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 IPR2025-01187
Patent No. 11,057,896

PETITION FOR *INTER PARTES* REVIEW

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I. PRELIMINARY STATEMENT

Petitioners Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (collectively "Samsung"), request *inter partes* review of U.S. Patent No. 11,057,896 ("the '896 patent"; Ex. 1001), assigned to Patent Owner Hannibal IP, LLC, and cancellation of claims 1-19.

The challenged claims are directed to methods and devices for 5G wireless communication and relate to using known Control Resource Sets ("CORESETs"). In 5G systems, a User Equipment ("UE," e.g., smartphone) often receives multiple CORESETs from a Base Station ("BS," e.g., cell tower). The UE then uses control information from these CORESETs to receive other signals from the BS. Under the 5G Standard existing in 2018, before the earliest priority date of the '896 patent, a UE could "monitor" multiple CORESETs configured for that UE. And because the UE could receive multiple CORESETs, each on a different beam, the 5G Standard instructed that a UE could assume some beams are interchangeable based on Quasi Co-Location ("QCL") assumptions transmitted to the UE. The 5G Standard also had rules for determining when to use a QCL assumption of a CORESET for purposes of receiving other known reference signals and data, e.g., the aperiodic Channel Status Information-Reference Signal ("CSI-RS") or the Physical Downlink Shared Channel ("PDSCH"). These known rules included selecting a CORESET with the "lowest" CORESET ID and determining a "scheduling offset" between the last symbol of the Physical Downlink Control Channel ("PDCCH") and the first symbol of the data scheduled for reception.

The '896 patent presents as inventive selecting the "lowest" CORESET IDs of only the "monitored" CORESETs to apply its QCL assumption. For example, claim 1 of the '896 patent requires applying a QCL assumption to a monitored CORESET "configured with a lowest CORESET [ID]" to receive a CSI-RS. Similarly, claim 10 requires applying a QCL assumption to a monitored CORESET "configured with a lowest CORESET [ID]" and based on a "scheduling offset" between an end of a PDCCH and the beginning of a PDSCH.

But the '896 patent should not have issued. The then-existing 5G Standard had already reflected these concepts. And more importantly, the particular technique that the '896 patent claims was previously proposed to the 5G Standard-setting body by others before the '896 patent's earliest priority date. For example, the proposals from Intel ("*Intel*"; Ex. 1006) and ZTE ("*ZTE*"; Ex. 1011) to the standard-setting body described ways to modify the 5G Standard in the same way the '896 patent then claimed. Others watching these 5G proposals, such as the *Intel* and *ZTE* proposals submitted online, knew about them.

Notably, the prior art *Intel* and *ZTE* proposals were not considered by the Examiner during the examination that led to the '896 patent. As set forth below, claims 1-19 of the '896 patent would have been obvious based on known UEs implementing 5G and proposals like *Intel* and *ZTE*. The Board should thus institute review and cancel all challenged claims.

II. STATE OF THE ART

A. 5G Telecommunication

As the '896 patent acknowledges, the alleged invention was aimed at the "next generation (e.g., Fifth Generation (5G) New Radio (NR))" of wireless telecommunication systems. Ex. 1001, 1:24-27. The development of 5G was a collaborative effort involving hundreds of engineers from many companies. Bims ¶¶46-58. These efforts often focused on a UE's speed and efficiency when handling "downlink" communications from the BS to the UE. *Id*.

The '896 patent describes and claims several fundamental aspects of a 5G system. These include: (a) Beams, (b) Bandwidth Parts (BWPs), (c) Control Resource Sets (CORESETs), (d) Quasi Co-Location (QCL) assumptions, and (e) other aspects like Physical Downlink Control Channel (PDCCH), Downlink Control Information (DCI), aperiodic Channel State Information-Reference Signals (CSI-RS), and Physical Downlink Shared Channel (PDSCH). While presented in a complex manner in the '896 patent's claims, these were fundamental aspects of 5G well known before the patent's filing. *Id*., ¶59.

Because the '896 patent focuses on a UE's downlink functionality, the below background generally describes these known 5G terms, along with the role each has in a downlink. *Id*., ¶60. Figures 1 and 2 below further illustrate these 5G terms. As explained further in the sections below, Fig. 1 concerns a more-typical situation where a "scheduling offset" is greater than a threshold, while Fig. 2 concerns a less-typical situation where the "scheduling offset" is less than the threshold.

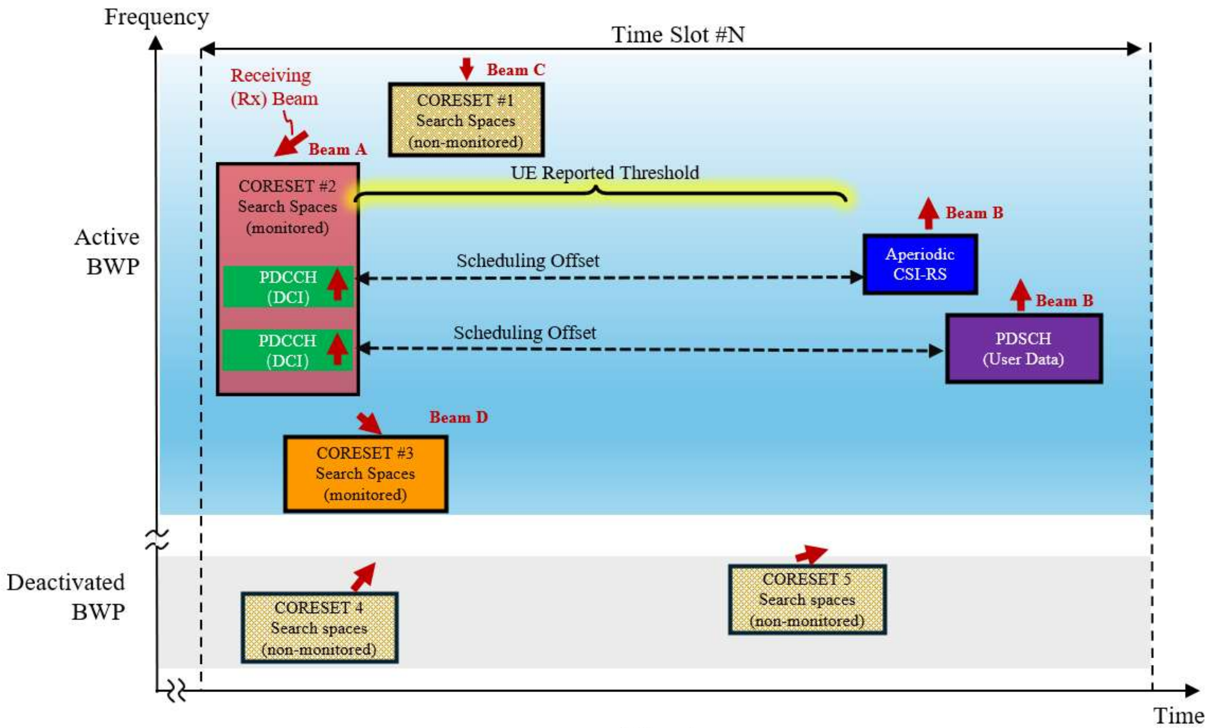

Fig. 1

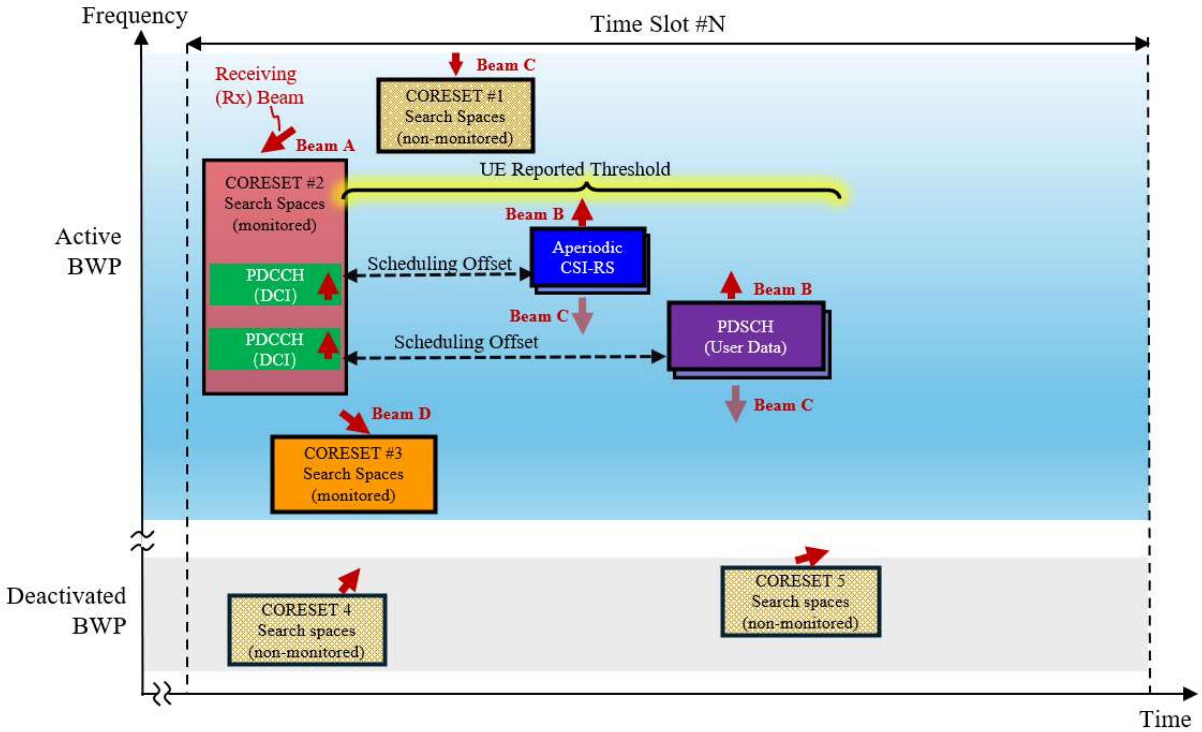

Fig. 2

Id.

B. A UE's Known Downlink in 5G

5G was known to provide substantially faster speeds, lower latency, and increased capacity, while increasing its flexibility. The following references the above figures and describes a typical 5G downlink. *Id*.

1. Beams

Typically, each BS transmits multiple beams to the UEs in that BS's serving cell. *Id*., ¶62. Because the beams received by a UE have varying signal reliability (e.g., due to interference, the UE's location, the UE's velocity, etc.), the 5G Standard defined how the UE may select which beam(s) to use, as well as how to use a CORESET on one beam (e.g., for scheduling the receipt of a PDSCH) and "switch" to another beam for receiving the scheduled PDSCH. *Id*., ¶63. For example, Figs. 1 and 2 show CORESETs #1 - #5, each on a different beam (e.g., beams C, A, and D for CORESETs #1, #2, and #3, respectively).

2. Bandwidth Parts (BWPs) and Time Slots

5G divides its frequency spectrum into BWPs. Each UE can have up to four BWPs, each BWP defining a different bandwidth and other differences. 5G also uses "time slot" as a basic unit in the time domain. And within the active BWP,[1] a UE may receive one or more beams during any one time slot. The physical resources allocated to a UE's BWP can thus be visualized via a grid in which the x-axis is the time domain (containing one or more time slots) and the y-axis is the frequency domain (containing the subcarriers of each available BWP). *Id*., ¶64.

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[1] Only one BWP is "active" at any given time for each UE. Typically, a UE can receive and monitor data (e.g., CORESETs, PDSCHs, etc.) within only the active BWP. Also, because each BWP has a different configuration, this enables 5G to offer increased flexibility by allowing a different BWP to become "active." For example, if a UE demands more data, then the UE can activate a BWP with a wider bandwidth. Bims n.3. The above figures illustrate CORESETs transmitted in the "active" BWP and those transmitted in a "deactivated" BWP.

For a downlink, an activated BWP specifies where in the frequency bandwidth a UE looks for data from a BS. Because the UE is allocated only one active BWP during any one time slot, the BS will then transmit data to that UE in that time slot(s) and by using the carrier frequency(ies) for that active BWP. *Id*., ¶65.

3. Control Resource Sets (CORESETs)

In 5G, a BS transmits within a BWP a PDCCH in various CORESETs on respective beams to each UE. *Id*., ¶66. Figs. 1 and 2 show five CORESETs transmitted to the UE, where a PDCCH in each CORESET is transmitted on a particular beam. The BS configures these CORESETs at a scheduled time within a time slot, usually at the slot's beginning. The UE can monitor up to 3 CORESETs within the currently active BWP. *Id*., ¶66. As shown, the BS can configure other CORESETs in the deactivated BWP(s) for the UE, but the UE will not monitor those. The UE may also not monitor other CORESETs within the active BWP (e.g., because the UE has not configured itself to do so). For example, Figs. 1 and 2 show the UE does not monitor CORESET #1 in the active BWP and does not monitor CORESETs #4 and #5 in a deactivated BWP.

Each CORESET has an associated time range (within a time slot) and an associated frequency range (within a BWP). And because the UE can receive multiple overlapping CORESETs during one time slot of the active BWP, each

CORESET has a unique identifier (e.g., the CORESET ID). *Id*., ¶67. Figs. 1 and 2 use #1 - #5 to signify such CORESET IDs. The BS will separately inform the UE of the IDs of all CORESETs configured for the UE in at least the currently active BWP. *Id*.

Each CORESET may contain, within its search spaces, control information that the UE will use during an associated downlink. A search space may include a PDCCH containing the DCI. The UE uses this PDCCH to schedule receiving the aperiodic CSI-RS or receiving the PDSCH (i.e., the payload data). *Id*., ¶68. The PDCCH thus functions as a control channel for transmitting schedule information, and the PDSCH functions as a data channel for transmitting messages. *Id*. More specifically, the DCI contains the instructions that tell the UE when (in the time domain) and where (in the frequency domain) to receive and decode the PDSCH payload data (e.g., web or video content). *Id*.

In 5G, the UE typically does not know which PDCCH it receives contains a DCI intended for that UE. *Id*., ¶69. This is because the DCI may be for a different UE. *Id*. The UE thus has to "search" through all the "search spaces" of the CORESET by decoding each PDCCH to determine if the decoded information contains a DCI for that UE. *Id*. If the UE does decode a DCI for that UE, then the UE will configure itself to receive the associated PDSCH. *Id*. This process requires a UE to blindly monitor the CORESETs. While this blind decoding has a complexity cost, it increases flexibility since scheduling the PDCCH's receipt is not needed. *Id*.

However, CORESETs configured for a UE may be "monitored" or "non-monitored." *Id*., ¶70. A "monitored" CORESET is one where the UE has been configured to search through the search spaces of that CORESET to determine if they include any DCI for that UE. *Id*. The UE does this at designated "monitoring occasions." *Id*. Other CORESETs are simply "not monitored" by the UE. *Id*.

At a more granular level, the smallest element within a CORESET is called a Resource Element ("RE"). Each RE corresponds to one symbol within the time domain. Thus, for example, a PDCCH within a search space may be composed of symbols. *Id*., ¶71.

Finally, as indicated above, a CORESET may also contain a DCI for receiving an aperiodic CSI-RS from the BS. Per the 5G Standard, the UE may use this CSI-RS to estimate channel quality, e.g., to track signal quality and monitor reception conditions. *Id*., ¶72.

C. Known "Beam Switching" in 5G

As discussed, it was already known to use different beams in a downlink. Thus, the flexibility in 5G was already understood to allow for the use of multiple beams when scheduling the receipt of the CSI-RS or PDSCH. *Id*., ¶73.

For example, a BS can configure multiple CORESETs that overlap at the UE in the time domain during a single cell operation. *Id*., ¶74. If the UE monitors each of these CORESETs (e.g., the UE decodes the search spaces within these CORESETs to determine which contain the PDCCH for that UE), then the UE may detect a PDCCH for that UE and use that PDCCH to schedule receiving the associated CSI-RS or PDSCH. *Id*.

For example, in Figs. 1 and 2 above, the UE can blindly decode CORESETs #2 and #3 but detect that CORESET #2 contains, for the UE, a PDCCH with DCI for scheduling receipt of the aperiodic CSI-RS and another PDCCH with DCI for scheduling receipt of the PDSCH. *Id*., ¶75.

Under the 5G Standard in 2018, if more than one monitored CORESET contained the PDCCH for the UE, then that UE could choose to use, e.g., for receiving the PDSCH, the information of the CORESET having the lowest ID. *Id*., ¶76. The UE could then switch to a new beam (e.g., for receiving the PDSCH) based on a threshold offset and other priority rules. *Id*.

For example, in Fig. 1 above, CORESET #2 is received with a beam direction that points to the down-left (e.g., beam A), while the DCI carried by CORESET #2 indicates that the receiving beam direction of the PDSCH points directly upward (e.g., beam B) (see red arrows). If the "scheduling offset" is larger than the associated UE threshold, then the UE could switch from beam A to beam

B without difficulty. But as shown in Fig. 2, if the "scheduling offset" is below the threshold, then the relevant 5G Standard instructed using the QCL of CORESET #1 (i.e., the CORESET with the lowest ID amongst all monitored and non-monitored CORESETs), and thus beam C with the direction that points directly downward. Thus, in the Fig. 2 scenario, the UE would apply the QCL of CORESET #1 to receive either the CSI-RS or the PDCCH on beam C. *Id*., ¶77.

D. Known "Quasi Co-Location (QCL)" Assumptions in 5G

A 5G system can assume some beams transmitted to the UE are reasonably close to one another in terms of reliability. When the beams are determined to have a high degree of similarity, the UE can interchange these beams without much degradation in performance. The UE can thus "assume" any of these beams can deliver data with sufficient reliability and that they each locate the UE in the wireless channel with reasonable accuracy. This is called a "quasi co-location" (QCL) assumption. *Id*., ¶78.

In 5G, a CORESET contains a Transmission Configuration Indication (TCI) defining a state indicating a QCL assumption (e.g., with respect to a PDCCH and a

CSI-RS or a PDSCH).[2] *Id.*, ¶79. The UE can use the QCL assumptions to compare the beams (e.g., a beam including a PDCCH and a beam including a PDSCH).

To further explain, the QCL information can be used to determine which beams are similar. *Id.*, ¶80. The UE may then assume that certain beams are similar for a particular downlink. *Id.* (explaining that Fig. 2 above shows a scenario where the UE would assume, under the 5G Standard, that beams B and C were similar based on the QCL of CORESET #1).

In general, a QCL assumption can be used to determine that a beam associated with a CORESET is a potential substitute for the beam used to receive subsequent information (e.g., CSI-RS or PDSCH). *Id.*, ¶81. So, if the BS transmits multiple CORESETs using beams deemed interchangeable due to their QCL assumption, the relevant 5G Standard stated that the UE can receive subsequent transmissions from the BS using an alternative beam deemed interchangeable within a designated time window. For example, in Fig. 2 above (which concerns a scenario where the scheduling offset is below the threshold), if the UE determines based on the QCL assumptions that beam C (of CORESET #1) and beam B

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[2] The QCL included within the TCI can get more detailed beyond the scope of this Petition. For example, the QCL can consist of different types, can define different property similarities, can define relationships with respect to DM-RS ports, etc.

(transmitting the PDSCH) are interchangeable, then the UE can use the CORESET of beam C to schedule receipt of a PDSCH of beam B – again, when the "scheduling offset" between the DCI of CORESET #2 and the PDSCH is less than a threshold. *Id.*, ¶81.

The 5G Standard instructed that the QCL is included in the part of the DCI that schedules a CSI-RS or PDSCH transmission. Specifically, the QCL is in the TCI field of the DCI. *Id.*, ¶82.

III. THE '896 PATENT

A. Alleged Invention

The '896 patent discusses several optional changes to the 5G Standard existing in 2018. But its claims relate to the subsection of the '896 patent entitled "Non-Monitored CORESET for a Default Aperiodic CSI-RS Beam," which is discussed with respect to FIG. 3. Ex. 1001, 13:1-45, FIG. 3. This embodiment concerns the downlink signaling from the BS to the UE. *Id.*; Bims ¶83.

The '896 patent addresses the downlink procedure that a UE performs when processing multiple CORESETs in a 5G system. Ex. 1001, 1:41-44, 1:66-2:20. The '896 patent's specification begins with the alleged "ambiguity" in the then-existing 5G specifications that caused concerns with "beam switching." *Id.*, 1:32-40.

To address this known problem of "beam switching," the '896 patent describes using the relevant 5G Standard's QCL assumptions for received beams. *Id.*, 1:17-20, 1:41-44. As the '896 patent acknowledges, a UE, in the then-existing

5G, monitors at least one CORESET in the active BWP in a time slot. *Id.*, 17:16-18, FIG. 9 (step 902). The BS may also have transmitted a non-monitored CORESET – perhaps one with the lowest CORESET ID in the active BWP – to the UE. *Id.*, 13:19-41. The relevant 5G Standard allowed the QCL for such a non-monitored CORESET to be used to receive an aperiodic CSI-RS if the "scheduling offset" was small enough. *Id.*, 13:32-41.

To reduce the potential for "beam switching" to a non-monitored CORESET when scheduling the receipt of a CSI-RS or PDSCH, the '896 patent proposes using the QCL assumption of the CORESET with the lowest CORESET ID of all "monitored" CORESETs, rather than amongst all (monitored and non-monitored) CORESETs. *Id.*, 13:32-45. The '896 patent also explains that the above can be readily applied to "scheduling a PDSCH from a PDCCH" when a small enough "scheduling offset" occurs. *Id.*, 17:23-36. The '896 patent describes that this is the same "scheduling offset" used in the 5G Standard, namely, an offset between an end of the PDCCH and a beginning of the PDSCH. *Id.*

B. Prosecution History

The application that issued as the '896 patent was filed on October 22, 2019. *Id.*, cover page, (22). It claims priority to U.S. Provisional Application No. 62/754,165, filed on November 1, 2018. *Id.*, cover page, item (60). During prosecution, the application received a first-action allowance. Ex. 1002, 176-185. The Examiner did not have the prior art in this Petition. *See generally* Ex. 1002.

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.[3]

IV. 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 five years of experience working with wireless mobile telecommunications systems. Additional relevant work experience can compensate for less education, and vice versa. Bims ¶¶95-96.

[3] Petitioners reserve the right to argue in an appropriate forum that certain limitations in the challenged claims are indefinite. Petitioners also reserve the right to challenge the priority date here and/or in other proceedings.

V. STATEMENT OF PRECISE RELIEF REQUESTED

A. Prior Art

None of the below described prior art was considered by the Examiner during prosecution.

1. *Guo*

U.S. Patent Application Publication No. 2018/0343653 ("*Guo*"; Ex. 1005) was published on November 29, 2018, and has a nonprovisional filing date of May 17, 2018. *Guo*, cover page, (22), (43). It is thus prior art to the '896 patent under at least 35 U.S.C. § 102(a)(2).

Guo is analogous art to the '896 patent because it too concerns 5G wireless communications, including using QCL assumptions for beam operations. *Guo*, title, [0044]-[0048], [0052]-[0053], [0098]-[0099], [0121]-[0214]; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. Indeed, *Guo* even concerns the same problem/solution that the '896 patent alleges: reducing unfavorable "beam switching" by using a CORESET's QCL to receive subsequent signals, such as a DL RS (e.g., aperiodic CSI-RS) or a PDSCH. *Guo*, [0125], [0134]-[0136], [0190]; Ex. 1001, Abstract, 13:1-45; Bims ¶¶98-99.

2. *Intel*

3GPP TSG RAN WG1 Meeting #94b R1-1810751, titled "Remaining Issues on Beam Management" and submitted by Intel Corporation ("*Intel*"; Ex. 1006), was made publicly available not later than September 29, 2018, on 3GPP's ftp server where it was accessible and known to be found by POSITAs. ("Rodermund"; Ex. 1029), ¶¶25, 109-117. *Intel* was also made publicly available and discussed by POSITAs at the 3GPP WG1 #94b meeting on October 8-12, 2018. *Id*. *Intel* is thus prior art to the '896 patent under 35 U.S.C. § 102(a)(1).

Intel is analogous art to the '896 patent because it too concerns 5G wireless communications, including using QCL assumptions for beam operations. *Intel*, 1-15; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. In fact, *Intel* was a proposed improvement to the then-existing 5G Standard itself. And *Intel* offered the same solution as the '896 patent: using a CORESET's QCL assumption to receive a PDSCH or CSI-RS. *Intel*, 1-4, 11-12; Ex. 1001, Abstract, 13:1-45; Bims ¶¶100-101.

3. ***ZTE***

3GPP TSG RAN WG1 Meeting #94 R1-1808197, titled "Maintenance for Reference signals and QCL" and submitted by ZTE Corporation ("*ZTE*"; Ex. 1011), was made publicly available not later than August 11, 2018, on 3GPP's ftp server where it was accessible and known to be found by POSITAs. Rodermund, ¶¶20, 63-71. *ZTE* was also made publicly available and discussed by POSITAs at the 3GPP WG1 #94 meeting on August 20-24, 2018. *Id*. *ZTE* is thus prior art to the '896 patent under 35 U.S.C. § 102(a)(1).

ZTE is analogous art to the ’896 patent because it too concerns 5G wireless communications, including using QCL assumptions for beam operations. *ZTE*, 11-14; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. Indeed, *ZTE* is another reference directed to the same solution as the ’896 patent: reducing unfavorable “beam switching” by using a CORESET’s QCL assumption to receive subsequent data, such as PDSCH. *ZTE*, 11-14; Ex. 1001, Abstract, 13:1-45; Bims ¶¶102-103.

4. *5G-Standard*

3GPP TS 38.214 v15.3.0, titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15)” (“*5G-Standard*”; Ex. 1012), is the relevant 5G Standard existing at the time of the alleged invention of the ’896 patent and at the time of the *Intel* and *ZTE* proposals. *5G-Standard,* relied upon as a primary reference in Grounds 3 and 4, was made publicly available not later than October 1, 2018, on 3GPP’s ftp server where it was accessible and known to be found by POSITAs. Rodermund, ¶¶31, 165-173. *5G-Standard* is thus prior art to the ’896 patent under 35 U.S.C. § 102(a)(1).

5G-Standard is certainly analogous art to the ’896 patent. It concerned 5G wireless communications as well as determining QCL assumptions for beam operations. *5G-Standard*, 8-72; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. It also concerned the use of a QCL assumption of a CORESET to receive a subsequent signal, such as PDSCH or CSI-RS. *5G-Standard*, 26-35, 39-41; Ex. 1001, Abstract, 13:1-45; Bims ¶¶104-105.

B. Challenges

Ground	Challenged Claims	35 U.S.C. Section	Prior Art
1	1-9, 11-19	103	*Guo* and *Intel*
2	10	103	*Guo* and *ZTE*
3	1-9, 11-19	103	*5G-Standard* and *Intel*
4	10	103	*5G-Standard* and *ZTE*

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-9 and 11-19 Are Obvious by *Guo* and *Intel*

1. Rationale for Combining *Guo* and *Intel*

Guo describes a UE consistent with the 5G Standard. *Guo*, [0044]-[0048], [0052], [0098]-[0099], [0105], [0121]; Bims ¶109. Per the 5G Standard and as *Guo* itself recognizes, the disclosed UE will configure a QCL to receive aperiodic CSI-RS. *Guo*, [0185], [0189]; Bims ¶109. The 5G Standard addressed this by specifying that "the UE applies a default QCL assumption" when "the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold." *5G-Standard*, 40; Bims ¶¶110-111. The Standard also specified that a UE uses the CORESET with the "lowest" ID of all CORESETs (whether monitored or not) configured for the UE in the current time slot and active BWP. *5G-Standard*, 26. While arguably implicit in *Guo* and the then-existing 5G Standard, *Guo* does not explicitly disclose that the UE would use the CORESET with the "lowest" ID amongst only the "monitored" CORESETs, and does not explicitly disclose that the UE would use that CORESET to schedule the CSI-RS.

Intel, however, expressly proposed a change to the 5G Standard itself that had these features. Specifically, *Intel* is a 3GPP meeting proposal to improve the 5G Standard. It recommended applying the QCL assumption of the monitored CORESET with the lowest ID for receiving the CSI-RS:

> The ***default beam for CSI-RS for CSI acquisition follows*** the TCI state in ***monitoring [a] CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID*** when multiple CORESETs are configured.

Intel, 1 (emphases added). Here, "the TCI state" refers to the type of QCL. *See, e.g.*, *5G-Standard*, 26 (explaining how the TCI states configure the QCL); Bims ¶112. Thus, *Intel* proposed using the CORESET "with [the] lowest CORESET ID" amongst only those CORESETs the UE "monitor[s]." Bims ¶112. The QCL of that monitored CORESET, according to *Intel*, would then be used to receive the CSI-RS. *Intel*, 1. *Intel* says this makes the UE "better" (e.g., more accurate). *Id.*; Bims ¶112.

Thus, a POSITA would have found it obvious to configure *Guo*'s 5G UE to use *Intel*'s proposed improvement of defaulting to the QCL of the "monitor[ed]" CORESET with the lowest ID when the offset is below a threshold. Bims ¶113.

a. Motivation to Combine

A POSITA would have been motivated to combine *Guo* and *Intel* for several reasons. Bims ¶¶114-117.

First, a POSITA would have appreciated that *Intel*'s method benefits *Guo*'s 5G UE. As *Intel* itself teaches, "it is better" that the CSI-RS and the PDSCH use the same "default beam" associated with the CORESET having the lowest ID amongst all monitored CORESETs, as this allows the CSI-RS to convey more accurate channel conditions for the PDSCH. *Intel*, 1-2; Bims ¶115. Thus, by modifying *Guo*'s 5G UE to include *Intel*'s 5G improvement, *Guo*'s UE can "better" determine which QCL to use when receiving multiple CORESETs. Bims ¶115. A POSITA would recognize these benefits. *Id*.

Second, the 5G Standard implemented by *Guo*'s UE provided its own motivation to apply *Intel*'s teaching. Bims ¶116. Specifically, the Standard specified that "a default QCL assumption" would be used to receive the CSI-RS when "the scheduling offset … is smaller" than the threshold. *5G-Standard*, 40. While neither *Guo* nor the Standard specified this "default QCL assumption," *Intel* does. *Intel*, 1; Bims ¶116. Specifically, *Intel* proposes this default QCL come from the "monitor[ed]" CORESET with the "lowest" ID. *Intel*, 1. Thus, by modifying *Guo*'s 5G UE to include *Intel*'s 5G improvement, *Guo*'s UE would avoid arbitrary beam switching and use, instead, the default proposed by *Intel*. Bims ¶116.

Third, *Intel* resolves the problem that *Guo* itself identifies. Bims ¶117. Specifically, in discussing the selection of a QCL for receiving a PDSCH, *Guo* describes that a 5G UE "might meet a difficulty in choosing the proper Rx beam" for that PDSCH when the DCI and that PDSCH are "transmitted in the same slot." *Guo*, [0125]. As *Guo* explains, "[o]nly after finishing decoding the DCI" can the UE determine which beam receives the PDSCH. *Id. Guo* recognizes, though, that if the "scheduling offset" between the DCI and the PDSCH is too small, the UE will have difficulty switching beams. *Guo*, [0125]-[0126], [0134]; Bims ¶117. While *Guo* describes this in connection with the PDSCH, a POSITA would have understood that the same problem applies to the aperiodic CSI-RS (or any other transmission that the UE needs to schedule). Bims ¶117; *Guo*, [0189]. Indeed, *Intel* explains one can improve a UE by using the QCL of the CORESET with the "lowest" ID amongst all "monitor[ed]" CORESETs when receiving the CSI-RS, in situations when the "scheduling offset" is too small. *Intel*, 1; Bims ¶117.

b. Expectation of Success

A POSITA would have had a reasonable expectation of success in combining *Guo* and *Intel*, and would have expected this combination to yield a predictable solution. The combination requires nothing more than a direct incorporation of *Intel*'s 5G improvement into *Guo*'s 5G UE. The resulting combination would thus be "better" by determining the default QCL (coming from the particular CORESET corresponding to the claimed "first CORESET") for receiving the CSI-RS when the scheduling offset is too small. Bims ¶118.

Also, a POSITA would have had a reasonable expectation of success in making this combination because *Intel*'s proposed 5G solution comports with *Guo*'s UE complying with the then-existing 5G Standard. Bims ¶119. Indeed, *Intel*'s approach, as well as *Guo*'s and the Standard's approach, all taught using CORESETs with the lowest ID. *Id*. *Intel* further taught it was "better" to do this amongst only the "monitor[ed]" CORESETs. *Intel*, 1. And the *Intel* solution was proposed to the engineering community attending the 5G Standard's development meetings. *Intel*, 1; Bims ¶119. All this suggests that POSITAs would readily adopt and know how to use *Intel*'s proposed solution to improve *Guo*'s UEs. Bims ¶119; *see also Keynetik, Inc. v. Samsung Elecs. Co.*, No. 2022-1127, 2023 WL 2003932, at *2 (Fed. Cir. Feb. 15, 2023) (citation omitted) ("Normally, once the function to be performed by software has been identified, writing code to achieve that function is within the skill of the art.").

2. Independent Claim 1

a. [1Preamble]: "A user equipment (UE) comprising:"

Guo discloses a UE for use with the 5G Standard. *Guo*, [0052]; Bims ¶120. As shown in *Guo*'s FIG. 1, network 100 includes multiple UEs 111-116 communicating with BSs.

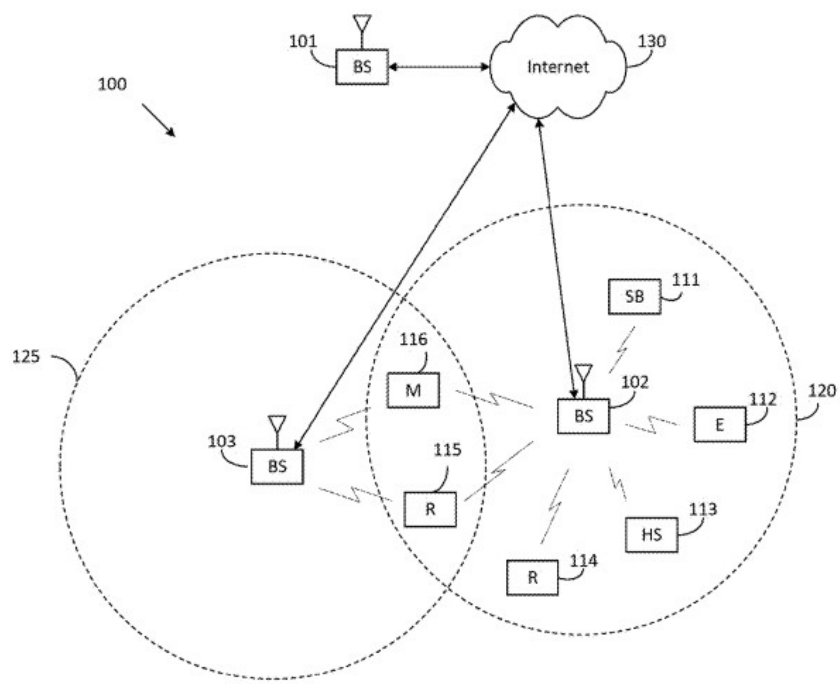


FIG. 1

Guo, [0050]-[0052], FIG. 1.

b. [1a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

Guo discloses [1a]. Bims ¶121. *Guo*'s UE, like any UE for use in 5G, includes these elements. For example, *Guo*'s FIG. 3 shows that each UE has a memory storing an operating system and applications, both having the claimed "computer-executable instructions." *Guo*, [0067], [0071], FIG. 3; *see also Guo*, [0017] (explaining that "application" refers to "computer programs, software components, [or] sets of instructions" "embodied in a computer readable medium"). *Guo* further explains that memory 360 includes non-transitory computer-readable media, such as random access memory ("RAM"), flash memory, or read-only memory ("ROM"). *Guo*, [0073]; *see also Guo*, [0017] (explaining the disclosed "non-transitory computer readable medium").

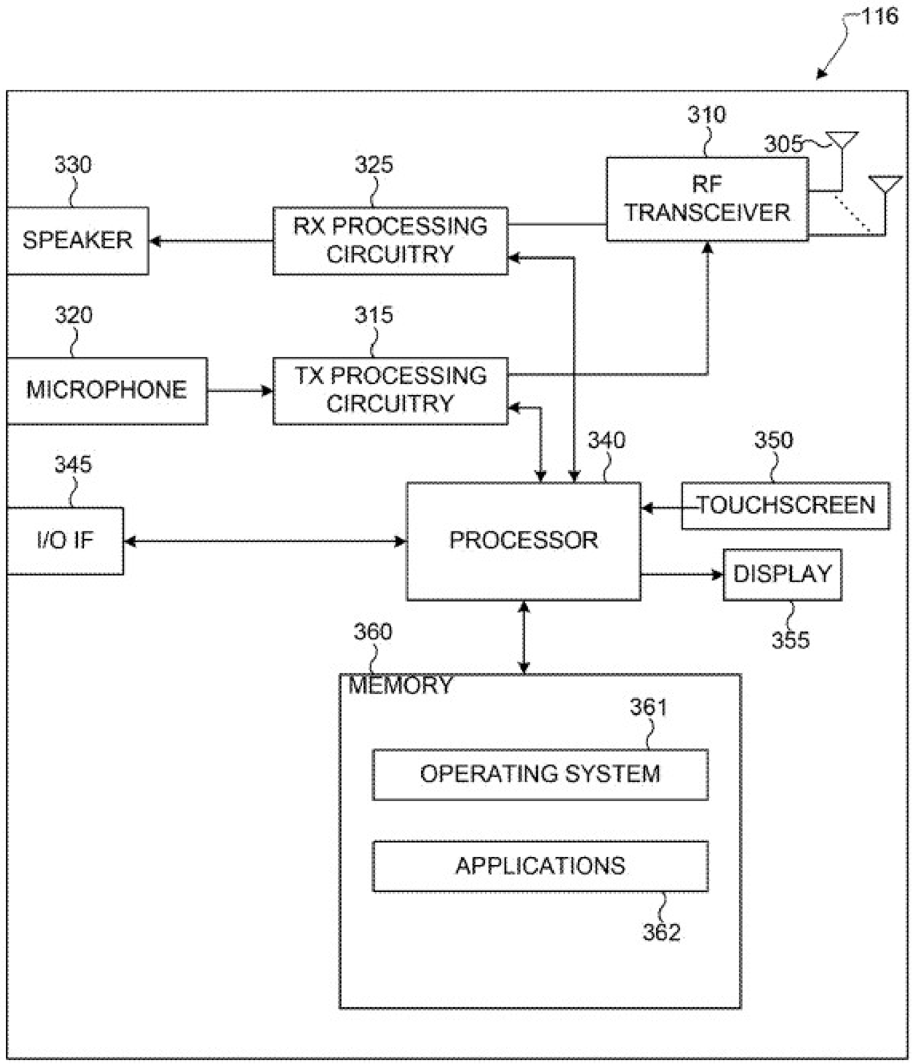


FIG. 3

Guo, FIG. 3.

c. [1b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

Guo discloses [1b]. Bims ¶122. *Guo*'s FIG. 3 (reproduced above) shows that *Guo*'s UE has a processor 340 coupled to memory 360. *Guo*, [0067], [0073],

FIG. 3. Processor 340 executes the instructions in memory to perform the 5G operations. *Guo*, [0070]-[0071].

d. [1c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and"

Guo discloses [1c]. Bims ¶¶123-125. First, *Guo* discloses a "plurality of" CORESETs "configured for the UE," as claimed. A 5G network, like that in *Guo*, supports up to twelve CORESETs for a UE, with three within each BWP. *See Guo*, [0044]-[0048] (explaining the disclosed UE implements 5G); *Intel*, 1 (describing "multiple CORESETs are configured" for a UE in a 5G system); Bims ¶123. *Guo*'s use of "one or more" also indicates that multiple CORESETs are configured for its UE. *Guo*, [0134]. *Guo*'s use of the "lowest CORESET ID" (*id.*; *see also Guo*, [0133]) also indicates that multiple CORESETs are configured for its UE, as the UE would otherwise have no need to select the "lowest" ID. Bims ¶124.

Second, *Guo* discloses that the UE will "monitor" at least one of these CORESETs within an "active [BWP] of a serving cell in a time slot," as claimed. Bims ¶125. Again, a fundamental feature of 5G is that the UE monitors at least one CORESET in the active BWP, where that BWP is associated with a serving cell to enable communication between each UE and BS. *Intel*, 1-2; Bims ¶125. *Guo* comports with this basic 5G feature, explaining that each UE is associated with a serving cell. *See, e.g.*, *Guo*, [0114] ("UE 1111 is associated with the serving cell 1112"); Bims ¶125.

e. [1d]: "apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),"

Guo/Intel renders obvious [1d]. Bims ¶126. As explained in Section VI.A.1 *supra*, *Intel* expressly discloses an improvement to the 5G Standard, where the UE receives an aperiodic CSI-RS by applying the QCL assumption of the "monitoring CORESET … with lowest CORESET ID" (the claimed "first CORESET of a set of one or more monitored CORESETs"). *Intel*, 1 (disclosing that the "default beam for CSI-RS ... acquisition follows the TCI state in [the] monitoring CORESET ... with lowest CORESET ID"); *5G-Standard*, 26 (explaining that the TCI state defines the QCL); Bims ¶126. And as described in Section VI.A.1 *supra*, it would have been obvious to combine the teachings of *Guo* and *Intel* to arrive at the claimed UE. Bims ¶126.

f. [1e]: "wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

Guo/Intel renders obvious [1e]. Bims ¶¶127-129. As discussed for [1d], *Intel* teaches that the "monitoring CORESET" (the claimed "first CORESET") is associated with the "lowest CORESET ID when multiple CORESETs are configured." *Intel*, 1; *supra* Section VI.A.2.e; Bims ¶127.

Regarding the claim requirement that this CORESET is associated with a "monitored search space," both *Guo* and *Intel* teach this. Specifically, a 5G UE monitors a CORESET by monitoring (e.g., blind decoding) one or more of the CORESET's search spaces. *Supra*, Section II.B.3; Bims ¶128. Indeed, the 5G Standard implemented by *Guo* and *Intel* specified that "the UE is provided … an association between the search space set *s* and a control resource set *p* by higher layer parameter *controlResourceSetId*." 3GPP TS 38.213 v15.3.0 ("*TS-38.213*"; Ex. 1019), 71-72; Ex. 1021, *TS38.331*, 309-11; *ZTE*, 12-13; Bims ¶128. A POSITA would thus readily understand that a 5G "monitored" CORESET has a "monitored search space," and, per *Intel* explained above, this search space is configured with the lowest CORESET ID among the monitored CORESETs, as claimed. Bims ¶128.

Finally, as discussed in Section VI.A.1 *supra*, it would have been obvious to combine the teachings of *Guo* and *Intel* to arrive at the claimed UE. Bims ¶129.

3. Claim 2

a. [2a] "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,"

Guo/Intel renders obvious [2a]. Bims ¶¶130-131. As explained for [1d] and [1e] (s*upra* Sections VI.A.2.e and VI.A.2.f), *Guo*/*Intel* discloses the "first

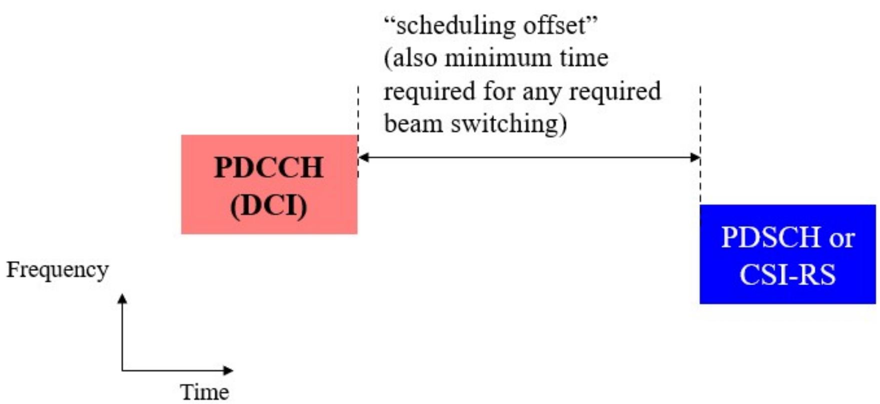
CORESET" of claim 2. Element [2a] additionally requires that the DCI from this "first CORESET" has the DCI used to schedule the aperiodic CSI-RS. Bims ¶130.

Guo's UE did this (i.e., using a CORESET's DCI to schedule an aperiodic CSI-RS) when implementing the 5G Standard. Bims ¶131. The Standard instructed that a "UE may be configured with a DCI field for triggering the aperiodic ZP-CSI-RS." *5G-Standard*, 25. While *5G-Standard* states that UEs "may" do this, UEs commonly did this. Bims ¶131. Indeed, *Guo* itself expressly describes an embodiment where the "DCI triggers the transmission of CSI-RS transmission in the same slot." *Guo*, [0190]. So, *Guo* explicitly discloses this. Bims ¶131; *see Intel*, 1 (disclosing a CORESET has a DCI for the CSI-RS).

b. [2b] "wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold."

Guo/Intel renders obvious, if not implicitly discloses, [2b]. Bims ¶¶132-135. The claim language here specifically defines that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of a resource carrying the aperiodic CSI-RS.

Guo discloses that the scheduling offset concerns "the minimum time duration this UE needs" to decode the DCI before "starting" receipt of the scheduled transmission. *Guo*, [0135] (comparing this offset to a threshold and mentioning this for PDSCH); Bims ¶¶109-111 (explaining this applies to CSI-RS too); *see Intel*, 1 (disclosing the offset is for CSI-RS). As the below diagram illustrates, the UE needs this time to switch from one beam (containing the DCI used to schedule receipt of a transmission) to another beam (containing the actual transmission). Bims ¶133. If the UE does not have enough time, then the UE needs to make a QCL assumption resulting in the reuse of a beam preconfigured for the scheduled transmission. *Id*.; *see also Guo*, [0128] (explaining that if the scheduling offset is below the threshold, then a QCL assumption can be used); s*ee also* s*upra* Sections VI.A.2.e and VI.A.2.f (explaining *Guo/Intel*'s resulting UE uses the QCL of the monitored CORESET with lowest ID to receive the CSI-RS when the "scheduling offset" is less than a "threshold"). All of this comports with the then-existing 5G Standard, instructing that this offset is between "the last symbol" of the PDCCH and "the first symbol" of the aperiodic CSI-RS resources. *5G-Standard*, 40; Bims ¶133.



Accordingly, *Guo/Intel* renders obvious – if not implicitly discloses – that the offset is between "an end" of the PDCCH's last symbol and "a beginning" of the CSI-RS's first symbol, as claimed.[4] Bims ¶134.

To confirm, a POSITA would have been motivated to configure the *Guo/Intel* combination to measure the offset in this specific way because, while other ways are at least possible, the specific claim language is directed to the very offset instructed by the then-existing 5G Standard and for which *Guo*'s UE was intended. Bims ¶135. Moreover, a POSITA would have had a reasonable expectation of success in making this modification because it would simply have required a minor software change to the UE's coded instructions to measure the offset in this precise way. *Id*.

4. Claim 3

a. "The UE of claim 1, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."

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[4] Even Patent Owner itself urges that the 5G Standard discloses this scheduling offset as between "an end of a last symbol" and "a beginning of a first symbol." Specifically, Patent Owner's own Complaint relies on this same effective language as disclosing [2b]. Ex. 1040, ¶ 54.

As explained for claim 1 (s*upra* Section VI.A.2), *Guo/Intel* renders obvious a UE that selects the "monitoring" CORESET with the lowest CORESET ID from amongst the multiple CORESETs "configured" for that UE. Claim 3 requires that the "first CORESET" of claim 1 "overlaps" a second CORESET by "at least one symbol" and that this second CORESET is "non-monitored." In other words, claim 3 broadly requires the existence of an overlapping CORESET configured for the UE that is not monitored. Notably, claim 3 is not directed to instructions configured on the UE, but simply to a CORESET scenario. Bims ¶ 136.

In practice, a UE typically receives multiple CORESETs that "overlap[] … in at least one symbol in a time domain," as claimed—including where those CORESETs are "configured to the UE," as also claimed. Bims ¶137 (explaining when this occurs). Again, both *Guo* and *Intel* concern 5G UEs. *Supra* Section VI.A.1. As the 5G Standard addressed, UEs may "deactivate" a current BWP and "activate" a new BWP. Ex. 1020, *TS-38.321*, 44-46; Bims ¶¶137-138. This could occur, for example, if the UE needed more bandwidth than that offered by the currently active BWP (e.g., if the UE downloads voluminous video data). Bims ¶138. If the BWP changes, then the BS would still transmit other CORESETs "configured to the UE" in the previous BWP. *Id*. Such CORESETs in such a deactivated BWP are not monitored. *Id*. Thus, a POSITA would readily appreciate that *Guo*'s UE would encounter instances where the "first CORESET" of claim 1 "overlaps" with another CORESET (claimed "second CORESET") "in at least one symbol in a time domain," as claimed. Bims ¶138 (discussing such occurrences).[5]

As to the claim's requirement that the second CORESET is "non-monitored" and associated with a "non-monitored search space configured to the UE," this too simply occurs when the UE switches to a new BWP. Bims ¶¶139-140. As explained, when a UE switches to a new BWP, the BS will still transmit CORESETs "configured to the UE" in the previous BWP after switching to the new active BWP. Bims ¶139. Because these CORESETs are no longer in the active BWP, such CORESETs are "non-monitored," and they are thus "associated with a non-monitored search space configured to the UE," as claimed. Bims ¶139. Indeed, as the 5G Standard explained, CORESETs in a deactivated BWP are not monitored. Ex. 1020, *TS-38.321*, 45; Bims ¶¶139-140.

5. Claim 4

a. "The UE of claim 3, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID."

[5] Claim 3 does not require that the claimed "second CORESET" is in the active BWP recited in claim 1. In fact, claim 5, which further depends from claim 3, further recites that this "second CORESET" is from a "deactivated" BWP.

Guo/Intel renders obvious claim 4. Bims ¶¶141-143. Claim 4 is not directed to instructions configured on the UE, but simply to a CORESET's configuration. In this regard, the 5G Standard (that *Guo*'s UE implements) required each CORESET to have an associated "search space" and a "search space ID." Ex. 1019, *TS-38.213*, 71-72; Bims ¶141. The monitored "first CORESET" of *Guo*/*Intel* thus has a "monitored search space" and its own "search space ID," and the non-monitored "second CORESET" has a "non-monitored search space" and its own "search space ID," as claimed. This just follows the 5G Standard, which *Guo* implements. *E.g.*, *Guo*, [0052]-[0053]; Bims ¶141.

As to the claimed scenario where the first search space ID "is lower" than the second search space ID, the 5G Standard did not restrict any numerical ordering of the search space IDs. Bims ¶142. A POSITA would understand that a first space ID being "lower" than a second search space ID is a likely scenario that is also obvious and conventional. Bims ¶¶142-143 (explaining how search space IDs are assigned in 5G and how one is inevitably "lower" than another, including for a monitored search space versus a non-monitored search space). Moreover, because the IDs would not be the same, one would always be "lower" than the other, and the first would routinely be lower than the second. *Id.*

6. Claim 5

a. "The UE of claim 3, wherein the second CORESET is configured on one of: a deactivated Bandwidth Part (BWP); and a deactivated Secondary Cell (SCell)."

Guo/Intel renders obvious claim 5. Bims ¶144. As described with respect to claim 3 (*supra* Section VI.A.4), the claimed "second CORESET" may be configured for a "deactivated Bandwidth Part (BWP)." Bims ¶144.

7. Claim 6

a. "The UE of claim 3, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain."

Guo/Intel renders obvious claim 6. Bims ¶¶145-147. Claim 6 is also not directed to instructions configured on the UE, but again directed to a CORESET scenario. As explained for claim 1 (*supra* Section VI.A.2), *Intel* and *Guo* explain that the UE may monitor multiple CORESETs close to one another, including scenarios where these overlap in "at least one symbol," as claimed. Indeed, *Intel* expressly teaches a CORESET with the "lowest" ID—implicitly stating that the UE monitors multiple CORESETs. *Intel*, 1; Bims ¶145.

A POSITA would further understand that such multiple CORESETs may "overlap[]" in "at least one symbol in the time domain," as claimed.[6] Bims ¶146

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[6] FIGS. 1-4 and 7 of the '896 patent all show overlapping CORESETs. The patent does not disclose any particular functionality for how to do this. Bims n.9. This comports with the simple fact that overlapping CORESETs inevitably occur in 5G. *Id*. And, dependent claim 6 here broadly recites the existence of CORESETs monitored by the UE, rather than instructions done by the UE.

(explaining examples of such occurrences and citing to prior art illustrating such occurrences). At the very least, it would have been obvious to a POSITA that the UE would encounter situations – or to configure the UE to handle such common situations – where multiple CORESETs "overlap[]" in "at least one symbol in the time domain," as claimed. Bims ¶147. Indeed, a POSITA would be motivated to do so because this would configure the UE to handle expected situations, and a POSITA would have had an expectation of success in doing so because to configure the UE to handle such scenarios would have required only minor software changes. *Id*.

8. Claim 7

a. "The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell."

Guo/Intel renders obvious claim 7. Bims ¶¶148-151. Like the other dependent claims, claim 7 is also not directed to the UE's instructions, but simply to the timing of transmissions received by the UE.

As discussed for [1c]-[1e] (*supra* Sections VI.A.2.d-VI.A.2.f), *Guo/Intel* concerns a 5G UE, where that UE monitors plural CORESETs and receives "a resource carrying the aperiodic CSI-RS," as claimed. *See also 5G-Standard*, 40 (discussing relationship between CORESET information and CSI-RS). As also discussed, *Guo/Intel* discloses that these CORESETs and the CSI-RS occur in "the active BWP of the serving cell," as claimed. *Supra* Section VI.A.2.d (explaining a

5G UE is configured to handle plural CORESETs within the activated BWP and in one time slot); Bims ¶149.

As to these CORESETs occurring in the "time slot," *Guo*/*Intel* discloses this too. UEs frequently receive, in practice, multiple CORESETs and a CSI-RS in the same time slot. Bims ¶150. The 5G Standard addressed this conventional scenario with the above-described "offset" for when a PDCCH and a CSI-RS occur too close (e.g., within the same slot). *Supra* Section VI.A.1; *5G-Standard*, 40; Bims ¶150 (explaining when multiple CORESETS and the CSI-RS are in same time slot). *Guo* even explicitly addresses this in an embodiment where CORESETs and the CSI-RS are "in the same slot." *Guo*, [0190]; Bims ¶151. Thus, at the very least, it would have been obvious to a POSITA that the UE would encounter, or be configured to handle, situations where multiple CORESETs and the CSI-RS are in the same "time slot." Bims ¶151. Indeed, a POSITA would be motivated to do so because this would configure the UE to handle common scenarios, and a POSITA would have had an expectation of success in doing so because to configure the UE in this way would have simply required minor software changes. *Id*.

9. Claim 8

a. [8a]: "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and"

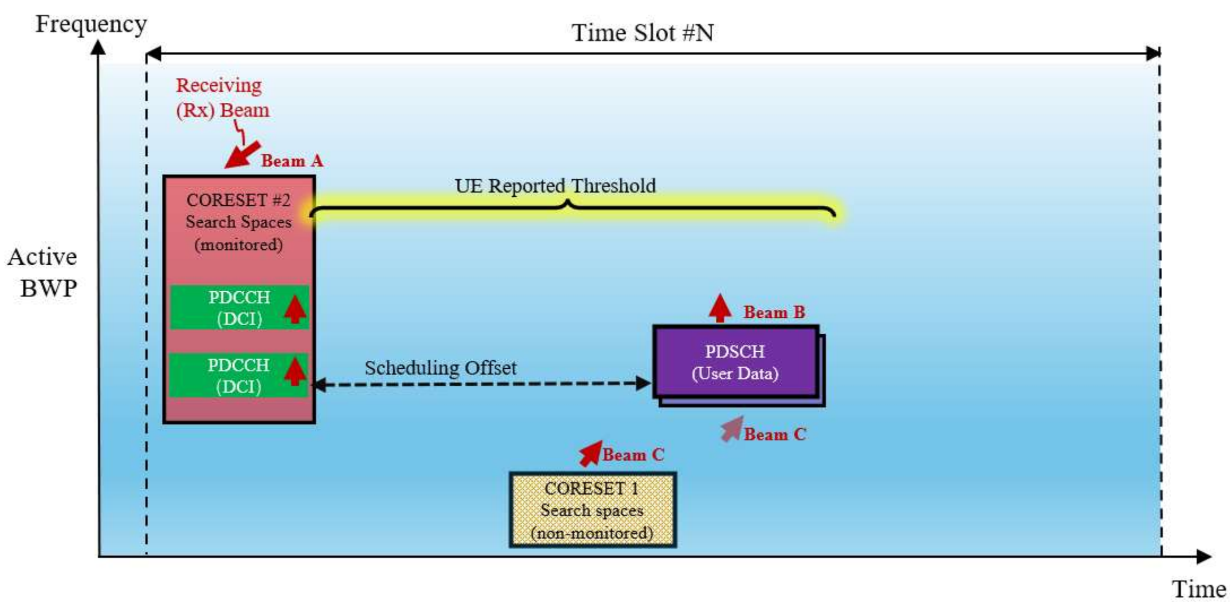
Guo/Intel renders obvious [8a]. Bims ¶152. [8a] recites the well-known and fundamental 5G feature of using the DCI in a CORESET to schedule the PDSCH, which *Guo/Intel* discloses. Bims ¶152; *Guo*, [0147]. Particularly, as discussed for [1d]-[1e], the claimed "first CORESET" is taught by *Intel*'s "monitoring CORESET." *Intel*, 1; *supra* Sections VI.A.2.e-VI.A.2.f. By monitoring that CORESET, the UE obtains from that CORESET a scheduling DCI of a PDSCH. *Guo*, [0145], [0147].

b. [8b]: "apply a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

Guo/Intel renders obvious [8b]. Bims ¶¶153-157. As detailed for claim 1 (*supra* Section VI.A.2), *Guo*/*Intel* discloses the claimed "first CORESET." Per the 5G Standard, the DCI from this CORESET would be obtained to schedule the PDSCH. *Guo*, [0133]-[0134]; Bims ¶153.

However, per the 5G Standard, and as *Guo* itself explains, if the "offset" between a CORESET's DCI and the corresponding PDSCH is "less than the threshold," then the UE may make a QCL assumption based on information associated with the lowest CORESET ID. *Guo*, [0134]; *5G-Standard*, 26; Bims ¶154; *see supra* Section VI.A.3.b (explaining disclosure of the claimed "scheduling offset").

The figure below illustrates this situation. Bims ¶155. Here, per the then-existing 5G Standard, the UE would use the QCL assumption of CORESET #1 (the claimed "second CORESET") to schedule receipt of the PDSCH. In other words, in the figure below, and when applying the above disclosure of at least *Guo*, the lowest CORESET ID in the current time slot (slot N, below) would be associated with CORESET #1 (the claimed "second CORESET"). The QCL assumption of this second CORESET is the claimed "second QCL assumption." Bims ¶155. As the below figure shows, CORESET #1 is non-monitored, e.g., because the UE did not schedule itself to do so. *Id*. So, per the then-existing 5G Standard, the UE would use the QCL of CORESET #1 because it has the lowest ID. *Id*.



Claim 8 here, unlike claim 1, does not require that this "second CORESET" is monitored or that the "second QCL assumption" is associated with the "lowest" ID. Claim 9 does define, however, that this "second CORESET" is "non-monitored." The UE's handling of this "second CORESET" is different in this regard. Moreover, the resulting UE of *Guo*/*Intel* may thus be configured to handle: (a) CORESETs (such as the "first CORESET") per the *Guo*/*Intel* combination for scheduling receipt of the CSI-RS, and (b) CORESETs (such as the "second CORESET") per the *Guo*'s disclosure consistent with the then-existing 5G Standard for scheduling receipt of the PDSCH. Bims ¶156. At the very least, a POSITA would have found it obvious for the UE to do this, such as for situations where the UE moves to a geographic region requiring either approach (a) or (b). *Id*.

As to the claim language that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of the PDSCH, *Guo* effectively discloses this too, if not rendering this particular way obvious. *See Supra* VI.A.3.b; *see also supra* n.4 (explaining even Patent Owner interprets the 5G Standard as disclosing the offset is between "an end of a last symbol" and "a beginning of a first symbol"); Bims ¶¶109-111 (explaining the Standard's "offset" is the same for both CSI-RS and PDSCH), 157.

c. [8c]: "wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain."

Guo/Intel renders obvious [8c]. Bims ¶¶158-159. Like claim 6 (*supra* Section VI.A.7), element [8c] recites a conventional situation in 5G in which a CORESET (including the PDCCH therein) overlaps with a PDSCH of another beam in at least one symbol in the time domain. Ex. 1019, *TS-38.213*, 70 (5G

Standard document addressing situation where the "PDSCH overlaps in at least one symbol with a PDCCH" that the "UE monitors in a Type1-PDCCH common search space …"); Bims ¶158 (explaining situations where a CORESET overlaps with a PDSCH). The above figure for [8b] shows this overlap.

A POSITA would understand that *Guo*'s CORESET with the lowest CORESET ID in the latest slot (the "second CORESET" in Section VI.A.9.b *supra*) would overlap with the PDSCH in at least one symbol in a time domain in certain applications, where the scheduling offset for the PDSCH is small, such as when that CORESET is associated with a Type1-PDCCH common search space. Bims ¶159.

10. Claim 9

a. "The UE of claim 8, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."

Guo/Intel renders obvious claim 9. Bims ¶160. As discussed for [8b] (*supra* Section VI.A.9b), the second CORESET is a "non-monitored" CORESET. Bims ¶160.

11. Claims 11-19

Claims 11-19 are substantially the same as claims 1-9. *Supra* Sections VI.A.2-VI.A.10. The main difference concerns the preamble. While claims 1-9 are directed to a UE device configured to perform method steps, claims 11-19 are directed to the "method" itself. Thus, for the same reasons for claims 1-9, *Guo*/*Intel* also renders obvious the method of claims 11-19. *Id.*; Bims ¶161.

B. Ground 2: Claim 10 Is Rendered Obvious by *Guo* and *ZTE*

1. Rationale for Combining *Guo* and *ZTE*

As discussed with respect to Ground 1, *Guo* discloses a 5G UE. *Guo*, [0044]-[0048], [0052], [0098]-[0099], [0105], [0121]. Neither *Guo* nor the then-existing 5G Standard, however, expressly disclosed that when the "scheduling offset" is less than a threshold, the UE will apply the QCL assumption for receiving the PDSCH from the CORESET having the "lowest" ID amongst only the "monitored" CORESETs, as claimed. Bims ¶162.

ZTE, though, proposed this very improvement for the 5G Standard itself. Specifically, *ZTE* proposed that, for receiving the PDSCH, the CORESET with the "lowest" CORESET ID should be a CORESET "associated with at least one search space set monitored by the UE":

> ***When the time offset between*** the reception of the DL ***DCI and the corresponding PDSCH is smaller than a threshold*** Threshold-Sched-Offset, [the] UE obtains [a] QCL parameter from the CORESET with the ***lowest CORESET-ID***[,] which [is] associated with at least one ***search space set monitored by [the] UE*** in the latest slot … [if] the PDSCH and the CORESET are in the same serving cell.

ZTE, 12-13 (emphases added); Bims ¶¶163-164.

a. Motivation to Combine

A POSITA would have been motivated to combine the teachings of *Guo* and *ZTE* for several reasons. Bims ¶¶165-168.

First, a POSITA would have appreciated *ZTE*'s improvement benefits *Guo*'s 5G UE. Bims ¶166; *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1309 (Fed. Cir. 2006). More specifically, including *ZTE*'s 5G improvement in *Guo*'s UE, would improve how the UE determines which QCL to use when receiving multiple CORESETs, particularly when scheduling the PDSCH. Bims ¶166. Indeed, as discussed in Ground 1, *Guo* uses the same lowest-CORESET-ID rule of the 5G Standard and that *ZTE* proposed to modify. *Guo*, [0134]; *5G-Standard*, 26-27; *ZTE*, 12-13; Bims ¶166. A POSITA would have recognized that *ZTE*'s improvement benefits *Guo*'s UE by making the UE more accurate. Bims ¶166.

Second, at the time of the alleged invention, POSITAs had been working on clarifying a 5G UE's procedure for QCL assumption. Bims ¶167. Several companies had proposed using the CORESET with the lowest ID amongst all "monitored" CORESETs, and then discussed these proposals at 3GPP meetings. *ZTE*, 12-13 ("Proposal 3"); *see also* Ex. 1016 ("*Nokia*"), 5 ("Issue 3.4"); Ex. 1017 ("*LG490*"), 5-6 ("Proposal 11"); *Intel*, 1-2 ("Proposal 4"). Thus, POSITAs were already motivated to improve the lowest-CORESET-ID rule of the then-existing 5G Standard and, as a result, would have considered *ZTE*'s proposal as a benefit. Bims ¶167.

Third, a POSITA would have appreciated that it was advantageous to apply *ZTE*'s improvement to *Guo*. Bims ¶168. As *ZTE* explains, to apply the lowest-CORESET-ID rule, the UE needs to know parameters of the CORESETs to know they are "in the latest slot." *ZTE*, 12-13; *Guo*, [0134]; *5G-Standard*, 26-27. But, as *ZTE* says, the relevant "time domain parameters … are included in the configuration of search space," requiring the UE to examine these search spaces. *ZTE*, 12. *ZTE* also explains the difficulty a UE would have if it has to examine non-monitored search spaces. *ZTE*, 12. ZTE's improvement avoids this difficulty. Bims ¶168. Therefore, a POSITA would have adopted *ZTE*'s improved rule focusing on only "monitored" CORESETs – i.e., that "the CORESET with the lowest CORESET-ID should be clarified as one CORESET associated with at least one search space set monitored by the UE." *ZTE*, 12; Bims ¶168.

b. Expectation of Success

A POSITA would have reasonably expected to succeed in modifying *Guo* with *ZTE*. Bims ¶169. *Guo* discloses a 5G UE and *ZTE* discloses an improvement to 5G. A POSITA modifying *Guo*'s UE would thus have had a high expectation that *ZTE*'s improvement would succeed. Bims ¶169. Indeed, *ZTE*'s improvement was to the 5G Standard, which *Guo* discloses that its UE follows. Bims ¶169.

Moreover, a POSITA would know how to successfully configure a UE to include *ZTE*'s improvement. For example, the 5G Standard documents addressed how to configure UEs and CORESETs to implement *ZTE*'s improvement of obtaining CORESET IDs of only monitored search spaces. Ex. 1021, *TS-38.331*, 238, 309; Bims ¶170. To configure *Guo*'s UE to implement *ZTE*'s improvement, a POSITA would have understood that this was straightforward. Bims ¶170 (explaining a relatively minor software update would be required to limit the examination to only monitored CORESETs); *Keynetik*, 2023 WL 2003932, at *2. A POSITA would have appreciated that *Guo*'s UE could know whether a CORESET ID is associated with a monitored CORESET. Bims ¶170.

2. Independent Claim 10

a. [10Preamble]: "A user equipment (UE) comprising:"

[10Preamble] is the same as [1Preamble], which *Guo* discloses as discussed. *Supra* Section VI.A.2.a; Bims ¶171.

b. [10a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

[10a] recites substantively the same limitations as [1a], which *Guo* discloses. *Supra* Section VI.A.2.b; Bims ¶172.

c. [10b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

[10b] recites substantively the same limitations as [1b], which *Guo* discloses. *Supra* Section VI.A.2.c; Bims ¶173.

d. [10c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;"

[10c] recites substantively the same limitations as [1c], which *Guo* discloses. *Supra* Section VI.A.2.d; Bims ¶174.

e. [10d]: "receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and"

Guo discloses [10d]. Bims ¶175. A 5G system receives DCI from a PDCCH to schedule the receipt of PDSCH. Indeed, *Guo* discloses that its UE will "receive[] PDCCH and decode a DCI" to "schedule[] PDSCH transmission." *Guo*, [0145], [0147]. This comports with the 5G Standard that *Guo*'s UE implemented. *5G-Standard*, 15 ("For a PDSCH scheduled with a DCI format 1_0 in any type of PDCCH...."); Bims ¶175.

f. [10e]: "apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

Guo discloses and/or renders obvious [10d]. Bims ¶¶176-179. Per the 5G Standard, *Guo* discloses that the UE may, when scheduling a corresponding PDSCH, apply a "quasi co-location" assumption when the "[scheduling] offset" is "less than a threshold." *Guo*, [0134]. As discussed for [10d], the claimed "PDCCH" is used to schedule the PDSCH. *Supra* Section VI.B.2.e; Bims ¶176-177.

Guo also specifies applying the QCL used for the "PDCCH … of the lowest CORESET ID in the latest slot" when scheduling the PDSCH. *Guo*, [0134]. Again, this comports with the 5G Standard. Bims ¶177. As *Guo* explains, since the PDCCH is "in the latest slot," it can be used to schedule the PDSCH. *Guo,* per the 5G Standard, however, used the "lowest CORESET ID" of all CORESETs, regardless of whether monitored or not. Bims ¶177.

As to the claim language that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of the PDSCH, *Guo* effectively discloses this too, if not rendering this particular way obvious. *See Supra* VI.A.3.b.; *see also* Bims ¶¶109-111 (explaining the 5G Standard's "scheduling offset" is the same for both CSI-RS and PDSCH), 178-179.

g. [10f]: "wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

Guo/ZTE renders obvious [10f]. Bims ¶¶180-183. As discussed in Section VI.B.1 *supra*, it would have been obvious to modify *Guo*'s QCL assumption—the lowest ID of all CORESETs (whether monitored or not)—to adopt *ZTE*'s improvement of limiting this to only the "monitored" CORESETs (i.e., *ZTE*'s disclosure of a CORESET "with at least one search space set monitored by UE"). *ZTE*, 12; Bims ¶180.

To confirm, a search space is part of every CORESET, such that a "monitored search space" refers to a CORESET that the UE "monitor[s]." Bims ¶181. The CORESET with a monitored search space, as disclosed in *ZTE*, thus corresponds to the claimed "one of a set of one or more monitored CORESETs." Bims ¶181. And as discussed for [10e] (*supra* Section VI.B.2.f), if the CORESET with the "lowest" ID is a "monitored" CORESET, a scenario that frequently occurred in 5G systems, then [10f] is accordingly met. Bims ¶182.

That said, and as discussed, *ZTE* discloses an improvement for *Guo*'s 5G UE, using only "monitored" CORESETs to determine the "lowest" ID when applying a QCL assumption for reception of the PDCCH to schedule receiving the PDSCH. And as discussed in Section VI.B.1 *supra*, it would have been obvious to combine the teachings of *Guo* and *ZTE* to arrive at the claimed UE. Bims ¶183.

C. Ground 3: Claims 1-9 and 11-19 Are Rendered Obvious by *5G-Standard* in View of *Intel*

1. Rationale for Combining *5G-Standard* and *Intel*

5G-Standard is the 5G Standard that existed in September 2018. It was made available on 3GPP's FTP site[7] no later than October 1, 2018. Rodermund, ¶¶31,

[7] The 3rd Generation Partnership Project ("3GPP") is the standard-setting body for 5G or 5G-NR.

165-173. *5G-Standard* disclosed the use of the "lowest CORESET-ID" in the context of QCL. *5G-Standard*, 26. It also disclosed:

> If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold[,] the UE applies a default QCL assumption [to receive the aperiodic CSI-RS resources].

5G-Standard, 40. Almost simultaneously, *Intel*—a proposal discussed during a 3GPP meeting during October 8-12, 2018—proposed the following:

> The default beam for CSI-RS for CSI acquisition follows the TCI state in ***monitoring*** [a] CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID when multiple CORESETs are configured.

Intel, 1 (emphasis added); Rodermund, ¶¶25, 109-117.

In 5G, the TCI state contains information specifying the QCL. *5G-Standard*, 26-27. So, *Intel*'s recommendation at the time was to use the QCL of the "monitoring" CORESET with the "lowest CORESET ID" as the default QCL for receiving aperiodic CSI-RS. Bims ¶184. As discussed below, a POSITA would have found it obvious to use *Intel*'s proposed improvement as the method to determine the default QCL contemplated by *5G-Standard* for receiving aperiodic CSI-RS. Bims ¶184.

a. Motivation to Combine

A POSITA would have been motivated to combine the teachings of *5G-Standard* and *Intel* for several reasons. Bims ¶¶185-190.

Both contemplate the same reasons to apply a default QCL assumption for receiving the aperiodic CSI-RS. Bims ¶186. *5G-Standard* discloses using the default QCL when the scheduling offset between the PDCCH and the CSI-RS is smaller than the threshold. *5G-Standard*, 40. Likewise, *Intel* discloses an improved way of determining the QCL default or default beam when the scheduling offset is smaller than the threshold. *Intel*, 1; Bims ¶186. Thus, a POSITA would have readily appreciated that *Intel*'s 5G technique can be used to improve *5G-Standard* itself. Bims ¶186.

Intel also concerns solving problems specifically in 5G. Bims ¶187. While *5G-Standard* contemplated a general QCL for receiving the CSI-RS (*5G-Standard*, 40), *Intel* provides an improved way of determining this QCL assumption. *Intel*, 1; Bims ¶187. A POSITA would have been motivated to apply *Intel*'s teaching to *5G-Standard* that is ready for this improvement. Bims ¶187.

Moreover, a POSITA would have appreciated that *Intel*'s approach, as explained by *Intel* itself, is "better" because it allows using the CSI-RS to detect the channel condition for the PDSCH. *Intel*, 1; Bims ¶188. Additionally, *Intel* addresses the issue of which QCL assumption a UE should use to determine the default QCL, when multiple CORESETs occur. Bims ¶188. A POSITA would recognize the benefit of *Intel*'s approach because it would make the UE's determination more accurate. Bims ¶188.

Finally, a POSITA would have been motivated to improve *5G-Standard* with *Intel*'s technique for the reasons given in *Intel* itself and for the reasons given to the 5G community. Bims ¶189. Both before and after the release of *5G-Standard*, members of the standardization working group submitted numerous proposals, each aimed at clarifying the way to apply the QCL assumptions. *See*, *e.g.*, *ZTE*, 12-13 ("Proposal 3"); Ex. 1016, *Nokia*, 5 ("Issue 3.4"); Ex. 1017, *LG490*, 5-6 ("Proposal 11"); Ex. 1026, *LG256*, 1-2 ("Proposal 3"); Ex. 1027, *CATT*, 3 ("Proposal 3"); Bims ¶189. As a result, POSITAs would have found it obvious to implement *Intel*'s technique into *5G-Standard*. Bims ¶189. Indeed, this was *Intel*'s very intent.

In summary, a POSITA would have been motivated to incorporate *Intel*'s 5G proposal into *5G-Standard* itself to determine the default QCL assumption for receiving CSI-RS, as this would harvest the many benefits of *Intel*'s technique and resolve challenges already identified by the 5G community. Bims ¶190.

b. Expectation of Success

A POSITA would have had a reasonable expectation of success in combining *5G-Standard* and *Intel*, and would have expected this combination to yield a predictable solution. Bims ¶191. As discussed, *5G-Standard* called for applying "a default QCL assumption" when the scheduling offset of the CSI-RS is less than a threshold, and *Intel* discloses a way to determine that "default QCL assumption." *5G-Standard*, 40; *Intel*, 1. As such, the combination requires nothing more than a direct incorporation of *Intel*'s teaching into *5G-Standard*. Bims ¶191.

A POSITA would also have had a reasonable expectation of success for implementing the resulting combination because it merely requires ordinary skill. Bims ¶192. Particularly, a POSITA could have configured the 5G UE to implement *Intel*'s added 5G functions by adding software that executes *Intel*'s proposed way to determine the default QCL assumption because this was well within the skill of the 5G art. Bims ¶192; *Keynetik*, 2023 WL 2003932, at *2.

2. Independent Claim 1

a. [1Preamble]: "A user equipment (UE) comprising:"

5G-Standard discloses [1Preamble], as it describes procedures performed by a UE. *E.g.*, *5G-Standard*, 34-70 ("5.2 UE procedure for reporting channel state information (CSI)"); Bims ¶193.

b. [1a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

5G-Standard discloses and/or renders obvious [1a]. Bims ¶194. UEs before the '896 patent, e.g., a pre-November 2018 cell phone, would have one or more non-transitory computer-readable media (e.g., ROM and RAM) storing instructions that, when executed, would cause the UE to perform certain functions, e.g., wireless communications. Bims ¶194. *5G-Standard* was for such phones; so, at the very least, a POSITA would have understood that the UE described in *5G-Standard*, a "2018-09" 5G standard, would have computer-readable media having computer-executable instructions. *5G-Standard*, 1; Bims ¶194. Moreover, to the extent Patent Owner argues or the Board finds that *5G-Standard* does not already disclose [1a], a POSITA would have found it obvious to have the UE perform the procedure specified in *5G-Standard* by executing computer-executable instructions stored in one or more non-transitory computer-readable media. Bims ¶194. And a POSITA would have had a reasonable expectation of success to do the above because such was well-known, conventional, and routine in the art before 2018. Bims ¶194.

c. [1b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

5G-Standard discloses and/or renders obvious [1b]. Bims ¶195. A POSITA would have understood that the UE described in *5G-Standard* would also need to have at least one processor coupled to the computer-readable media, to execute the instructions on that media. Bims ¶195; *see also*, *e.g.*, *Guo*, [0067], [0070]-[0071]. Moreover, to the extent Patent Owner argues or the Board finds that *5G-Standard* does not already disclose [1b], a POSITA would have found it obvious to perform the UE procedure specified in *5G-Standard* by using a processor coupled to the one or more non-transitory computer-readable media to execute the computer-executable instructions. Bims ¶195. A POSITA would have been motivated to do so because the above provides computer processing speeds and improved user experience. Bims ¶195. And a POSITA would have had a reasonable expectation of success because fast and powerful processing chips suitable for mobile phones were widely available before 2018. Bims ¶195.

d. [1c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and"

5G-Standard discloses, and/or *5G-Standard/Intel* renders obvious, [1c]. Bims ¶¶196-197. *5G-Standard* discloses that "one or more CORESETs within the active BWP of the serving cell are configured for the UE" and "in the latest slot." *5G-Standard*, 26; *see also id.*, 24-25; Bims ¶196. *Intel* discloses this also. *Intel*, 1 (disclosing "multiple CORESETs are configured" for a UE in a 5G system). *See also supra* Section VI.A.2.d (explaining fundamental feature of 5G is that the UE monitors at least one CORESET in the active BWP).

Further, as discussed in Section VI.C.1, it would have been obvious to combine the teachings of *5G-Standard* and *Intel* to have the UE receive an aperiodic CSI-RS using "monitoring [a] CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID when multiple CORESETs are configured." *Intel*, 1. As explained, *Intel* teaches that multiple CORESETs can be configured for the UE, and at least one of them (the "CORESET … with lowest CORESET ID") is monitored by the UE in the active BWP in the latest slot. *Id.*; Bims ¶197.

e. [1d]: "apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),"

5G-Standard/Intel renders obvious [1d]. Bims ¶198. *Intel* teaches that "[t]he default beam for [receiving] CSI-RS for CSI acquisition follows the TCI state in monitoring [a] CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID." *Intel*, 1. *Intel*'s disclosure of a "monitor[ed] CORESET … with lowest CORESET ID" discloses the claimed "first CORESET of a set of one or more monitored CORESETs." Bims ¶198. Moreover, *Intel*'s teaching of following the TCI state of the monitored CORESET discloses the claimed "apply[ing] a first Quasi Co-Location (QCL) assumption" because the TCI state refers to information including at least the claimed QCL assumption. *5G-Standard*, 26, 40; Bims ¶198.

Finally, for at least the reasons discussed in Section VI.C.1 *supra*, it would have been obvious to combine the teachings of *5G-Standard* and *Intel*. Bims ¶198.

f. [1e]: "wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

5G-Standard/Intel renders obvious [1e]. Bims ¶199. As discussed in Section VI.C.2.e *supra*, *5G-Standard/Intel*'s monitored CORESET with the lowest

CORESET ID discloses the claimed “first CORESET.” *See also Intel*, 1; Bims ¶199. Moreover, for the reasons in Section VI.A.2.f *supra*, a POSITA would readily understand that the monitored CORESET includes a monitored search space “configured with” a lowest CORESET ID, as claimed. Bims ¶199.

3. Claim 2

a. [2a]: “The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,”

5G-Standard/Intel renders obvious [2a]. Bims ¶200. It was well known in 5G that aperiodic CSI-RS is scheduled by DCI in CORESETs. Bims ¶200; *supra* Section VI.A.3.a. Both *5G-Standard* and *Intel* refer to a “scheduling offset” between “the triggering DCI and … the aperiodic CSI-RS resources.” *5G-Standard*, 40; *Intel*, 1. Moreover, as discussed for [1c] and [1d] (*supra* Sections VI.C.2.d-VI.C.2.e), *5G-Standard/Intel* teaches that the first CORESET is a “monitoring CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID when multiple CORESETs are configured.” *Intel*, 1; Bims ¶200; *see also supra* Sections VI.A.2d-VI.A.2.e (detailing the teachings of *Guo* that implements the 5G Standard). Since the monitored CORESET is in the latest slot, e.g., the slot containing the CSI-RS transmission, a POSITA would understand that the monitored CORESET is before the CSI-RS in time, and, thus, would carry the scheduling DCI, such that the UE obtains that scheduling DCI from that monitored CORESET. Bims ¶200.

b. [2b] "wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold."

5G-Standard implicitly discloses [2b] by disclosing that the default QCL assumption for CSI-RS is used "[i]f the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold." *5G-Standard*, 40; Bims ¶201; *see also supra*, Section VI.A.3.b (explaining relevant disclosure in the 5G Standard – and explaining how this comports with the Patent Owner's own interpretation too).

As Section VI.A.3.b explains, a POSITA would understand that the scheduling offset refers to the time window for the UE to switch its receiving beam for receiving the CSI-RS. *5G-Standard*, 40; *Intel*, 1; Bims ¶202. Because the UE cannot start the beam switching until after the end of the DCI duration and must complete the beam switching before the arrival of the CSI-RS, a POSITA would understand that the scheduling offset is the time window between the "end" of the last symbol of the scheduling DCI and the "beginning" of the first symbol of the CSI-RS. *Id*.

4. Claim 3

For the reasons discussed with respect to claim 3, *supra* Section VI.A.4, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.4 comports with the 5G Standard. Bims ¶203.

5. Claim 4

For the reasons discussed with respect to claim 4, *supra* Section VI.A.5, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.5 comports with the 5G Standard. Bims ¶204.

6. Claim 5

For the reasons discussed with respect to claim 5, *supra* Section VI.A.6, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.6 comports with the 5G Standard. Bims ¶205.

7. Claim 6

For the reasons discussed with respect to claim 6, *supra* Section VI.A.7, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.7 comports with the 5G Standard. Bims ¶206.

8. Claim 7

a. "The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell."

5G-Standard/Intel renders obvious claim 7. Bims ¶207. As discussed for [2a] in Section VI.C.3.a *supra*, *Intel* teaches that multiple CORESETs are configured "in [the] latest slot," which would be the slot containing the CSI-RS transmission. Bims ¶207. Moreover, it was a fundamental feature of 5G that only one downlink BWP was active in a UE at a given time, and the control information (e.g., CORESETs) and data (e.g., CSI-RS) were transmitted in an activated serving cell. Bims ¶207; Ex. 1018, *TS38.211*, § 4.4.5; Ex. 1019, *TS-38.213*, 69. Therefore, a POSITA would understand that the plurality of CORESETs and the resource carrying the aperiodic CSI-RS are provided in the same time slot and the same active BWP of the serving cell. Bims ¶207.

Moreover, for the reasons discussed with respect to claim 7, *supra* Section VI.A.8, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.8 comports with the 5G Standard. Bims ¶207.

9. Claim 8

For the reasons discussed with respect to claim 8, *supra* Section VI.A.9, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.9 comports with the 5G Standard. Bims ¶208.

10. Claim 9

For the reasons discussed with respect to claim 9, *supra* Section VI.A.10, *5G-Standard*/*Intel* renders this claim obvious – particularly since the disclosure of *Guo* detailed in Section VI.A.10 comports with the 5G Standard. Bims ¶209.

11. Claims 11-19

Claims 11-19 are substantially the same as claims 1-9 discussed above. *Supra* Sections VI.C.2-VI.C.10. The main difference concerns the preamble, with claims 1-9 being directed to a UE device configured to perform a "method," while claims 11-19 concern the "method" itself. Thus, for the same reasons discussed with respect to claims 1-9, *5G-Standard*/*Intel* also renders obvious the method of claims 11-19. *Supra id.*; Bims ¶210.

D. Ground 4: Claim 10 Is Rendered Obvious by *5G-Standard* in View of *ZTE*

1. Rationale for Combining *5G-Standard* and *ZTE*

As discussed with respect to Ground 1, the then-existing 5G Standard disclosed that the UE would apply the QCL, for receiving the PDSCH, from the CORESET having the "lowest" ID amongst all CORESETs configured for that UE—not amongst only the "monitored" CORESETs, as claimed. Bims ¶211.

As explained, though, *ZTE* proposed this improvement to the 5G Standard itself. Specifically, *ZTE* proposed that the CORESET with the "lowest" CORESET ID should be a CORESET "***associated with at least one search space set monitored***" by the UE. *ZTE*, 12 (emphasis added); Bims ¶212. A POSITA would have found it obvious to modify *Guo*'s 5G UE to include *ZTE*'s proposed improvement to 5G. Bims ¶212.

a. Motivation to Combine

A POSITA would have been motivated to combine the teachings of *5G-Standard* and *ZTE* for several reasons. Bims ¶¶213-215.

First, a POSITA would have appreciated that *ZTE*'s 5G improvement benefits *5G-Standard*. Bims ¶214. Indeed, at the time of the alleged invention, POSITAs had been working on clarifying 5G's procedure for QCL assumption done by a UE. Bims ¶214. Several companies had proposed modifying *5G-Standard* to include improvements consistent with *ZTE*. *See, e.g.*, Ex. 1016, *Nokia*, 5 ("Issue 3.4"); Ex. 1017, *LG490*, 5-6 ("Proposal 11"); *Intel*, 1-2 ("Proposal 4"); Bims ¶214. These improvements would have made a UE more accurate. Bims ¶214. Thus, POSITAs were already motivated to improve the lowest-CORESET-ID rule of *5G-Standard* and, as a result, would have considered *ZTE*'s proposed change as a beneficial solution. Bims ¶214.

Second, *5G-Standard* motivated POSITAs to apply *ZTE*'s teaching. Bims ¶215. Specifically, *5G-Standard* specified that "a default QCL assumption" would be used when "the scheduling offset … is smaller than the UE reported threshold." *5G-Standard*, 40. While *5G-Standard* does not specify this particular "default QCL assumption," *ZTE* explains this. *ZTE*, 12-13; Bims ¶215. For instance, *ZTE* proposes that the "monitored" CORESET with the "lowest" ID be used for the PDSCH. *ZTE*, 12-13. A POSITA would thus have been motivated to apply *ZTE*'s 5G improvement to *Guo*'s 5G UE. Bims ¶215.

b. Expectation of Success

A POSITA would have reasonably expected to succeed in modifying *5G-Standard* with *ZTE*. Bims ¶¶216-217. Indeed, *ZTE*'s improvement is directed to *5G-Standard* itself. Bims ¶216.

In this regard, a POSITA would know how to successfully configure a UE of *5G-Standard* to include *ZTE*'s improvement. Configuring such a UE to implement *ZTE*'s improvement would involve updating a CORESET's search space configuration and its association between the search space and CORESET ID—updates that a POSITA would have understood were straightforward. Bims ¶217 (explaining that a relatively minor software update would be required); *Keynetik*, 2023 WL 2003932, at *2.

2. Independent Claim 10

a. [10Preamble]: "A user equipment (UE) comprising:"

5G-Standard discloses [10Preamble]. *Supra* Section VI.C.2.a; Bims ¶218.

b. [10a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

5G-Standard discloses and/or renders obvious [10a]. *Supra* Section VI.C.2.b; Bims ¶219.

c. [10b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

5G-Standard discloses and/or renders obvious [10b]. *Supra* Section VI.C.2.c; Bims ¶220.

d. [10c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;"

5G-Standard discloses [10c]. Bims ¶¶221-222; *see also Supra* Section VI.C.2.d. First, *5G-Standard* discloses plural CORESETs "configured for the UE." In *5G-Standard*, a UE can support up to twelve CORESETs. Bims ¶221 (citing other 5G Standard documents at Ex. 1018, *TS38.211*, § 4.4.5 and Ex. 1021, *TS38.331*, 238).

Second, *5G-Standard* discloses that the UE will "monitor" at least one CORESET "within an active [BWP] of a serving cell in a time slot," as claimed. *5G-Standard*, 24; Bims ¶222 (citing other 5G Standard documents – i.e., Ex. 1018, *TS-38.211*, § 4.4.5; Ex. 1019, *TS-38.213*, 69, stating that when a UE monitors a CORESET, the "UE monitors a set of PDCCH candidates in one or more control resource sets on the active DL BWP on each activated serving cell" and there is "a single downlink [BWP] … active at a given time.").

e. [10d]: "receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and"

5G-Standard discloses [10d]. Bims ¶223. In 5G, a UE necessarily receives DCI from a PDCCH to schedule the receipt of PDSCH. Bims ¶223. For example, *5G-Standard* discloses that its UE will receive PDCCH and decode a DCI to schedule PDSCH transmission. *5G-Standard*, 10.

f. [10e]: "apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

5G-Standard discloses [10e]. Bims ¶224. *5G-Standard* discloses rules for determining the QCL "for reception of the PDCCH to receive the PDSCH" based on a "scheduling offset." With regard to the specific claim language that this known scheduling offset is specifically between "an end of a last symbol" of the PDCCH and the "beginning of a first symbol" of the PDSCH, this is an obvious specific implementation of the "scheduling offset" taught by *5G-Standard*. *See supra* Section VI.A.3.b (explaining *5G-Standard*'s disclosure relevant to "end of a last symbol" and "beginning of a first symbol"); *see also supra* Section VI.D.2.e (explaining that "PDCCH" is used for scheduling the PDSCH); Bims ¶¶109-111 (explaining the Standard's "scheduling offset" is the same for both CSI-RS and PDSCH).

g. [10f]: "wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

5G-Standard/ZTE renders obvious [10f]. Bims ¶225. As discussed in Section VI.D.1 *supra*, it would have been obvious to modify *5G-Standard*'s QCL assumption—the lowest ID of all CORESETs (whether monitored or not)—to limit this to only the "monitored" CORESETs (i.e., a CORESET "with at least one search space set monitored by UE"). *ZTE*, 12-13; Bims ¶225; *see also supra* Section VI.A.2.f (explaining that a monitored CORESET has a "monitored search space").

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

The '896 patent claims priority to U.S. Provisional Application No. 62/754,165 and is related to U.S. Patent Nos. 11,641,661 and 11,974,302. Petitioners are concurrently challenging the '661 patent in IPR2025-01190.

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

VIII. GROUNDS FOR STANDING

Petitioners certify that the ’896 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 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 29, 2025

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

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 13,978.

Dated: July 29, 2025

By: / Joshua L. Goldberg /
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CLAIMS APPENDIX

1. **[1Preamble]** A user equipment (UE) comprising:

[1a] one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and

[1b] at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:

[1c] monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and

[1d] apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),

[1e] wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs.

2. **[2a]** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,

[2b] wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold.

3. The UE of claim 1, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

4. The UE of claim 3, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID.

5. The UE of claim 3, wherein the second CORESET is configured on one of:

a deactivated Bandwidth Part (BWP); and

a deactivated Secondary Cell (SCell).

6. The UE of claim 3, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain.

7. The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell.

8. **[8a]** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and

[8b] apply a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[8c] wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain.

9. The UE of claim 8, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

10. **[10Preamble]** A user equipment (UE) comprising:

[10a] one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and

[10b] at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:

[10c] monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;

[10d] receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and

[10e] apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[10f] wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs.

11. **[11Preamble]** A method of wireless communications, the method comprising:

[11a] monitoring, by a user equipment (UE), at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and

[11b] applying, by the UE, a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),

[11c] wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among a set of one or more monitored CORESETs.

12. **[12a]** The method of claim 11, further comprising:

obtaining, by the UE, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS from the first CORESET,

[12b] wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold.

13. The method of claim 11, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

14. The method of claim 13, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-

monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID.

15. The method of claim 13, wherein the second CORESET is configured on one of:

a deactivated Bandwidth Part (BWP); and

a deactivated Secondary Cell (SCell).

16. The method of claim 13, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain.

17. The method of claim 11, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell.

18. **[18a]** The method of claim 11, further comprising:

obtaining, by the UE, Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first

CORESET; and

[18b] applying, by the UE, a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[18c] wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain.

19. The method of claim 18, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

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 1001-1027 and 1029-1040** were served via FedEx Priority Overnight on July 29, 2025, on the correspondence address of record below indicated in the Patent Office's Patent Center for U.S. Patent No. 11,057,896:

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Courtesy copies have been concurrently served by the same means on the following at:

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Respectfully submitted,

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