UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

G+ COMMUNICATIONS, LLC Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD.; SAMSUNG ELECTRONICS AMERICA, INC.; Defendants.	§ § § § § § § § § § § § § § § §	Case No. 2:22-cv-78 **JURY TRIAL DEMANDED**

COMPLAINT FOR INFRINGEMENT OF A PATENT

Plaintiff G+ Communications, LLC ("G+"), by and through its attorneys, for its Complaint against Defendants Samsung Electronics Co., Ltd. ("SEC"), and Samsung Electronics America, Inc. ("SEA") (collectively, "Samsung" or "Defendants"), and demanding trial by jury, hereby alleges, on information and belief with regard to the actions of Samsung and on knowledge with regard to its own actions, as follows:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 271, *et seq*., to enjoin and obtain damages resulting from Samsung's unauthorized use, sale, and offer to sell in the United States, of products, methods, processes, services and/or systems that infringe G+'s United States patents, as described herein.

2. Samsung, directly and through subsidiaries or intermediaries (including distributors, retailers, and others), manufactures, provides, uses, sells, offers for sale, imports, and/or distributes infringing products and services, and encourages others to use their products and services in an infringing manner, as set forth herein.

3. G+ seeks past and future damages and prejudgment and post-judgment interest for Samsung's infringement of the Asserted Patents, as defined below.

4. G+ has attempted to negotiate in good faith with Samsung to reach an agreement for a license to G+'s patent portfolio on terms that are Fair, Reasonable, and Non-Discriminatory ("FRAND").

5. For example, on September 8, 2021, G+ notified Samsung of its patent portfolio, which contains worldwide patent assets including patents in multiple jurisdictions as part of a family of standard essential patents ("SEPs"). G+'s patent portfolio includes patents that have been declared essential (as that term is defined by ETSI) to practicing the 3GPP 5G Standard.

6. G+'s September 8, 2021, correspondence further notified Samsung that its products infringe one or more claims of the Asserted Patents (as defined below) and thus require a license. In particular, G+ identified the following exemplary infringing Samsung products: the Galaxy Note20 5G, Galaxy S20 FE 5G, Galaxy S21 5G, Galaxy A Series 5G, and Galaxy Z Fold2 5G devices, and other similar 5G capable devices (collectively, the "Accused Products").

7. G+ indicated in its September 8, 2021, correspondence that "G+, in conformance with ETSI's IPR Policy, is prepared to grant Samsung an irrevocable non-exclusive license to" the Asserted Patents on a FRAND basis and requested a response from Samsung no later than thirty days from receipt of the letter.

8. The negotiations have been unsuccessful. Therefore, G+ files this Complaint seeking a judgment of and relief for patent infringement by Samsung.

PARTIES

9. Plaintiff G+ Communications LLC is a limited liability company organized and existing under the laws of the State of Delaware, with its principal place of business located at 101

E. Park Blvd., Suite 600, Plano, Texas 75074.

10. G+ is the owner of the entire right, title, and interest of the Asserted Patents, as defined below, including the right to sue for and collect past, present, and future damages and to seek and obtain injunctive or any other relief for infringement.

11. Defendant Samsung Electronics Co., Ltd. is a Korea corporation with its principal place of business at 129 Samsung-Ro Yeongtong-gu, Gyeonggi-do 16677 Suwon-Shi, Republic of Korea. SEC may be served pursuant to FED. R. CIV. P. 4(f)(1).

12. Defendant Samsung Electronics America, Inc. is a New York corporation. SEA is a wholly owned subsidiary of SEC. SEA may be served through its registered agent CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

13. SEA is registered to do business in the State of Texas and has been since at least June 10, 1996.

14. SEC exercises direction and control over the performance of SEA. Alternatively, Defendants form a joint business enterprise such that the performance by one Defendant is each attributable to the other Defendant.

15. SEC and SEA, individually and collectively as a common business enterprise, conduct business operations in the Eastern District of Texas at facilities located at 6625 Excellence Way Plano, TX 75023 ("Plano Facility").

16. SEA employs full-term personnel such as sales personnel and engineers in this District.

17. Samsung has authorized sellers and sales representatives that offer and sell products pertinent to this Complaint throughout the State of Texas, including in this District, and to consumers throughout this District, such as: Best Buy, 422 West TX-281 Loop, Suite 100,

Longview, Texas 75605; AT&T Store, 1712 East Grand Avenue, Marshall, Texas 75670; T-Mobile, 1806 East End Boulevard North, Suite 100, Marshall, TX 75670; Verizon authorized retailers, including Russell Cellular, 1111 East Grand Avenue, Marshall, Texas 75670; Victra, 1006 East End Boulevard, Marshall, Texas 75670; and Cricket Wireless authorized retailer, 120 East End Boulevard South, Marshall, TX 75670.

JURISDICTION AND VENUE

18. This is an action for patent infringement which arises under the patent laws of the United States, in particular, 35 U.S.C. §§ 271, 281, 283, 284, and 285.

19. This Court has exclusive jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331, 1332, and 1338(a).

20. This Court has personal jurisdiction over Samsung in this action pursuant to due process and/or the Texas Long Arm Statute, by virtue of at least the substantial business each Defendant conducts in this forum, directly and/or through intermediaries, including but not limited to: (1) having committed acts within the Eastern District of Texas giving rise to this action and having established minimum contacts with this forum such that the exercise of jurisdiction over each Defendant would not offend traditional notions of fair play and substantial justice; (2) having directed its activities to customers in the State of Texas and this District, solicited business in the State of Texas and this District, transacted business within the State of Texas and this District and attempted to derive financial benefit from residents of the State of Texas and this District, including benefits directly related to the instant patent infringement causes of action set forth herein; (3) having placed their products and services into the stream of commerce throughout the United States and having been actively engaged in transacting business in Texas and in this District; and

(4) either individually, as members of a common business enterprise, and/or in conjunction with third parties, having committed acts of infringement within Texas and in this District.

21. Samsung conducts business in this District and maintains regular and established places of business within this District. For example, Samsung has maintained regular and established places of business with offices and/or other facilities in this Judicial District of Texas at least at 6625 Excellence Way Plano, Texas 75023. *See e.g.*, https://www.sra.samsung.com/locations/. On information and belief, Defendants have placed or contributed to placing infringing products including, but not limited to, the Accused Products into the stream of commerce knowing or understanding that such products would be sold and used in the United States, including in this District. On information and belief, Samsung also has derived substantial revenues from infringing acts in this District, including from the sale and use of the Accused Products.

22. Samsung has committed and continues to commit acts of infringement in this District directly and through third parties by, among other things, making, selling, advertising (including through websites), offering to sell, distributing, and/or importing products and/or services that infringe the Asserted Patents as defined below.

23. Each Defendant has, directly or through its distribution network, purposefully and voluntarily placed infringing products in the stream of commerce knowing and expecting them to be purchased and used by consumers in Texas.

24. Each Defendant has committed direct infringement in Texas.

25. Each Defendant has committed indirect infringement based on acts of direct infringement in Texas.

26. Each Defendant has transacted, and as of the time of filing of the Complaint, continues to transact business within this District.

27. Samsung derives substantial revenues from its infringing acts in this District, including from its manufacture and sale of infringing products in the United States.

28. Venue is proper against SEC in this District pursuant to 28 U.S.C. § 1391(c)(3) because SEC is a foreign corporation not resident in the United States and venue is proper in any district against a foreign corporation.

29. Venue is proper against SEA in this District pursuant to 28 U.S.C. § 1400(b) because each has committed acts of infringement in this District and each maintains a regular and established place of business in this District, at least at Samsung's Plano Facility.

COMPLIANCE WITH FRAND

30. In the telecommunications industry, global standards are fundamental to ubiquitous connectivity and enable any company—even a company with no history in the wireless communication development—to enter the market and sell smartphones.

31. The European Telecommunications Standards Institute (ETSI) is an independent, non-profit standard setting organization (SSO) that produces globally accepted standards in the telecommunications industry. In addition to its own activities, ETSI is also one of several SSOs that are organization partners of the Third Generation Partnership Project (3GPP), which maintains and develops globally applicable technical specifications, including for 3GPP 5G mobile systems. Together, ETSI and its members have developed open standards that ensure worldwide interoperability between networks, devices, and network operators.

32. ETSI has developed and promulgated an IPR Policy, which is intended to strike a balance between the need for open standards on the one hand, and the rights of IPR owners on the

other hand. Clause 15.6 of the ETSI IPR Policy defines the term "ESSENTIAL" to mean that "it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, to make, sell, lease, otherwise dispose of, repair, use or operate EQUIPMENT or METHODS which comply with a STANDARD without infringing that IPR."

33. G+ is the assignee of numerous patents, originally assigned to ZTE Corporation ("ZTE"), that are, and remain, essential (as that term is defined by ETSI) to practicing the 3GPP 5G Standard.

34. Each of the Asserted Patents has been declared to ETSI, by its original assignee, as essential to practicing the 3GPP 5G Standard.

35. G+, in conformance with ETSI's IPR Policy, has informed Samsung that it is prepared to grant Samsung an irrevocable license to G+'s standard essential patents including the Asserted Patents, on FRAND terms.

36. Each Defendant requires a license to one or more essential patents owned by G+.

37. On September 8, 2021, G+ sent Samsung correspondence initiating G+'s good faith efforts to license their essential patents to Samsung on FRAND terms. Enclosed in the letter were evidence of use charts pertaining to six U.S. Patents, including three of the Asserted Patents.

38. On February 8, 2022, G+ sent Samsung further correspondence and enclosed three additional evidence of use charts that provided mapping to the 5G standards. Two of those charts correspond to two of the Asserted Patents.

39. Samsung has not substantively responded and failed to affirmatively state that it is willing to comply with its FRAND obligations.

40. Since September 2021, G+ corresponded with Samsung representatives on several occasions. During this correspondence, G+'s representatives presented, in good faith, technical details evidencing the essentiality of G+'s 5G essential patents.

41. G+'s representatives also provided Samsung with a license offer made on FRAND terms.

42. To date, Samsung has not reciprocated G+'s good faith efforts. Samsung has failed to negotiate in good faith and has not indicated that it is willing comply with FRAND. Samsung has instead declined to take a license to G+'s valuable intellectual property, including the Asserted Patents.

43. Samsung has been operating and continues to operate without a license to G+'s essential patents. Given Samsung's unwillingness to license G+'s essential patents, or to cease its infringement, G+ has filed this lawsuit for the purpose of protecting its patent rights in the United States.

44. The parties' licensing negotiations have been unsuccessful for the simple reason that Samsung refuses to respond in any substantive manner or pay FRAND royalties for G+'s valuable patent portfolios.

45. Samsung has not complied with its FRAND obligations requiring, not only that the licensor is fair and reasonable in providing licensing terms, but also that the licensee is fair and reasonable in accepting them when they are offered.

46. Plaintiff has made good faith efforts to negotiate, including but not limited to providing technical details regarding the Asserted Patents and their "standards essential" nature and offering to license the Asserted Patents and other offered patents on FRAND terms. However,

Samsung has not engaged in good faith discussions or negotiations with Plaintiff. Indeed, Samsung has not even responded to Plaintiff in any substantive manner.

47. By not complying with its FRAND obligations, Samsung has frustrated performance and therefore waived its right to demand FRAND compliance from Plaintiff.

48. The United States Department of Justice, with the United States Patent and Trademark Office (USPTO) and the National Institute of Standards and Technology (NIST), have made clear that patent owners and potential licensees of essential patents should "engage in good-faith negotiations to reach F/RAND license terms" to "help reduce the costs and other burdens associated with litigation." 2019 Policy Statement on Remedies for SEPs Subject to Voluntary F/RAND Commitments, https://www.justice.gov/atr/page/file/1228016/download (December 19, 2019).

GENERAL PATENT INFRINGEMENT ALLEGATIONS

49. Samsung has imported/exported into/from the United States, manufactured, used, marketed, offered for sale, and/or sold in the United States, smartphones and other smart devices that infringe the Asserted Patents. Samsung's Accused Products, which infringe one or more claims of the Asserted Patents, are all Samsung products capable of implementing the 3GPP 5G Standard, including, but not necessarily limited to, all 5G capable models in Samsung's Galaxy 5G product line. For example, as shown below, Samsung advertises that its Galaxy 5G devices support the 5G standard:

Network & Connectivity	Galaxy S21 5G and S21+ 5G	Galaxy S21 Ultra 5G
	5G	5G
	5G Non-Standalone (NSA), Standalone (SA), Sub6 / mmWave	5G Non-Standalone (NSA), Standalone (SA), Sub6 / mmWave
	LTE	LTE
	Enhanced 4x4 MIMO, Up to 7CA, LTE Cat.20 Up to 2.0Gbps Download / Up to 200Mbps Upload	Enhanced 4x4 MIMO, Up to 7CA, LTE Cat.20 Up to 2.0Gbps Download / Up to 200Mbps Upload

https://www.samsung.com/global/galaxy/galaxy-s21-5g/specs/.

50. Samsung has directly and indirectly infringed and continues to directly and indirectly infringe each of the Asserted Patents by engaging in acts constituting infringement under 35 U.S.C. § 271(a), (b), and/or (c), including but not necessarily limited to one or more of making, using, selling and offering to sell, in this District and elsewhere in the United States, and importing into and exporting from the United States, the Samsung Accused Products or components thereof.

51. Samsung provides instruction manuals that instruct the users of the Accused Products to use the Accused Products in a manner that infringes the Asserted Patents. For example, Samsung advertises the compatibility of the Accused Products with 5G.

52. Further, Samsung tests each of the Accused Products in the United States and thereby directly performs the claimed method and/or uses the claimed apparatus, thus infringing the Asserted Patents.

53. Samsung's acts of infringement have caused damage to G+. G+ is entitled to recover from Samsung the damages sustained by G+ because of Samsung's wrongful acts in an amount subject to proof at trial.

54. Samsung's infringement of the Asserted Patents is willful. Samsung continues to commit acts of infringement despite a high likelihood that its actions constitute infringement, and

Samsung knew or should have known that its actions constituted an unjustifiably high risk of infringement.

55. In the interest of providing detailed averments of infringement, G+ has identified below at least one claim per patent to demonstrate infringement. However, the selection of claims should not be considered limiting, and additional claims of the Asserted Patents that are infringed by Samsung will be disclosed in compliance with the Court's rules related to infringement contentions.

COUNTS OF PATENT INFRINGEMENT

56. G+ alleges that Samsung has infringed and continues to infringe the following United States patents (collectively, the "Asserted Patents"):

- United States Patent No. 8,761,776 (the "'776 Patent") (Exhibit A);
- United States Patent No. 10,448,430 (the "'430 Patent") (Exhibit B);
- United States Patent No. 9,184,881 (the "'881 Patent") (Exhibit C);
- United States Patent No. 10,736,130 (the "'130 Patent") (Exhibit D); and
- United States Patent No. 10,594,443 (the "'443 Patent") (Exhibit E).

COUNT I
INFRINGMENT OF U.S. PATENT NO. 8,761,776

57. G+ incorporates by reference paragraphs 1 - 56 as though fully set forth herein.

58. Samsung infringes, contributes to the infringement of, and/or induces infringement of the '776 Patent by making, using, selling, offering for sale, exporting from, and/or importing into the United States products and/or methods covered by one or more claims of the '776 Patent including, but not limited to, at least the Accused Products.

59. For example, and as shown below, the Accused Products infringe at least claim 1 of the '776 patent by virtue of their compatibility with and practice of the 3GPP 5G Standard. For example, and to the extent the preamble is limiting, each of the Accused Products comprises **A cell reselection method, by which a terminal, which is currently associated with a serving cell**

on a serving frequency with a first priority, performs reselection among cells on multiple frequencies, other than the serving frequency, with a second priority. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):

5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

(Pages 21 and 22 of standard document)

5.2.4.2 Measurement rules for cell re-selection

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, the UE may choose not to perform intra-frequency measurements.
- Otherwise, the UE shall perform intra-frequency measurements.
- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:
  - For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].
  - For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:
    - If the serving cell fulfils Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;
    - Otherwise, the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

(Page 23 of standard document)

5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > $Thresh_{X, HighQ}$ during a time interval $Treselection_{RAT}$

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > $Thresh_{X, HighP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < $Thresh_{Serving, LowQ}$ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > $Thresh_{X, LowQ}$ during a time interval $Treselection_{RAT}$.

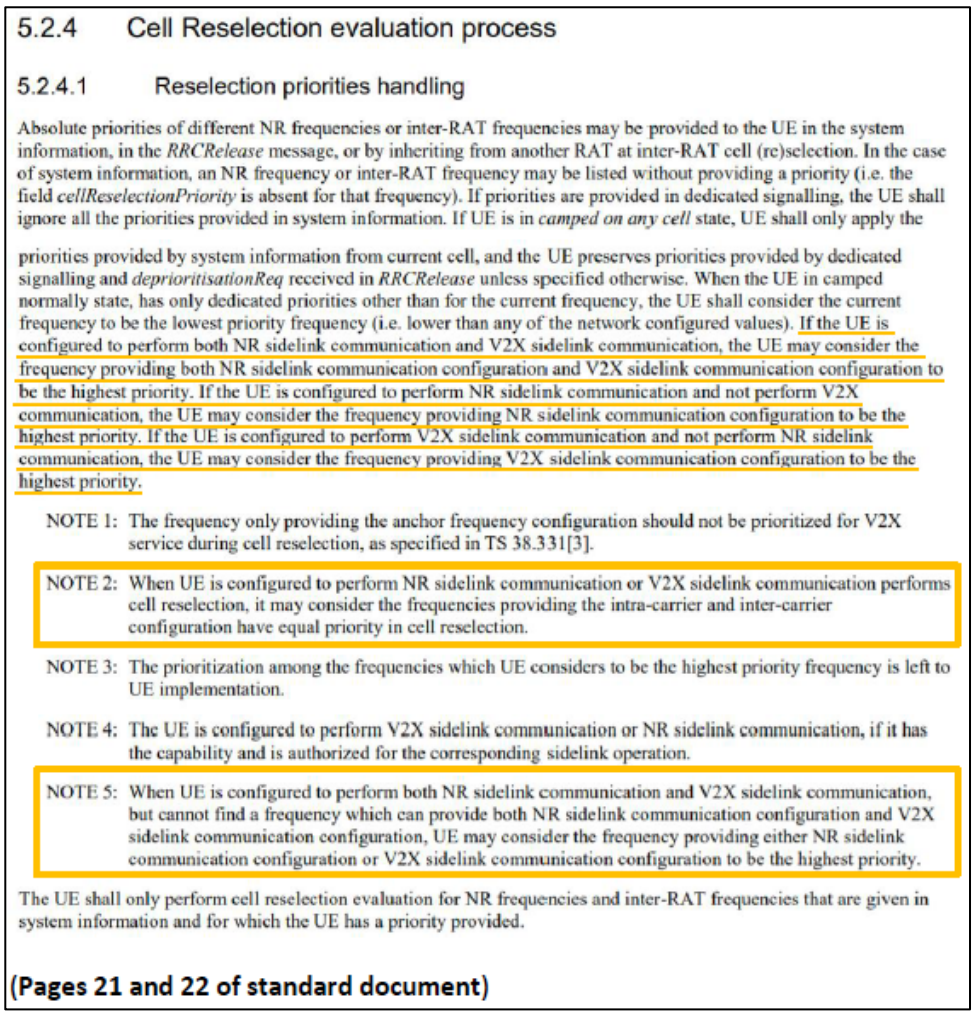
Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < $Thresh_{Serving, LowP}$ and a cell of a lower priority RAT/ frequency fulfils Srxlev > $Thresh_{X, LowP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

(Page 25 of standard document)

60. Each of the Accused Products further comprises a cell reselection method, including: **setting the cells on multiple frequencies with the second priority as same-priority cells**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):



5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

(Pages 21 and 22 of standard document)

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;
- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

(Pages 25 and 26 of standard document)

61. Each of the Accused Products further comprises a cell reselection method, including: **selecting cells on multiple frequencies with the second priority according to a priority-based reselection principle when a terminal performs cell reselection**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):

5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the

priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

(Pages 21 and 22 of standard document)

5.2.4.2 Measurement rules for cell re-selection

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, the UE may choose not to perform intra-frequency measurements.
- Otherwise, the UE shall perform intra-frequency measurements.
- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:
  - For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].
  - For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:
    - If the serving cell fulfils Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;
    - Otherwise, the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

(Page 23 of standard document)

5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > $Thresh_{X, HighQ}$ during a time interval $Treselection_{RAT}$

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > $Thresh_{X, HighP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < $Thresh_{Serving, LowQ}$ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > $Thresh_{X, LowQ}$ during a time interval $Treselection_{RAT}$.

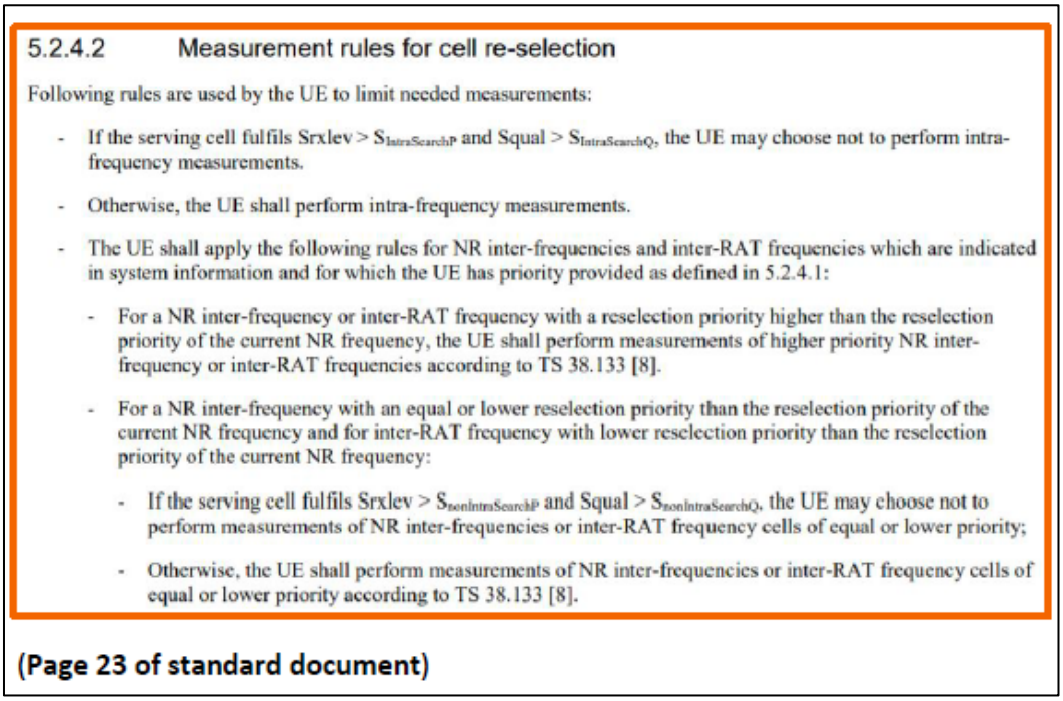
Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < $Thresh_{Serving, LowP}$ and a cell of a lower priority RAT/ frequency fulfils Srxlev > $Thresh_{X, LowP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

(Page 25 of standard document)

62. Each of the Accused Products further comprises a cell reselection method, including: **selecting a cell as a reselected cell by the terminal from among the same-priority cells based on a best-cell reselection principle**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):

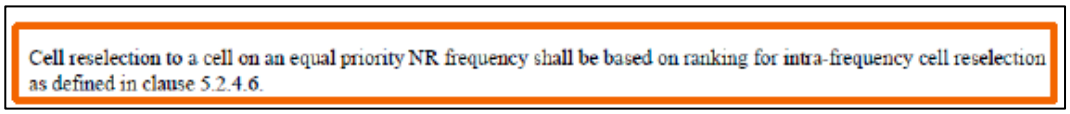


5.2.4.2 Measurement rules for cell re-selection

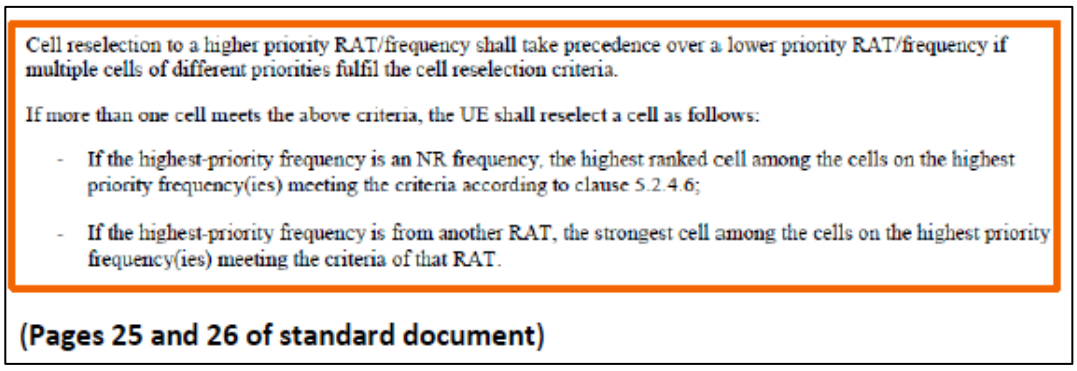
Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, the UE may choose not to perform intra-frequency measurements.
- Otherwise, the UE shall perform intra-frequency measurements.
- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:
  - For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].
  - For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:
    - If the serving cell fulfils Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;
    - Otherwise, the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

(Page 23 of standard document)



Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

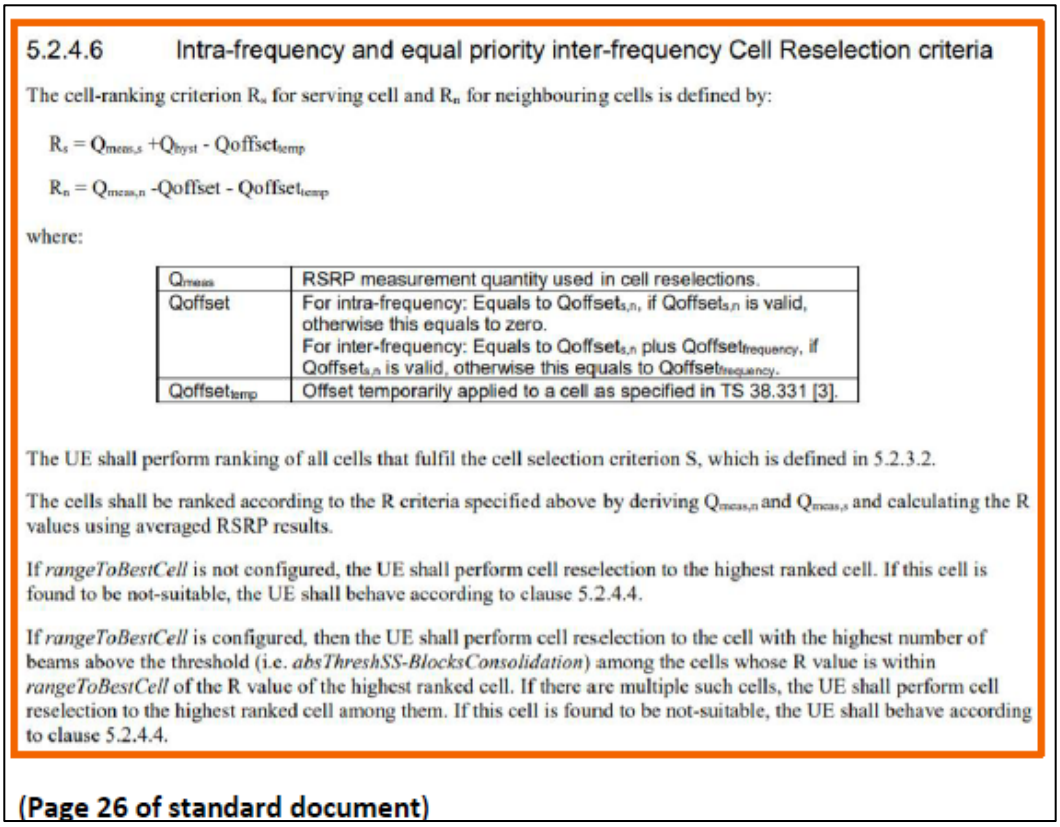


Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;
- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

(Pages 25 and 26 of standard document)



5.2.4.6 Intra-frequency and equal priority inter-frequency Cell Reselection criteria

The cell-ranking criterion R_s for serving cell and R_n for neighbouring cells is defined by:

$R_s = Q_{meas,s} + Q_{hyst} - Qoffset_{temp}$

$R_n = Q_{meas,n} - Qoffset - Qoffset_{temp}$

where:

Q_{meas}	RSRP measurement quantity used in cell reselections.
Qoffset	For intra-frequency: Equals to $Qoffset_{s,n}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to zero. For inter-frequency: Equals to $Qoffset_{s,n}$ plus $Qoffset_{frequency}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to $Qoffset_{frequency}$.
$Qoffset_{temp}$	Offset temporarily applied to a cell as specified in TS 38.331 [3].

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving $Q_{meas,n}$ and $Q_{meas,s}$ and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured, then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

(Page 26 of standard document)

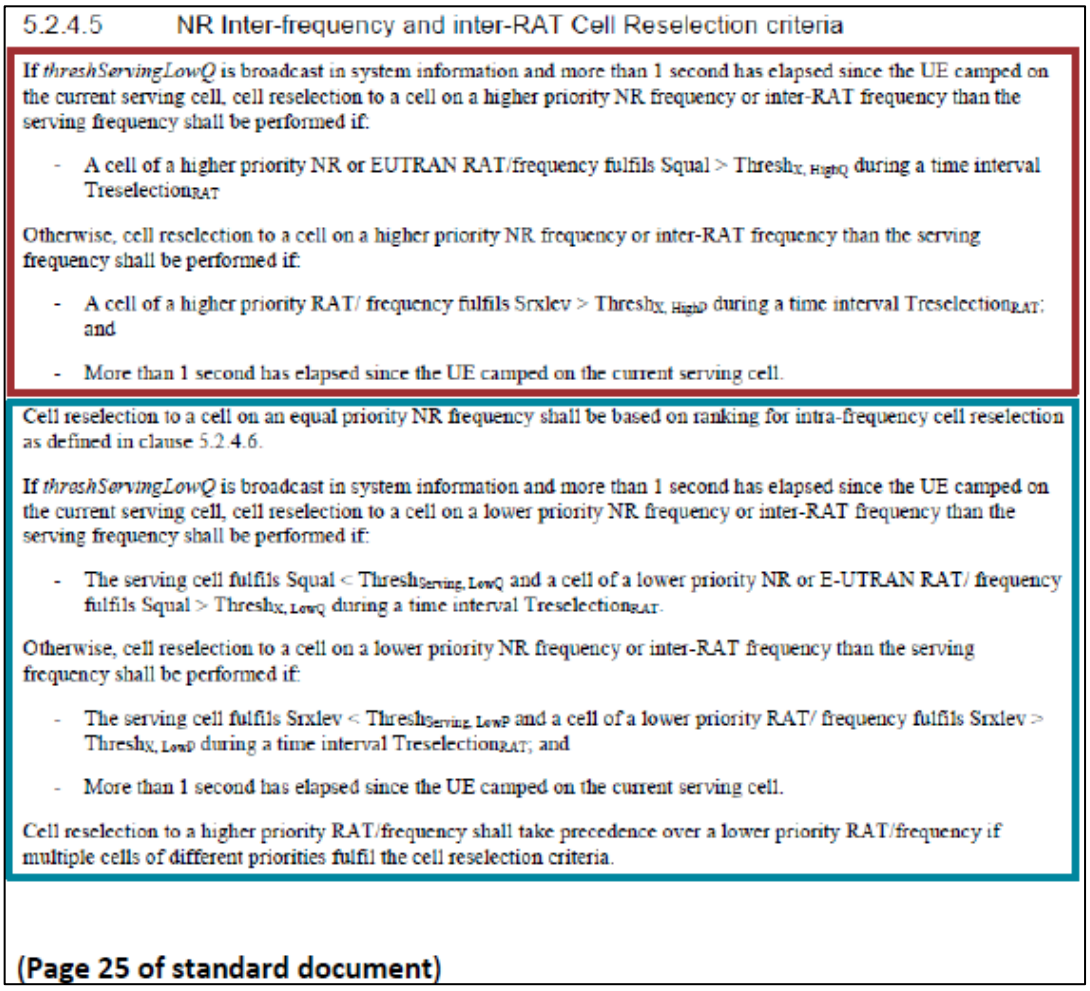
63. Each of the Accused Products further comprises wherein the same-priority cells include one of the following: **cells on multiple frequencies with the second priority that is higher than the first priority**; **cells on multiple frequencies with the second priority that is lower than the first priority; and a serving cell, and cells on the serving frequency and on one or more frequencies having the same priority with the serving frequency**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):

5.2.4.2 Measurement rules for cell re-selection

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, the UE may choose not to perform intra-frequency measurements.
- Otherwise, the UE shall perform intra-frequency measurements.
- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:
  - For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].
  - For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:
    - If the serving cell fulfils Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;
    - Otherwise, the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

(Page 23 of standard document)



5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > $Thresh_{X, HighQ}$ during a time interval $Treselection_{RAT}$

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > $Thresh_{X, HighP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < $Thresh_{Serving, LowQ}$ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > $Thresh_{X, LowQ}$ during a time interval $Treselection_{RAT}$.

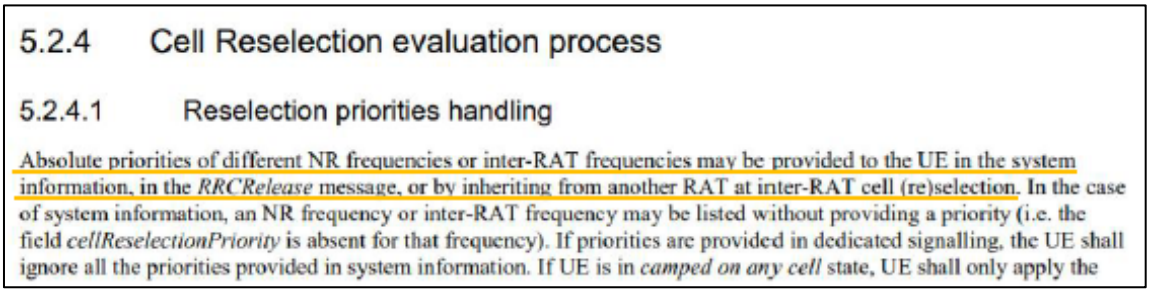
Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < $Thresh_{Serving, LowP}$ and a cell of a lower priority RAT/ frequency fulfils Srxlev > $Thresh_{X, LowP}$ during a time interval $Treselection_{RAT}$; and
- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

(Page 25 of standard document)

64. Each of the Accused Products further comprises **wherein the priority of the same-priority cells is equal to the absolute priority of corresponding frequencies**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):



5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the

priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

(Pages 21 and 22 of standard document)

5.2.4.7.0 General reselection parameters

Cell reselection parameters are broadcast in system information and are read from the serving cell as follows:

absThreshSS-BlocksConsolidation

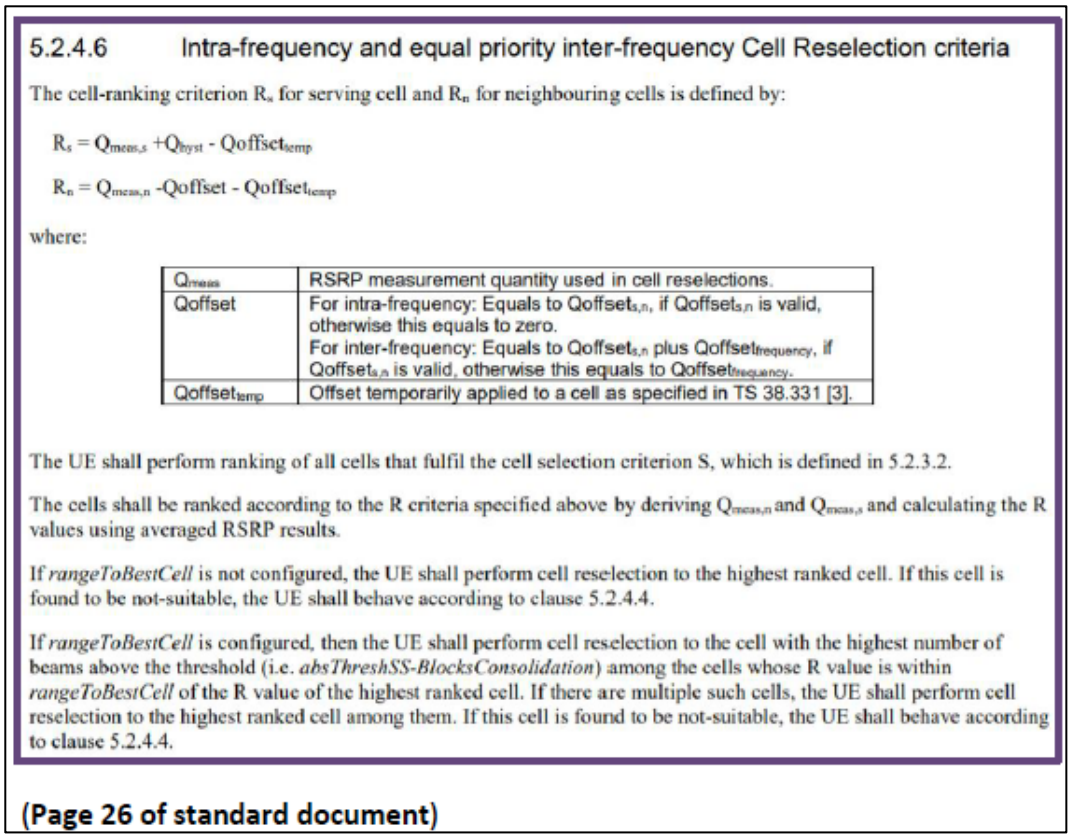
This specifies the minimum threshold for beams which can be used for selection of the highest ranked cells, if *rangeToBestCell* is configured, and for beams used for derivation of cell measurement quantity. The parameter in *SIB2* applies to the current serving frequency and the parameter in *SIB4* applies to the corresponding inter-frequency.

cellReselectionPriority

This specifies the absolute priority for NR frequency or E-UTRAN frequency.

(Page 26 of standard document)

65. Each of the Accused Products further comprises **wherein the best-cell reselection principle is an offset-based cell reselection principle**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.304 version 16.1.0 Release 16 (5G; NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state):



5.2.4.6 Intra-frequency and equal priority inter-frequency Cell Reselection criteria

The cell-ranking criterion R_s for serving cell and R_n for neighbouring cells is defined by:

$R_s = Q_{meas,s} + Q_{hyst} - Qoffset_{temp}$

$R_n = Q_{meas,n} - Qoffset - Qoffset_{temp}$

where:

Q_{meas}	RSRP measurement quantity used in cell reselections.
Qoffset	For intra-frequency: Equals to $Qoffset_{s,n}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to zero. For inter-frequency: Equals to $Qoffset_{s,n}$ plus $Qoffset_{frequency}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to $Qoffset_{frequency}$.
$Qoffset_{temp}$	Offset temporarily applied to a cell as specified in TS 38.331 [3].

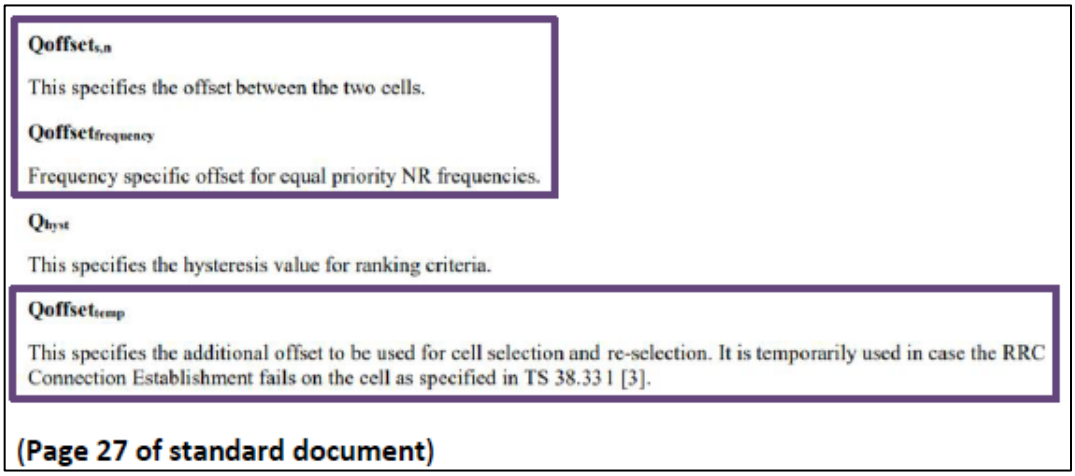
The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving $Q_{meas,n}$ and $Q_{meas,s}$ and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured, then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

(Page 26 of standard document)



$Qoffset_{s,n}$

This specifies the offset between the two cells.

$Qoffset_{frequency}$

Frequency specific offset for equal priority NR frequencies.

Q_{hyst}

This specifies the hysteresis value for ranking criteria.

$Qoffset_{temp}$

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the RRC Connection Establishment fails on the cell as specified in TS 38.331 [3].

(Page 27 of standard document)

66. Thus, as just illustrated above, the Accused Products directly infringe one or more claims of the '776 Patent. Samsung makes, uses, sells, offers for sale, exports, and/or imports, in this District and/or elsewhere in the United States, these devices and thus directly infringes the '776 Patent.

67. Samsung has had knowledge and notice of the ’776 Patent since at least September 8, 2021.

68. Samsung indirectly infringes the ’776 patent, as provided in 35 U.S.C. §271(b), by inducing infringement by others, such as Samsung’s customers and end-users, in this District and elsewhere in the United States. For example, Samsung’s customers and end-users directly infringe through their use of the inventions claimed in the ’776 Patent. Samsung induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting they use the Accused Products in an infringing manner, including in-store technical support, online technical support, marketing, product manuals, advertisements, and online documentation. As a result of Samsung’s inducement, Samsung’s customers and end-users use the Accused Products in the way Samsung intends and directly infringe the ’776 Patent. Samsung performs these affirmative acts with knowledge of the ’776 Patent and with the intent, or willful blindness, that the induced acts directly infringe the ’776 Patent.

69. Samsung also indirectly infringes the ’776 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement committed by others, such as customers and end users, in this District and elsewhere in the United States. Samsung’s affirmative acts of selling and offering to sell, in this District and elsewhere in the United States, the Accused Products and causing the Accused Products to be manufactured, used, sold, and offered for sale contribute to Samsung’s customers and end-users use of the Accused Products, such that the ’776 Patent is directly infringed. The accused components within the Accused Products are material to the invention of the ’776 Patent, are not staple articles or commodities of commerce, have no

substantial non-infringing uses, and are known by Samsung to be especially made or adapted for use in the infringement of the '776 Patent. Samsung performs these affirmative acts with knowledge of the '776 Patent and with intent, or willful blindness, that Samsung causes the direct infringement of the '776 Patent.

70. Samsung's infringement of the '776 Patent has damaged and will continue to damage G+.

71. Moreover, Samsung's risk of infringement of the Asserted Patents was either known or was so obvious that it should have been known to Samsung.

72. Notwithstanding this knowledge, Samsung has knowingly or with reckless disregard willfully infringed the '776 Patent. Samsung continues to infringe despite knowledge of G+'s Asserted Patents. Samsung has thus had actual notice of infringement of the '776 Patent and acted despite an objectively high likelihood that its actions constituted infringement of G+'s valid patent rights, either literally or equivalently.

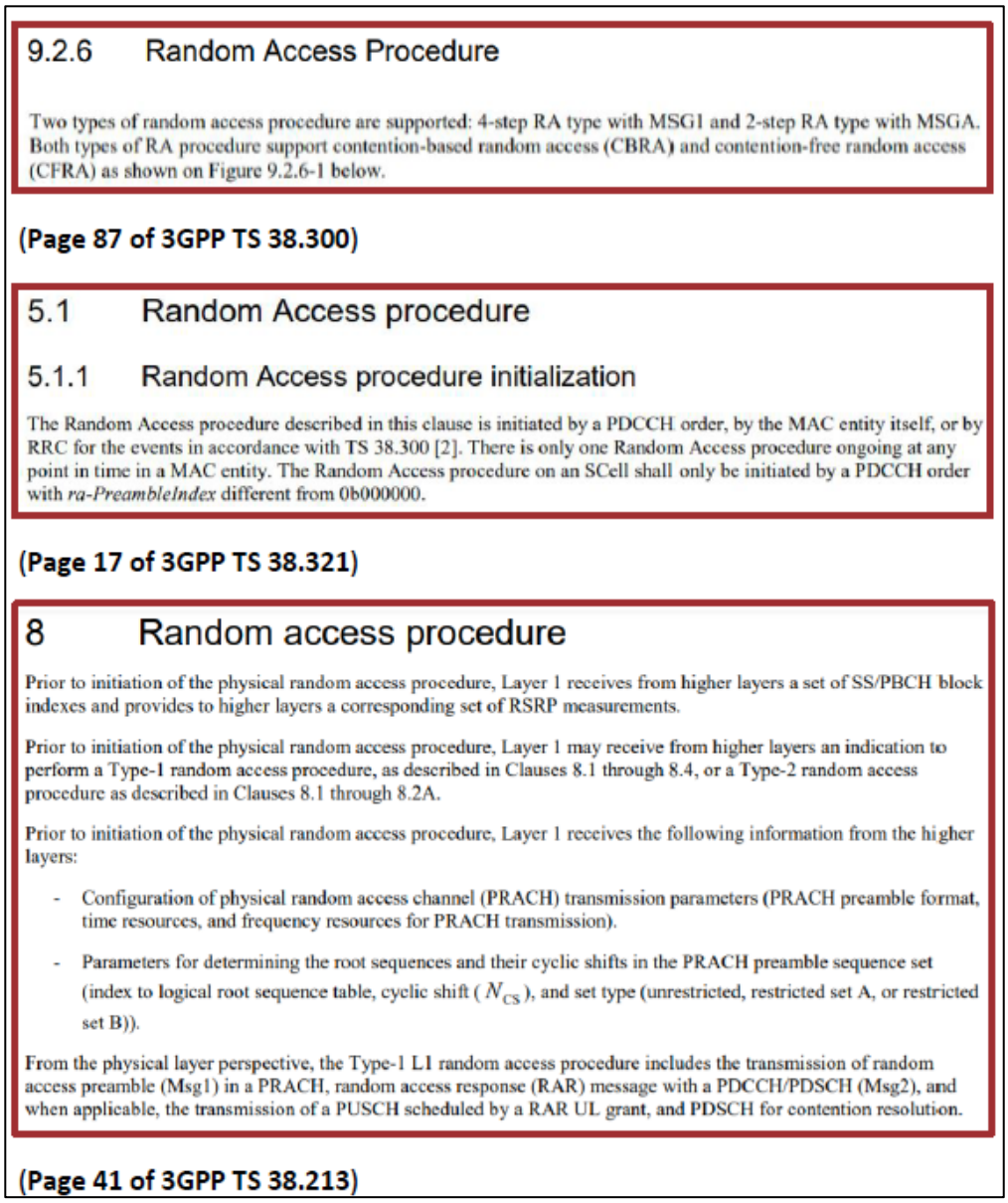
73. This objective risk was either known or so obvious that it should have been known to Samsung. Accordingly, Plaintiff seeks enhanced damages pursuant to 35 U.S.C. §§ 284 and 285.

COUNT II
INFRINGMENT OF U.S. PATENT NO. 10,448,430

74. G+ incorporates by reference paragraphs 1 - 56 as though fully set forth herein.

75. Samsung infringes, contributes to the infringement of, and/or induces infringement of the '430 Patent by making, using, selling, offering for sale, exporting from, and/or importing into the United States products and/or methods covered by one or more claims of the '430 Patent including, but not limited to, at least the Accused Products.

76. For example, and as shown below, the Accused Products infringe at least claim 1 of the ’430 Patent by virtue of their compatibility with and practice of the 3GPP 5G Standard. For example, and to the extent the preamble is limiting, each of the Accused Products comprises **a random access method**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2), 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification), and 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control):



9.2.6 Random Access Procedure

Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below.

(Page 87 of 3GPP TS 38.300)

5.1 Random Access procedure

5.1.1 Random Access procedure initialization

The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell shall only be initiated by a PDCCH order with *ra-PreambleIndex* different from 0b000000.

(Page 17 of 3GPP TS 38.321)

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

(Page 41 of 3GPP TS 38.213)

77. Each of the Accused Products further comprises **a random access method** comprising **sending, by a first User Equipment (UE) in a UE group, a preamble to an evolved Node B (eNB) over a time-frequency resource,** the time-frequency resource comprising a time domain resource and a frequency domain resource. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2), 3GPP TS 38.321 version 16.4.0 Release

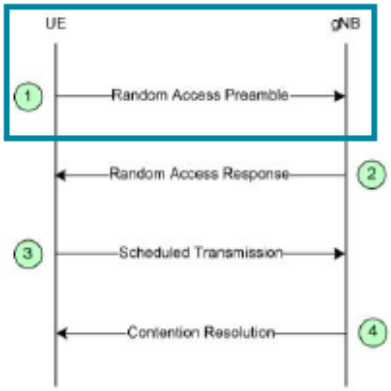
16 (5G; NR; Medium Access Control (MAC) protocol specification), and 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control):

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

(Pages 87 and 88 of 3GPP TS 38.300)

5.1.3 Random Access Preamble transmission

The MAC entity shall, for each Random Access Preamble:

1> if *PREAMBLE_TRANSMISSION_COUNTER* is greater than one; and

1> if the notification of suspending power ramping counter has not been received from lower layers; and

1> if LBT failure indication was not received from lower layers for the last Random Access Preamble transmission; and

1> if SSB or CSI-RS selected is not changed from the selection in the last Random Access Preamble transmission:

2> increment *PREAMBLE_POWER_RAMPING_COUNTER* by 1.

1> select the value of *DELTA_PREAMBLE* according to clause 7.3;

1> set *PREAMBLE_RECEIVED_TARGET_POWER* to *preambleReceivedTargetPower* + *DELTA_PREAMBLE* + (*PREAMBLE_POWER_RAMPING_COUNTER* – 1) × *PREAMBLE_POWER_RAMPING_STEP* + *POWER_OFFSET_2STEP_RA*;

1> except for contention-free Random Access Preamble for beam failure recovery request, compute the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted;

1> instruct the physical layer to transmit the Random Access Preamble using the selected PRACH occasion, corresponding RA-RNTI (if available), *PREAMBLE_INDEX*, and *PREAMBLE_RECEIVED_TARGET_POWER*.

The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s\_id + 14 \times t\_id + 14 \times 80 \times f\_id + 14 \times 80 \times 8 \times ul\_carrier\_id$$

where s_id is the index of the first OFDM symbol of the PRACH occasion ($0 \le s\_id < 14$), t_id is the index of the first slot of the PRACH occasion in a system frame ($0 \le t\_id < 80$), where the subcarrier spacing to determine t_id is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], f_id is the index of the PRACH occasion in the frequency domain ($0 \le f\_id < 8$), and ul_carrier_id is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier).

(Pages 27 and 28 of 3GPP TS 38.321)

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

8.1 Random access preamble

Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following:

- A configuration for PRACH transmission [4, TS 38.211].
- A preamble index, a preamble SCS, $P_{PRACH,target,f,c}$, a corresponding RA-RNTI, and a PRACH resource.

A PRACH is transmitted using the selected PRACH format with transmission power $P_{PRACH,b,f,c}(i)$, as described in Clause 7.4, on the indicated PRACH resource.

For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

(Pages 41 and 42 of 3GPP TS 38.213)

7.4 Physical random access channel

A UE determines a transmission power for a physical random access channel (PRACH), $P_{PRACH,b,f,c}(i)$, on active UL BWP b of carrier f of serving cell c based on DL RS for serving cell c in transmission occasion i as

$$P_{PRACH,b,f,c}(i) = \min\left\{P_{CMAX,f,c}(i), P_{PRACH,target,f,c} + PL_{b,f,c}\right\} \text{ [dBm]}$$

where $P_{CMAX,f,c}(i)$ is the UE configured maximum output power defined in [8-1, TS 38.101-1], [8-2, TS 38.101-2] and [8-3, TS 38.101-3] for carrier f of serving cell c within transmission occasion i, $P_{PRACH,target,f,c}$ is the PRACH target reception power *PREAMBLE_RECEIVED_TARGET_POWER* provided by higher layers [11, TS 38.321] for the active UL BWP b of carrier f of serving cell c, and $PL_{b,f,c}$ is a pathloss for the active UL BWP b of carrier f based on the DL RS associated with the PRACH transmission on the active DL BWP of serving cell c and calculated by the UE in dB as *referenceSignalPower* − higher layer filtered RSRP in dBm, where RSRP is defined in [7, TS 38.215] and the higher layer filter configuration is defined in [12, TS 38.331]. If the active DL BWP is the initial DL BWP and for SS/PBCH block and CORESET multiplexing pattern 2 or 3, as described in Clause 13, the UE determines $PL_{b,f,c}$ based on the SS/PBCH block associated with the PRACH transmission.

78. Each of the Accused Products further comprises **a random access method** comprising **monitoring, by at least one of the first UE or a second UE in the UE group, a Random Access Response (RAR) corresponding to the preamble and sent by the eNB, wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group**. As shown below, this functionality is described in the 3GPP 5G Standard,

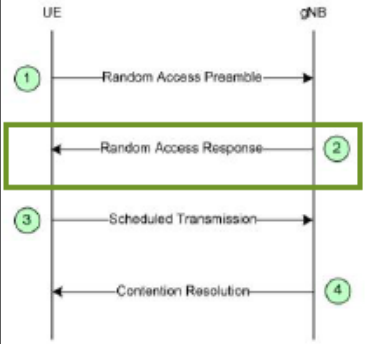
including but not limited to 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2), 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification), and 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control):

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

(Pages 87 and 88 of 3GPP TS 38.300)

5.1.4 Random Access Response reception

Once the Random Access Preamble is transmitted and regardless of the possible occurrence of a measurement gap, the MAC entity shall:

1> if the contention-free Random Access Preamble for beam failure recovery request was transmitted by the MAC entity:

2> start the *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;

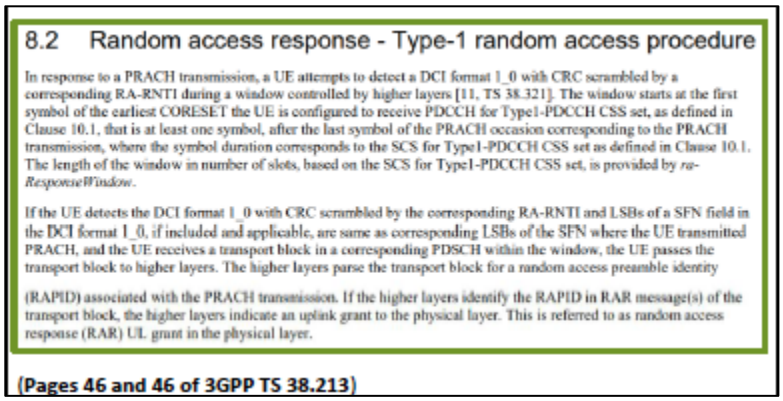
2> monitor for a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* of the SpCell identified by the C-RNTI while *ra-ResponseWindow* is running.

1> else:

2> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;

2> monitor the PDCCH of the SpCell for Random Access Response(s) identified by the RA-RNTI while the *ra-ResponseWindow* is running.

(Page 30 of 3GPP TS 38.321)



8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in Clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in Clause 10.1. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.

If the UE detects the DCI format 1_0 with CRC scrambled by the corresponding RA-RNTI and LSBs of a SFN field in the DCI format 1_0, if included and applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers parse the transport block for a random access preamble identity

(RAPID) associated with the PRACH transmission. If the higher layers identify the RAPID in RAR message(s) of the transport block, the higher layers indicate an uplink grant to the physical layer. This is referred to as random access response (RAR) UL grant in the physical layer.

(Pages 46 and 46 of 3GPP TS 38.213)

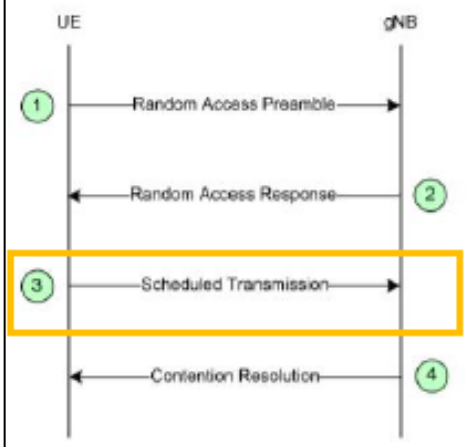
79. Each of the Accused Products further comprises a random access method comprising **after monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB: sending, by at least one of the first UE or the second UE, a message 3 according to a Uplink (UL) grant allocated thereto, wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2), 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification), and 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control):

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

(Pages 87 and 88 of 3GPP TS 38.300)

Msg3: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

(Page 10 of 3GPP TS 38.321)

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;

1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;

1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:

2> if the C-RNTI MAC CE was included in Msg3:

3> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI; or

(Page 35 of 3GPP TS 38.321)

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or

1> if an uplink grant has been received in a Random Access Response:

2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:

3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.

2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

(Page 42 of 3GPP TS 38.321)

6.1.3.2 C-RNTI MAC CE

The C-RNTI MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2.

It has a fixed size and consists of a single field defined as follows (Figure 6.1.3.2-1):

- C-RNTI: This field contains the C-RNTI of the MAC entity. The length of the field is 16 bits.

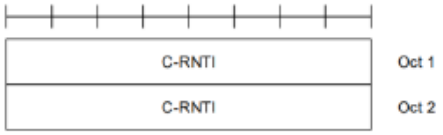


Figure 6.1.3.2-1: C-RNTI MAC CE

(Page 114 of 3GPP TS 38.321)

8.3 PUSCH scheduled by RAR UL grant

An active UL BWP, as described in Clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

(Page 49 of 3GPP TS 38.213)

A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI. Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321]. The UE always transmits the PUSCH scheduled by a RAR UL grant without repetitions.

(Page 51 of 3GPP TS 38.213)

80. Thus, as just illustrated above, the Accused Products directly infringe one or more claims of the ’430 Patent. Samsung makes, uses, sells, offers for sale, exports, and/or imports, in

this District and/or elsewhere in the United States, these devices and thus directly infringes the '430 Patent.

81. Samsung has had knowledge and notice of the '430 Patent since at least September 8, 2021.

82. Samsung indirectly infringes the '430 Patent, as provided in 35 U.S.C. §271(b), by inducing infringement by others, such as Samsung's customers and end-users, in this District and elsewhere in the United States. For example, Samsung's customers and end-users directly infringe through their use of the inventions claimed in the '430 Patent. Samsung induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting they use the Accused Products in an infringing manner, including in-store technical support, online technical support, marketing, product manuals, advertisements, and online documentation. As a result of Samsung's inducement, Samsung's customers and end-users use the Accused Products in the way Samsung intends and directly infringe the '430 Patent. Samsung performs these affirmative acts with knowledge of the '430 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '430 Patent.

83. Samsung also indirectly infringes the '430 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement committed by others, such as customers and end users, in this District and elsewhere in the United States. Samsung's affirmative acts of selling and offering to sell, in this District and elsewhere in the United States, the Accused Products and causing the Accused Products to be manufactured, used, sold, and offered for sale contribute to Samsung's customers and end-users use of the Accused Products, such that the '430 Patent is

directly infringed. The accused components within the Accused Products are material to the invention of the '430 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Samsung to be especially made or adapted for use in the infringement of the '430 Patent. Samsung performs these affirmative acts with knowledge of the '430 Patent and with intent, or willful blindness, that Samsung causes the direct infringement of the '430 Patent.

84. Samsung's infringement of the '430 Patent has damaged and will continue to damage G+.

85. Moreover, Samsung's risk of infringement of the Asserted Patents was either known or was so obvious that it should have been known to Samsung.

86. Notwithstanding this knowledge, Samsung has knowingly or with reckless disregard willfully infringed the '430 Patent. Samsung continues to infringe despite knowledge of G+'s Asserted Patents. Samsung has thus had actual notice of infringement of the '430 Patent and acted despite an objectively high likelihood that its actions constituted infringement of G+'s valid patent rights, either literally or equivalently.

87. This objective risk was either known or so obvious that it should have been known to Samsung.

88. Accordingly, Plaintiff seeks enhanced damages pursuant to 35 U.S.C. §§ 284 and 285.

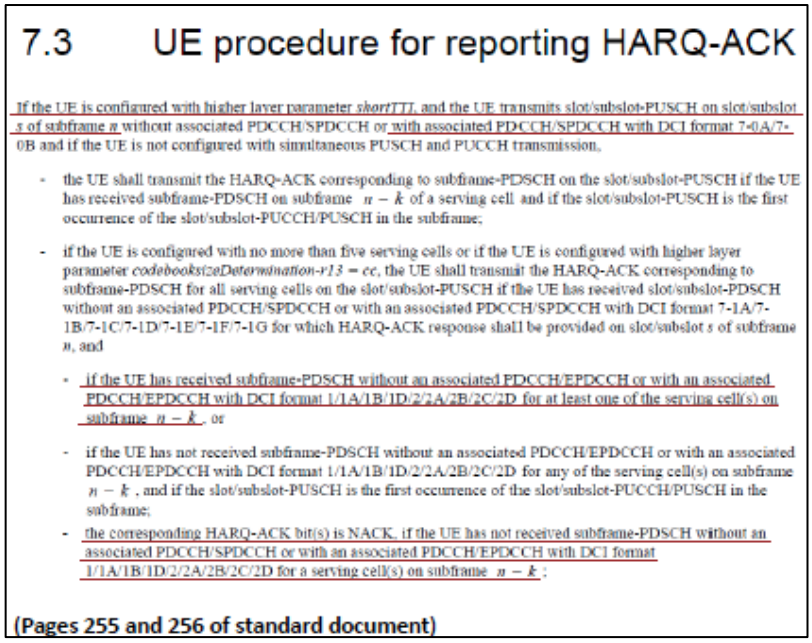
COUNT III
INFRINGMENT OF U.S. PATENT NO. 9,184,881

89. G+ incorporates by reference paragraphs 1 - 56 as though fully set forth herein.

90. Samsung infringes, contributes to the infringement of, and/or induces infringement of the '881 Patent by making, using, selling, offering for sale, exporting from, and/or importing

into the United States products and/or methods covered by one or more claims of the ’881 Patent including, but not limited to, at least the Accused Products.

91. For example, and as shown below, the Accused Products infringe at least claim 9 of the ’881 Patent by virtue of their compatibility with and practice of the 3GPP 5G Standard. For example, and to the extent the preamble is limiting, each of the Accused Products comprises a method for feeding back confirmation information on a physical uplink shared channel, wherein, when the confirmation information is fed back together with uplink data on the physical uplink shared channel, in a situation that a user equipment fails to detect a physical downlink control channel corresponding to transmitted data in a sub-frame transmitting data, the user equipment feeds back a negative acknowledgement message as confirmation information of this downlink sub-frame. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.213 version 16.2.0 Release 16 (5G; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures):



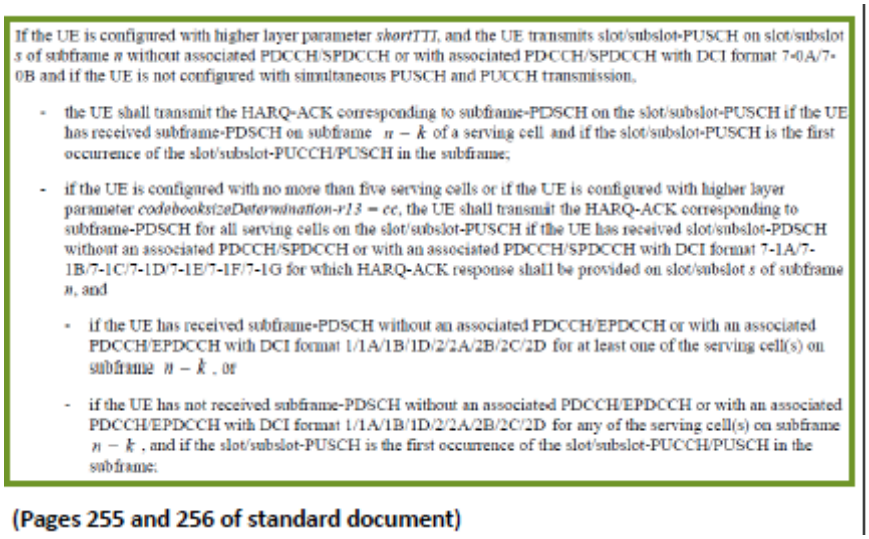
7.3 UE procedure for reporting HARQ-ACK

If the UE is configured with higher layer parameter *shortTTI*, and the UE transmits slot/subslot-PUSCH on slot/subslot s of subframe n without associated PDCCH/SPDCCH or with associated PDCCH/SPDCCH with DCI format 7-0A/7-0B and if the UE is not configured with simultaneous PUSCH and PUCCH transmission,

- the UE shall transmit the HARQ-ACK corresponding to subframe-PDSCH on the slot/subslot-PUSCH if the UE has received subframe-PDSCH on subframe $n-k$ of a serving cell and if the slot/subslot-PUSCH is the first occurrence of the slot/subslot-PUCCH/PUSCH in the subframe;
- if the UE is configured with no more than five serving cells or if the UE is configured with higher layer parameter *codebooksizeDetermination-r13* = *cc*, the UE shall transmit the HARQ-ACK corresponding to subframe-PDSCH for all serving cells on the slot/subslot-PUSCH if the UE has received slot/subslot-PDSCH without an associated PDCCH/SPDCCH or with an associated PDCCH/SPDCCH with DCI format 7-1A/7-1B/7-1C/7-1D/7-1E/7-1F/7-1G for which HARQ-ACK response shall be provided on slot/subslot s of subframe n, and
  - if the UE has received subframe-PDSCH without an associated PDCCH/EPDCCH or with an associated PDCCH/EPDCCH with DCI format 1/1A/1B/1D/2/2A/2B/2C/2D for at least one of the serving cell(s) on subframe $n-k$, or
  - if the UE has not received subframe-PDSCH without an associated PDCCH/EPDCCH or with an associated PDCCH/EPDCCH with DCI format 1/1A/1B/1D/2/2A/2B/2C/2D for any of the serving cell(s) on subframe $n-k$, and if the slot/subslot-PUSCH is the first occurrence of the slot/subslot-PUCCH/PUSCH in the subframe;
- the corresponding HARQ-ACK bit(s) is NACK, if the UE has not received subframe-PDSCH without an associated PDCCH/SPDCCH or with an associated PDCCH/EPDCCH with DCI format 1/1A/1B/1D/2/2A/2B/2C/2D for a serving cell(s) on subframe $n-k$;

(Pages 255 and 256 of standard document)

92. Each of the Accused Products further comprises **in a situation that the user equipment detects the physical downlink control channel corresponding to the transmitted data in the sub-frame transmitting the data, the user equipment analyzes data in this downlink sub-frame, and feeds back an acknowledgement message as the confirmation information in a situation that the analysis is successful, otherwise, the negative acknowledgement message is fed back as the confirmation information**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.213 version 16.2.0 Release 16 (5G; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures):



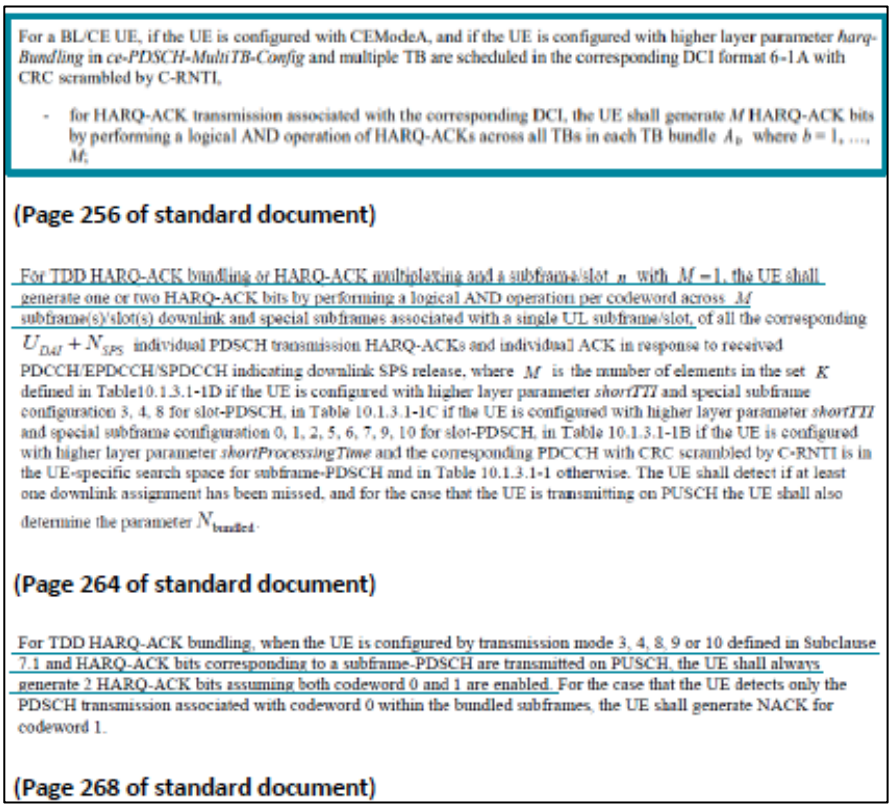
If the UE is configured with higher layer parameter *shortTTI*, and the UE transmits slot/subslot-PUSCH on slot/subslot s of subframe n without associated PDCCH/SPDCCH or with associated PDCCH/SPDCCH with DCI format 7-0A/7-0B and if the UE is not configured with simultaneous PUSCH and PUCCH transmission,

- the UE shall transmit the HARQ-ACK corresponding to subframe-PDSCH on the slot/subslot-PUSCH if the UE has received subframe-PDSCH on subframe $n-k$ of a serving cell and if the slot/subslot-PUSCH is the first occurrence of the slot/subslot-PUCCH/PUSCH in the subframe;
- if the UE is configured with no more than five serving cells or if the UE is configured with higher layer parameter *codebooksizeDetermination-r13* = *cc*, the UE shall transmit the HARQ-ACK corresponding to subframe-PDSCH for all serving cells on the slot/subslot-PUSCH if the UE has received slot/subslot-PDSCH without an associated PDCCH/SPDCCH or with an associated PDCCH/SPDCCH with DCI format 7-1A/7-1B/7-1C/7-1D/7-1E/7-1F/7-1G for which HARQ-ACK response shall be provided on slot/subslot s of subframe n, and
  - if the UE has received subframe-PDSCH without an associated PDCCH/EPDCCH or with an associated PDCCH/EPDCCH with DCI format 1/1A/1B/1D/2/2A/2B/2C/2D for at least one of the serving cell(s) on subframe $n-k$, or
  - if the UE has not received subframe-PDSCH without an associated PDCCH/EPDCCH or with an associated PDCCH/EPDCCH with DCI format 1/1A/1B/1D/2/2A/2B/2C/2D for any of the serving cell(s) on subframe $n-k$, and if the slot/subslot-PUSCH is the first occurrence of the slot/subslot-PUCCH/PUSCH in the subframe;

(Pages 255 and 256 of standard document)

93. Each of the Accused Products further comprises **in a situation that the user equipment feeds back a plurality of groups of the confirmation information, an amount of the confirmation information fed back in each group is equal to a maximum number of codeword streams in this downlink sub-frame, and respective confirmation information in each group corresponds to the confirmation information of the codeword stream of a corresponding downlink sub-frame**. As shown below, this functionality is described in the 3GPP

5G Standard, including but not limited to 3GPP TS 36.213 version 16.2.0 Release 16 (5G; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures):



For a BL/CE UE, if the UE is configured with CEModeA, and if the UE is configured with higher layer parameter *harq-Bundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI format 6-1A with CRC scrambled by C-RNTI,

- for HARQ-ACK transmission associated with the corresponding DCI, the UE shall generate M HARQ-ACK bits by performing a logical AND operation of HARQ-ACKs across all TBs in each TB bundle A_b where $b = 1, \ldots, M$;

(Page 256 of standard document)

For TDD HARQ-ACK bundling or HARQ-ACK multiplexing and a subframe/slot n with $M = 1$, the UE shall generate one or two HARQ-ACK bits by performing a logical AND operation per codeword across M subframe(s)/slot(s) downlink and special subframes associated with a single UL subframe/slot, of all the corresponding $U_{DAI} + N_{SPS}$ individual PDSCH transmission HARQ-ACKs and individual ACK in response to received PDCCH/EPDCCH/SPDCCH indicating downlink SPS release, where M is the number of elements in the set K defined in Table10.1.3.1-1D if the UE is configured with higher layer parameter *shortTTI* and special subframe configuration 3, 4, 8 for slot-PDSCH, in Table 10.1.3.1-1C if the UE is configured with higher layer parameter *shortTTI* and special subframe configuration 0, 1, 2, 5, 6, 7, 9, 10 for slot-PDSCH, in Table 10.1.3.1-1B if the UE is configured with higher layer parameter *shortProcessingTime* and the corresponding PDCCH with CRC scrambled by C-RNTI is in the UE-specific search space for subframe-PDSCH and in Table 10.1.3.1-1 otherwise. The UE shall detect if at least one downlink assignment has been missed, and for the case that the UE is transmitting on PUSCH the UE shall also determine the parameter $N_{bundled}$.

(Page 264 of standard document)

For TDD HARQ-ACK bundling, when the UE is configured by transmission mode 3, 4, 8, 9 or 10 defined in Subclause 7.1 and HARQ-ACK bits corresponding to a subframe-PDSCH are transmitted on PUSCH, the UE shall always generate 2 HARQ-ACK bits assuming both codeword 0 and 1 are enabled. For the case that the UE detects only the PDSCH transmission associated with codeword 0 within the bundled subframes, the UE shall generate NACK for codeword 1.

(Page 268 of standard document)

94. Each of the Accused Products further comprises **in a situation that the number of the codeword streams of the downlink sub-frame is smaller than the maximum number of the codeword streams of the downlink sub-frame, the user equipment feeds back the confirmation information of the maximum number of the codeword streams, wherein confirmation information without a corresponding codeword stream is set as a predefined fixed value**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.213 version 16.2.0 Release 16 (5G; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures):

For the case that the UE is transmitting on PUSCH and the PUSCH transmission is performed based on a detected PDCCH/EPDCCH/SPDCCH with DCI format 0/4/7-0A/7-0B intended for the UE and TDD UL/DL configurations 1-6, if $V_{DAI}^{UL} \neq (U_{DAI} + N_{SPS} - 1) \bmod 4 + 1$ the UE detects that at least one downlink assignment has been missed and the UE shall generate NACK for all codewords where $N_{bundled}$ is determined by the UE as $N_{bundled} = V_{DAI}^{UL} + 2$. If the UE does not detect any downlink assignment missing, $N_{bundled}$ is determined by the UE as $N_{bundled} = V_{DAI}^{UL}$. UE shall not transmit HARQ-ACK if $U_{DAI} + N_{SPS} = 0$ and $V_{DAI}^{UL} = 4$.

(Page 265 of standard document)

For TDD HARQ-ACK bundling, when the UE is configured by transmission mode 3, 4, 8, 9 or 10 defined in Subclause 7.1 and HARQ-ACK bits corresponding to a subframe-PDSCH are transmitted on PUSCH, the UE shall always generate 2 HARQ-ACK bits assuming both codeword 0 and 1 are enabled. For the case that the UE detects only the PDSCH transmission associated with codeword 0 within the bundled subframes, the UE shall generate NACK for codeword 1.

(Page 268 of standard document)

Comment: As per the patent specification, for any missing codeword stream of the downlink sub-frame, the confirmation information is set to a default value of NACK information "...**in the situation of the single codeword stream the ACK/NACK information of the other codeword streams is default value, the default value is the NACK information.**"

95. Each of the Accused Products further comprises **when the user equipment fails to detect the physical downlink control channel corresponding to the transmitted data in the sub-frame which transmits the data, the user equipment feeds back the negative acknowledgement message as the confirmation information of each codeword stream in a group corresponding to this downlink sub-frame**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.213 version 16.2.0 Release 16 (5G; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures):

For the case that the UE is transmitting on PUSCH and the PUSCH transmission is performed based on a detected PDCCH/EPDCCH/SPDCCH with DCI format 0/4/7-0A/7-0B intended for the UE and TDD UL/DL configurations 1-6, if $V_{DAI}^{UL} \neq (U_{DAI} + N_{SPS} - 1) \bmod 4 + 1$ the UE detects that at least one downlink assignment has been missed and the UE shall generate NACK for all codewords where $N_{bundled}$ is determined by the UE as $N_{bundled} = V_{DAI}^{UL} + 2$. If the UE does not detect any downlink assignment missing, $N_{bundled}$ is determined by the UE as $N_{bundled} = V_{DAI}^{UL}$. UE shall not transmit HARQ-ACK if $U_{DAI} + N_{SPS} = 0$ and $V_{DAI}^{UL} = 4$.

(Page 265 of standard document)

For TDD HARQ-ACK bundling, when the UE is configured by transmission mode 3, 4, 8, 9 or 10 defined in Subclause 7.1 and HARQ-ACK bits corresponding to a subframe-PDSCH are transmitted on PUSCH, the UE shall always generate 2 HARQ-ACK bits assuming both codeword 0 and 1 are enabled. For the case that the UE detects only the PDSCH transmission associated with codeword 0 within the bundled subframes, the UE shall generate NACK for codeword 1.

(Page 268 of standard document)

96. Thus, as just illustrated above, the Accused Products directly infringe one or more claims of the ’881 Patent. Samsung makes, uses, sells, offers for sale, exports, and/or imports, in this District and/or elsewhere in the United States, these devices and thus directly infringes the ’881 Patent.

97. Samsung has had knowledge and notice of the ’881 Patent since at least September 8, 2021.

98. Samsung indirectly infringes the ’881 Patent, as provided in 35 U.S.C. §271(b), by inducing infringement by others, such as Samsung’s customers and end-users, in this District and elsewhere in the United States. For example, Samsung’s customers and end-users directly infringe through their use of the inventions claimed in the ’881 Patent. Samsung induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting they use the Accused Products in an infringing manner, including in-store technical support, online technical support, marketing, product manuals, advertisements, and online documentation. As a result of Samsung’s inducement,

Samsung's customers and end-users use the Accused Products in the way Samsung intends and directly infringe the '881 Patent. Samsung performs these affirmative acts with knowledge of the '881 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '881 Patent.

99. Samsung also indirectly infringes the '881 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement committed by others, such as customers and end users, in this District and elsewhere in the United States. Samsung's affirmative acts of selling and offering to sell, in this District and elsewhere in the United States, the Accused Products and causing the Accused Products to be manufactured, used, sold, and offered for sale contribute to Samsung's customers and end-users use of the Accused Products, such that the '881 Patent is directly infringed. The accused components within the Accused Products are material to the invention of the '881 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Samsung to be especially made or adapted for use in the infringement of the '881 Patent. Samsung performs these affirmative acts with knowledge of the '881 Patent and with intent, or willful blindness, that Samsung causes the direct infringement of the '881 Patent.

100. Samsung's infringement of the '881 Patent has damaged and will continue to damage G+.

101. Moreover, Samsung's risk of infringement of the Asserted Patents was either known or was so obvious that it should have been known to Samsung.

102. Notwithstanding this knowledge, Samsung has knowingly or with reckless disregard willfully infringed the '881 Patent. Samsung continues to infringe despite knowledge of G+'s Asserted Patents. Samsung has thus had actual notice of infringement of the '881 Patent and

acted despite an objectively high likelihood that its actions constituted infringement of G+'s valid patent rights, either literally or equivalently.

103. This objective risk was either known or so obvious that it should have been known to Samsung.

104. Accordingly, Plaintiff seeks enhanced damages pursuant to 35 U.S.C. §§ 284 and 285.

COUNT IV
INFRINGMENT OF U.S. PATENT NO. 10,736,130

105. G+ incorporates by reference paragraphs 1 - 56 as though fully set forth herein.

106. Samsung infringes, contributes to the infringement of, and/or induces infringement of the '130 Patent by making, using, selling, offering for sale, exporting from, and/or importing into the United States products and/or methods covered by one or more claims of the '130 Patent including, but not limited to, at least the Accused Products.

107. For example, and as shown below, the Accused Products infringe at least claim 1 of the '130 patent by virtue of their compatibility with and practice of the 3GPP 5G Standard. For example, and to the extent the preamble is limiting, each of the Accused Products comprises **a method for uplink control signal transmission**. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.211 version 16.5.0 Release 16 (5G; NR; Physical channels and modulation), 3GPP TS 38.212 version 16.5.0 Release 16 (5G; NR; Multiplexing and channel coding), 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2).

4.1 Uplink

Table 4.1-1 specifies the mapping of the uplink transport channels to their corresponding physical channels. Table 4.1-2 specifies the mapping of the uplink control channel information to its corresponding physical channel.

Table 4.1-1

TrCH	Physical Channel
UL-SCH	PUSCH
RACH	PRACH

Table 4.1-2

Control information	Physical Channel
UCI	PUCCH, PUSCH

(Page 10 of TS 38.212)

5.3.3 Physical uplink control channel

Physical uplink control channel (PUCCH) carries the Uplink Control Information (UCI) from the UE to the gNB. Five formats of PUCCH exist, depending on the duration of PUCCH and the UCI payload size.

- Format #0: Short PUCCH of 1 or 2 symbols with small UCI payloads of up to two bits with UE multiplexing capacity of up to 6 UEs with 1-bit payload in the same PRB;
- Format #1: Long PUCCH of 4-14 symbols with small UCI payloads of up to two bits with UE multiplexing capacity of up to 84 UEs without frequency hopping and 36 UEs with frequency hopping in the same PRB;
- Format #2: Short PUCCH of 1 or 2 symbols with large UCI payloads of more than two bits with no UE multiplexing capability in the same PRBs;
- Format #3: Long PUCCH of 4-14 symbols with large UCI payloads with no UE multiplexing capability in the same PRBs;
- Format #4: Long PUCCH of 4-14 symbols with moderate UCI payloads with multiplexing capacity of up to 4 UEs in the same PRBs.

(Page 33 of TS 38.300)

6.3.2.2 Sequence and cyclic shift hopping

PUCCH formats 0, 1, 3, and 4 use sequences $r_{u,v}^{(\alpha,\delta)}(n)$ given by clause 5.2.2 with $\delta = 0$ where the sequence group u and the sequence number v depend on the sequence hopping in clause 6.3.2.2.1 and the cyclic shift α depends on the cyclic shift hopping in clause 6.3.2.2.2.

(Page 39 of TS 38.211)

108. Each of the Accused Products further comprises a method for mapping the initial location of a downlink pilot comprising **sending, by a user terminal, K predefined sequences on M** transmission symbols in a Transmission Time Interval (TTI) to send B-bit uplink control information, wherein M is a positive integer, K is an integer, 1<K<2B, B is an integer greater than

or equal to 1, on each of the M transmission symbols, one of the K predefined sequences is sent and each of the K predefined sequences has a length of N and is mapped to N subcarriers of the transmission symbols corresponding to the each of the K predefined sequences, wherein N=2n with n being a positive integer. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 38.211 version 16.5.0 Release 16 (5G; NR; Physical channels and modulation):

5.2 Sequence generation

5.2.2 Low-PAPR sequence generation type 1

The low-PAPR sequence $r_{u,v}^{(\alpha,\delta)}(n)$ is defined by a cyclic shift α of a base sequence $\bar{r}_{u,v}(n)$ according to

$$r_{u,v}^{(\alpha,\delta)}(n) = e^{j\alpha n}\bar{r}_{u,v}(n), \quad 0 \le n < M_{ZC}$$

where $M_{ZC} = mN_{sc}^{RB}/2^{\delta}$ is the length of the sequence. Multiple sequences are defined from a single base sequence through different values of α and δ.

Base sequences $\bar{r}_{u,v}(n)$ are divided into groups, where $u \in \{0,1,...,29\}$ is the group number and v is the base sequence number within the group, such that each group contains one base sequence ($v = 0$) of each length $M_{ZC} = mN_{sc}^{RB}/2^{\delta}$, $1/2 \le m/2^{\delta} \le 5$ and two base sequences ($v = 0,1$) of each length $M_{ZC} = mN_{sc}^{RB}/2^{\delta}$, $6 \le m/2^{\delta}$. The definition of the base sequence $\bar{r}_{u,v}(0),...,\bar{r}_{u,v}(M_{ZC}-1)$ depends on the sequence length M_{ZC}.

5.2.2.1 Base sequences of length 36 or larger

For $M_{ZC} \ge 3N_{sc}^{RB}$, the base sequence $\bar{r}_{u,v}(0),...,\bar{r}_{u,v}(M_{ZC}-1)$ is given by

$$\bar{r}_{u,v}(n) = x_q(n \bmod N_{ZC})$$
$$x_q(m) = e^{-j\frac{\pi q m(m+1)}{N_{ZC}}}$$

where

$$q = \lfloor \bar{q} + 1/2 \rfloor + v \cdot (-1)^{\lfloor 2\bar{q} \rfloor}$$
$$\bar{q} = N_{ZC} \cdot (u+1)/31$$

The length N_{ZC} is given by the largest prime number such that $N_{ZC} < M_{ZC}$.

(Page 19 of TS 38.211)

6.3.2 Physical uplink control channel

6.3.2.1 General

The physical uplink control channel supports multiple formats as shown in Table 6.3.2.1-1. In case intra-slot frequency hopping is configured for PUCCH formats 1, 3, or 4 according to clause 9.2.1 of [5, TS38.213], the number of symbols in the first hop is given by $\lfloor N_{symb}^{PUCCH}/2 \rfloor$ where N_{symb}^{PUCCH} is the length of the PUCCH transmission in OFDM symbols.

Table 6.3.2.1-1: PUCCH formats.

PUCCH format	Length in OFDM symbols $N_{\text{symb}}^{\text{PUCCH}}$	Number of bits
0	1 – 2	≤2
1	4 – 14	≤2
2	1 – 2	>2
3	4 – 14	>2
4	4 – 14	>2

6.3.2.2 Sequence and cyclic shift hopping

PUCCH formats 0, 1, 3, and 4 use sequences $r_{u,v}^{(\alpha,\delta)}(n)$ given by clause 5.2.2 with $\delta = 0$ where the sequence group u and the sequence number v depend on the sequence hopping in clause 6.3.2.2.1 and the cyclic shift α depends on the cyclic shift hopping in clause 6.3.2.2.2.

6.3.2.3 PUCCH format 0

6.3.2.3.1 Sequence generation

The sequence $x(n)$ shall be generated according to

$$x(l \cdot N_{\text{sc}}^{\text{RB}} + n) = r_{u,v}^{(\alpha,\delta)}(n)$$

$$n = 0,1,\ldots,N_{\text{sc}}^{\text{RB}} - 1$$

$$l = \begin{cases} 0 & \text{for single-symbol PUCCH transmission} \\ 0,1 & \text{for double-symbol PUCCH transmission} \end{cases}$$

where $r_{u,v}^{(\alpha,\delta)}(n)$ is given by clause 6.3.2.2 with m_{cs} depending on the information to be transmitted according to clause 9.2 of [5, TS 38.213].

(Pages 38-40 of TS 38.211)

109. Thus, as just illustrated above, the Accused Products directly infringe one or more claims of the '130 Patent. Samsung makes, uses, sells, offers for sale, exports, and/or imports, in this District and/or elsewhere in the United States, these devices and thus directly infringes the '130 Patent.

110. Samsung has had knowledge and notice of the '130 Patent since at least September 8, 2021.

111. Samsung indirectly infringes the '130 Patent, as provided in 35 U.S.C. §271(b), by inducing infringement by others, such as Samsung's customers and end-users, in this District and

elsewhere in the United States. For example, Samsung's customers and end-users directly infringe through their use of the inventions claimed in the '130 Patent. Samsung induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting they use the Accused Products in an infringing manner, including in-store technical support, online technical support, marketing, product manuals, advertisements, and online documentation. As a result of Samsung's inducement, Samsung's customers and end-users use the Accused Products in the way Samsung intends and directly infringe the '130 Patent. Samsung performs these affirmative acts with knowledge of the '130 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '130 Patent.

112. Samsung also indirectly infringes the '130 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement committed by others, such as customers and end users, in this District and elsewhere in the United States. Samsung's affirmative acts of selling and offering to sell, in this District and elsewhere in the United States, the Accused Products and causing the Accused Products to be manufactured, used, sold, and offered for sale contribute to Samsung's customers and end-users use of the Accused Products, such that the '130 Patent is directly infringed. The accused components within the Accused Products are material to the invention of the '130 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Samsung to be especially made or adapted for use in the infringement of the '130 Patent. Samsung performs these affirmative acts with knowledge of the '130 Patent and with intent, or willful blindness, that Samsung causes the direct infringement of the '130 Patent.

113. Samsung's infringement of the '130 Patent has damaged and will continue to damage G+.

114. Moreover, Samsung's risk of infringement of the Asserted Patents was either known or was so obvious that it should have been known to Samsung.

115. Notwithstanding this knowledge, Samsung has knowingly or with reckless disregard willfully infringed the '130 Patent. Samsung continues to infringe despite knowledge of G+'s Asserted Patents. Samsung has thus had actual notice of infringement of the '130 Patent and acted despite an objectively high likelihood that its actions constituted infringement of G+'s valid patent rights, either literally or equivalently.

116. This objective risk was either known or so obvious that it should have been known to Samsung.

117. Accordingly, Plaintiff seeks enhanced damages pursuant to 35 U.S.C. §§ 284 and 285.

COUNT V
INFRINGEMENT OF U.S. PATENT NO. 10,594,443

118. G+ incorporates by reference paragraphs 1 - 56 as though fully set forth herein.

119. Samsung infringes, contributes to the infringement of, and/or induces infringement of the '443 Patent by making, using, selling, offering for sale, exporting from, and/or importing into the United States products and/or methods covered by one or more claims of the '443 Patent including, but not limited to, at least the Accused Products.

120. For example, and as shown below, the Accused Products infringe at least claim 1 of the '443 patent by virtue of their compatibility with and practice of the 3GPP 5G Standard. For example, and to the extent the preamble is limiting, each of the Accused Products comprises **a method for transmitting hybrid automatic repeat request (HARQ) information**. As shown

below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS "TS 36.212 version 14.13.0 Release 14 (2020-07) and 3GPP TS 36.302 version 16.1.0 Release 16 (2020-07).

6.2 Downlink model

6.2.1 Downlink-Shared Channel

The physical-layer model for Downlink Shared Channel transmission is described based on the corresponding PDSCH or NPDSCH physical-layer-processing chain, see Figure 6.2.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

- **Higher-layer data passed to/from the physical layer**
- N (up to two) transport blocks of dynamic size delivered to the physical layer once every TTI.
- **CRC and transport-block-error indication**
- Transport-block-error indication delivered to higher layers.

Multi-antenna processing

- MAC Scheduler partly configures mapping from modulated code words (for each stream) to the available number of antenna ports.
- **Mapping to physical resource**
- L2-controlled resource assignment.
- **Support of L1 control signalling**
- Transmission of scheduler related control signals.
- **Support for Hybrid-ARQ-related signalling**

The model of Figure 6.2.1-1 also captures:

- Transport via physical layer of Hybrid-ARQ related information associated with the PDSCH, to the peer HARQ process at the receiver side;
- Transport via physical layer of corresponding HARQ acknowledgements to PDSCH transmitter side.

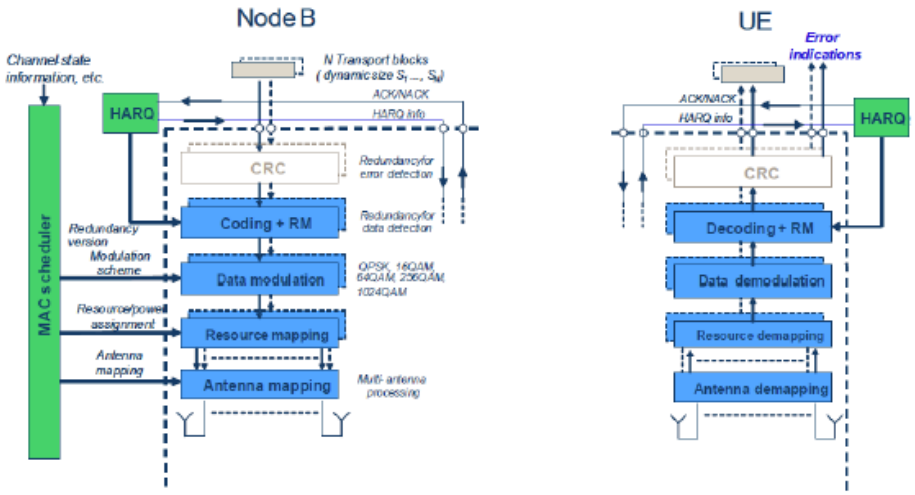


Figure 6.2.1-1: Physical-layer model for DL-SCH transmission

(Pages 11 and 12 of 136.302 standard document)

121. Each of the Accused Products comprises detecting, by a first node, N transmission blocks received from a second node and generating M bits of HARQ information according to a detection result: the M bits of HARQ information being used to indicate a receiving status of the N transmission blocks. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.302 and 36.212.

6.2 Downlink model

6.2.1 Downlink-Shared Channel

The physical-layer model for Downlink Shared Channel transmission is described based on the corresponding PDSCH or NPDSCH physical-layer-processing chain, see Figure 6.2.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

- **Higher-layer data passed to/from the physical layer**
- N (up to two) transport blocks of dynamic size delivered to the physical layer once every TTI.
- **CRC and transport-block-error indication**
- Transport-block-error indication delivered to higher layers.

Multi-antenna processing

- MAC Scheduler partly configures mapping from modulated code words (for each stream) to the available number of antenna ports.
- **Mapping to physical resource**
- L2-controlled resource assignment.
- **Support of L1 control signalling**
- Transmission of scheduler related control signals.
- **Support for Hybrid-ARQ-related signalling**

The model of Figure 6.2.1-1 also captures:

- Transport via physical layer of Hybrid-ARQ related information associated with the PDSCH, to the peer HARQ process at the receiver side;
- Transport via physical layer of corresponding HARQ acknowledgements to PDSCH transmitter side.

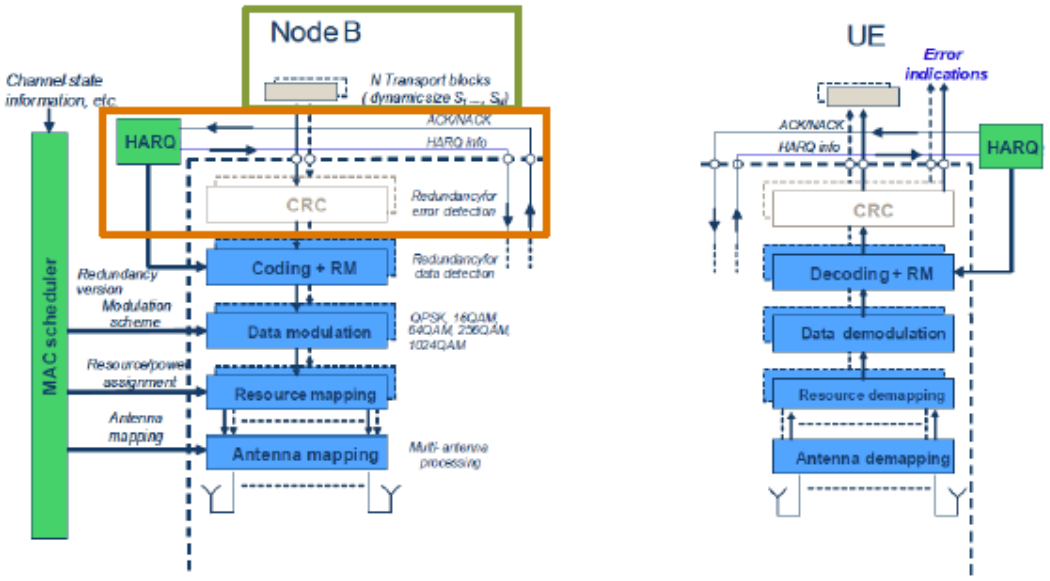


Figure 6.2.1-1: Physical-layer model for DL-SCH transmission

(Pages 11 and 12 of 136.302 standard document)

If HARQ-ACK feedback consists of O^{ACK}>22 bits of information as a result of the aggregation of HARQ-ACK bits corresponding to one or more DL cells with which the UE is configured by higher layers, the coded bit sequence is denoted by $q_0^{ACK}, q_1^{ACK}, q_2^{ACK}, \ldots, q_{Q_{ACK}-1}^{ACK}$. The CRC attachment, channel coding and rate matching of the HARQ-ACK bits are performed according to clauses 5.1.1 setting L to 8 bits, 5.1.3.1 and 5.1.4.2, respectively. The input bit sequence to the CRC attachment operation is $o_0^{ACK}, o_1^{ACK}, \ldots, o_{O^{ACK}-1}^{ACK}$. The output bit sequence of the CRC attachment operation is the input bit sequence to the channel coding operation. The output bit sequence of the channel coding operation is the input bit sequence to the rate matching operation.

(Page 30 of 136.212 standard document)

122. Each of the Accused Products further comprises among the M bits, M2 bits being used to indicate positions of k erroneous transmission block in the N transmission blocks, M2≤M. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.212.

If HARQ-ACK feedback consists of O^{ACK}>22 bits of information as a result of the aggregation of HARQ-ACK bits corresponding to one or more DL cells with which the UE is configured by higher layers, the coded bit sequence is denoted by $q_0^{ACK}, q_1^{ACK}, q_2^{ACK}, \ldots, q_{Q_{ACK}-1}^{ACK}$. The CRC attachment, channel coding and rate matching of the HARQ-ACK bits are performed according to clauses 5.1.1 setting L to 8 bits, 5.1.3.1 and 5.1.4.2, respectively. The input bit sequence to the CRC attachment operation is $o_0^{ACK}, o_1^{ACK}, \ldots, o_{O^{ACK}-1}^{ACK}$. The output bit sequence of the CRC attachment operation is the input bit sequence to the channel coding operation. The output bit sequence of the channel coding operation is the input bit sequence to the rate matching operation.

(Page 30 of 136.212 standard document)

5.1.1 CRC calculation

Denote the input bits to the CRC computation by $a_0, a_1, a_2, a_3, \ldots, a_{A-1}$, and the parity bits by $p_0, p_1, p_2, p_3, \ldots, p_{L-1}$. A is the size of the input sequence and L is the number of parity bits. The parity bits are generated by one of the following cyclic generator polynomials:

- $g_{CRC24A}(D) = [D^{24} + D^{23} + D^{18} + D^{17} + D^{14} + D^{11} + D^{10} + D^7 + D^6 + D^5 + D^4 + D^3 + D + 1]$ and;
- $g_{CRC24B}(D) = [D^{24} + D^{23} + D^6 + D^5 + D + 1]$ for a CRC length $L = 24$ and;
- $g_{CRC16}(D) = [D^{16} + D^{12} + D^5 + 1]$ for a CRC length $L = 16$.
- $g_{CRC8}(D) = [D^8 + D^7 + D^4 + D^3 + D + 1]$ for a CRC length of $L = 8$.

The encoding is performed in a systematic form, which means that in GF(2), the polynomial:

$$a_0 D^{A+23} + a_1 D^{A+22} + \ldots + a_{A-1} D^{24} + p_0 D^{23} + p_1 D^{22} + \ldots + p_{22} D^1 + p_{23}$$

yields a remainder equal to 0 when divided by the corresponding length-24 CRC generator polynomial, $g_{CRC24A}(D)$ or $g_{CRC24B}(D)$, the polynomial:

$$a_0 D^{A+15} + a_1 D^{A+14} + \ldots + a_{A-1} D^{16} + p_0 D^{15} + p_1 D^{14} + \ldots + p_{14} D^1 + p_{15}$$

yields a remainder equal to 0 when divided by $g_{CRC16}(D)$, and the polynomial:

$$a_0 D^{A+7} + a_1 D^{A+6} + \ldots + a_{A-1} D^8 + p_0 D^7 + p_1 D^6 + \ldots + p_6 D^1 + p_7$$

yields a remainder equal to 0 when divided by $g_{CRC8}(D)$.

The bits after CRC attachment are denoted by $b_0, b_1, b_2, b_3, \ldots, b_{B-1}$, where $B = A + L$. The relation between a_k and b_k is:

$b_k = a_k$ for $k = 0, 1, 2, \ldots, A-1$

$b_k = p_{k-A}$ for $k = A, A+1, A+2, \ldots, A+L-1$.

(Page 10 of 136.212 standard document)

123. Each of the Accused Products further comprises a length type of M2 including a first length type or a second length type; the first length type indicating a value of M2 being predefined, and the second length type indicating a value of M2 being determined based on k. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.212.

If HARQ-ACK feedback consists of O^{ACK}>22 bits of information as a result of the aggregation of HARQ-ACK bits corresponding to one or more DL cells with which the UE is configured by higher layers, the coded bit sequence is denoted by $q_0^{ACK}, q_1^{ACK}, q_2^{ACK}, \ldots, q_{Q_{ACK}-1}^{ACK}$. The CRC attachment, channel coding and rate matching of the HARQ-ACK bits are performed according to clauses 5.1.1 setting L to 8 bits, 5.1.3.1 and 5.1.4.2, respectively. The input bit sequence to the CRC attachment operation is $o_0^{ACK}\ o_1^{ACK}, \ldots, o_{O^{ACK}-1}^{ACK}$. The output bit sequence of the CRC attachment operation is the input bit sequence to the channel coding operation. The output bit sequence of the channel coding operation is the input bit sequence to the rate matching operation.

(Page 30 of 136.212 standard document)

5.1.1 CRC calculation

Denote the input bits to the CRC computation by $a_0, a_1, a_2, a_3, \ldots, a_{A-1}$, and the parity bits by $p_0, p_1, p_2, p_3, \ldots, p_{L-1}$. A is the size of the input sequence and L is the number of parity bits. The parity bits are generated by one of the following cyclic generator polynomials:

- $g_{CRC24A}(D) = [D^{24} + D^{23} + D^{18} + D^{17} + D^{14} + D^{11} + D^{10} + D^7 + D^6 + D^5 + D^4 + D^3 + D + 1]$ and;
- $g_{CRC24B}(D) = [D^{24} + D^{23} + D^6 + D^5 + D + 1]$ for a CRC length $L = 24$ and;
- $g_{CRC16}(D) = [D^{16} + D^{12} + D^5 + 1]$ for a CRC length $L = 16$.
- $g_{CRC8}(D) = [D^8 + D^7 + D^4 + D^3 + D + 1]$ for a CRC length of $L = 8$.

The encoding is performed in a systematic form, which means that in GF(2), the polynomial:

$$a_0 D^{A+23} + a_1 D^{A+22} + \ldots + a_{A-1} D^{24} + p_0 D^{23} + p_1 D^{22} + \ldots + p_{22} D^1 + p_{23}$$

yields a remainder equal to 0 when divided by the corresponding length-24 CRC generator polynomial, $g_{CRC24A}(D)$ or $g_{CRC24B}(D)$, the polynomial:

$$a_0 D^{A+15} + a_1 D^{A+14} + \ldots + a_{A-1} D^{16} + p_0 D^{15} + p_1 D^{14} + \ldots + p_{14} D^1 + p_{15}$$

yields a remainder equal to 0 when divided by $g_{CRC16}(D)$, and the polynomial:

$$a_0 D^{A+7} + a_1 D^{A+6} + \ldots + a_{A-1} D^8 + p_0 D^7 + p_1 D^6 + \ldots + p_6 D^1 + p_7$$

yields a remainder equal to 0 when divided by $g_{CRC8}(D)$.

The bits after CRC attachment are denoted by $b_0, b_1, b_2, b_3, \ldots, b_{B-1}$, where $B = A + L$. The relation between a_k and b_k is:

$b_k = a_k$ for $k = 0, 1, 2, \ldots, A\text{-}1$

$b_k = p_{k-A}$ for $k = A, A+1, A+2, \ldots, A+L\text{-}1$.

(Page 10 of 136.212 standard document)

124. Each of the Accused Products further comprises transmitting, by the first node, the HARQ information to the second node. As shown below, this functionality is described in the 3GPP 5G Standard, including but not limited to 3GPP TS 36.302.

6.2 Downlink model

6.2.1 Downlink-Shared Channel

The physical-layer model for Downlink Shared Channel transmission is described based on the corresponding PDSCH or NPDSCH physical-layer-processing chain, see Figure 6.2.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

- **Higher-layer data passed to/from the physical layer**
- N (up to two) transport blocks of dynamic size delivered to the physical layer once every TTI.
- **CRC and transport-block-error indication**
- Transport-block-error indication delivered to higher layers.

Multi-antenna processing

- MAC Scheduler partly configures mapping from modulated code words (for each stream) to the available number of antenna ports.
- **Mapping to physical resource**
- L2-controlled resource assignment.
- **Support of L1 control signalling**
- Transmission of scheduler related control signals.
- **Support for Hybrid-ARQ-related signalling**

The model of Figure 6.2.1-1 also captures:

- Transport via physical layer of Hybrid-ARQ related information associated with the PDSCH, to the peer HARQ process at the receiver side;
- Transport via physical layer of corresponding HARQ acknowledgements to PDSCH transmitter side.

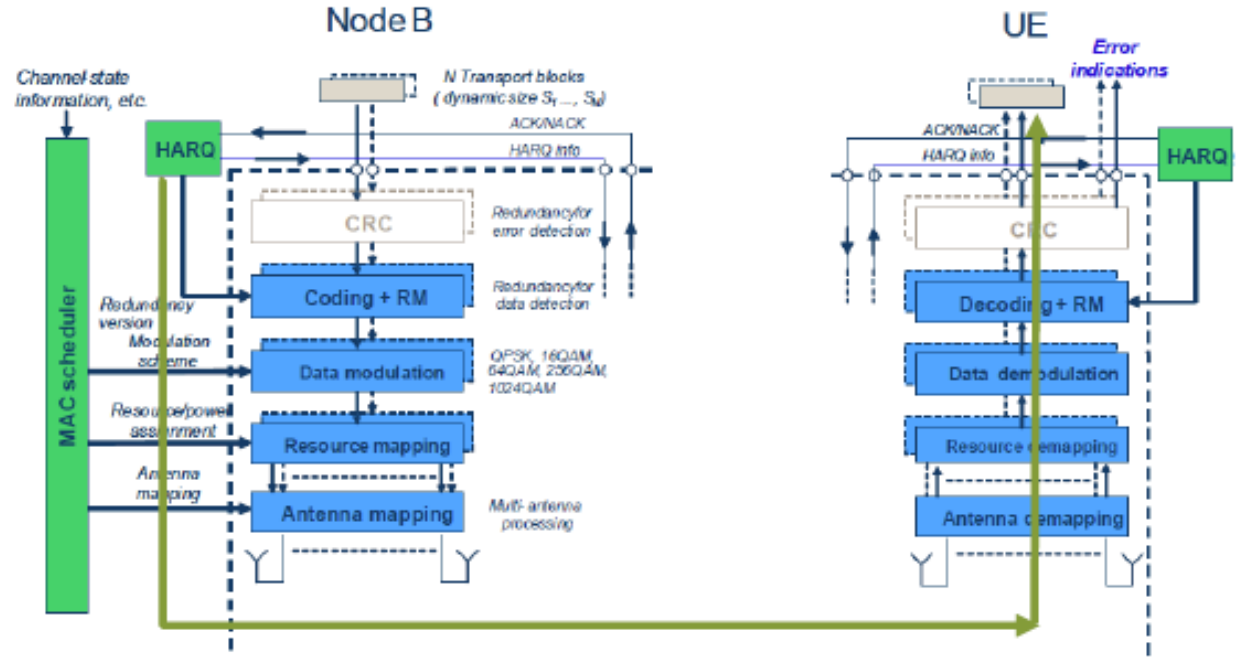


Figure 6.2.1-1: Physical-layer model for DL-SCH transmission

(Pages 11 and 12 of 136.302 standard document)

125. Thus, as just illustrated above, the Accused Products directly infringe one or more claims of the ’443 Patent. Samsung makes, uses, sells, offers for sale, exports, and/or imports, in this District and/or elsewhere in the United States, these devices and thus directly infringes the ’443 Patent.

126. Samsung has had knowledge and notice of the ’443 Patent since at least September 8, 2021.

127. Samsung indirectly infringes the ’443 patent, as provided in 35 U.S.C. §271(b), by inducing infringement by others, such as Samsung’s customers and end-users, in this District and elsewhere in the United States. For example, Samsung’s customers and end-users directly infringe through their use of the inventions claimed in the ’443 Patent. Samsung induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise

making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting they use the Accused Products in an infringing manner, including in-store technical support, online technical support, marketing, product manuals, advertisements, and online documentation. As a result of Samsung's inducement, Samsung's customers and end-users use the Accused Products in the way Samsung intends and directly infringe the '443 Patent. Samsung performs these affirmative acts with knowledge of the '443 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '443 Patent.

128. Samsung also indirectly infringes the '443 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement committed by others, such as customers and end users, in this District and elsewhere in the United States. Samsung's affirmative acts of selling and offering to sell, in this District and elsewhere in the United States, the Accused Products and causing the Accused Products to be manufactured, used, sold, and offered for sale contribute to Samsung's customers and end-users use of the Accused Products, such that the '443 Patent is directly infringed. The accused components within the Accused Products are material to the invention of the '443 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Samsung to be especially made or adapted for use in the infringement of the '443 Patent. Samsung performs these affirmative acts with knowledge of the '443 Patent and with intent, or willful blindness, that Samsung causes the direct infringement of the '443 Patent.

129. Samsung's infringement of the '443 Patent has damaged and will continue to damage G+.

130. Moreover, Samsung's risk of infringement of the Asserted Patents was either known or was so obvious that it should have been known to Samsung.

131. Notwithstanding this knowledge, Samsung has knowingly or with reckless disregard willfully infringed the '443 Patent. Samsung continues to infringe despite knowledge of G+'s Asserted Patents. Samsung has thus had actual notice of infringement of the '443 Patent and acted despite an objectively high likelihood that its actions constituted infringement of G+'s valid patent rights, either literally or equivalently.

132. This objective risk was either known or so obvious that it should have been known to Samsung. Accordingly, Plaintiff seeks enhanced damages pursuant to 35 U.S.C. §§ 284 and 285.

NOTICE

133. G+ has complied with the notice requirement of 35 U.S.C. § 287 and does not currently distribute, sell, offer for sale, or make products embodying the Asserted Patents. This notice requirement has been complied with by all relevant persons at all relevant times.

134. Samsung has had actual knowledge of the Asserted Patents and its infringement thereof at least as of receipt of Plaintiff's notice letter dated September 8, 2021. Alternatively, Samsung has had actual knowledge of the Asserted Patents at least as of the date of Samsung's receipt of charts comparing the claims of the Asserted Patents to the 5G standard.

JURY DEMAND

135. Plaintiff G+ demands a trial by jury of all matters to which it is entitled to trial by jury, pursuant to FED. R. CIV. P. 38.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff G+ prays for judgment and seeks relief against Samsung as follows:

A. A declaration that the claims of the Asserted Patents are valid and enforceable;

B. A declaration that one or more claims of the Asserted Patents is infringed by Samsung, literally and/or under the doctrine of equivalents;

C. A declaration that one or more claims of the Asserted Patents is indirectly infringed by each of the Defendants;

D. That the Court award damages adequate to compensate G+ for the patent infringement that has occurred, together with prejudgment and post-judgment interest and costs, and an ongoing royalty for continued infringement;

E. That the Court award any other equitable relief which may be requested and to which G+ is entitled;

F. That the Court find this case to be exceptional pursuant to 35 U.S.C. § 285;

G. That the Court determine that Samsung's acts of infringement were willful;

H. That the Court award enhanced damages against Samsung pursuant to 35 U.S.C. § 284;

I. That the Court award reasonable attorneys' fees; and

J. That the Court award such other relief to G+ as the Court deems just and proper.

RESERVATION OF RIGHTS

G+'s investigation is ongoing, and certain material information remains in the sole possession of Samsung or third parties, which will be obtained via discovery herein. G+ expressly

reserves the right to amend or supplement the causes of action set forth herein in accordance with FED. R. CIV. P. 15.

Dated: March 14, 2022

Respectfully Submitted,

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ATTORNEYS FOR PLAINTIFF
G+ COMMUNICATIONS, LLC

CERTIFICATE OF SERVICE

This is to certify that on March 14, 2022, a true and correct copy of the foregoing instrument was delivered to all counsel of record through the court electronic filing system.

/s/ Bradley D. Liddle