *Hong* and *TS-38.321* renders obvious claims 1-8, 10-17, and 19-20. Kakaes, ¶¶212-261.

1. Independent Claim 1

As discussed above for Ground 1, *Shi* discloses limitations [1pre]-[1d]. To the extent Patent Owner argues that *Shi* and *TS-38.321* do not render obvious limitation [1e], the combination of *Shi*, *Hong*, and *TS-38.321* renders it obvious. Kakaes, ¶¶213-226. As discussed above, *Shi* discloses that one of the following recovery procedures is triggered by the RRC layer: “RRC connection re-establishment; Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing; and RRC reconfiguration.” *Shi*, 5:31-34.

Like *Shi, Hong* discloses that a terminal (UE) manages a counter for counting the number of LBT failures and triggering a recovery procedure in response to the counter exceeding a threshold value. *Hong*, [177]-[178], [187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Also like *Shi, Hong* discloses that the UE can initiate an RRC connection reestablishment/resumption procedure in response to LBT failure. *Hong*, [195]; *Hong Priority*, [0095]. According to *Hong*, the RRC connection reestablishment/resumption procedure includes, among other things, “reset[ting] the MAC.” *Hong*, [195]; *Hong Priority*, [0095]. A POSITA would have understood that resetting the MAC means resetting the MAC layer, including each MAC entity in the MAC layer. *Hong* therefore discloses resetting a MAC entity in the MAC layer in response to a request from an upper layer (RRC layer) of the UE. Kakaes, ¶214.

As discussed for Ground 1, a POSITA would have found it obvious that resetting a MAC entity of the MAC layer would include resetting the LBT failure counter when the counter is maintained at the MAC layer, as taught in *Shi*. *Shi*, 6:3-5, 4:32-35, 8:21-23, 9:5-9; Kakaes, ¶215. Further, it was well known to a POSITA that resetting a MAC entity includes, for example, resetting counters associated with the MAC entity. Kakaes, ¶215 (citing Ex. 1007, 43-44; Ex. 1016, [0009], [0051], [0073], [0078], [0083]); Rodermund, ¶¶72-81. For example, *TS-38.321* discloses that, “[i]f a reset of the MAC entity is requested by upper layers,

the MAC entity shall,” among other things, “reset *BFI_COUNTER*.” *TS-38.321*, 43-44. Similar to the LBT failure counter, a “*BFI_COUNTER*” counts the number of beam failure instance indications and triggers a recovery procedure when the counter reaches a threshold value. *TS-38.321*, 47-48; Kakaes, ¶215.

A POSITA would have been motivated to implement *Hong*’s teachings of resetting the MAC layer entity as part of RRC connection re-establishment in *Shi*’s method. Kakaes, ¶216. Both *Shi* and *Hong* disclose wireless communication systems that include LBT failure counters for counting the number of LBT failures and triggering an LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Hong*, [177]-[178], [187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Both *Shi* and *Hong* also disclose that the UE can initiate an RRC connection reestablishment procedure in response to LBT failure. *Shi*, 5:31-34; *Hong*, [195]; *Hong Priority*, [0095].

A POSITA would therefore have found it obvious to combine *Shi* and *Hong* by implementing *Hong*’s teachings of resetting the MAC layer entity as part of RRC connection re-establishment in *Shi*’s method, because this was a well-known, conventional procedure, as taught by *Hong*. Kakaes, ¶217. A POSITA would have understood that *Hong*’s disclosure simply provides additional details and explanation about the details of *Shi*’s RRC connection re-establishment procedure,

and, thus, would have found it obvious to look to the conventional procedure described in *Hong* to understand and implement the details not expressly described in *Shi*'s method. *Id.*

A POSITA would have been motivated to implement *Hong*'s teachings of resetting the MAC layer entity as part of RRC connection re-establishment in *Shi*'s method because of the well-known benefits of resetting the MAC layer. Kakaes, ¶218. As discussed above for Ground 1, resetting the MAC entity involves clearing any data or recorded values and restarting any timers or counters. *Id.* A POSITA would have understood that, if the upper layer requests that the MAC entity be reset, then all of the configurations associated with the MAC entity would be reset, and not just some configurations, in order to improve the chances of resolving the issue that is causing the need to reset the MAC entity (e.g., LBT failure). *Id.* A POSITA therefore would have been motivated to reset the MAC layer entity as part of RRC connection re-establishment. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *Hong*'s teachings of resetting the MAC layer entity in *Shi*'s method. Kakaes, ¶219. In fact, *Shi* already teaches how to reset a MAC entity as part of the SCG-RLF processing. *Shi*, 5:37-40. Thus, it would simply be a matter of applying these same techniques for the RRC connection re-establishment procedure. Kakaes, ¶219. Further, as mentioned

above, *Shi* and *Hong* include similar components that perform similar functions. Further, *Hong* simply provides additional details and explanation about how *Shi*'s RRC connection re-establishment occurs. *Id.* Thus, it would have been straightforward to implement *Hong*'s teachings of resetting the MAC layer entity as part of RRC connection re-establishment in *Shi*'s method. *Id.*

Moreover, for at least the reasons discussed above for Ground 1, a POSITA would have further been motivated to incorporate *TS-38.321*'s teachings of resetting a failure counter in response to resetting a MAC entity into *Shi/Hong*'s method, and a POSITA would have had a reasonable expectation of success of doing so. Kakaes, ¶¶220-225; *see supra* Section VI.A.1.f.

Therefore, *Shi* in combination with *Hong* and *TS-38.321* renders obvious limitation [1e]. Kakaes, ¶¶213-226.

2. Claim 2

- a. **“The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: switch an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.”**

Shi and *Hong* render obvious the additional limitations of claim 2. Kakaes, ¶¶227-232.

For example, as explained for limitation [1d], *Shi* discloses determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold. *Shi* also discloses “reconfiguring the uplink BWP” in response to the LBT failure event. *Shi*, 5:35-37. As discussed in Section II.B, a Bandwidth Part (BWP) is a specific frequency band available to the service provider that the provider can make available to a device to communicate on. Kakaes, ¶228.

Therefore, according to Dr. Kakaes, a POSITA would have understood that reconfiguring the BWP includes switching from a BWP that is not available (e.g., has had too many failed attempts) to another BWP in the expectation that it would be available, i.e., performing a reconfiguration of the BWP, as *Shi* explains. *Id.*

To the extent Patent Owner argues *Shi* does not disclose or render obvious this limitation, *Shi* and *Hong* render it obvious. Specifically, *Hong* discloses that the base station can instruct the UE to “change the subband/**BWP**/cell/CC in which the channel access failure [i.e., LBT failure] was detected.” *Hong*, [199]; *Hong Priority*, [0098]. *Hong* therefore discloses switching an active BWP of the UE to another BWP after determining that the LBT failure event has occurred. Kakaes, ¶229.

A POSITA would have found it obvious to combine *Shi* and *Hong* by adopting *Hong*’s teachings in *Shi*’s method because it was well known to switch BWPs in response to LBT failure detected at an active BWP, as taught by *Hong*.

Kakaes, ¶230. As discussed above for limitation [1e], both *Shi* and *Hong* disclose wireless communication systems that include LBT failure counters for counting the number of LBT failures and triggering an LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Hong*, [177]-[178], [187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Both *Shi* and *Hong* also disclose that the UE can initiate an RRC connection reestablishment procedure in response to LBT failure. *Shi*, 5:31-34; *Hong*, [195]; *Hong Priority*, [0095]. *Shi* also discloses “reconfiguring the uplink BWP” in response to the LBT failure event. *Shi*, 5:35-37. And *Hong* discloses changing an active BWP of the UE to another BWP in response to LBT failure at the active BWP. *Hong*, [199]; *Hong Priority*, [0098].

A POSITA would have been motivated to implement *Hong*’s teaching of switching BWPs in response to LBT failure in *Shi*’s method because doing so can help the UE to successfully engage in communication with a base station. Kakaes, ¶231. For example, as *Hong* acknowledges, it is important to allocate to the terminal radio resources that have a higher probability of LBT success in a subsequent uplink data transmission or retransmission. *Hong*, [102]-[103]; *Hong Priority*, [0041]; Kakaes, ¶231. That is, by switching from a BWP where LBT is known to have failed a number of times to a different BWP, the UE may improve its chances of successfully completing the LBT procedure, and thereby improve

the efficiency of communication. Kakaes, ¶231. Thus, a POSITA would have been motivated to implement *Hong*'s method because of the advantages provided by *Hong*'s method. *Id.*; see *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417, 421 (2007); *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1338-41 (Fed. Cir. 2020).

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *Hong*'s teachings in *Shi*'s method. Kakaes, ¶232. As mentioned above, the availability and usage of multiple BWP was known to a POSITA. *Id.* Further, *Shi* and *Hong* include similar components that perform similar functions. *Shi*'s UE is also already capable of reconfiguring BWPs. *Shi*, 5:35-37. Thus, it would simply be a matter of configuring *Shi*'s method to allow the switching of the BWP as part of the reconfiguration of the BWPs, to the extent it is not already part of it. Kakaes, ¶232. And therefore, it would have been straightforward to implement *Hong*'s teachings to *Shi*'s existing method. *Id.*

3. Claim 5

- a. “The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).”

Shi and *Hong* render obvious the additional limitations of claim 5. Kakaes, ¶¶233-242.

For example, as discussed above for limitation [1e], *Shi* discloses one of the following recovery procedures is triggered by the RRC layer: “**RRC connection re-establishment**; Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing; and RRC reconfiguration.” *Shi*, 5:31-34. *Shi* further discloses that, “when initiating **RRC connection re-establishment** and **initiating a connection re-establishment request** to the network side, the connection re-establishment request includes: the number of LBT failures, and/or an **event that triggers LBT**.” *Id.*, 5:44-49.

To the extent Patent Owner argues that *Shi* does not disclose performing a re-establishment procedure “when the LBT failure event occurs in a Primary Cell (PCell),” according to Dr. Kakaes, a POSITA would understand that *Shi*’s disclosure that an “RRC connection re-establishment” applies to a PCell whenever, for example, there is no SCG and there is only one cell for the UE to use in

communicating with the base station, and that one cell is, by definition, a Primary Cell (PCell). Kakaes, ¶¶234-235.

To the extent Patent Owner argues that *Shi* does not disclose or render obvious, *Shi* and *Hong* render this limitation obvious. Kakaes, ¶236. Specifically, *Hong* discloses that, **if a channel access failure (LBT failure) occurs in a PCell (Primary Cell)**, the terminal **transmits an RRC connection re-establishment request message** to the base station, initiating an **RRC connection re-establishment procedure**. *Hong*, [135]; *Hong Priority*, [0096]; *see also Hong*, [149], [162], [183]; *Hong Priority*, [0099].

A POSITA would have found it obvious to combine *Shi* and *Hong* by adopting *Hong*'s re-establishment procedure triggered by an LBT failure in a PCell to *Shi*'s RRC connection re-establishment procedure. Kakaes, ¶237. *Shi* contemplates a UE with dual connectivity with PCells and SCells based on its ability to trigger “**Secondary Cell Group (SCG)–Radio Link Failure (RLF)** processing.” *Shi*, 5:31-34; Kakaes, ¶237. A POSITA would have understood that an LBT failure can take place in a PCell or an SCell. Kakaes, ¶237.

A POSITA would have been motivated to implement *Hong*'s connection re-establishment procedure triggered by an LBT failure in a PCell to recover from an LBT failure in *Shi*'s method. Kakaes, ¶238. Both *Shi* and *Hong* disclose wireless communication systems that include LBT failure counters for counting the number

of LBT failures and triggering an LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Hong*, [177]-[178], [187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Both *Shi* and *Hong* also disclose that the UE can initiate an RRC connection re-establishment procedure in response to LBT failure. *Shi*, 5:31-34; *Hong*, [195]; *Hong Priority*, [0095].

A POSITA would therefore have found it obvious to combine *Shi* and *Hong* by implementing *Hong*'s teachings of a connection re-establishment procedure triggered by an LBT failure in a PCell to recover from an LBT failure in *Shi*'s method, because this was a well-known, conventional procedure, as taught by *Hong*. Kakaes, ¶239. A POSITA would have understood that *Hong*'s disclosure simply provides additional details and explanation about the details of *Shi*'s RRC connection re-establishment procedure, and thus would have found it obvious to look to the conventional procedure described in *Hong* to understand and implement the details not expressly described in *Shi*'s method. *Id.*

A POSITA would have been motivated to implement *Hong*'s connection re-establishment procedure triggered by an LBT failure in a PCell to recover from an LBT failure because doing so would improve efficiency, reliability, and mobility of *Shi*'s wireless communication network. Kakaes, ¶240. Indeed, *Hong* provides that its method can reduce service interruptions when frequent LBT failures occur

for a base station and cause data transmission to be difficult. *Hong*, [102]-[103]; *Hong Priority*, [0041]; Kakaes, ¶240. *Hong* further provides that its method makes it possible to control data transmission to be more stable by allocating to the terminal radio resources that have a higher probability of LBT success in a subsequent uplink data transmission or retransmission. Kakaes, ¶¶240-241.

A POSITA would have had a reasonable expectation of success combining *Shi* and *Hong* because they both involve similar wireless network components (e.g., a UE with dual connectivity to MCG and SCG) and procedures that perform similar functions (e.g., a connection re-establishment procedure when there is an LBT failure event). Kakaes, ¶242. Thus, a POSITA would have had a reasonable expectation of combining *Hong*'s connection re-establishment procedure in response to an LBT failure in a PCell with *Shi*'s connection re-establishment procedure because doing so would have involved combining prior art elements according to known wireless communication techniques (e.g., a connection re-establishment procedure for an LBT failure in a PCell) to yield predictable results to improve efficiency and reliability of wireless communications. *Id.*

4. **Claim 6**

- a. **“The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).”**

Shi and *Hong* render obvious the additional limitations of claim 6. Kakaes, ¶¶243-251.

For example, as discussed above for limitation [1e], *Shi* discloses one of the following recovery procedures is triggered by the RRC layer: “RRC connection re-establishment; **Secondary Cell Group (SCG)–Radio Link Failure (RLF) processing**; and RRC reconfiguration.” *Shi*, 5:31-34. *Shi* explains that the SCG–RLF processing is to “suspend all Signaling Radio Bearers (SRB) and Data Radio Bearers (DRB) of the SCG, reset the SCG Media Access Control (MAC) address entity, and **report the number of LBT failures** to the network **via an MCG**.” *Shi*, 5:37-40.

As the ’535 patent explains, a “UE configured with multi-connectivity may be connected to a Master Node (MN) as an anchor and one or more Secondary Nodes (SNs) for data delivery. Each one of these nodes may be formed by a cell group that includes one or more cells. For example, an MN may be formed by a Master Cell Group (MCG), and an SN may be formed by a Secondary Cell Group

(SCG).” ’535 patent, 4:57-64. A POSITA would have thus understood that “MCG” described in *Shi* refers to “Master Cell Group,” which forms a master node.

Kakaes, ¶¶244-245.

To the extent that *Shi* does not disclose this limitation, *Hong* discloses that, **if a channel access failure (LBT failure) occurs in a PSCell** or SCell, then the terminal transmits a PSCell (Primary SCel) or SCell (Secondary Cell) failure information message or an **SCG (Secondary Cell Group) failure information message** to the base station. *Hong*, [135]; *Hong Priority*, [0088]-[0089]; *see also Hong*, [184]; *Hong Priority*, [0099]. *Hong* further discloses that a terminal using a **PSCell** of an SCG in an unlicensed band can **transmit SCG LBT failure-related information** to the base station **via an MCG**. For example, the terminal can transmit an SCG Failure Information message to the base station. *Hong*, [188], [218], [228]; *Hong Priority*, [0088]. As discussed above, a POSITA would have thus understood that “MCG” described in *Hong* refers to “Master Cell Group,” which forms a master node. Kakaes, ¶246; ’535 patent, 4:57-64.

A POSITA would have found it obvious to implement *Hong*’s teachings of transmitting an SCG failure report indicating the channel access failure (e.g., LBT failure) to a master node when the LBT failure event occurs in a PSCell into *Shi*’s method. Kakaes, ¶247. As disclosed in *Shi* and *Hong*, it was well known that a wireless communication network includes a Secondary Cell Group, which can

include a “PSCell,” which is a special cell among the SCells, to which a PUCCH transmission function is allocated. *Hong*, [111]; *Hong Priority*, [0099]. And it was well known that an LBT failure can take place in a PSCell. Kakaes, ¶247; *Hong*, [200]; *Hong Priority*, [0099].

A POSITA would have been motivated to implement *Hong*’s transmitting an SCG failure report indicating the channel access failure (e.g., LBT failure) to a master node when the LBT failure event occurs in a PSCell in *Shi*’s method. Kakaes, ¶248. Both *Shi* and *Hong* disclose wireless communication systems that include LBT failure counters for counting the number of LBT failures and triggering an LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Hong*, [177]-[178], [187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Both *Shi* and *Hong* also disclose that the UE can initiate an RRC connection reestablishment procedure in response to LBT failure. *Shi*, 5:31-34; *Hong*, [195]; *Hong Priority*, [0095].

A POSITA would therefore have found it obvious to combine *Shi* and *Hong* by implementing *Hong*’s teachings of transmitting an SCG failure report indicating the LBT failure to a master node when the LBT failure event occurs in a PSCell in *Shi*’s method, because this was a well-known, conventional procedure, as taught by *Hong*. Kakaes, ¶249. A POSITA would have understood that *Hong*’s disclosure

simply provides additional details and explanation about the details of *Shi*'s RRC connection re-establishment procedure, and thus would have found it obvious to look to the conventional procedure described in *Hong* to understand and implement the details not expressly described in *Shi*'s method. *Id.*

A POSITA would have been motivated to implement *Hong*'s procedure for transmitting an SCG failure report to a master node when there is an LBT failure event in a PSCell in *Shi*'s method because doing so would improve efficiency, reliability, and mobility of *Shi*'s wireless communication network. Kakaes, ¶250. Indeed, *Hong* provides that its method can reduce service interruptions when frequent LBT failures occur for a base station and cause data transmission to be difficult. *Hong*, [102]-[103]; *Hong Priority*, [0041]; Kakaes, ¶250. *Hong* further provides that its method makes it possible to control data transmission to be more stable, by allocating to the terminal radio resources that have a higher probability of LBT success in a subsequent uplink data transmission or retransmission. *Id.*

A POSITA would have had a reasonable expectation of success combining *Shi* and *Hong* because they both involve similar wireless network components (e.g., a UE with dual connectivity to MCG and SCG) and procedures that perform similar functions (e.g., providing a failure report to a master node when there is an LBT failure event). Kakaes, ¶251. Thus, a POSITA would have had a reasonable expectation of combining *Hong*'s transmission of an SCG LBT failure report to an

MCG (master node) when there is an LBT failure event in a PSCell with *Shi*'s method because doing so would have involved combining prior art elements according to known wireless communication techniques (e.g., generating an SCG failure report when an LBT failure event occurs in a PSCell) to yield predictable results to improve efficiency and reliability of wireless communications. *Id.*

5. Claim 7

To the extent Patent Owner argues that *Shi* does not disclose this limitation, it would have been obvious in view of *Shi* and *Hong*. Kakaes, ¶¶252-255. For example, *Hong* discloses that a threshold value associated with LBT failure can be configured by the base station. *Hong*, [128], [145]; *Hong Priority*, [0092]. A POSITA would have thus understood that *Hong* discloses that the UE receives a configuration from the base station that indicates the threshold. Kakaes, ¶252.

A POSITA would have found it obvious to combine *Shi* and *Hong* by adopting *Hong*'s teachings in *Shi*'s method because it was well known for the UE to receive from the base station a configuration indicating a threshold associated with LBT failure, as taught by *Hong*. Kakaes, ¶253. As discussed above, both *Shi* and *Hong* disclose wireless communication systems that include LBT failure counters for counting the number of LBT failures and triggering a LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Hong*, [177]-[178],

[187], [195]; *Hong Priority*, [0070]-[0074], [0087], [0095]. Both *Shi* and *Hong* also disclose that the UE can initiate an RRC connection reestablishment procedure in response to LBT failure. *Shi*, 5:31-34; *Hong*, [195]; *Hong Priority*, [0095]. *Hong* further discloses the UE receiving a configuration from the base station indicating a threshold associated with LBT failure. *Hong*, [128], 145]; *Hong Priority*, [0092].

A POSITA would have been motivated to implement *Hong*'s teaching of receiving a configuration that indicates the threshold in *Shi*'s method because it is very common for the base station to communicate one or more configuration parameters to the UE. Kakaes, ¶254. Further, the base station may be better positioned than the UE to determine an appropriate threshold value associated with LBT failure because the base station may gather information from other UEs that may indicate the most appropriate threshold. *Id.* Thus, a POSITA would have been motivated to implement *Hong*'s teaching of receiving a configuration that indicates the threshold in *Shi*'s method. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *Hong*'s teachings in *Shi*'s method. Kakaes, ¶255. As mentioned above, *Shi* and *Hong* include similar components that perform similar functions. *Shi*'s UE is also already capable of configuring the threshold value. *Shi*, 7:27-28. And therefore, it would have been

straightforward to implement *Hong*'s teachings to *Shi*'s existing method. Kakaes, ¶255.

6. Independent Claim 10

As discussed for Ground 1, *Shi* discloses limitations [10pre]-[10c]. Further, as discussed for limitation [1e] above, *Shi*, *Hong*, and *TS-38.321* render obvious limitation [10d]. Therefore, *Shi*, *Hong*, and *TS-38.321* render obvious claim 1. Kakaes, ¶256.

7. Claim 11

- a. **“The method of claim 10, further comprising: switching an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.”**

As discussed for claim 2, *Shi* and *Hong* render obvious the additional limitations of claim 11. Kakaes, ¶257.

8. Claim 14

- a. **“The method of claim 10, further comprising: performing a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).”**

As discussed for claim 5, *Shi* and *Hong* render obvious the additional limitations of claim 14. Kakaes, ¶258.

9. Claim 15

- a. **“The method of claim 10, further comprising: transmitting, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).”**

As discussed for claim 6, *Shi* and *Hong* render obvious the additional limitations of claim 15. Kakaes, ¶259.

10. Claim 16

As discussed for claim 7, *Shi* and *Hong* render obvious the additional limitations of claim 16. Kakaes, ¶260.

11. Claims 3-4, 8, 12-13, 17, and 19-20

As discussed for Ground 1, *Shi* discloses, or *Shi* and/or *TS-38.321* render obvious, the additional limitations of claims 3-4, 8, 12-13, 17, and 19-20. Kakaes, ¶261.

C. Ground 3: Claims 2-3 and 11-12 Are Obvious over *Shi* in view of *TS-38.321* and *Terry*

Shi in view of *TS-38.321* and *Terry* renders obvious claims 2-3 and 11-12. Kakaes, ¶¶262-272.

1. Claim 2

Shi and *Terry* render obvious the additional limitations of claim 2. Kakaes, ¶¶263-268.

For example, as explained for limitation [1d], *Shi* discloses determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold. *Shi* also discloses “reconfiguring the uplink BWP” in response to the LBT failure event. *Shi*, 5:35-37. As discussed in Section II.B, a Bandwidth Part (BWP) is a specific frequency band available to the service provider that the provider can make available to a device to communicate on. Kakaes, ¶264.

Therefore, according to Dr. Kakaes, a POSITA would have understood that reconfiguring the BWP includes switching from a BWP that is not available (e.g., has had too many failed attempts) to another BWP in the expectation that it would be available, i.e., performing a reconfiguration of the BWP, as *Shi* explains. *Id.*

To the extent that Patent Owner argues *Shi* does not disclose this limitation, *Shi* and *Terry* render it obvious. Specifically, *Terry* discloses switching to an alternate Bandwidth Part (BWP) based on a detected LBT failure. *Terry*, [0040]-[0041], [0045], [00115], [00117]; *Terry Provisional*, [0027], [00108], [00114], [00116]. *Terry* therefore discloses switching an active BWP of the UE to another BWP after determining that the LBT failure event has occurred. Kakaes, ¶265.

A POSITA would have found it obvious to combine *Shi* and *Terry* by adopting *Terry*’s teachings in *Shi*’s method because it was well known to switch BWPs in response to LBT failure detected at an active BWP, as taught by *Terry*. Kakaes, ¶266. Both *Shi* and *Terry* disclose wireless communication systems that

include LBT failure counters for counting the number of LBT failures and triggering a LBT failure recovery procedure when the LBT failure counter is greater than or equal to a threshold. *Shi*, 2:37-3:29, 4:26-35, 5:6-8, 5:31-40, 7:29-39; *Terry*, [0071]; *Terry Provisional*, [0068]. *Shi* also discloses “reconfiguring the uplink BWP” in response to the LBT failure event. *Shi*, 5:35-37. And *Terry* discloses changing an active BWP of the UE to another BWP in response to LBT failure at the active BWP. *Terry*, [0040]-[0041], [0045], [00115], [00117]; *Terry Provisional*, [0027], [00108], [00114], [00116].

A POSITA would have been motivated to implement *Terry*’s teaching of switching of BWPs in response to LBT failure in *Shi*’s method because doing so can help the UE to successfully engage in communication with a base station. Kakaes, ¶267. For example, as *Terry* acknowledges, “LBT Failures can result in unnecessary and unintended effects” on MAC procedures. *Terry*, [0051]; *Terry Provisional*, [0048]; Kakaes, ¶267. That is, by switching from a BWP where LBT is known to have failed a number of times to a different BWP, the UE may improve its chances of successfully completing the LBT procedure, and thereby improve the efficiency of communication. Kakaes, ¶267. Thus, a POSITA would have been motivated to implement *Terry*’s method because of the advantages provided by *Terry*’s method. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *Terry*'s teachings in *Shi*'s method. Kakaes, ¶268. As mentioned above, the availability and usage of multiple BWP was known to a POSITA. *Id.* Furthermore, *Shi* and *Terry* include similar components that perform similar functions. *Id.* *Shi*'s UE is also already capable of reconfiguring BWPs. *Shi*, 5:35-37. Thus, it would simply be a matter of configuring *Shi*'s method to allow the switching of the BWP as part of the reconfiguration of the BWPs, to the extent it is not already part of it. Kakaes, ¶268. And therefore, it would have been straightforward to implement *Terry*'s teachings to *Shi*'s existing method. *Id.*

2. Claim 3

To the extent Patent Owner argues that *Shi* does not render obvious this limitation, it would have been obvious in view of *Shi* and *Terry*. Kakaes, ¶¶269-270. For example, *Terry* discloses that, after an LBT Failure Counter reaches a maximum threshold, “[t]he LBT State may also be indicated to higher layers,” for example, “to affect RRC procedures.” *Terry*, [0071]; *Terry Provisional*, [0068]. As discussed in Section VI.A.2, because *Shi*'s MAC layer maintains the counter to determine when there has been an LBT failure event, and because its RRC layer triggers the recovery procedure, it would have been obvious for the MAC layer to indicate that there is an LBT failure problem to the RRC layer, so that the RRC

layer can promptly trigger the recovery procedure. Kakaes, ¶269. Indeed, a POSITA would have recognized that it would be most efficient for the MAC layer to communicate the LBT failure problem to the RRC layer as it is the RRC layer that is responsible for taking appropriate corrective action(s). *Id.* Thus, a POSITA would have been motivated to modify *Shi*'s MAC layer to indicate whether there is an LBT failure problem to the RRC layer, as taught by *Terry*. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to modify *Shi*'s MAC layer to indicate whether there is an LBT failure problem to its RRC layer. Kakaes, ¶270. Because *Shi*'s MAC layer and RRC layer are already in communication (*Shi*, 5:35-37; Ex. 1013, 16–17), it would have been a straightforward modification for the MAC layer to indicate to the RRC layer that there is a LBT failure problem, thus allowing the RRC layer to engage in whatever corrective action is deemed appropriate. Kakaes, ¶270.

3. Claim 11

As discussed for claim 2, *Shi* and *Terry* render obvious the additional limitations of claim 11. Kakaes, ¶271.

4. Claim 12

As discussed for claim 3, *Shi* and *Terry* render obvious the additional limitations of claim 12. Kakaes, ¶272.

D. Ground 4: Claims 9 and 18 Are Obvious over *Shi* in View of *Hong*, TS-38.321, and *Alfarhan*

Shi in view of *Hong*, TS-38.321, and *Alfarhan* renders obvious claims 9 and 18. Kakaes, ¶¶273-279.

1. Claim 9

- a. “The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.”**

Shi, *Hong*, and *Alfarhan* render obvious the additional limitations of claim 9. Kakaes, ¶¶274-278.

For example, as discussed in Section VI.B.2, *Hong* discloses switching an active BWP of the UE to another BWP after determining that the LBT failure event has occurred. Also, as discussed in Section VI.B.1, *Shi* and *Hong* each disclose resetting the LBT failure counter in certain conditions.

A POSITA would have found it obvious to reset the LBT counter when the UE switches from an active BWP of the UE to another BWP. Kakaes, ¶¶275-276. It was well known to a POSITA to reset a counter when switching from one BWP to another BWP, as taught by *Alfarhan*. Kakaes, ¶276. Specifically, *Alfarhan* discloses that “[u]pon switching to a different sub-band and/or BWP for a preamble transmission attempt ... [t]he WTRU [wireless transmit/receive unit] 102

may **reset the preamble attempt counter upon and/or after switching**

BWPs/sub-bands.” *Alfarhan*, [0165]; *Alfarhan Provisional*, [0158], [0184].

A POSITA would have been motivated to implement *Alfarhan*’s teachings of resetting a counter when switching BWPs into *Shi*’s method. Kakaes, ¶277. Like *Shi*, *Alfarhan* discloses an LBT procedure in a wireless communication network. *Alfarhan*, [0161]-[0165]; *Alfarhan Provisional*, [0154]-[0158]. A POSITA would have been motivated to reset the LBT failure counter when the UE switches from an active BWP of the UE to another BWP because the existing LBT failure counter would no longer be accurate for the new BWP. Kakaes, ¶277. Thus, it would not make sense to use the existing count value when restarting communication on a new BWP. *Id.* For example, if the existing count was used for the new BWP, the UE would prematurely detect LBT failure after only one attempt at LBT transmission. *Id.* Thus, a POSITA would have been motivated to reset the LBT failure counter for the new BWP to clear the count and start the counting from the beginning. *Id.*

A POSITA would have had a reasonable expectation of success as it would have been straightforward for a POSITA to implement *Alfarhan*’s teachings of resetting a counter when switching BWPs in *Shi*’s method. Kakaes, ¶278. In fact, *Shi* already teaches how to reset the LBT failure counter under certain circumstances. *Shi*, 5:29-30. Thus, it would simply be a matter of changing the

condition or adding another condition upon which *Shi*'s method resets the LBT failure counter. Kakaes, ¶278. Further, as mentioned above, *Alfarhan* and *Shi* include similar components that perform similar functions. Thus, it would have been straightforward to implement *Alfarhan*'s additional disclosure regarding resetting a counter when switching BWPs in *Shi*'s existing LBT method. *Id.*

2. Claim 18

- a. **“The method of claim 10, further comprising:
resetting the LBT failure counter when the UE
switches from an active Bandwidth Part (BWP) of the
UE to another BWP.”**

As discussed for claim 9, *Shi*, *Hong*, and *Alfarhan* render obvious the additional limitations of claim 18. Kakaes, ¶279.

VII. MANDATORY NOTICES

A. Real Party-in-Interest

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

B. Related Matters

Hannibal IP LLC asserted the '535 patent in the following litigation:
Hannibal IP, LLC v. Samsung Electronics Co., Ltd., Case No. 4:25-cv-00200 (E.D. Tex.).

The '535 patent claims priority to U.S. Provisional Application No. 62/790,099. U.S. Patent Application No. 17/592,664, now U.S. Patent No. 11,805,544; and U.S. Patent Application No. 18/370,986, which is pending, each claim priority to the '535 patent.

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Please address all correspondence to counsel at the addresses above.

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

VIII. GROUNDS FOR STANDING

Petitioners certify that the '535 patent is available for IPR and that
Petitioners are not barred or estopped from requesting IPR challenging the patent
claims on the grounds identified herein.

IX. CONCLUSION

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

Dated: July 11, 2025

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

CLAIMS APPENDIX

1. **[1pre]** A user equipment (UE) comprising:
[1a] one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
[1b] receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
[1c] increase an LBT failure counter when the MAC entity receives the LBT failure indication;
[1d] determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
[1e] reset the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.
2. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: switch an active

Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.

3. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: indicate, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.
4. The UE of claim 3, wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a Radio Link Failure (RLF) recovery procedure.
5. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).
6. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: transmit, to a master

node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

7. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: receive a configuration that indicates the threshold.
8. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the threshold is reconfigured.
9. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.
10. **[10pre]** A method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE), the method comprising:

- [10a] receiving, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
 - [10b] increasing an LBT failure counter when the MAC entity receives the LBT failure indication;
 - [10c] determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
 - [10d] resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.
11. The method of claim 10, further comprising: switching an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.
12. The method of claim 10, further comprising: indicating, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.
13. The method of claim 12, further comprising: performing a Radio Link Failure (RLF) recovery procedure.

14. The method of claim 10, further comprising: performing a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).
15. The method of claim 10, further comprising: transmitting, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).
16. The method of claim 10, further comprising: receiving a configuration that indicates the threshold.
17. The method of claim 10, further comprising: resetting the LBT failure counter when the threshold is reconfigured.
18. The method of claim 10, further comprising: resetting the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.

19. The user equipment (UE) of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.
20. The method of claim 10, further comprising: resetting the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.

CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, Petitioners certify that the word count of Petitioners' Petition for *Inter Partes* Review (exclusive of any table of contents, table of authorities, mandatory notices under § 42.8, certificates of service and word count, and list of exhibits or claim listing) as measured by Microsoft Word is 13,981.

Dated: July 11, 2025

By: /Joshua L. Goldberg/

Joshua L. Goldberg

Lead Counsel

Reg. No. 59,369

CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105(a), the **Petition for *Inter Partes* Review, the associated powers of attorney, and Exhibits 1001-1023** were served via FedEx Priority Overnight on July 11, 2025, on the correspondence address of record below indicated in the Patent Office's Patent Center for U.S. Patent No. 11,272,535:

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Dated: July 11, 2025

Respectfully submitted,

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